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Programmable Logic Controller

Positioning Module

XGT Series

User's Manual

XGF-PN8A
XGF-PN8B

Safety Instructions

- Read this manual carefully before installing, wiring, operating, servicing or inspecting this equipment.
- Keep this manual within easy reach for quick reference.

http://eng.lsis.biz

Before using the product …

For your safety and effective operation, please read the safety instructions thoroughly before using the product.

- Safety Instructions should always be observed in order to prevent accident or risk with the safe and proper use the product.

- Instructions are divided into "Warning" and "Caution", and the meaning of the terms is as follows.

⚠ ***Warning***	This symbol indicates the possibility of serious injury or death if some applicable instruction is violated
⚠ ***Caution***	This symbol indicates the possibility of severe or slight injury, and property damages if some applicable instruction is violated

Moreover, even classified events under its caution category may develop into serious accidents relying on situations. Therefore we strongly advise users to observe all precautions properly just like warnings.

- The marks displayed on the product and in the user's manual have the following meanings.

  ⚠ Be careful! Danger may be expected.

  ⚠ Be careful! Electric shock may occur.

- The user's manual even after read shall be kept available and accessible to any user of the product.

Safety Instructions for design process

⚠ Warning

- ***Please install a protection circuit on the exterior of PLC so that the whole system may operate safely regardless of failures from external power or PLC.*** Any abnormal output or operation from PLC may cause serious problems to safety in whole system.
  - Install protection units on the exterior of PLC like an interlock circuit that deals with opposite operations such as emergency stop, protection circuit, and forward/reverse rotation or install an interlock circuit that deals with high/low limit under its position controls.
  - If any system error (watch-dog timer error, module installation error, etc.) is detected during CPU operation in PLC, all output signals are designed to be turned off and stopped for safety. However, there are cases when output signals remain active due to device failures in Relay and TR which can't be detected. Thus, you are recommended to install an addition circuit to monitor the output status for those critical outputs which may cause significant problems.
- ***Never overload more than rated current of output module nor allow to have a short circuit***. Over current for a long period time may cause a fire .
- ***Never let the external power of the output circuit to be on earlier than PLC power***, which may cause accidents from abnormal output operation.
- ***Please install interlock circuits in the sequence program for safe operations in the system when exchange data with PLC or modify operation modes using a computer or other external equipments*** Read specific instructions thoroughly when conducting control operations with PLC.

Safety Instructions for design process

⚠ Caution

- ***I/O signal or communication line shall be wired at least 100mm away from a high-voltage cable or power line.*** Fail to follow this

Safety Instructions on installation process

⚠ Caution

- ***Use PLC only in the environment specified in PLC manual or general standard of data sheet.*** If not, electric shock, fire, abnormal operation of the product may be caused.
- ***Before install or remove the module, be sure PLC power is off.*** If not, electric shock or damage on the product may be caused.
- ***Be sure that every module is securely attached after adding a module or an extension connector.*** If the product is installed loosely or incorrectly, abnormal operation, error or dropping may be caused. In addition, contact failures under poor cable installation will be causing malfunctions as well.
- ***Be sure that screws get tighten securely under vibrating environments.*** Fail to do so will put the product under direct vibrations which will cause electric shock, fire and abnormal operation.
- ***Do not come in contact with conducting parts in each module***, which may cause electric shock, malfunctions or abnormal operation.

Safety Instructions for wiring process

⚠ Warning

- ***Prior to wiring works, make sure that every power is turned off.*** If not, electric shock or damage on the product may be caused.
- ***After wiring process is done, make sure that terminal covers are installed properly before its use.*** Fail to install the cover may cause electric shocks.

⚠ Caution

- ***Check rated voltages and terminal arrangements in each product prior to its wiring process.*** Applying incorrect voltages other than rated voltages and misarrangement among terminals may cause fire or malfunctions.
- ***Secure terminal screws tightly applying with specified torque.*** If the screws get loose, short circuit, fire or abnormal operation may be caused. Securing screws too tightly will cause damages to the module or malfunctions, short circuit, and dropping.
- ***Be sure to earth to the ground using Class 3 wires for FG terminals which is exclusively used for PLC***. If the terminals not grounded correctly, abnormal operation or electric shock may be caused.
- ***Don't let any foreign materials such as wiring waste inside the module while wiring,*** which may cause fire, damage on the product or abnormal operation.
- ***Make sure that pressed terminals get tighten following the specified torque. External connector type shall be pressed or soldered using proper equipments.***

Safety Instructions for test-operation and maintenance

⚠ Warning

- ***Don't touch the terminal when powered***. Electric shock or abnormal operation may occur.
- ***Prior to cleaning or tightening the terminal screws, let all the external power off including PLC power.*** If not, electric shock or abnormal operation may occur.
- ***Don't let the battery recharged, disassembled, heated, short or soldered***. Heat, explosion or ignition may cause injuries or fire.

⚠ Caution

- ***Do not make modifications or disassemble each module.*** Fire, electric shock or abnormal operation may occur.
- ***Prior to installing or disassembling the module, let all the external power off including PLC power.*** If not, electric shock or abnormal operation may occur.
- ***Keep any wireless equipment such as walkie-talkie or cell phones at least 30cm away from PLC***. If not, abnormal operation may be caused.
- ***When making a modification on programs or using run to modify functions under PLC operations, read and comprehend all contents in the manual fully.*** Mismanagement will cause damages to products and accidents.
- ***Avoid any physical impact to the battery and prevent it from dropping as well.*** Damages to battery may cause leakage from its fluid. When battery was dropped or exposed under strong impact, never reuse the battery again. Moreover skilled workers are needed when exchanging batteries.

Safety Instructions for waste disposal

⚠ Caution

- ***Product or battery waste shall be processed as industrial waste.*** The waste may discharge toxic materials or explode itself.

Revision History

Version	Date	Remark	Revised position
V 1.0	’11.4	First Edition	-
V1.1	’11.9	XGF-PN8B module added	-
V1.2	’12.5	Torque control command added Latch Position data Read command added Latch Reset command added Latch Set command added Servo Parameter Read command added User CAM command added	6-80, 7-33 6-81, 7-11 6-82, 7-59 6-83, 7-60 6-76, 7-68 6-24, 7-40, A2-144

※ The number of User’s manual is indicated right part of the back cover.

Thank you for purchasing PLC of LSIS Co.,Ltd.
Before use, make sure to carefully read and understand the User's Manual about the functions, performances, installation and programming of the product you purchased in order for correct use and importantly, let the end user and maintenance administrator to be provided with the User's Manual.

The User's Manual describes the product. If necessary, you may refer to the following description and order accordingly. In addition, you may connect our website (http://eng.lsis.biz/) and download the information as a PDF file.

Relevant User's Manuals

Title	Description
XG5000 User's Manual (for XGK, XGB)	XG5000 software user manual describing online function such as programming, print, monitoring, debugging by using XGK, XGB CPU
XG5000 User's Manual (for XGI, XGR)	XG5000 software user manual describing online function such as programming, print, monitoring, debugging by using XGI, XGR CPU
XGK/XGB Instructions & Programming User's Manual	User's manual for programming to explain how to use instructions that are used PLC system with XGK, XGB CPU.
XGI/XGR/XEC Instructions & Programming User's Manual	User's manual for programming to explain how to use instructions that are used PLC system with XGI, XGR,XEC CPU.
XGK CPU User's Manual (XGK-CPUA/CPUE/CPUH/CPUS/CPUU)	XGK-CPUA/CPUE/CPUH/CPUS/CPUU user manual describing about XGK CPU module, power module, base, IO module, specification of extension cable and system configuration, EMC standard
XGI CPU User's Manual (XGI-CPUU/CPUH/CPUS)	XGI-CPUU/CPUH/CPUS user manual describing about XGI CPU module, power module, base, IO module, specification of extension cable and system configuration, EMC standard
XGR redundant series User's Manual	XGR- CPUH/F, CPUH/T user manual describing about XGR CPU module, power module, extension drive, base, IO module, specification of extension cable and system configuration, EMC standard

Current XGF-PN8A/B manual is written based on the following version.

Related OS version list

Product name	***OS version***
XGK-CPUH, CPUS, CPUA, CPUE, CPUU	V3.7
XGI-CPUU, CPUH, CPUS	V3.1
XGR-CPUH/F, CPUH/T	V1.6
XG5000(XG-PM)	V3.63

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Table of Contents

Chapter 1 Overview

This user's manual describes the standard of positioning module, installation method, the method to use each positioning function, programming and the wiring with external equipment.

1.1 Characteristics

The characteristics of positioning module are as follows.

(1) The positioning module is available for XGT Series.

(2) Various positioning control function
It has various functions needed for positioning system such as position control, speed control etc.
(a) The operation data including positioning address and operation method, operation pattern is available to set up to 400 for each axis.
With this operation data, positioning for each axis is carried out
(b) Various sing-axis operations are available.
1) Position Control
2) Speed Control
3) Feed Control
4) Multi-axis Simultaneous Start
5) Point Operation
(c) Various Multi-axis Operations are available.
1) Circular arc Interpolation (up to 4 groups, 2 axes per one group)
2) Linear Interpolation (up to 8 axes)
3) Helical Interpolation
4) Ellipse Interpolation
(d) Switching Control in operation is available.
1) Position/Speed Control Switching
2) Speed/Position Control Switching
3) Speed/Torque Control Switching
(e) Cam Control is available.
It is available to create up to 8 kinds of cam data with various cam profile of XG-PM.
(f) Various Homing Control Function.
1) 10 methods are available for XGF-PN8A's Homing (Set up at the servo parameter)
a) upper limit +Z phase (CW)
b) lower limit +Z phase (CCW)
c) DOG +Z phase (CW)
d) DOG +Z phase (CCW)
e) upper limit+ DOG +Z phase(CW)
f) lower limit+ DOG +Z phase (CCW)
g) Z phase (CW)
h) Z phase (CCW)
i) DOG (CW)
j) DOG (CCW)
2) For XGF-PN8B's Homing, you can use Homing method supported by each servo driver.
3) Available to set the origin of machine without homing by setting the floating origin
(g) For the Acceleration/Deceleration method, it is available to select trapezoid or S-type.
(3) High speed start process
Due to the realization of high speed start process, the start time reduced to 0.8ms~2.4 ㎳(XGF-PN8A), 1ms~3ms (XGF-PN8B). In addition, there is no delay time between axes in Simultaneous start and interpolation start.

(4) Connection with the servo driver through EtherCAT[*1]

(a) Able to connect with up to 8 servo driver through EtherCAT

(b) Wiring between positioning module and servo driver, between servo drivers is done with Ethernet Cable. So wiring is simple.

(c) You can easily check and set up the servo driver information and parameter at the positioning module

(d) Max. connection distance is 100m.

(5) Able to realize the absolute position system

You can realize the absolute position system just by connecting to the servo driver using the absolute position encoder and in case of ON/OFF, it can know the current position of the motor without homing.

(6) Easy maintenance

Various data such as operation data, operation parameter are saved on FRAM(Ferroelectric Random Access Memory) in positioning module. Therefore, data will be saved without delay time and there is no limit in writing count.

(7) The number of positioning module can be used in one base is not limited
(But, they have to be used within the capacity of power module.)

(8) Self-diagnosis, monitoring and test are available with strong software package, XG-PM.
(a) Monitoring Function (Module & Servo driver)
(b) Trace Function
(c) Trend Function
(d) Reading and Saving Module Parameter/Operation Data
(e) Reading and Saving Servo Parameter
(f) Servo tuning function (XGF-PN8A)
(g) Creation of Cam Data
(h) Simulation Function
(i) Providing details about errors and the solution for it
(j) Print Function of various forms
(k) Editing operation data in Excel program is available

(9) Applicable XGT CPU version for XGF-PN8A

XGT CPU Module Type	Version
XGK CPU Module	V3.4 or above
XGI CPU Module	V3.0 or above
XGR CPU Module	V1.6 or above

Applicable XGT CPU version for XGF-PN8B

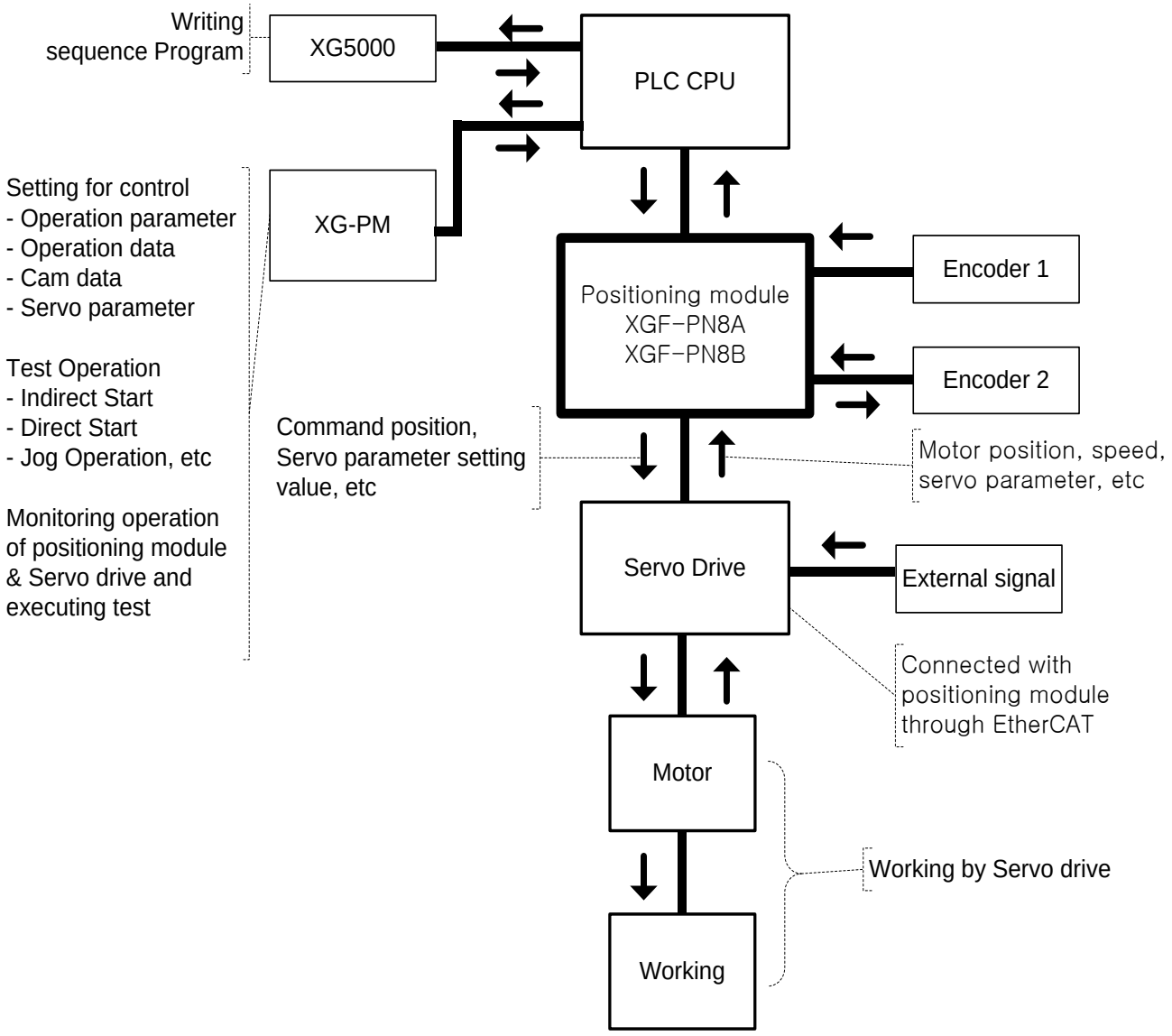
XGT CPU Module Type	Version
XGK CPU module	V3.71 or above
XGI CPU module	V3.40 or above
XGR CPU module	V1.91 or above

Note

1. What is EtherCAT?
   EtherCAT, Open Industrial Ethernet Solution, is developed by Beckhoff at 2002 and at 2003, November EtherCAT Technology Group (ETG-http://www.ethercat.org) is organized and it opens its technology. At 2005, February, that is authorized as IEC standard specification. Because of fast control speed and easiness for use and maintenance, it is widely used in the industrial field and conforming its performance
   In our positioning module, data communication with service driver is done with master-slave method through EtherCAT, and electric Ethernet Cable is used.

1.2 Signal Flow of Positioning Module

The flow of PLC system using the positioning module is as follows.



1.3 Function overview of Positioning module

Describe Representative functions of positioning module (Coordinate & Linear Interpolation, Circular Interpolation & Stop) briefly.

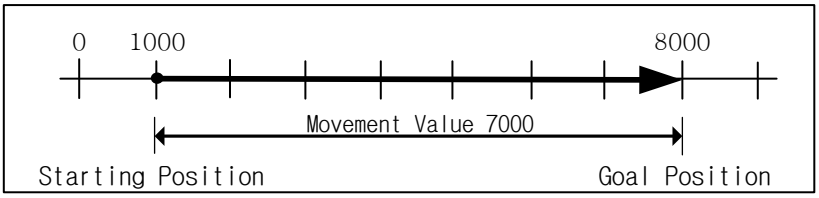
1.3.1 Position Control

Execute positioning control for the designated axis from starting position(current position) to goal position(the position to move to).

(1) Control by Absolute coordinates

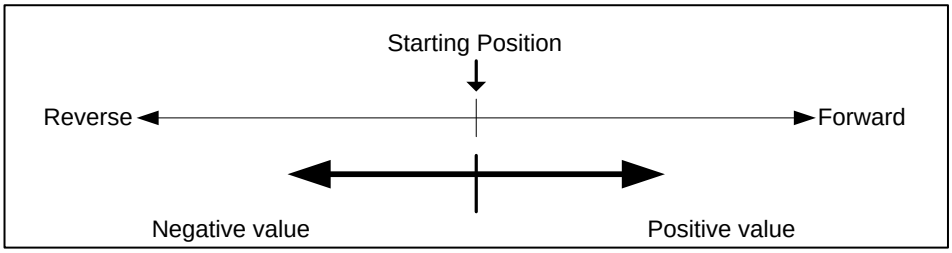
(a) Execute positioning control from starting position to goal position designated in positioning data
(b) Positioning control is executed based on origin designated in homing
(c) Moving direction is decided by starting position and goal position.
■Starting Position < Goal Position : Forward Positioning Operation
■Starting Position > Goal Position : Reverse Positioning Operation

[Example]
■Starting Position : 1000
■Goal Position : 8000
Value of Forward movement is 7000 (7000=8000-1000)



(2) Control by Incremental Coordinates

(a) Execute positioning control from starting position as much as goal movement value.
The difference from absolute coordinates control is that the goal position is movement value, not position value.
(b) Moving direction depends on sign of movement value.
■Positive value (+ or 0) : Positioning operation with forward direction
■Negative value (-) : Positioning operation with reverse direction

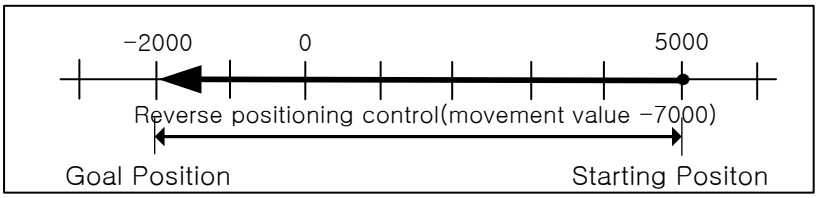


[Example]

■ Starting Position : 5000

■ Goal Position : -7000

In this condition, it moves reversely and stops at -2000.



1.3.2 Interpolation Control

(1) Linear Interpolation Control

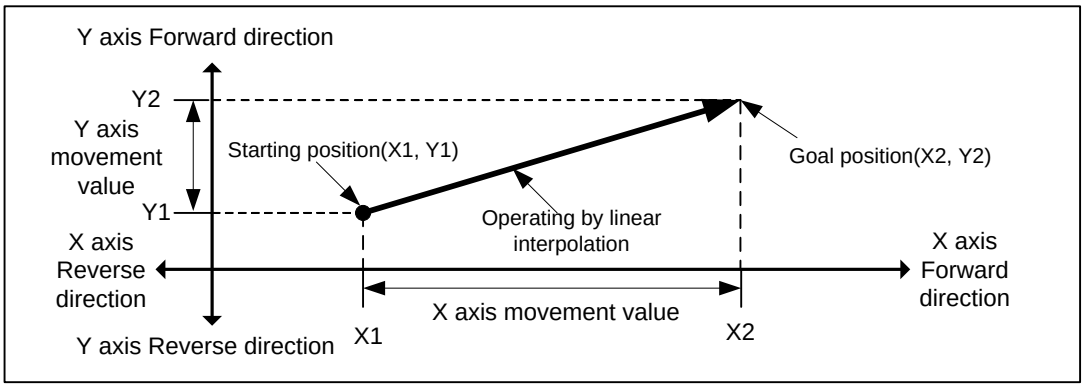
Execute Linear interpolation control with designated axis at start position (Current position).
Combination of interpolation axis is unlimited and it is available to execute max. 4 axis Linear interpolation control.

(a) Linear interpolation by absolute coordinates

1) Execute Linear interpolation from starting position to goal position designated by positioning data.
2) Positioning control is executed based on origin designated in homing.
3) Movement direction is designated by starting position & goal position of each axis.

■ Starting position < Goal position : Positioning operation with forward direction

■ Starting position > Goal position : Positioning operation with reverse direction

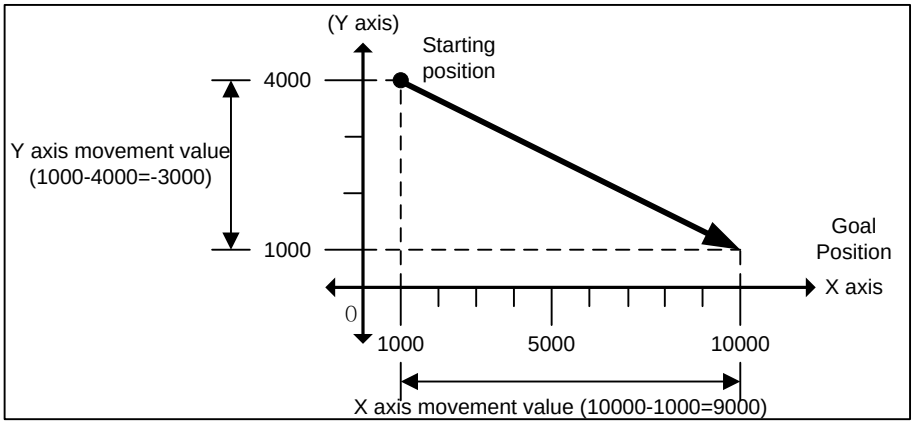


[Example]

■ Starting Position (1000, 4000)

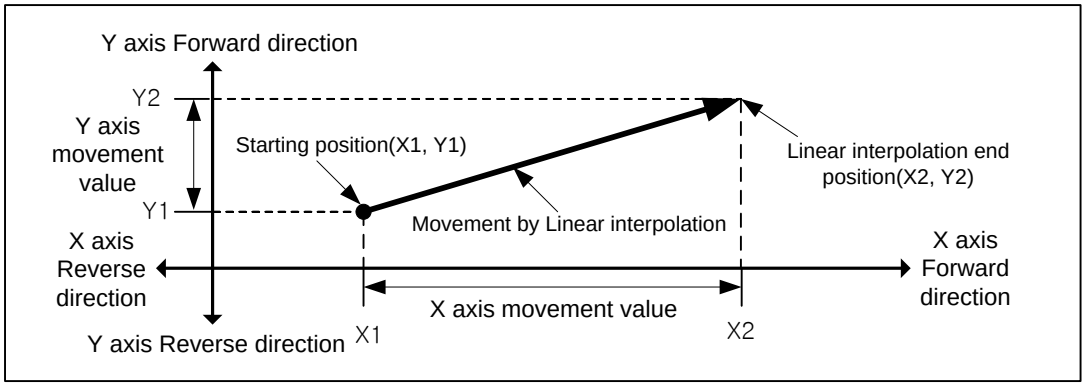
■ Goal Position (10000, 1000)

In this condition, operation is as follows.



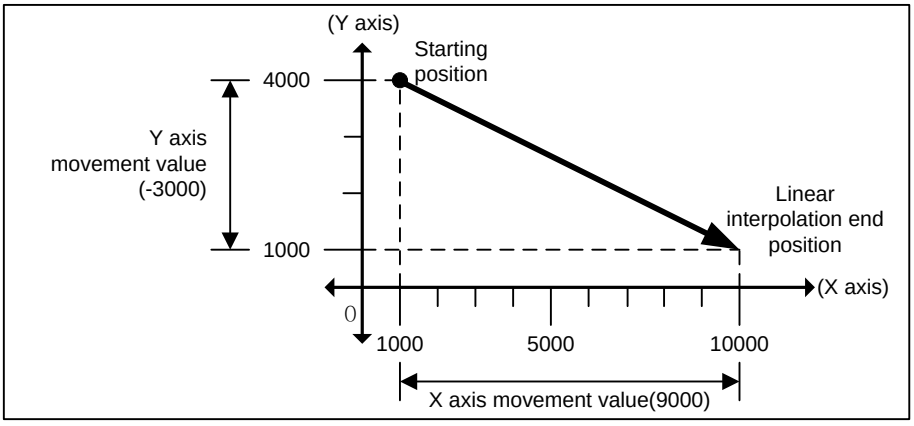
(b) Linear Interpolation by incremental coordinates

1) Goal value becomes movement value
2) Moving direction depends on movement value is positive or negative.
   ■Positive value (+ or 0) : Positioning operation with forward direction
   ■Negative value (-) : Positioning operation with reverse direction



[Example]

■ Starting position (1000, 4000)
■ Goal position (9000, -3000)
  In this condition, operation is as follows.



(2) Circular Interpolation Control

Execute interpolation operation along the trace of circle with 2 axes in forward direction that already designated for each axis.

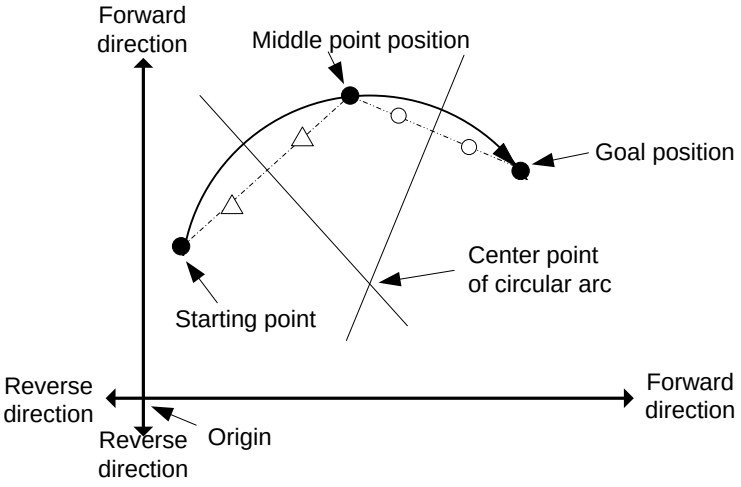
Circular interpolation has 3 types according to auxiliary point, Middle point method passing auxiliary point, Center point method using auxiliary point as center of circle and Radius method using auxiliary point as radius of circle.

In addition, it is available to be executed more than 360° circular interpolation according to the value of "circular interpolation turns'.

The combination of 2 axes that used in circular interpolation is unlimited. (Available to use any 2 of axis1~8)

(a) Middle Point Specified Circular interpolation

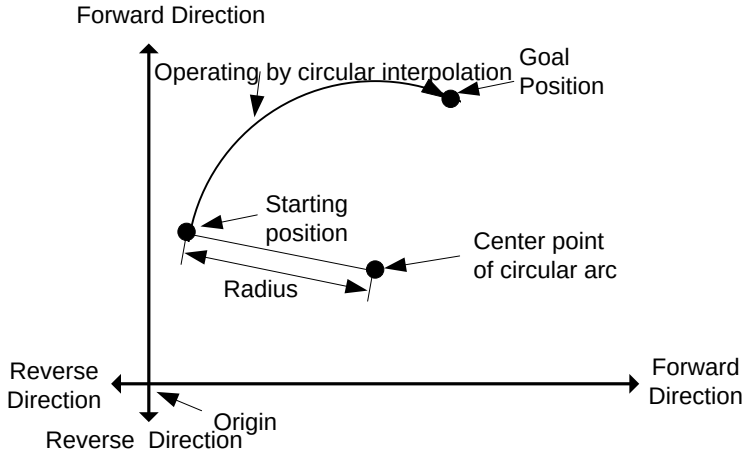
1) Starts operating at starting position and executes circular interpolation through the designated middle point.
2) There will be a circular arc whose center point is crossing point of perpendicular bisection between starting position and middle point or middle point and goal position.



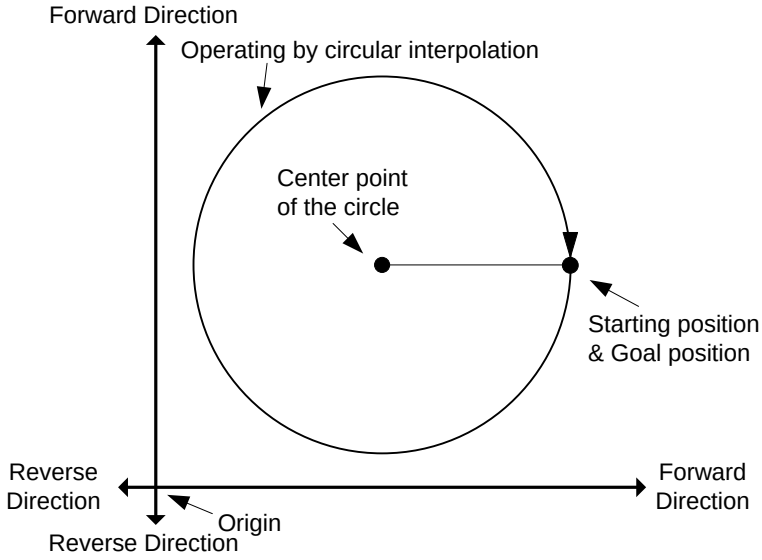
3) Control unit "degree" is not available to be used for circular interpolation control.
4) Movement direction is automatically designated by goal position and auxiliary point of circular interpolation.

(b) Center Point Specified Circular interpolation

1) Starts operating from starting position and execute circular interpolation along trace of circle that has distance from starting point to designated center point as radius.



2) If the goal position is same as starting position, it is available to have an operation like a circle that has distance from starting point to auxiliary point as its radius.

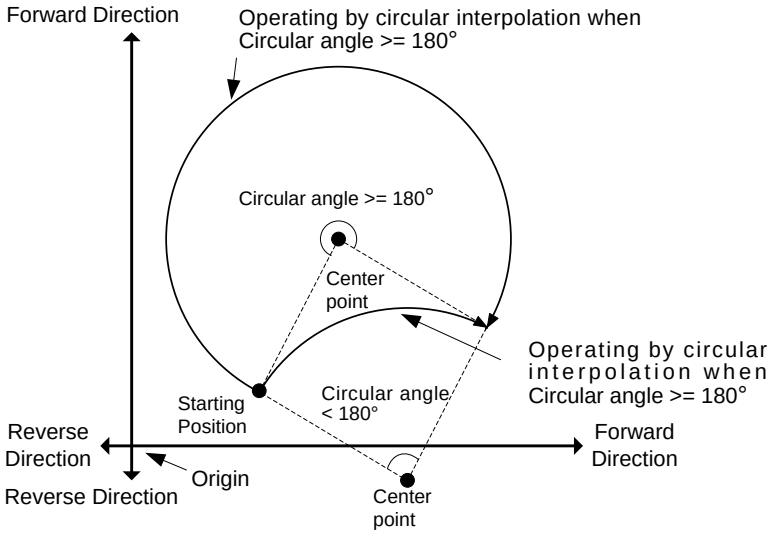


3) Control unit “degree” is not available to be used for circular interpolation control.

4) Direction is determined in setting of “Cir int. mode” (Center point CW, Center point CCW).

(c) Radius Specified Circular interpolation

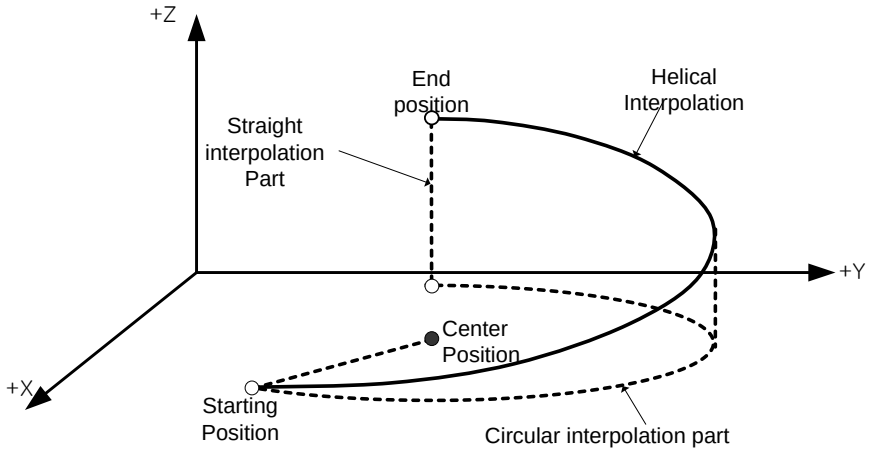
1) Starts operating from starting position and execute circular interpolation along trace of circular arc that has value designated in auxiliary point of main axis as it radius. Depending on size setting of circular arc(<180°,>=180°), center point of circular arc will be different.



2) In radius designation form, goal position can not be set the same as starting position.
3) Control unit “degree” is not available to be used for circular interpolation control.
4) The direction and arc size are determined in “Cir. int. mode”.

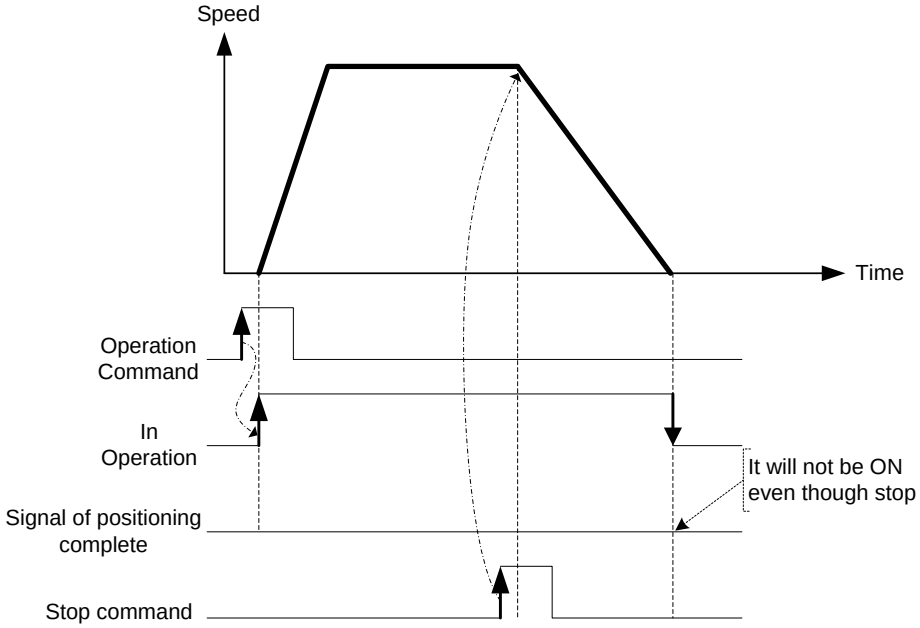
(3) Helical Interpolation

(1) Moves along the designated trace of circular arc depending on circular arc interpolation setting and executes Linear interpolation synchronously.
(2) It is available to execute helical interpolation of more than 360°depending on ‘Circular interpolation turns’ setting.
(3) The combination of axis that used for helical interpolation control is unlimited, 3 axes among axis1 ~ 8 are used.



1.3.3 Speed Control

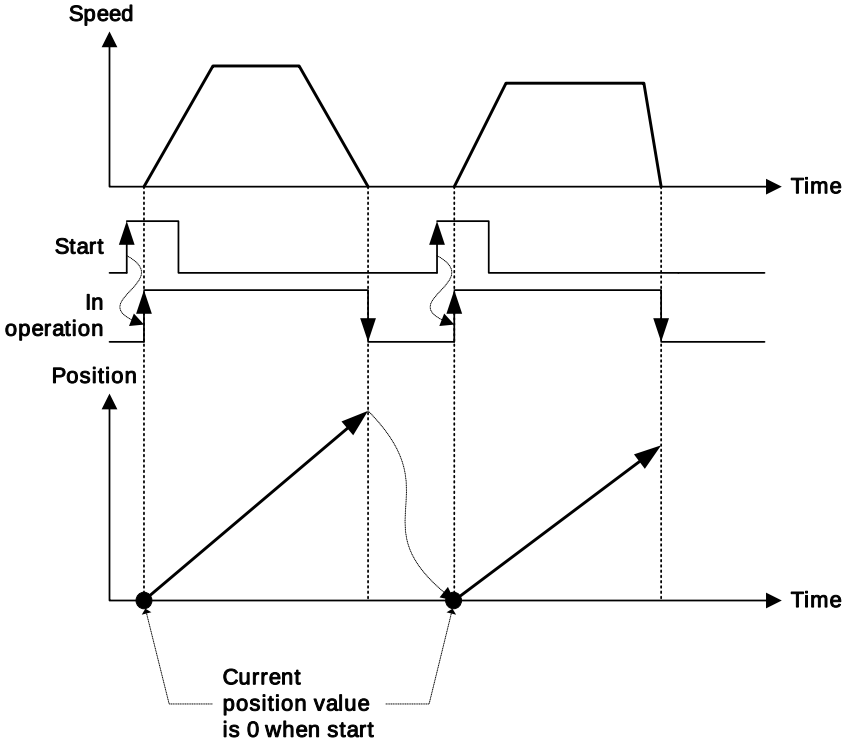
(1) It is executed by positioning operation start command (Direct start, Indirect start, Synchronous start) and keeps operating with designated speed until Dec. stop command.
(2) Speed control has forward operation and reverse operation.
 (a) Forward operation : Position value >= 0
 (b) Reverse operation : Position value < 0
(3) In case of speed control, M code will be on only when M code mode is “With”.
(4) Operating Timing



1.3.4 FEED Control

(1) After executed by positioning start, resets the current position as 0 and starts positioning as much as movement value already set.
(2) Movement direction is decided by movement value.
(3) Feed control has forward direction operation and reverse direction operation.
  (a) Forward direction : Position value >= 0
  (b) Reverse direction : Position value <0

(4) Operation timing is as follows.



Chapter 2 Specifications

2.1 General Specifications

The following table shows the general specification of XGT series.

<table>
<tr><th>No.</th><th>Item</th><th colspan="6">Specifications</th><th>Related specifications</th></tr>
<tr><td>1</td><td>Ambient temperature</td><td colspan="6">0℃ ~ +55℃</td><td>-</td></tr>
<tr><td>2</td><td>Storage temperature</td><td colspan="6">-25℃ ~ +70℃</td><td>-</td></tr>
<tr><td>3</td><td>Ambient humidity</td><td colspan="6">5 ~ 95%RH (Non-condensing)</td><td>-</td></tr>
<tr><td>4</td><td>Storage humidity</td><td colspan="6">5 ~ 95%RH (Non-condensing)</td><td>-</td></tr>
<tr><td rowspan="8">5</td><td rowspan="8">Vibration resistance</td><td colspan="4">Occasional vibration</td><td>-</td><td>-</td></tr>
<tr><td>Frequency</td><td colspan="2">Acceleration</td><td>Amplitude</td><td>How many times</td><td rowspan="8">IEC61131-2</td></tr>
<tr><td>10 ≤ f < 57 ㎐</td><td colspan="2">-</td><td>0.075 ㎜</td><td rowspan="5">10 times each directions (X, Y and Z)</td></tr>
<tr><td>57 ≤ f ≤ 150 ㎐</td><td colspan="2">9.8 ㎨ (1G)</td><td>-</td></tr>
<tr><td colspan="4">For continuous vibration</td></tr>
<tr><td>Frequency</td><td colspan="2">Acceleration</td><td>Amplitude</td></tr>
<tr><td>10 ≤ f < 57 ㎐</td><td colspan="2">-</td><td>0.035 ㎜</td></tr>
<tr><td>57 ≤ f ≤ 150 ㎐</td><td colspan="2">4.9 ㎨ (0.5G)</td><td>-</td></tr>
<tr><td>6</td><td>Shock resistance</td><td colspan="6">• Peak acceleration: 147 m/s^2(15G)
• Duration: 11ms
• Half-sine, 3 times each direction per each axis</td><td>IEC61131-2</td></tr>
<tr><td rowspan="5">7</td><td rowspan="5">Noise resistance</td><td>Square wave Impulse noise</td><td colspan="5">± 1,500V</td><td>LSIS standard</td></tr>
<tr><td>Electrostatic discharge</td><td colspan="5">Voltage : 4kV (contact discharging)</td><td>IEC 61131-2, IEC 61000-4-2</td></tr>
<tr><td>Radiated electromagnetic field noise</td><td colspan="5">80 ~ 1,000 MHz, 10V/m</td><td>IEC 61131-2, IEC 61000-4-3</td></tr>
<tr><td rowspan="2">Fast transient /bust noise</td><td>Segment</td><td>Power supply module</td><td colspan="3">Digital/analog input/output communication interface</td><td rowspan="2">IEC 61131-2, IEC 61000-4-4</td></tr>
<tr><td>Voltage</td><td>2kV</td><td colspan="3">1kV</td></tr>
<tr><td>8</td><td>Environment</td><td colspan="6">Free from corrosive gasses and excessive dust</td><td>-</td></tr>
<tr><td>9</td><td>Altitude</td><td colspan="6">Up to 2,000 ms</td><td>-</td></tr>
<tr><td>10</td><td>Pollution degree</td><td colspan="6">Less than equal to 2</td><td>-</td></tr>
<tr><td>11</td><td>Cooling</td><td colspan="6">Air-cooling</td><td>-</td></tr>
</table>

N0ote

(1) IEC (International Electrotechnical Commission):
An international nongovernmental organization which promotes internationally cooperated standardization in electric/electronic field, publishes international standards and manages applicable estimation system related with.

(2) Pollution degree:
An index indicating pollution degree of the operating environment which decides insulation performance of the devices. For instance, Pollution degree 2 indicates the state generally that only non-conductive pollution occurs. However, this state contains temporary conduction due to dew produced.

2.2 Performance Specifications

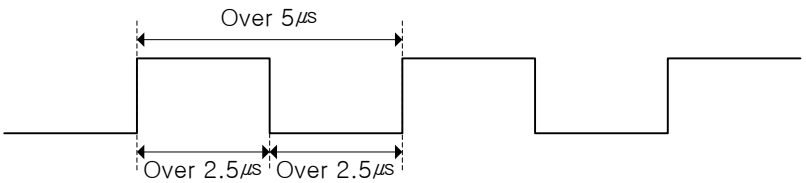
The following table shows the performance specifications of XGT Positioning Module.

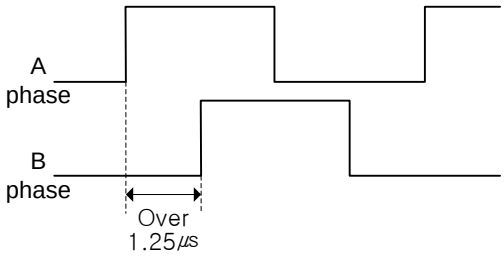
2.2.1 Function Specifications

<table>
<tr><th colspan="3">Items</th><th>Specification</th></tr>
<tr><td colspan="2">No. of control axis</td><td>8</td></tr>
<tr><td colspan="2">Interpolation function</td><td>2~8 axes linear interpolation, 2 axes circular interpolation, 3 axes helical interpolation</td></tr>
<tr><td colspan="2">Control method</td><td>Position control, Speed control, Speed/Position control, Position/Speed control, Position/Torque Control, Feed control</td></tr>
<tr><td colspan="2">Control unit</td><td>Pulse, ㎜, inch, degree</td></tr>
<tr><td colspan="2">Positioning data</td><td>Each axis can have up to 400 operation data .(Operation step number : 1 ~ 400)
Available to set with XG-PM or program</td></tr>
<tr><td rowspan="3">XG-PM</td><td>Connection</td><td>RS-232C port of CPU module or USB</td></tr>
<tr><td>Setting data</td><td>Common, Basic, Extended, Servo parameter, Operation data, Cam data, Command information</td></tr>
<tr><td>Monitor</td><td>Operation information, Trace, Input terminal information, Error information</td></tr>
<tr><td colspan="2">Back-up</td><td>Save the parameter, operation data in FRAM ROM (No need of Battery)</td></tr>
<tr><td rowspan="4">POSITIONING</td><td>Positioning method</td><td>Absolute method/Incremental method</td></tr>
<tr><td>Position address range</td><td>
<table>
<tr><th></th><th>Absolute</th><th>Incremental</th><th>Speed/Position, Position/Speed Switching control</th></tr>
<tr><td>㎜</td><td>-214748364.8~ 214748364.7(㎛)</td><td>-214748364.8~ 214748364.7(㎛)</td><td>-214748364.8~ 214748364.7(㎛)</td></tr>
<tr><td>Inch</td><td>-21474.83648 ~ 21474.83647</td><td>-21474.83648 ~ 21474.83647</td><td>-21474.83648 ~ 21474.83647</td></tr>
<tr><td>degree</td><td>-21474.83648 ~ 21474.83647</td><td>-21474.83648 ~ 21474.83647</td><td>-21474.83648 ~ 21474.83647</td></tr>
<tr><td>pulse</td><td>-2147483648 ~ 2147483647</td><td>-2147483648 ~ 2147483647</td><td>-2147483648 ~ 2147483647</td></tr>
</table>
</td></tr>
<tr><td>Speed range</td><td>
<table>
<tr><td>㎜</td><td>0.01 ~ 20000000.00(㎜/min)</td></tr>
<tr><td>Inch</td><td>0.001 ~ 2000000.000(Inch/min)</td></tr>
<tr><td>degree</td><td>0.001 ~ 2000000.000(degree/min)</td></tr>
<tr><td>pulse</td><td>1 ~ 20,000,000(pulse/SEC)</td></tr>
<tr><td>rpm</td><td>0.1 ~ 100000.0(RPM)</td></tr>
</table>
</td></tr>
<tr><td>Acc./Dec. process</td><td>Trapezoid type, S-type</td></tr>
<tr><td>Acc./Dec. time</td><td>1 ~ 2,147,483,647 ㎳
selection is available from 4 types of acceleration/deceleration pattern</td></tr>
<tr><td colspan="2">Manual Operation</td><td>Jog Operation, MPG Operation, Inching Operation</td></tr>
<tr><td colspan="2">Homing method</td><td>[XGF-PN8A]
upper limit + Z phase (CW), lower limit + Z phase (CCW), DOG + Z phase (CW), DOG + Z phase (CCW), upper limit + DOG + Z phase (CW), lower limit + DOG + Z phase (CCW), Z phase (CW), Z phase (CCW), DOG(CW), DOG(CCW)
[XGF-PN8B]
Refer to the method supported by the servo driver</td></tr>
<tr><td colspan="2">Speed change function</td><td>Speed change (Percent/Absolute value)</td></tr>
</table>

Items		Specification
Torque unit		Rated torque % designation
Absolute position system		Available (when using absolute encoder type servo driver)
External Encoder input	Channel	2 channels
	Max. Input	200 kpps
	Input form	Line drive input (RS-422A IEC specification), open collector output type encoder
	Input type	CW/CCW, PULSE/DIR, Phase A/B
	Connection connector	12-point connector
Communication Period		800 ㎲ (XGF-PN8A), 1ms (XGF-PN8B)
Max. transmission distance		100m
Communication cable		Over CAT.5 STP (Shielded Twisted-pair) cable
Error indication		Indicated by LED
Communication status indication		Indicated by LED
Consumable current		500mA
Weight		115g

2.2.2 Encoder Input Specification

<table>
<tr><th>Item</th><th colspan="2">Specification</th></tr>
<tr><td>Input voltage</td><td>5V (4.5V ~ 5.5V)</td><td rowspan="4">In accordance with RS-422A Line Driver Level</td></tr>
<tr><td>Input current</td><td>7 ㎃ ~ 11 ㎃</td></tr>
<tr><td>Min. On guarantee voltage</td><td>4.1V</td></tr>
<tr><td>Max. Off guarantee voltage</td><td>1.7V</td></tr>
<tr><td>Input pulse</td><td colspan="2">1) Pulse width
 

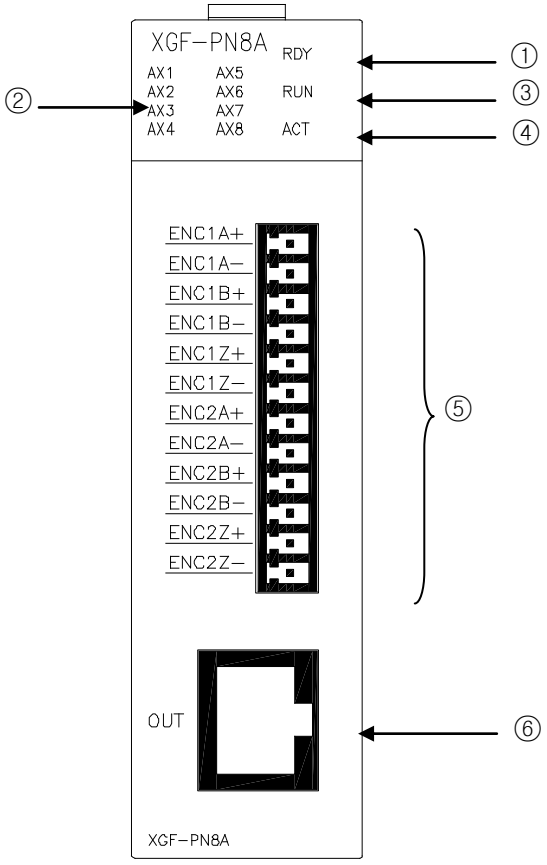
2) Phase difference
 

When A phase input pulse is ahead of B phase input pulse : Position value increases

When B phase input pulse is ahead of A phase input pulse : Position value decreases</td></tr>
</table>

2.3 The Name of Each Part

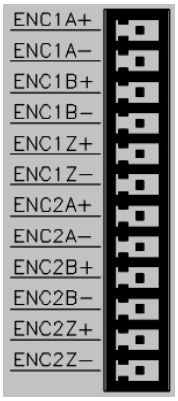
2.3.1 The name of each part



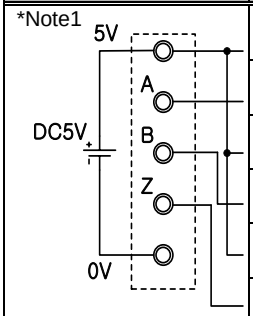
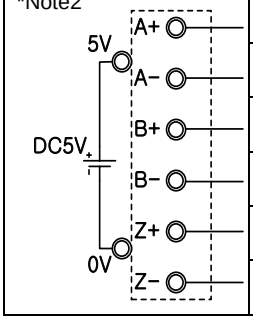
No.	Name	Description
①	Module ready signal	On: Positioning module normal status Off: Power OFF or CPU module reset status Flicker: Positioning module abnormal status
②	Operation indicator LED (AX1 ~ AX8)	On: applicable axis is running Off: applicable axis is stop status Flicker: applicable axis is error status
③	Communication status indicator LED	On: communication with servo driver is connected Off: communication with servo driver is disconnected Flicker: Error occurs during communicating with servo driver
④	TRX status LED	On: Wiring with servo driver is done Off: Wiring with servo driver is not done Flicker: communicating with servo driver
⑤	Connector for encoder wiring	Connector to connect with encoder
⑥	RJ-45 connector	RJ-45 connector to connect with servo driver

2.3.2 Specification of interface with external device

(1) Pin arrangement of connector

Pin arrangement	Pin No.	Signal name		Signal direction
	1	ENC1A+	Encoder 1 A+ input	input
	2	ENC1A-	Encoder 1 A- input	
	3	ENC1B+	Encoder 1 B+ input	
	4	ENC1B-	Encoder 1 B- input	
	5	ENC1Z+	Encoder 1 Z+ input	
	6	ENC1Z-	Encoder 1 Z- input	
	7	ENC2A+	Encoder 2 A+ input	
	8	ENC2A-	Encoder 2 A- input	
	9	ENC2B+	Encoder 2 B+ input	
	10	ENC2B-	Encoder 2 B- input	
	11	ENC2Z+	Encoder 2 Z+ input	
	12	ENC2Z-	Encoder 2 Z- input	

(2) Internal circuit

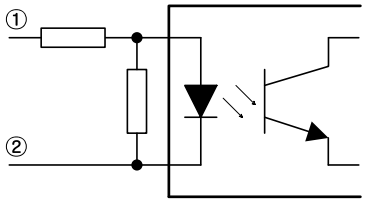
Item	Pin No.	Signal	
*Note1 	1	ENC1A+	Encoder 1A+ input
	2	ENC1A-	Encoder 1 A- input
	3	ENC1B+	Encoder 1 B+ input
	4	ENC1B-	Encoder 1 B- input
	5	ENC1Z+	Encoder 1 Z+ input
	6	ENC1Z-	Encoder 1 Z- input
*Note2 	7	ENC2A+	Encoder 2 A+ input
	8	ENC2A-	Encoder 2 A- input
	9	ENC2B+	Encoder 2 B+ input
	10	ENC2B-	Encoder 2 B- input
	11	ENC2Z+	Encoder 2 Z+ input
	12	ENC2Z-	Encoder 2 Z- input

Note

*Note1
Wiring of encoder 1 is example about 5V voltage output type (open collector). When using 12V, 24V type MPG, change the input voltage from 5V to 12V or 24V and in case of 12V, connect 910Ω resistor to ENC1 A+(pin 1), ENC1 B+ (pin3), in case of 24V, 2.4kΩ resistor, before connecting the power source (adding PULL-UP resistor is needed)

*Note2
Wiring of encoder 2 is example about 5V voltage output type (line driver)

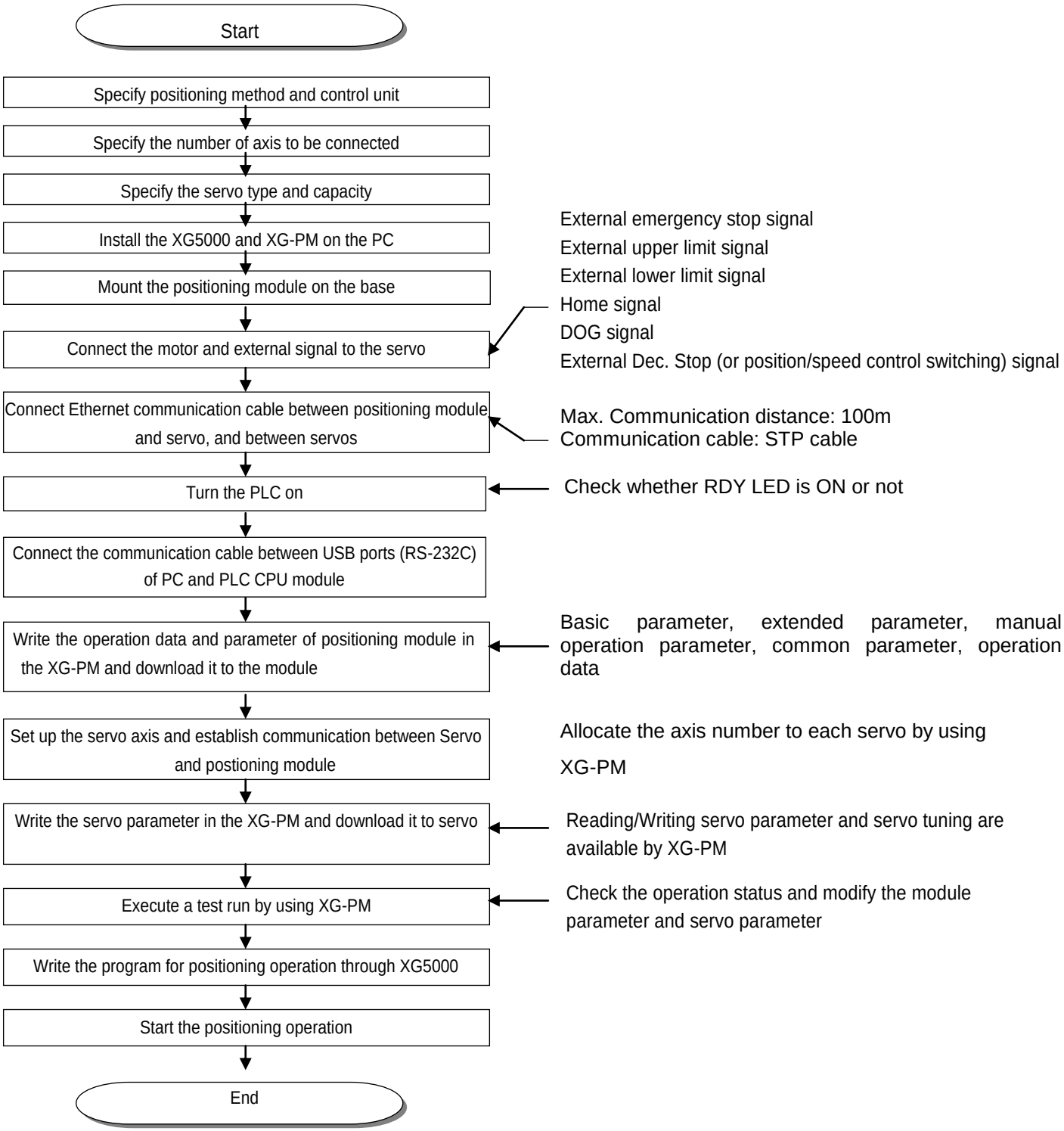
This describes the internal circuit of the module when connecting the encoder.

Item	Internal circuit	No.	Terminal	Pin number		Signal name
				Encoder 1	Encoder 2	
Input		①	A+	1	7	A phase pulse input +
		②	A-	2	8	A phase pulse input -
		①	B+	3	9	B phase pulse input +
		②	B-	4	10	B phase pulse input -
		①	Z+	5	11	Z phase pulse input +
		②	Z-	6	12	Z phase pulse input -

Chapter 3 Operation Order and Installation

3.1 Operation Order

▶ Here describes the Operation order in case of positioning operation by positioning module.



3.2 Installation

3.2.1 Installation Environment

This machine has a good reliability regardless of installation environment but cares should be taken in the following items to guarantee the reliability and safety of the system.

(1) Environment Condition

- Install the control panel available for water-proof, anti-vibration.
- The place free from continuous impact or vibration.
- The place not exposed to direct rays.
- The place with no dew phenomena by rapid temperature change.
- The place where surrounding temperature maintains 0-55℃.

(2) Installation Construction

- In case of processing the screw hole or wiring, cares should be taken not to put the wiring remnants to PLC inside.
- Install on the good place to operate.
- Do not install the high voltage machine on the same Panel.
- The distance from duct or surrounding module shall be more than 50mm.
- Ground to the place where surrounding noise environment is good enough.

3.2.2 Notices in Handling

Here describes the notices in handling the positioning module from opening to installation.

(1) Do not fall down or apply the strong impact.
(2) Do not remove PCB from the case. It may cause the failure.
(3) In wiring, cares should be taken not to put the wiring remnants or foreign materials to the upper part of module. If something entered, it should be removed.
(4) The removal of module in the status of power ON is prohibited.

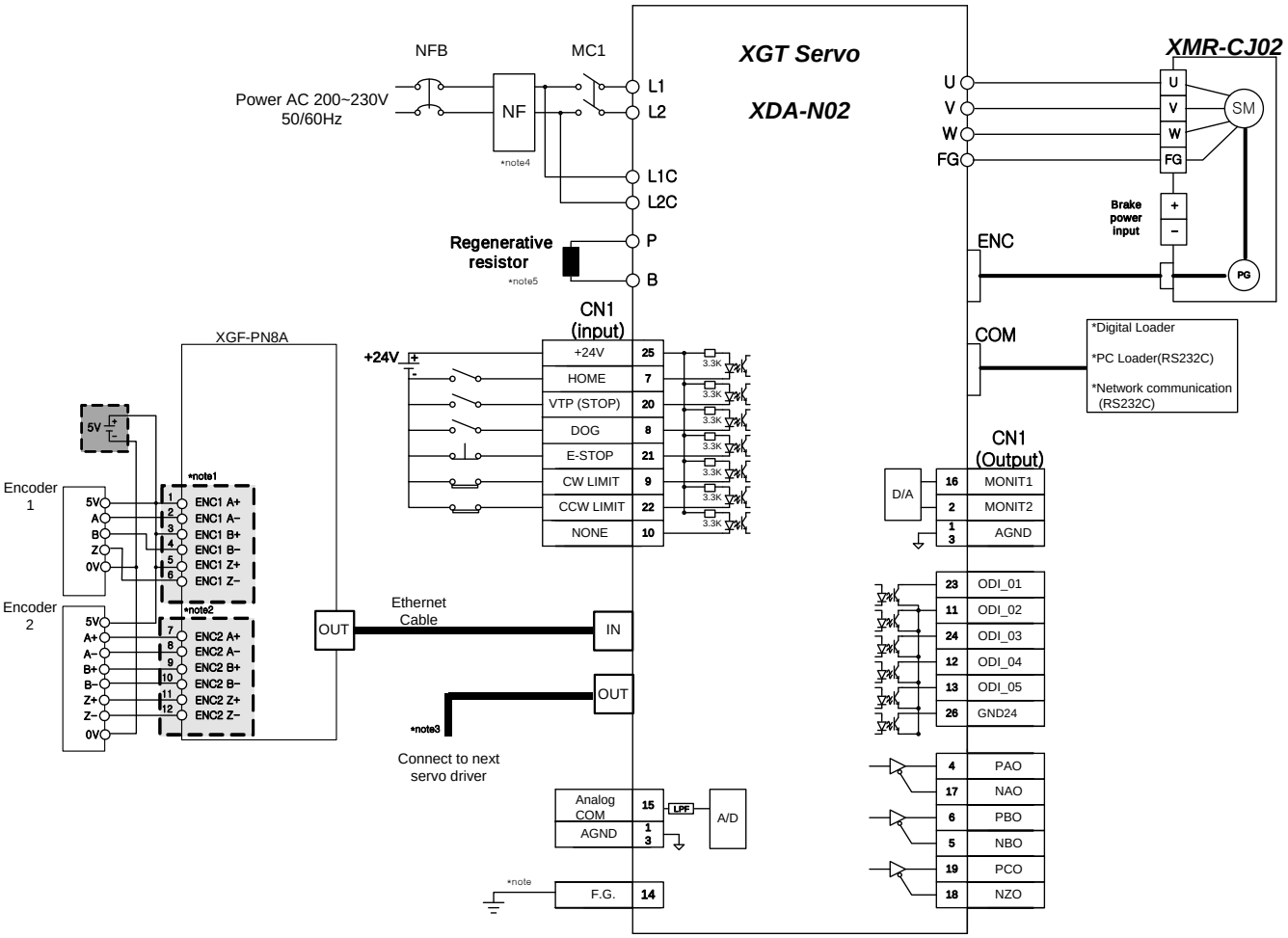
3.3 Notices in Wiring

3.3.1 Notices in Wiring

(1)The length of connecting cable between positioning module and drive machine shall be as short as possible. (Max. length: 2m and 10m).
(2)For alternating current and external I/O signal of positioning module, it is required to use the separate cables to avoid the surge or induction noise generated from the alternating current.
(3)The wires should be selected considering surrounding temperature, allowable current and it is recommended to be more than max. size AWG22(0.3㎟).
(4)In wiring, if it is too close to the high temperature machine or material or it is directly contacted to the oil for a long time, the short-circuit will occur that may cause the damage or malfunction.
(5)Make sure to check the polarity before applying the external contact signal to the terminal board.
(6)In case of wiring the high voltage cable and power cables together, the induction noise occurs that may cause the malfunction or failure.
(7)In case of wiring by the pipe, the grounding of pipe is required.
(8)For the communication cable between the positioning module and the driver, user STP CAT-5 or above for connection
(9)When the communication error occurs during operation of positioning module, which may be caused by noise interference in wiring between the positioning module and the driver. At this time, attach Ferrite Core to the communication cable to prevent the noise

3.3.2 Connection Example of Servo and Stepping Motor Drive Machine

(1) This is wiring example connecting 200W servo drive/motor to positioning module (XGF-PN8A).



Note

*Note1

Wiring of encoder 1 is an example about 5V voltage output (open collector) type.

*Note2

Wiring of encoder 2 is an example about 5V voltage output (line driver) type.

*Note3

When connecting more than 2 servo drivers, connect first servo driver's IN to the positioning module's OUT and for other servo drivers, connect previous servo driver's OUT to next servo driver's IN. last servo driver's OUT doesn't need to be connected. And connection order is not related with axis order.

*Note4

NF is abbreviation of Noise Filer. It is necessary to prevent the noise from coming in.

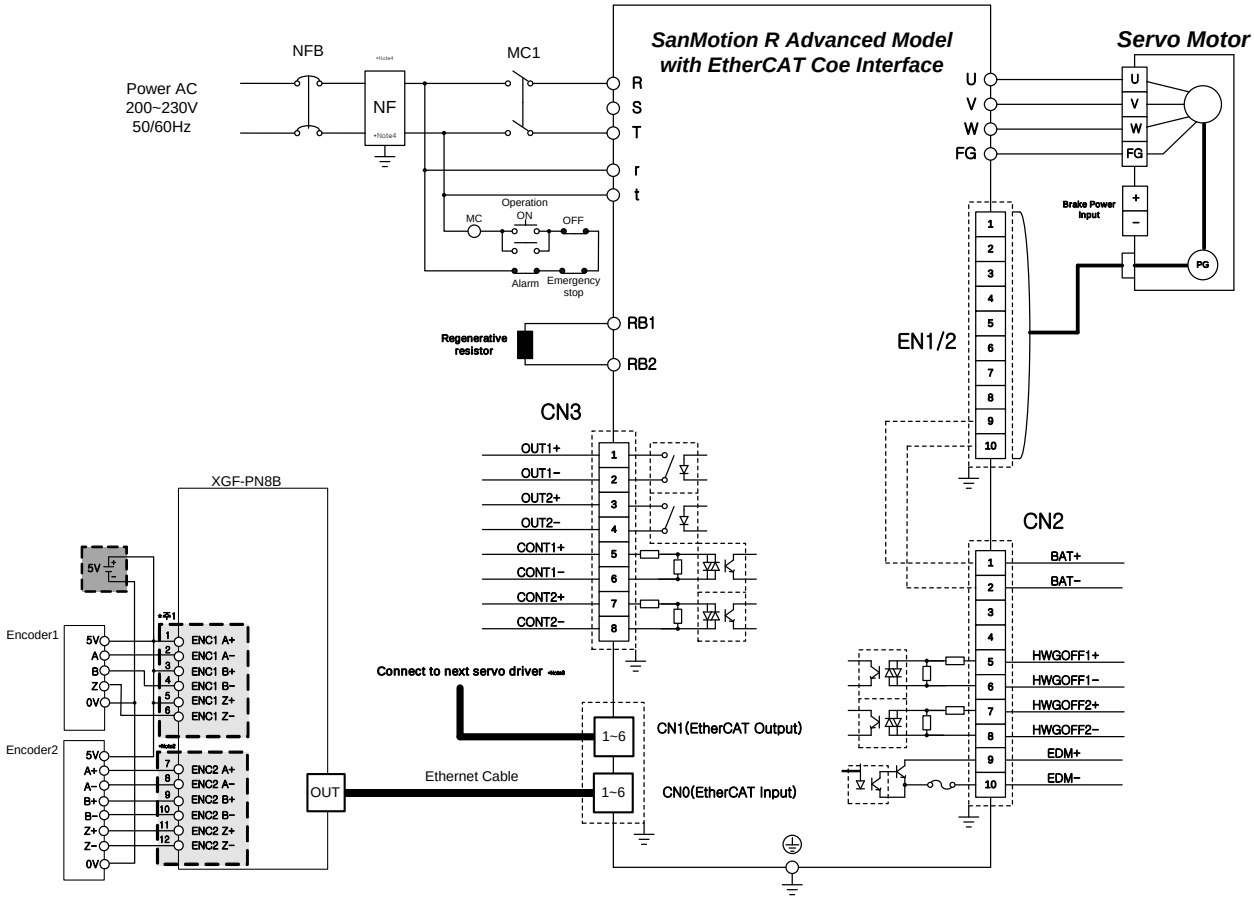
*Note5

The regenerative resistor of the XDA-N005/N010 is installed at the inside of driver as bult-in type. The regenerative resistor of XDA-N001/N002/N004, XDA-N015 and above is not built-in type. Therefore, check the capacity and apply it to the driver.

*Note6

Surely connect the ground line of CN1 cable to FG (Frame Ground) terminal.

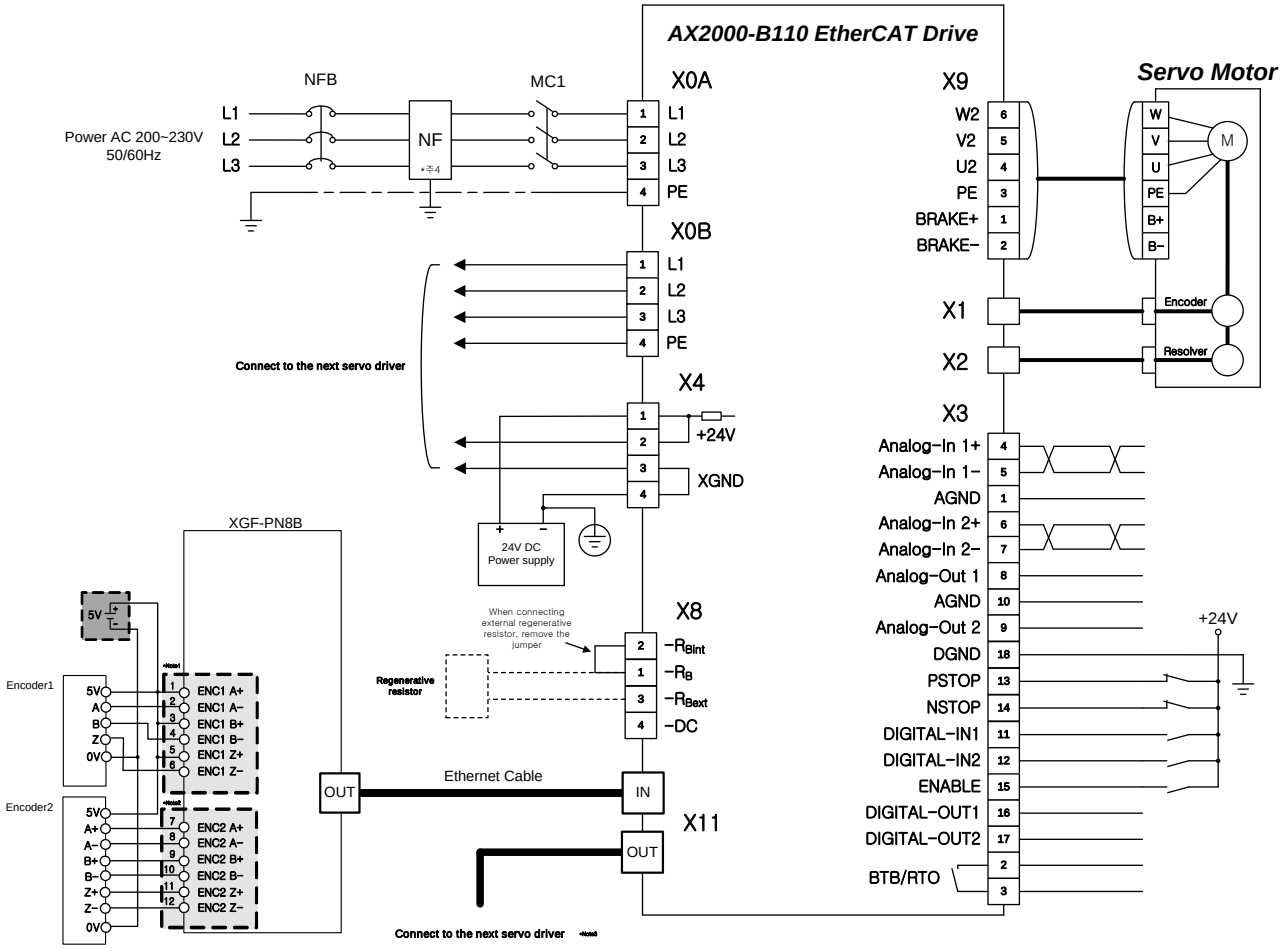
(2) This is wiring example connecting SanMotion R Advanced Model EtherCAT servo drive/motor to network standard type positioning module (XGF-PN8B). For detail on installation and wiring, refer to the driver manual.



Note

*Note1
Wiring of encoder 1 is an example about 5V voltage output (open collector) type.
*Note2
Wiring of encoder 2 is an example about 5V voltage output (line driver) type.
*Note3
When connecting more than 2 servo drivers, connect first servo driver's IN to the positioning module's OUT and for other servo drivers, connect previous servo driver's OUT to next servo driver's IN. last servo driver's OUT doesn't need to be connected. And connection order is not related with axis order.
*Note4
NF is abbreviation of Noise Filer. It is necessary to prevent the noise from coming in.

(3) This is wiring example connecting BeckHoff AX2000 servo drive/motor to network standard type positioning module (XGF-PN8B). For detail on installation and wiring, refer to the driver manual.



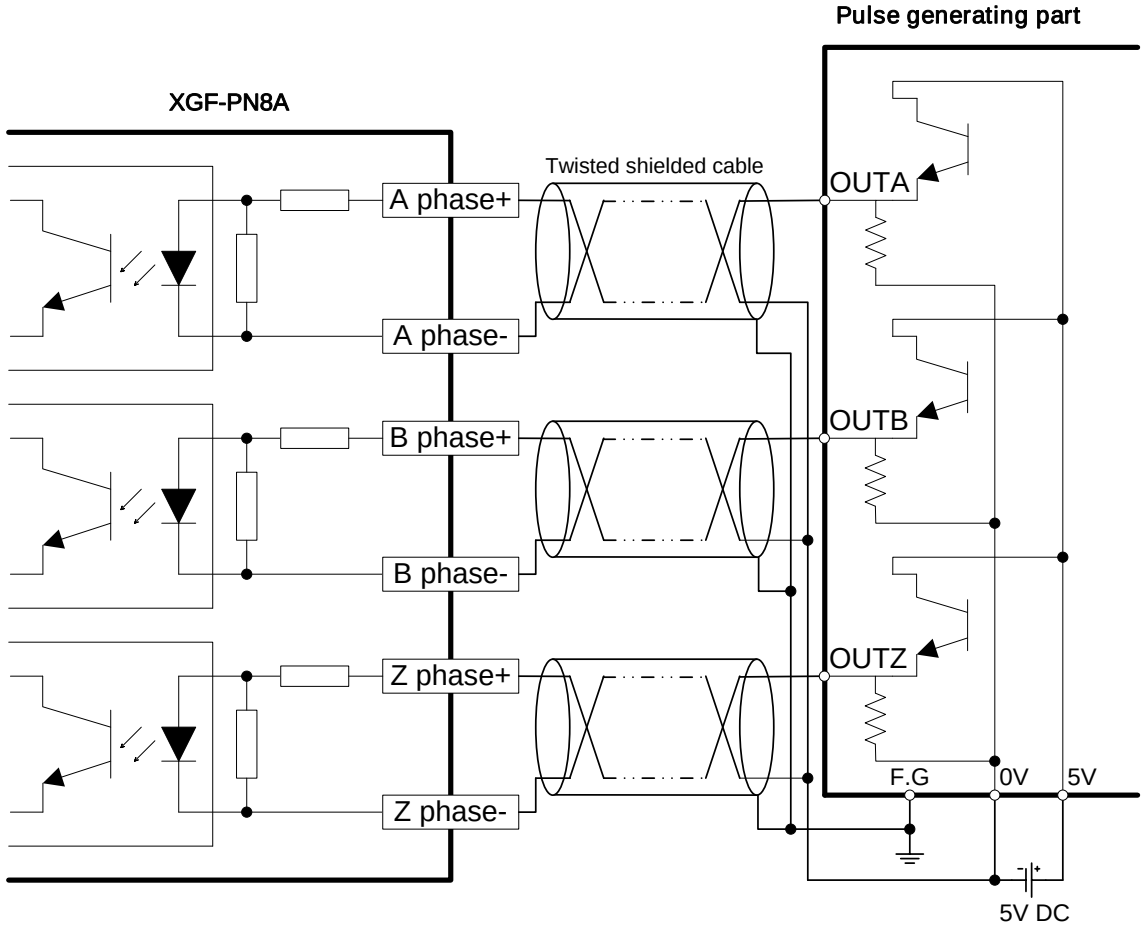
Note

*Note1
Wiring of encoder 1 is an example about 5V voltage output (open collector) type.
*Note2
Wiring of encoder 2 is an example about 5V voltage output (line driver) type.
*Note3
When connecting more than 2 servo drivers, connect first servo driver's IN to the positioning module's OUT and for other servo drivers, connect previous servo driver's OUT to next servo driver's IN. last servo driver's OUT doesn't need to be connected. And connection order is not related with axis order.
*Note4
NF is abbreviation of Noise Filer. It is necessary to prevent the noise from coming in.

3.3.3 Encoder Input (DC 5V Voltage Output) Wiring Example

When Pulse Generator is a Voltage Output type, wiring example of positioning module and Encoder input part is as follows.

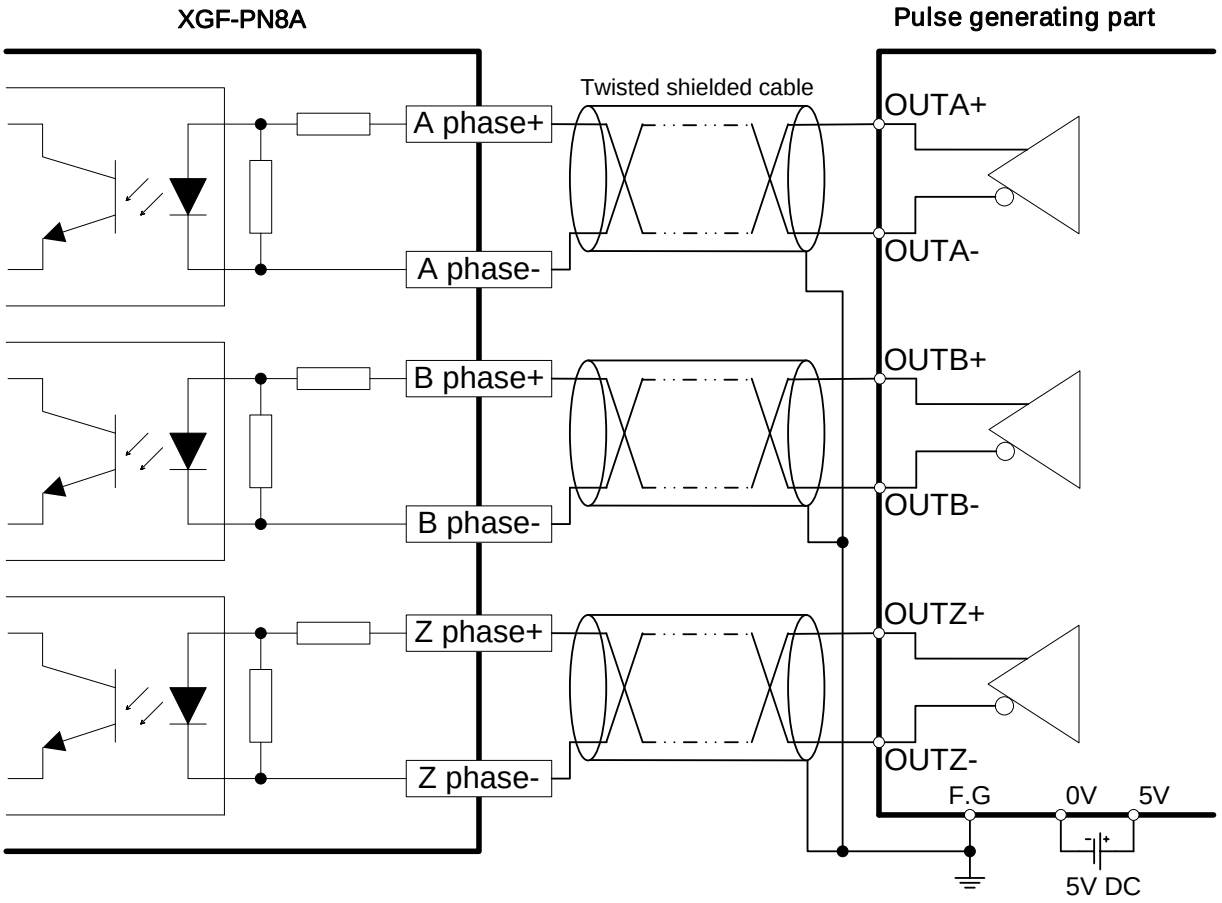
In case pulse generator is totem-pole output and used as voltage output style, wiring is equal.



Notes

Before Wiring, please consider maximum output distance of pulse generator.

3.3.4 Encoder Input (5V Line Driver Output) Wiring Example



Notes

Before Wiring, please consider maximum output distance of pulse generator.

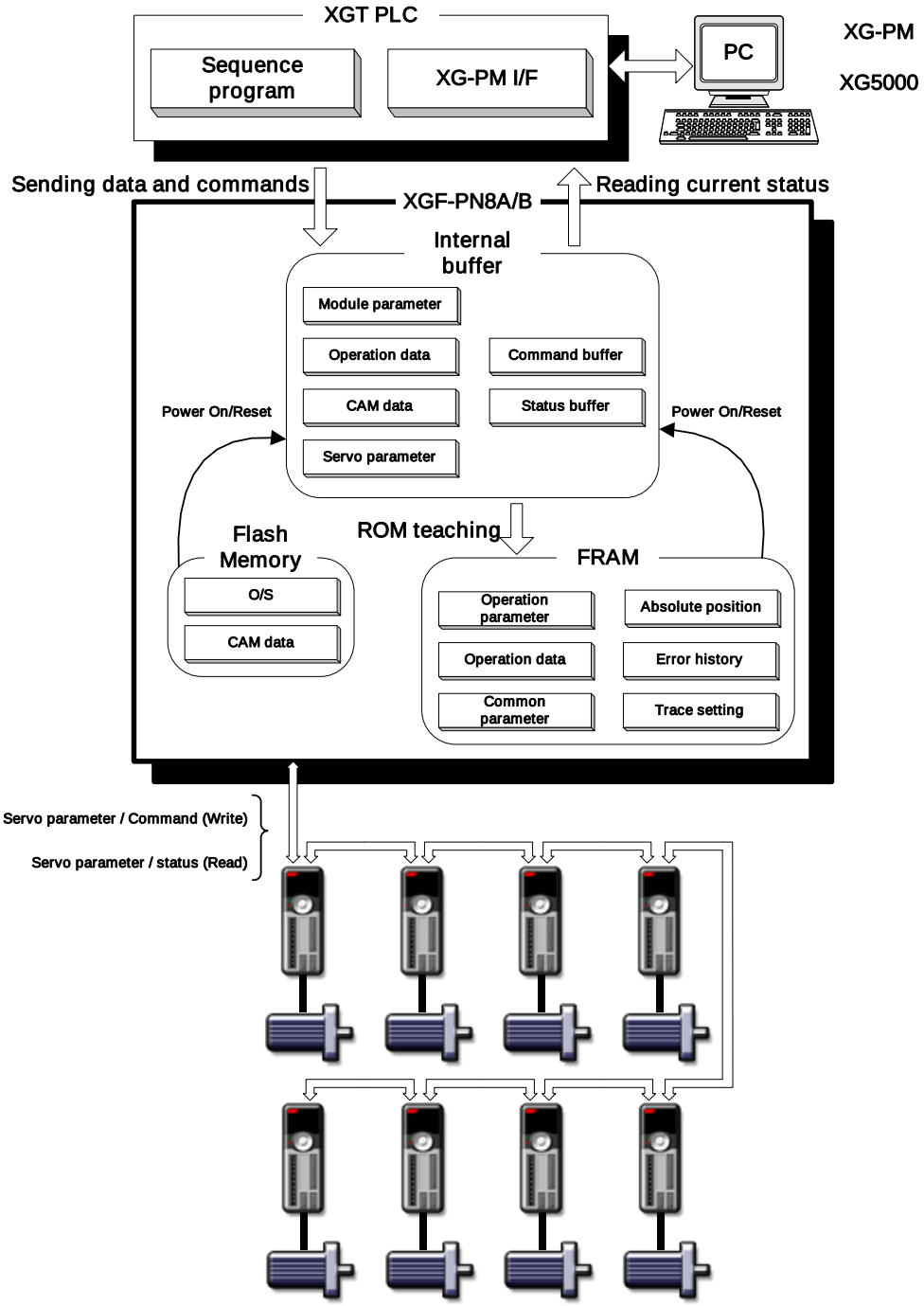
Chapter 4 Positioning Parameter & Operation Data

This chapter describes parameter and operation data to be set by software package with positioning module.

Item of Parameter and operation data should be set for each axis. (But common parameter shall be applied to all axes equally)

4.1 Parameter & Operation data

This picture describes process of parameter and operation data saved in the module.



4.2 Basic Parameter

▶ Here describes about basic parameter of positioning module.

4.2.1 Basic parameter

Basic parameter item		Setting range
Speed limit		㎜ : 1 ~ 2,147,483,647 [X10^{-2} ㎜/min] Inch : 1 ~ 2,147,483,647 [X10^{-3}Inch/min] degree : 1 ~ 2,147,483,647 [X10^{-3} degree/min] pulse : 1 ~ 2,147,483,647 [pulse/sec]
Acceleration time 1		1 ~ 2,147,483,647 [ms]
Acceleration time 2		
Acceleration time 3		
Acceleration time 4		
Deceleration time 1		1 ~ 2,147,483,647 [ms]
Deceleration time 2		
Deceleration time 3		
Deceleration time 4		
Deceleration time for EMG stop		1 ~ 2,147,483,647 [ms]
Pulse per rotation		1 ~ 200,000,000
Travel per rotation		
Control word	unit (bit 2 ~ 3)	0:Pulse, 1:mm, 2:Inch, 3:Degree
	Unit multiplier (bit 4 ~ 5)	0: x 1, 1: x 10, 2: x 100, 3: x 1000
	Speed command unit (bit 6)	0: unit/time, 1: rpm
	Encoder select (bit 7)	0:Incremental Encoder, 1:Absolute Encoder
	Current position display correction(bit 8 ~ 15)	0 ~ 255

Notes

1. For Deceleration time in case of stop, when it stops by DEC. stop, DEC. time set in command is applied. At this time, if DEC. time is set as 0 in command, DEC. time set in basic parameter is applied. In case it stops by EMG stop because of internal factor, not external factor, EMG stop deceleration time in basic parameter is applied.
2. Among basic parameters, “Encoder select” is applied to only XGF-PN8B module.

4.2.2 Basic parameter setting

(1) Unit

(a) You can set the command unit for positioning control according to control object. The command unit (mm, inch, pulse, degree) can be set for each axis separately.

(b) In case of changing the unit setting, as the value of other parameter and operation data does not change, the value of parameter or operation data should be set within the setting range of the unit to be changed.

Ex) mm, inch, pulse : X-Y Table, Conveyor

degree : a body of rotation (360degree/rotation)

(2) Pulse per Rotation

(a) Only in case of using mm, inch, degree as a positioning command unit, you should set pulse per rotation

(b) For XGF-PN8A, multiply the value in “Encoder pulses” of servo parameter P1-13 by 4 and use the result as “Pulse per rotation”. If the value does not correspond with parameter value of servo drive, command and motor action can be different.

Travel per pulse = Transfer per rotation (Al) / Pulse per rotation (Ap)

(3) Travel per rotation and unit multiplier

(a) Only in case of using mm, inch, degree as a positioning command unit, you should set travel per rotation and multiplier

(b) Machine’s travel per rotation of motor is determined by the structure of machine.

If the lead of ball screw (mm/rev) is PB and the rate of deceleration is 1/n,

Transfer amount per rotation (AL) = PB ×1/n.

(c) Settable Travel per rotation (Al) is listed below

Setting unit	mm	Inch	degree
Travel per rotation	0.1 ~ 20000000.0 um	0.00001 ~ 2000.00000 inch	0.00001 ~ 2000.00000 degree

In case AL exceeds the above range, the travel per rotation (Al) should be set as follows:

Transfer amount (AL) = PB ×1/n

= Travel per rotation (Al) × Unit multiplier (Am)

Note)

In case unit is mm, unit multiplier (Am) is 1,10,100,1000. If the value of “PB ×1/n” exceeds 20000000.0 ㎛, it is required to adjust the unit multiplier so that the travel per rotation (Al) does not exceed 20000000.0 ㎛.

Ex1) In case that (AL) = PB ×1/n = 2500000.0 ㎛(= 2500 ㎜),

(AL) = (Al) × (Am) = 25000000 ×1

Ex2) In case that (AL) = PB ×1/n = 25000000.0 ㎛(= 25000 ㎜),

(AL) = (Al) × (Am) = 25000000 ×10

= 2500000 ×100

(4) Speed Limit, Acceleration Time, Deceleration Time

(a) Speed Limit

Speed limit is maximum speed can be set by positioning operation.

All of the operating speed should be set to be lower than speed limit in positioning operation.

(b) Acceleration Time

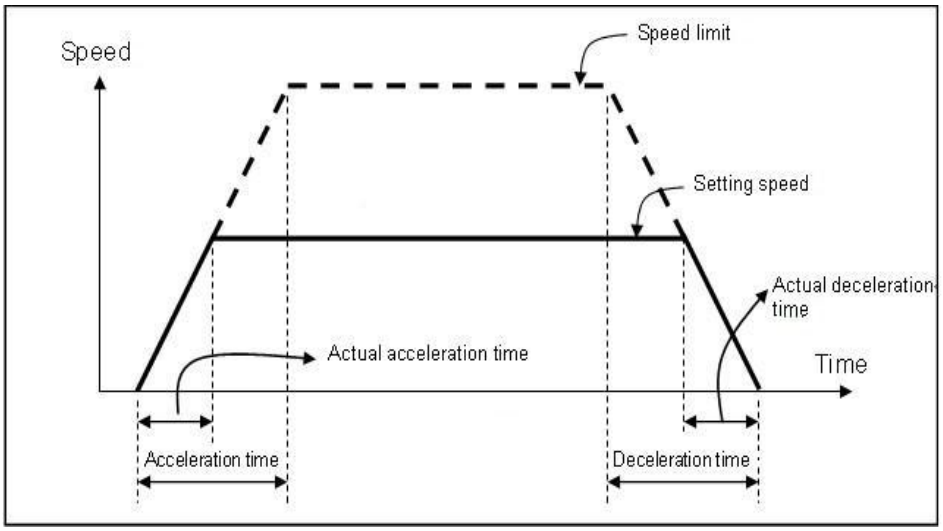
The time required to reach from speed “0” (stop state) to the speed limit which is set by parameter.

(It doesn’t mean that the time require to reach to the operation speed.)

(c) Deceleration Time

The time required to reach from the speed limit set by parameter to the bias speed “0” (stop state).

(It doesn’t mean that the time require to reach from the operation speed to the speed “0”.)



(5) Encoder Select

(a) This item is applied to only XGF-PN8B. It sets up the encoder type. If you use absolute position system, select 1: absolute encoder.

(b) The following describes setting of 「Encoder Select」

Item	Setting value	Contents
Encoder select	0: Incremental encoder	After power On/Off, it doesn’t keep previous position of the servo motor. After power On/Off, “Origin Fix” status is always off.
	1: Absolute encoder	Absolute position system is activated. After power On/Off, it keeps previous position of the servo motor. For “Origin fix” status, it keeps previous status, too.

(6) Current Position Display Correction

(a) The Current Position Display Correction is a parameter used to display the current position value of the servo motor as an command position without displaying it as a fixed value according to user applications and gain setting if there are little changes in the current position value.

(b) If not during the operation, display the current position value as command position value when the difference between the command position and the current position is within the Current Position Display Correction.

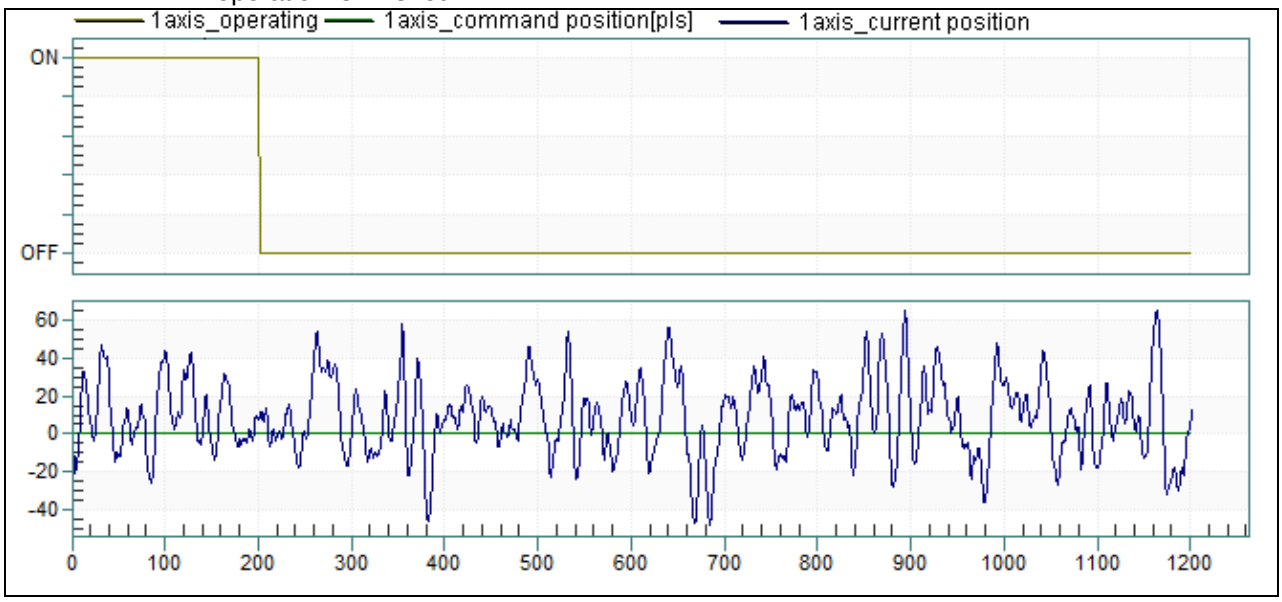
(c) The following values can be set as the Current Position Display Correction.

Setting unit	pulse	mm	Inch	degree
Current Position Display Correction	0 ~ 255	0.0 ~ 25.5 um	0.0 ~ 0.00255 inch	0.0 ~ 0.00255 degree

(d) The following shows an example of the Current Position Display Correction according to its value when the command location is 0.

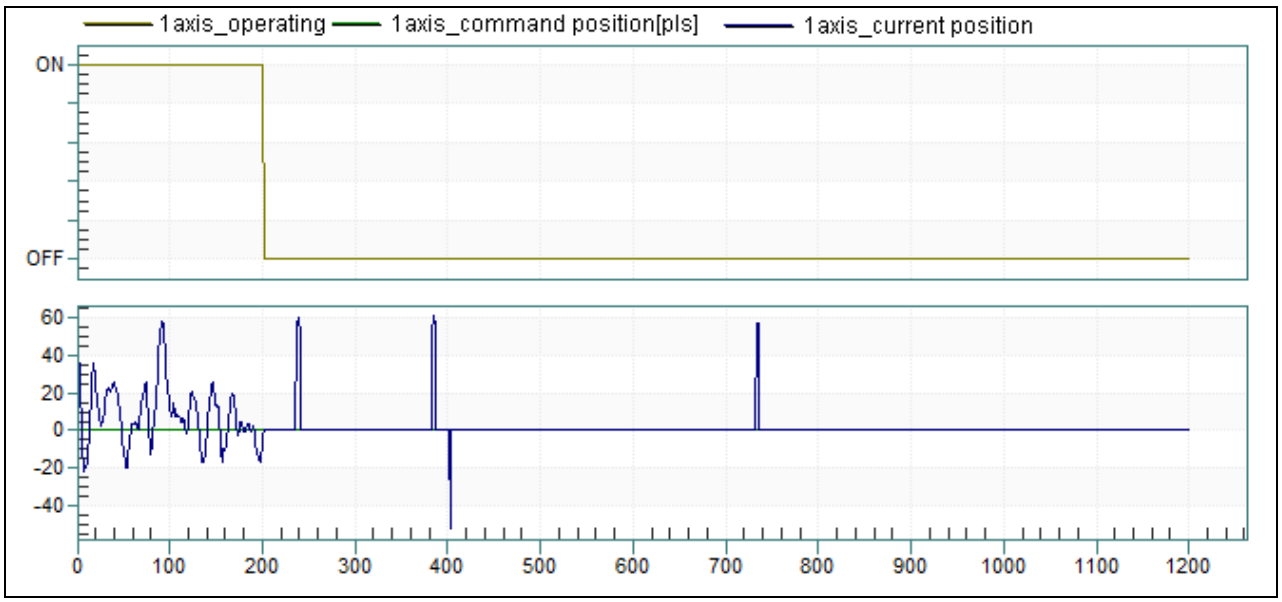
① Current Position Correction = 0 pls

- The motor's actual position value is still displayed as the current position value even after the operation is finished.



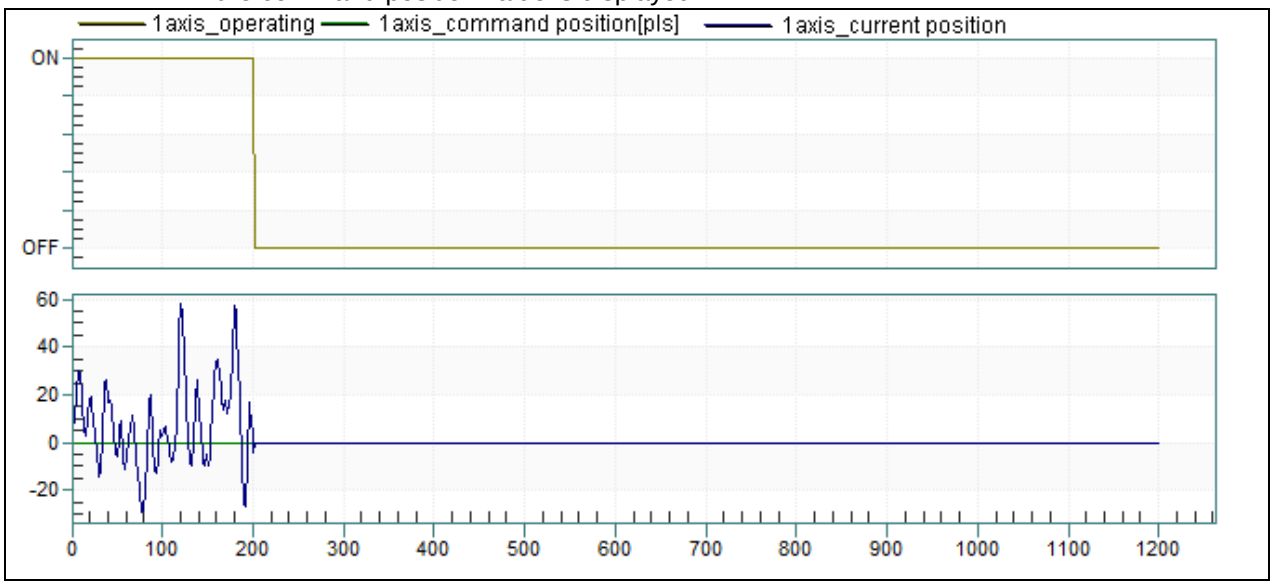
② Current Position Correction = 50 pls

- If current position value is within ±50 from the command position after the operation is finished, the command position value is displayed.



③ Current Position Correction = 100 pls

- If current position value is within ±100 from the command position after the operation is finished, the command position value is displayed.



4.3 Extended Parameter

It describes about extended parameter of positioning module.

4.3.1 Contents of extended parameter

Extended parameter Items		Setting Range
Software upper limit		㎜: -2147483648 ~ 2147483647[X10^{-4} ㎜] Inch: -2147483648 ~ 2147483647[X10^{-5}Inch] degree: -2147483648 ~ 2147483647[X10^{-5}degree] pulse: -2147483648 ~ 2147483647[pulse]
Software lower limit		
Infinite running repeat position		mm: 1 ~ 2147483647[X10^{-4} ㎜] Inch: 1 ~ 2147483647[X10^{-5}Inch] degree: 1 ~ 2147483647[X10^{-5}degree] pulse: 1 ~ 2147483647[pulse]
Position completion time		0 ~ 65,535 [unit: ms]
S-Curve ratio		1 ~ 100 [unit: %]
In-position width		mm: 0 ~ 2147483647[X10^{-4} ㎜] Inch: 0 ~ 2147483647[X10^{-5}Inch] degree: 0 ~ 2147483647[X10^{-5}degree] pulse: 0 ~ 2147483647[pulse]
Arc insertion position in 2-axis linear interpolation continuous operation		
Control Word	Acceleration/Deceleration pattern (bit 1)	0:Trapezoid operation, 1:S-Curve operation
	M Code mode (bit 2 ~ 3)	0:NONE, 1:WITH, 2:AFTER
	Software limit detect (bit 5)	0:Don't detect, 1: Detect
	Interpolation speed selection (bit 4)	0: main axis speed, 1: synthetic speed
	External command selection (bit6 ~ 7)	0: External VTP, 1: External stop, 2: External latch
	External command (bit8)	0: Disable, 1: Enable
	Speed/Position switching coordinate(bit9)	0: incremental, 1: absolute
	Positioning complete condition (bit 10 ~ 11)	0 : Dwell time 1 : In-position 2 : Dwell time and in-position 3 : Dwell time or In-position
	Infinite running repeat (bit 12)	0: Disable, 1: Enable
	Interpolation continuous operation Type (bit 13)	0 : Pass target position 1 : Pass near position
	Arc insertion in 2-axis linear interpolation continuous operation (bit 14)	0 : Don't insert 1 : Insert arc continuous operation
	Pos.-specified speed override coordinate (bit 15)	0: absolute, 1: incremental

- External command selection and external command items are applied to only XGF-PN8A.

Notes

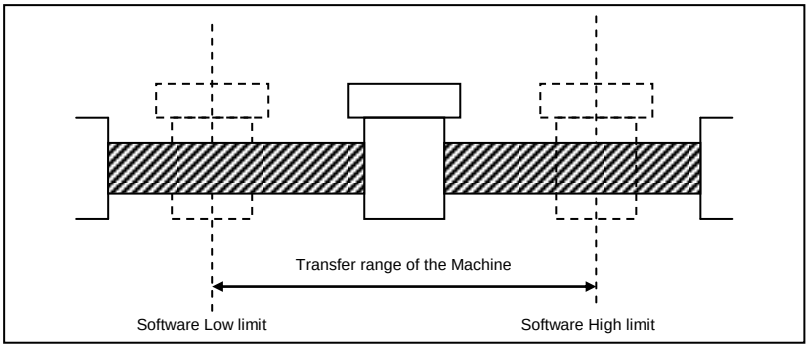
In case of XGF-PN8B, external command selection and external command items are applied only when LS MECAPIONL 7N servo drive is used. The servo drive's DI#1 signal is used as external command. To use DI#1 as external command signal, do not assign other functions to DI#1 in Defining Servo Parameter Input Signal (0x2200, 0x2201) item.

4.3.2 Extended parameter setting

(1) Software Upper/Lower Limit

(a) The function is designed so that the machine does not execute the positioning operation out of the range by setting the range of machine available to move through software upper limit and software lower limit. That is, this function is used to prevent any breakaway by incorrect operation position setting and incorrect operation by user program fault.

(b) External input upper/lower limit can be also set besides the software upper/lower limit.



(c) The range check of software upper/lower limit shall be done at the start of operation and during operating.

(d) If the software upper/lower limit is detected, error (Software upper limit error: 501, Software lower limit error: 502) occurs and the pulse output of positioning module shall be disabled.

Therefore, when you want to operate again, it is required to reset error.

(e) Setting range

Unit	Software upper/lower limit range
pulse	-2147483648～2147483647[pulse]
㎜	-2147483648～2147483647[X10^{-4}㎜]
Inch	-2147483648～2147483647[X10^{-5}Inch]
degree	-2147483648～2147483647[X10^{-5}degree]

But Software upper limit value always should be higher than software lower limit, at least same.

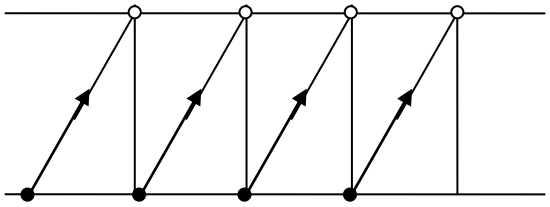
(f) If the software upper/lower limit was set by default value (upper limit: 2,147,483,647, lower limit: -2,147,483,648) or same value, then it wouldn't detect upper/lower limit.

(2) Infinite running repeat position

(a) When using “Infinite running repeat” mode, it sets the repeated position value.

(b) This is applied when “Infinite running repeat” in the extended parameter is “1: Enable”. When this parameter setting value is “0: Disable”, command position and current position is expressed within position expression range according to value set in “Unit” of basic parameter.

(c) When “Infinite running repeat” parameter is “1: enable”, command position and current position is expressed as 0 ~ “infinite running repeat position-1”.



(d) Setting range

Unit	Infinite running repeat position range
pulse	1～2147483647[pulse]
㎜	1～2147483647[X10^{-4} ㎜]
Inch	1～2147483647[X10^{-5}Inch]
degree	1～2147483647[X10^{-5}degree]

(3) Infinite running repeat

(a) It sets whether to enable or disable “Infinite running repeat”

(b) When you set “Infinite running repeat” as “1: enable”, command position and current position refreshes within the range set in “Infinite running repeat position” periodically.

(c) When you don’t use “Infinite running repeat” function, set as “0: disable”.

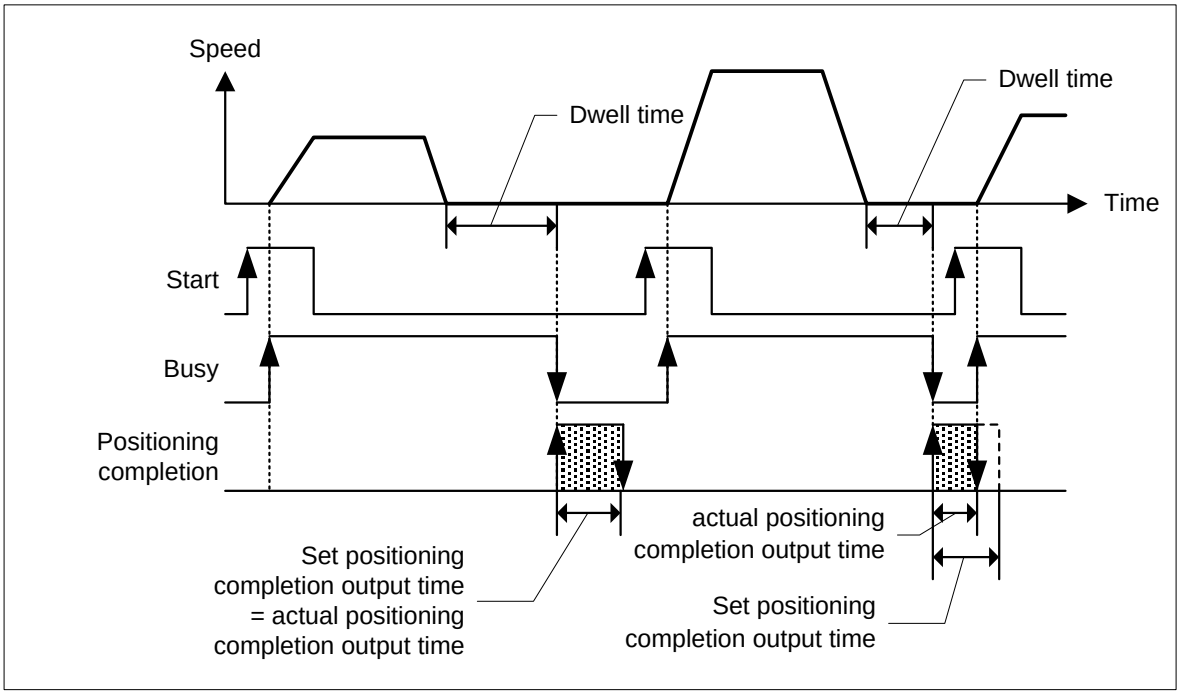
(4) Positioning Completion Time

(a) Positioning completion signal shall be OFF after sustaining “ON” for Positioning Completion Time after positioning is completed and positioning completion signal becomes “ON” in single operation, repeat operation, keep operation, continuous operation, linear interpolation operation, circular interpolation operation, speed/position switching control operation, inching operation

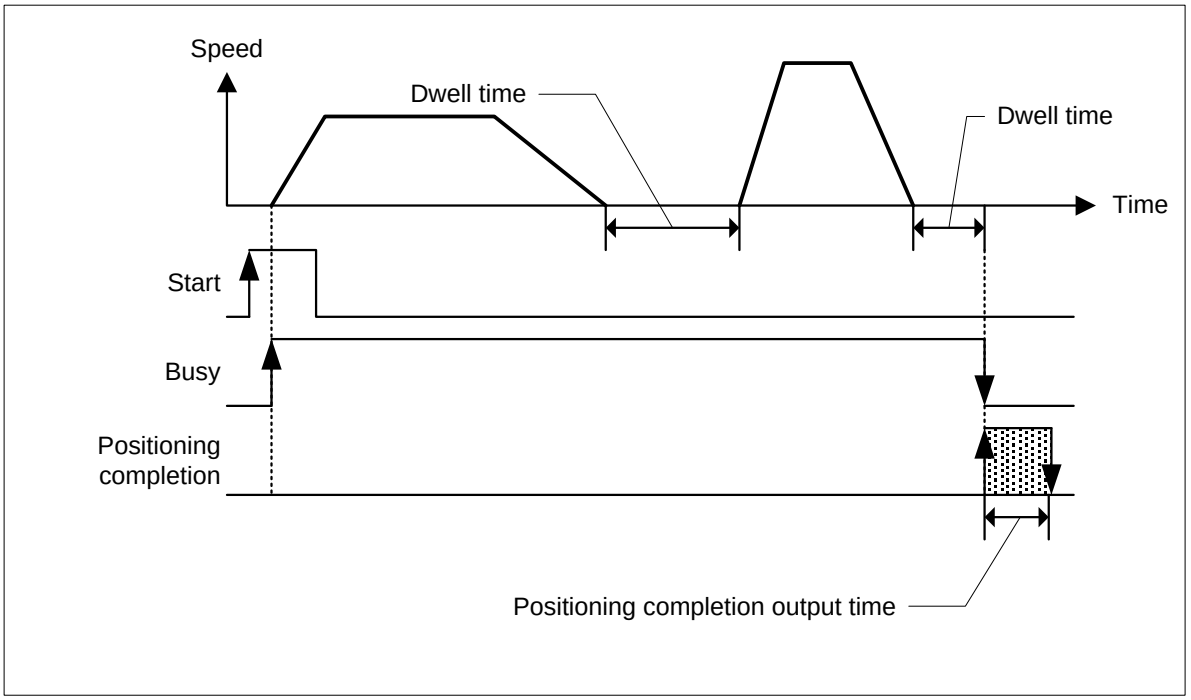
At this time, if all start command is executed while positioning completion signal is ON, completion signal shall be OFF immediately. In case of keep operation and continuous mode operation, positioning completion signal will be on after all steps end.

(b) The setting range is 0 ~ 65,535 (unit: 1 ㎳).

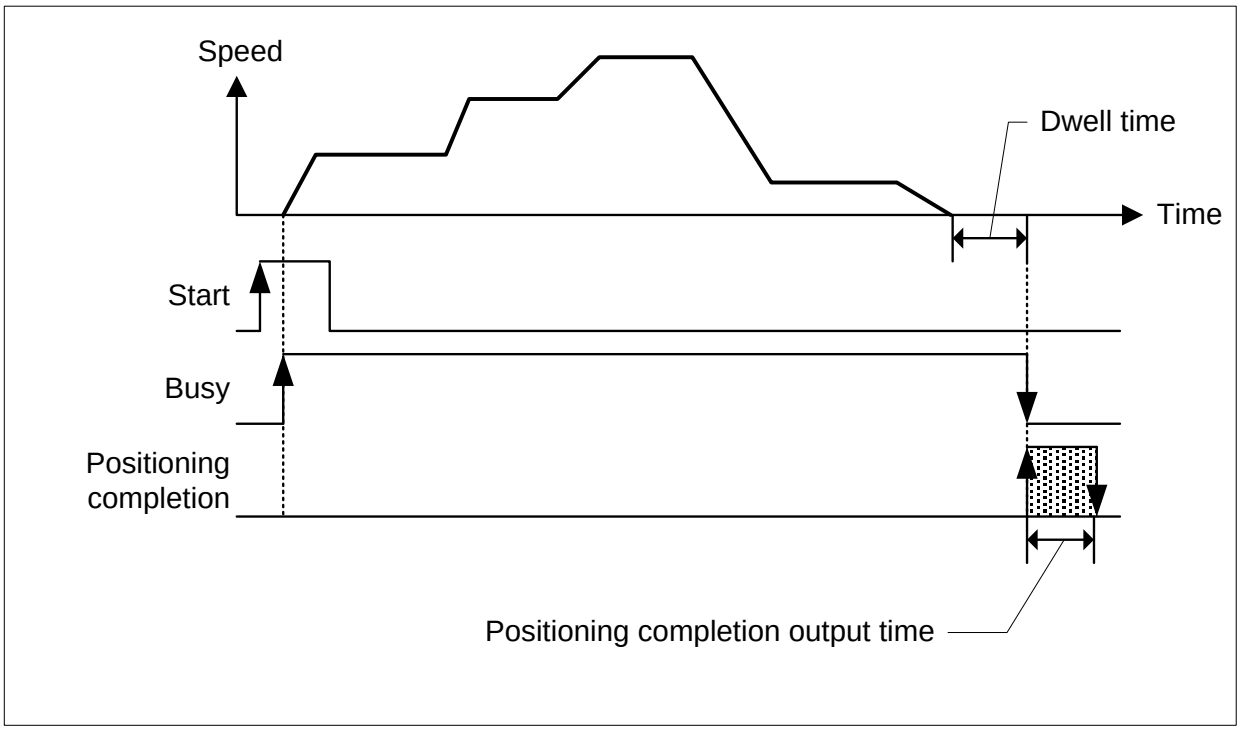
(c) The action of single operation mode is as follows :



(d) The action of Keep operation mode is as follows :



(e) The action of Continuous operation mode is as follows.



(5) M Code Output

(a) M code mode set by parameter shall be applied to all position data of the corresponding axis.

(b) Available to set M code number differently at each operation step no. of positioning data.

(c) M code number setting range : 1 ~ 65,535

(d) Available to read and use M code for the identification of operation step no. in operation and the execution of auxiliary works (Clamp, Drill rotation, tool change etc).

(e) M code signal occurring during the operation shall be reset by M code “Off” command.

Notes

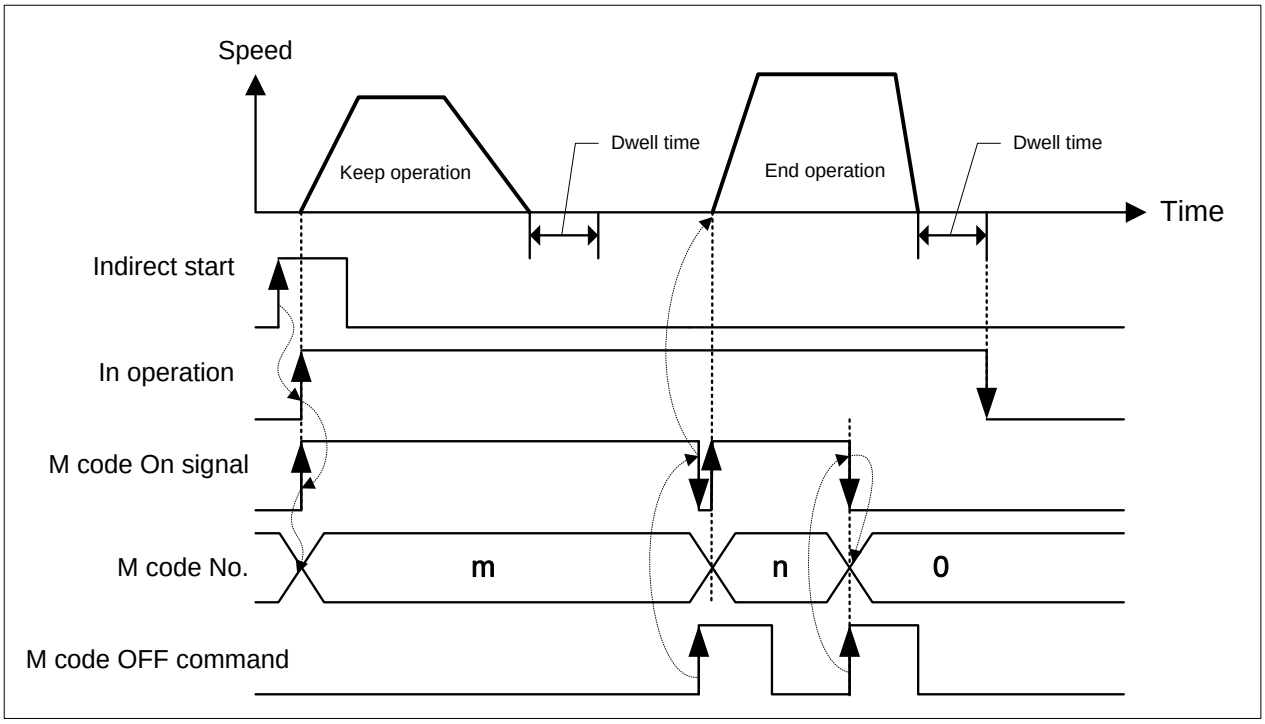
If you execute the next step after the positioning is completed and M code signal is “ON”, the next operation step no. does not work and the error (In case of indirect start, E233) will occur. Therefore, in order to execute the positioning of the next operation step number, M code signal should be “OFF” by M code “Off” command

(f) There are two kinds of M code mode according to the output timing of M code signal: With mode and After mode.

(In case of setting NONE, There is no M code signal, even if M code No was set.)

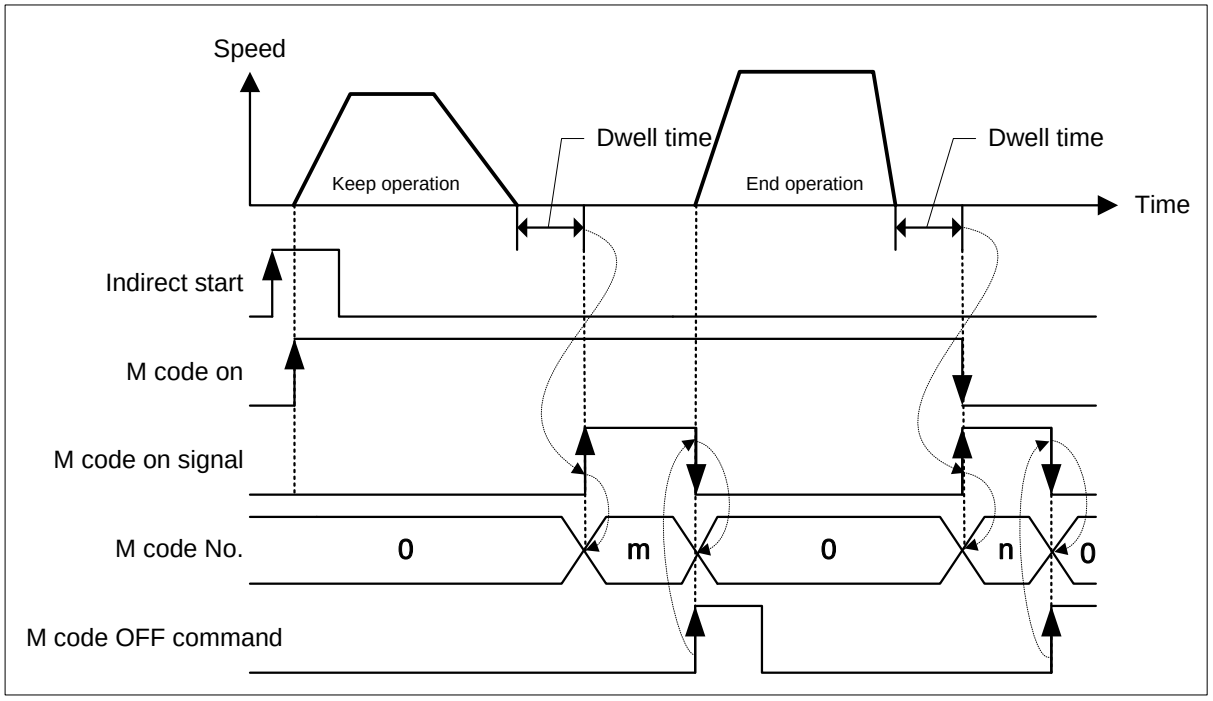
1) With mode

It turns on the M code signal and outputs M code number with start of positioning [Indirect start, direct start and simultaneous start].



2) After mode

It turns on the M code signal and outputs M code number after completion of positioning [indirect start, direct start, simultaneous start].



(6) Enable/disable external command

(a) If selecting and using one among External Speed/Location Control Shift, External Stop Command, External Latch Command, set the external command Enable/Disable to “Enable”.

(b) If “Disable” is set, it won’t work even though one among “External Speed/Location Control Shift”, “External Stop Command” and “External Latch Command” is selected.

(c) In case of XGF-PN8B, it is valid only when LS MECAPIONL 7N servo drive is used. The servo drive’s DI#1 signal is used as external command.

(7) External command selection

(a) Set which one will be used among “External Speed/Location Control Shift”, “External Stop Command”, “External Latch Command” as external command.

(b) If you make the selected external command operated by the external signal, enable “External command” item.

(c) In case of XGF-PN8B, it is valid only when LS MECAPIONL 7N servo drive is used. The servo drive’s DI#1 signal is used as external command. To use D1#1 as external command signal, do not assign other functions to DI#1 in Defining Servo Parameter Input Signal (0x2200, 0x2201) item.

(d) “External Latch Command” is applied only to XGF-PN8A modules. In XGF-PN8B modules, use the servo drive’s touch probe Input 1 signal instead of external command signal for latch function.

(8) Software limit detect

(a) Selects whether to stop the operation or not when detecting software limit.

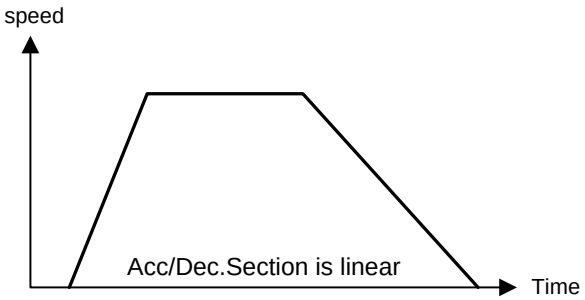
(b) If the software upper/lower limit is set as default value (upper limit: 2,147,483,647, lower limit: -2,147,483,648) or same value, it wouldn't detect software upper/lower limit.

(9) Acceleration/Deceleration Pattern

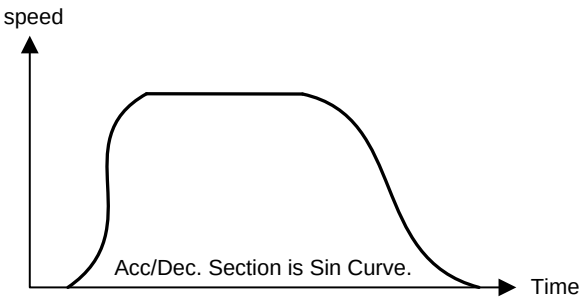
(a) There are 2 kinds of Acceleration/Deceleration operation pattern: Trapezoid operation and S-Curve operation.

(b) In case of positioning operation, it is available to select operation pattern (either trapezoid operation or S-Curve operation) at the section of acceleration and de deceleration.(c) As it is not possible to use S-Curve operation pattern in case of continuous operation mode and speed override, care should be taken in setting.

(d) In case of using S-Curve acceleration/deceleration, it is available to protect the motor from the load effect at the point that the motor starts to move the moving object and stops it.



<Trapezoid Acceleration/Deceleration>



<S-Curve Acceleration/Deceleration>

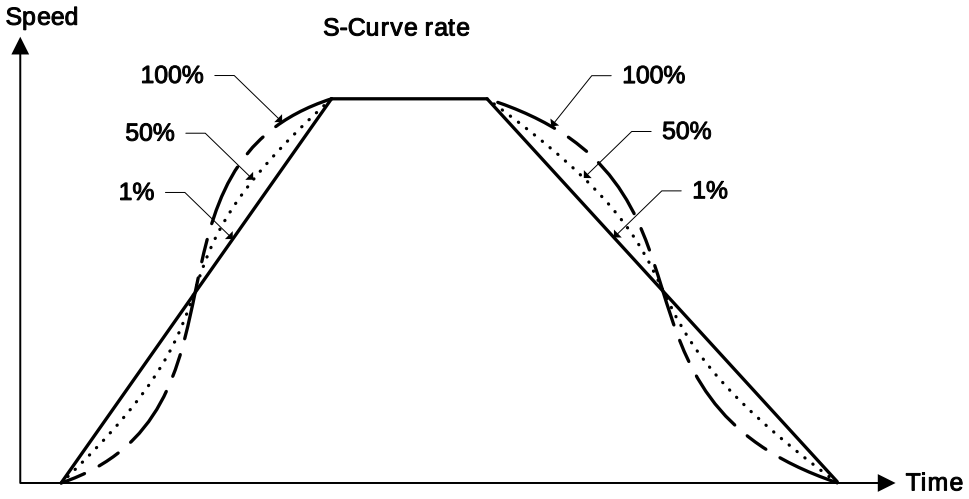
(10) S-curve rate

(a) In case of selecting S-Curve operation as an acceleration/deceleration pattern, S-Curve rate (1~100%) should be set.

(b) According to S-Curve rate, S-Curve operation pattern shall be formed in accordance with sine curve.

(c) If S-Curve rate is 1%, it becomes the same as trapezoid operation and if the 100% rate is set, it becomes the acceleration/deceleration curve which is the closest to the Sin Curve.

(d) The figure as below shows the example of S-Curve rate setting

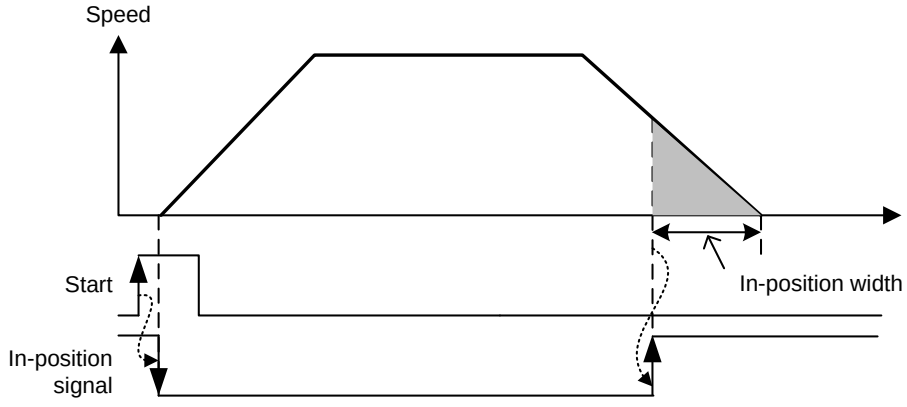


(11) In-position width

(a) Sets the position range from the target position where In-position signal (External signal Bit 11) is ON.

(b) When positioning starts, In-position signal is OFF, and if it goes in “In-position width” from target position, it will be ON.

(c) In-position signal can be used as a trigger when you execute auxiliary work before positioning completion



(d) In case of the followings, it doesn’t check “In-position”.

1) Stop by Dec. stop or Emg. Stop command

2) Speed control

(e) In case of the followings, it turns off “In-position” signal.

1) When executing “floating origin setting” command
2) When executing “Current position preset” command
3) When turning SERVO off
4) When starting positioning

(f) Setting range

Unit	Setting range for in-position width
pulse	0～2147483647[pulse]
㎜	0～2147483647[X10^{-4}㎜]
Inch	0～2147483647[X10^{-5}Inch]
degree	0～2147483647[X10^{-5}degree]

(12) Positioning Completion Condition

(a) Positioning Completion signal notify that operation has been completed without stop factor

(b) There are 4 kinds of methods for positioning completion condition.

1) by dwell time

2) by in-position signal

3) by using both dwell time and in-position signal

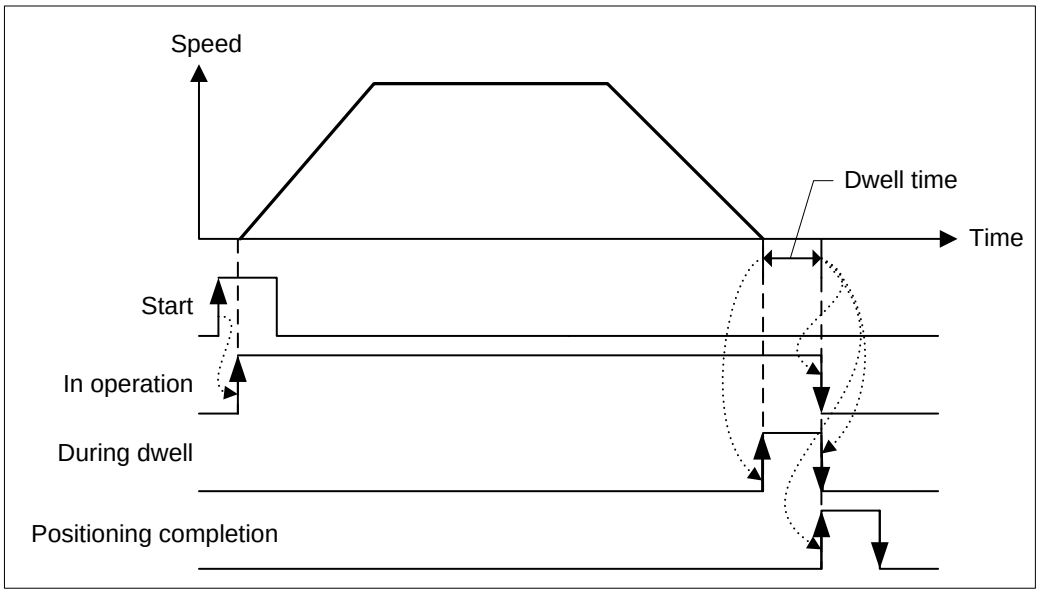
4) by using either dwell time or in-position signal.

(c) Though target reaches goal position and positioning is complete, “in operation” status is kept until positioning completion condition is met. If positioning completion condition is met, “in operation” signal will be off and it goes to “Positioning completion” status.

(d) The following is timing diagram for each method.

1) Method by dwell time

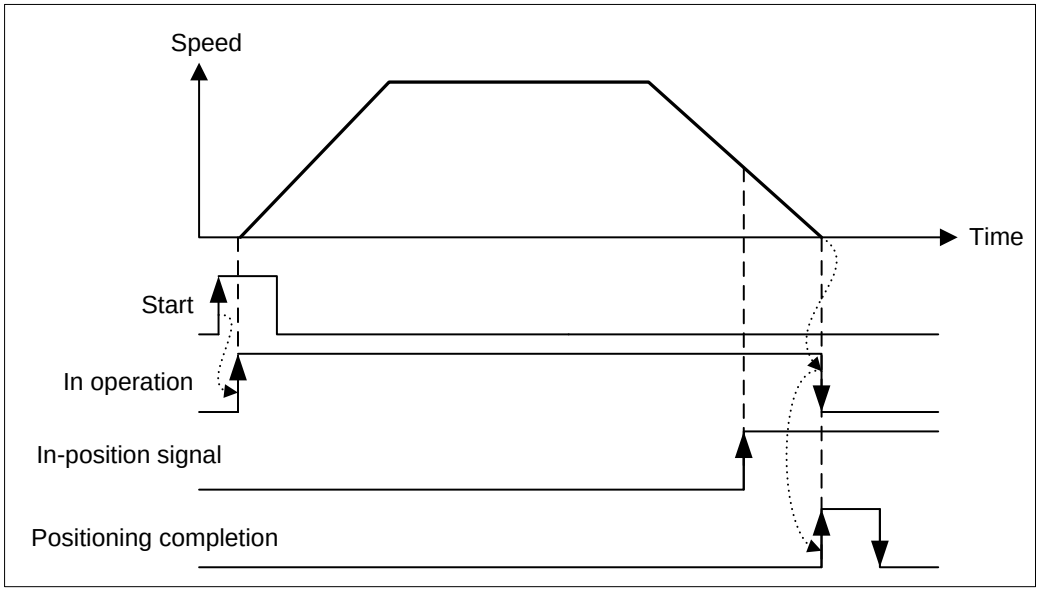
If it reaches goal and stops, positioning complete signal will be on after Dwell time



2) Method by in-position signal

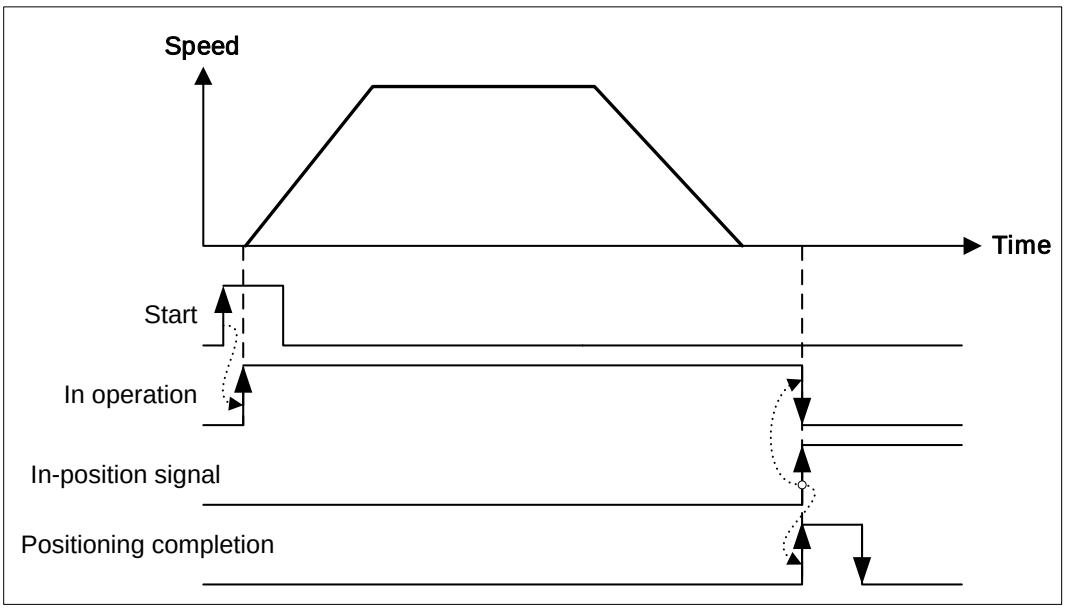
a) In case that in-position signal becomes ON before positioning is completed

Positioning complete signal will be on when reaching goal and positioning is completed



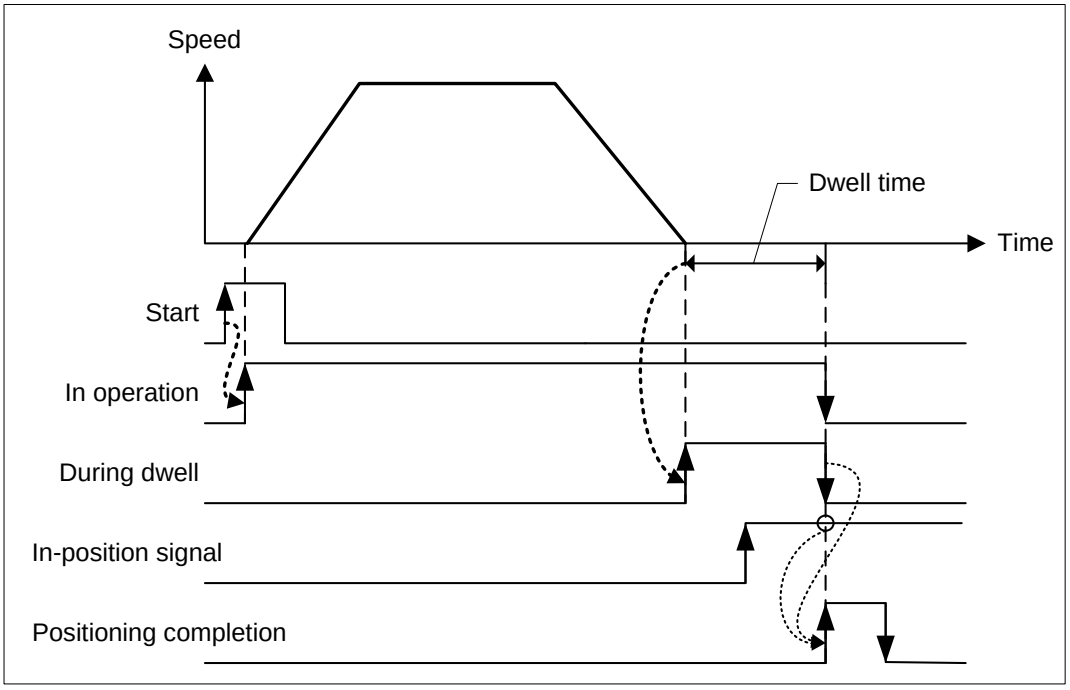
b) In case In-positioning signal becomes on after positioning is completed.

After reaching goal and positioning is completed, wait until In-position signal becomes on. When In-position signal becomes on, positioning complete signal will be on.

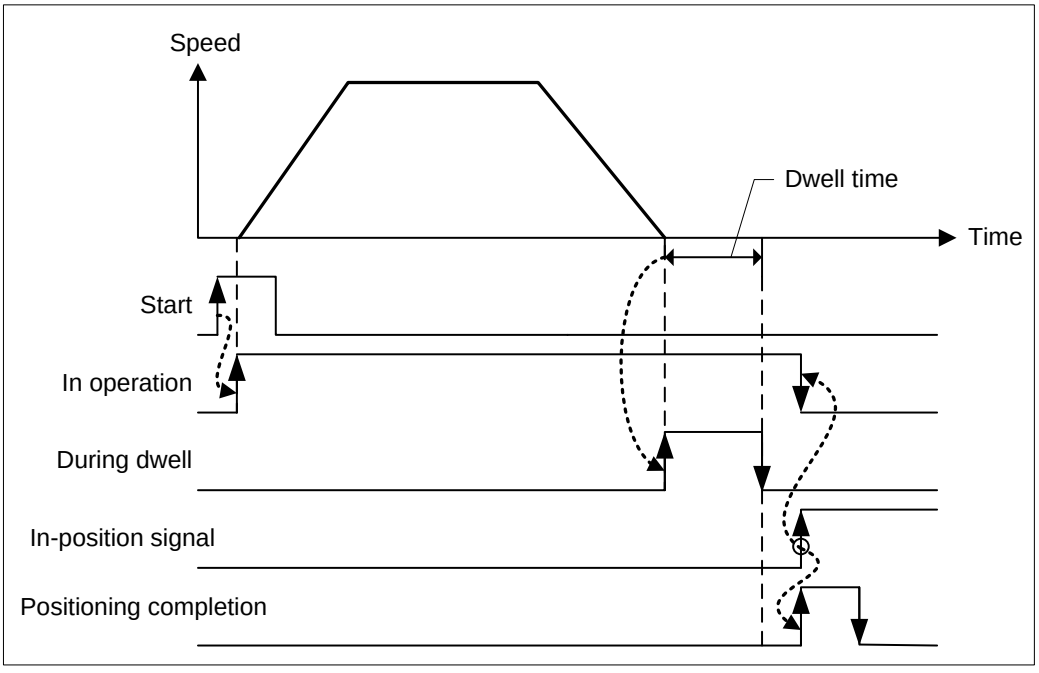


3) Method by using both dwell time and in-position signal

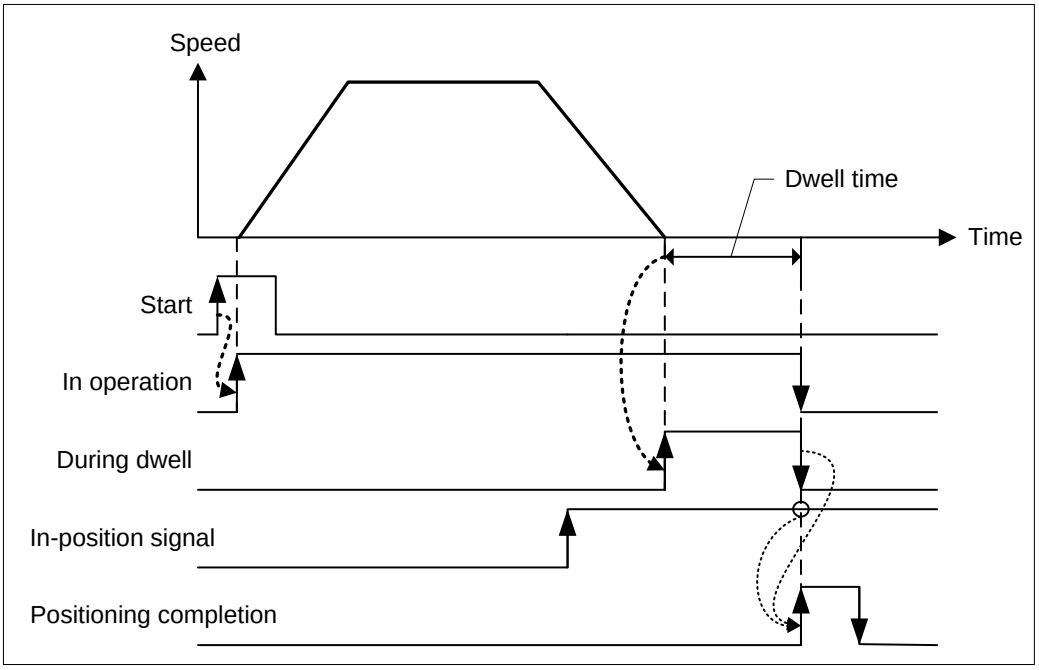
a) In case that in-position signal occurs before dwell time is ended



b) In case that in-position signal occurs after dwell time is ended.

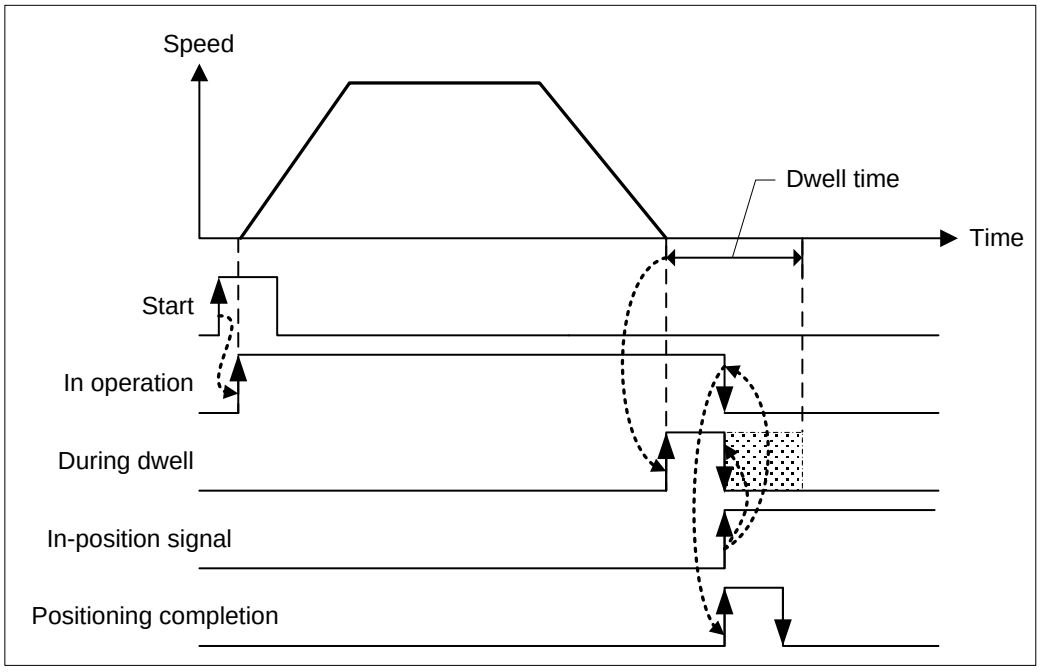


c) In case that in-position signal occurs during pulse output

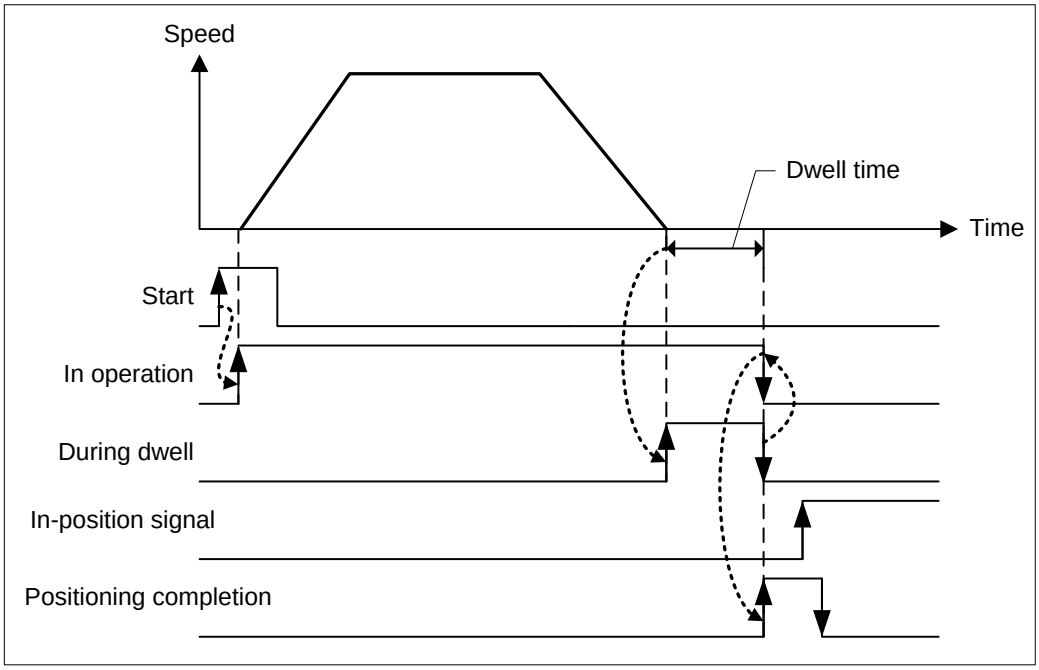


4) Method by using either dwell time or in-position signal

a) In case that in-position signal occurs before dwell time is ended



b) In case that in-position signal occurs after dwell time is ended.



(13) Interpolation continuous operation method

In case control method is linear interpolation or circular interpolation and operation method is continuous operation, positioning control will be different in accordance with the value set in “Int continuous opr. Type”.

Items	Setting value	Description
Interpolation continuous operation method	0 : Pass target position	In case of continuous operation from current step to next step, it passes target position of current step
	1 : Pass near position	In case of continuous operation from current step to next step, it passes near target position of current step

For further information, please refer to operation mode (4) continuous operation of 9.2.2 positioning control.

(14) Arc insertion during 2-axis linear interpolation continuous operation

When executing linear interpolation, determine whether to add arc during 2-axis linear interpolation continuous operation.

Here describes Arc insertion during 2-axis linear interpolation continuous operation

Setting item	Setting Value	Content
Arc insertion during 2-axis linear interpolation continuous operation	0 : Don't insert	When executing 2-axis linear continuous interpolation, doesn't inserts arc.
	1 : insert arc	When executing 2-axis linear continuous interpolation, inserts arc.

For further information about Arc insertion during 2-axis linear interpolation continuous operation, please refer to (4) 2-axis linear interpolation continuous operation arc insertion of 2-axis linear interpolating control of 9.2.6.

(15) Arc insertion position

When 「Arc insertion」 was set as "insert arc", confirms the arc insertion position and resets the start position of circular interpolation(Goal position of linear path 1) and goal position(Start position of linear path 2).

This is the setting of 'Arc insertion position'.

Setting item	Setting value	Content
Arc insertion position	0 ~ 2147483647	Set the position where circular will be inputted. It is relative distance from goal position.

For further information about inputting circular arc in 2-axis linear interpolation continuous operation, please refer to (4) inputting circular arc in 2-axis linear interpolation continuous operation of control linear interpolation (9.2.6).

(16) Position-specified speed override coordinate

Position-specified speed override command is the command changing the operation speed when the object reaches the specified position. At this time, operation may be different according to the type of position value. Position value can be absolute position value or incremental position value.

This is the setting of 'Position-specified speed override coordinate'.

Item	Setting value	Content
Position-specified speed override coordinate	0 : ABS	Speed changes at the specified absolute position.
	1 : INC	Speed changes at the position as far as the set value from start position.

For further information, refer to 9.5.6 position-specified speed override.

(17) Speed/Position switching coordinate

If "Speed/Position switching signal" is inputted during speed control, speed control changes into position control and executes position control with the value set in target position. At this time, this sets whether to consider the target position as absolute position value or incremental position value.

This is the setting of "Speed/Position switching coordinate".

Item	Setting value	Content
Speed/position switching coordinate	0 : INC	Executes positioning as far as the set value from position where speed/position switching command is executed.
	1 : ABS	Considers the set value as absolute position and executes positioning into the set absolute position.

For further information, refer to 9.2.14 speed/position switching control.

(18) Interpolation speed selection

It selects whether to consider the operation speed of the position data as main axis speed or synthetic speed.

For detailed comparison, refer to the example calculating interpolation speed in Ch9.2.6 and Ch9.2.7.

4.4 Manual Operation Parameter

Here describes Manual operation parameter of positioning module.

Manual operation parameter is used for the operation of JOG, Inching.

4.4.1 Manual Operation Parameter

Manual operating parameter item	Setting range
JOG high speed	㎜ : 1 ~ 2,147,483,647 [X10^{-2} ㎜/sec] Inch : 1 ~ 2,147,483,647 [X10^{-3}Inch/sec] degree : 1 ~ 2,147,483,647 [X10^{-3} degree/sec] pulse : 1 ~ 2,147,483,647 [pulse/sec]
JOG low speed	
JOG acceleration speed (ms)	0 ~ 2,147,483,647 [ms]
JOG deceleration speed (ms)	
Inching Speed	㎜ : 1 ~ 65,535[X10^{-2} ㎜/ min] Inch : 1 ~ 65,535[X10^{-3}Inch/ min] degree : 1 ~ 65,535[X10^{-3} degree/ min] pulse : 1 ~ 65,535[pulse/sec]

4.4.2 Manual Operation Parameter Setting

(1) JOG high Speed

(a) Jog speed is related to Jog operation (a kind of manual operation) and has 2 types of operation : Jog low speed operation and Jog high speed operation.

(b) For further information, please refer to 9.3.1 JOG Operation.

(c) JOG high speed operation has operation pattern as acceleration, constant speed, deceleration section. Therefore, acceleration section and deceleration section is controlled by JOG acceleration/deceleration time.

(d) Jog high speed setting range

All controls executed by the positioning module are done within speed limit. So Jog high speed can't exceed the speed limit. And, Jog high speed have to be larger than or same as Jog low speed.

Jog low speed ≤ Jog high speed ≤ Speed limit

(2) JOG Low Speed

(a) JOG low speed operation has operation pattern as acceleration, constant speed, deceleration section.

(b) JOG low speed setting range : 1 ~ Jog high speed

(3) JOG Acceleration/Deceleration Time

(a) This means JOG acceleration/deceleration time when Jog high speed and low speed operation.

(b) JOG acceleration/deceleration time setting range : 0 ~ 2,147,483,647 [ms]

In case of set by 0, operate set by acceleration time 1 and deceleration time of parameter.

(4) Inching Speed

(a) The speed necessary for inching operation is set here.

(b) Inching speed setting range : 1 ~ 65,535(unit/time)

4.5 Common Parameter

Here describes common parameter of positioning module.

The common parameter is applied to the connected all axes.

4.5.1 Common parameter

Configuration of Common Parameter		Setting range
Control word	Encoder 1 pulse input (bit 0/1/2)	0:CW/CCW 1 multiplier 1:PULSE/DIR 1 multiplier 2:PULSE/DIR 2 multiplier 3:PHASE A/B 1 multiplier 4:PHASE A/B 2 multiplier 5:PHASE A/B 4 multiplier
	Encoder 1 Z phase clear (bit 3)	0: Disable, 1: Enable
	Encoder 2 pulse input (bit 4/5/6)	0:CW/CCW 1 multiplier 1:PULSE/DIR 1 multiplier 2:PULSE/DIR 2 multiplier 3:PHASE A/B 1 multiplier 4:PHASE A/B 2 multiplier 5:PHASE A/B 4 multiplier
	Encoder 2 Z phase clear (bit 7)	0: Disable, 1: Enable
	Speed override	0 : % designate, 1 : Speed designate
Encoder 1 Max. value		-2147483648 ~ 2147283647
Encoder 1 Min. value		
Encoder 2 Max. value		
Encoder 2 Min. value		

4.5.2 Common Parameter Setting

(1) Encoder pulse input mode

(a) If you want to use signal of a manual pulse generator or Servo drive encoder as input, you can select suitable signal for a manual pulse generator or Servo drive encoder.

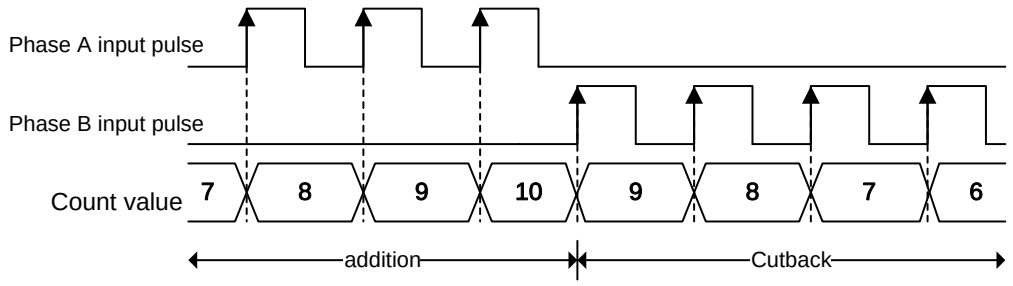
(b) You should select and set one from among CW/CCW 1 multiplier, PULSE/DIR 1 multiplier, PULSE/DIR 2 multiplier, PHASE A/B 1 multiplier, PHASE A/B 2 multiplier and PHASE A/B 4 multiplier as an encoder input signal.

1) CW/CCW 1 multiplier

When the Phase A input pulse was grow, or the phase B input pulse was grow, act to count.

It act to additional work when the Phase B input pulse is 'Low' and the Phase A input pulse is increased. It acts to cutback when the Phase A is 'Low' and the Phase B input pulse is grow.

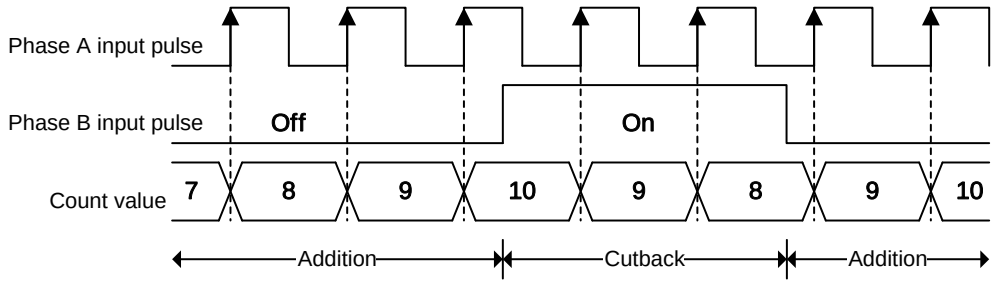
Addition/Cutback	Phase A input pulse High	Phase A input pulse Low
Phase B input pulse High	-	Cutback count
Phase B input pulse Low	Addition count	-



2) PULSE/DIR 1 multiplier

In case of increasing Phase A input pulse, act to count. Addition/cutback was decided by Phase B.

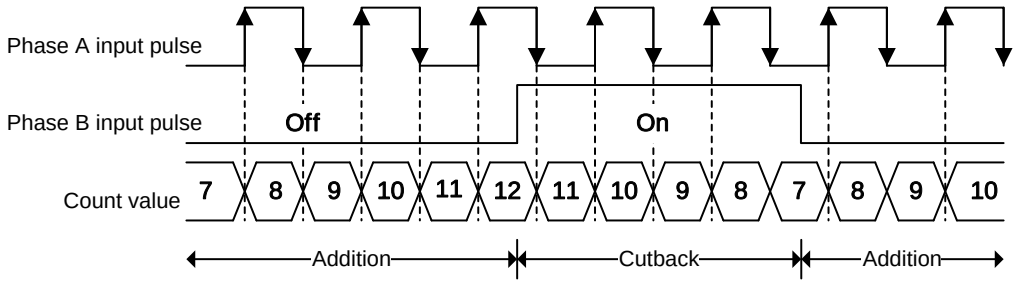
Addition/Cutback	Increasing Phase A input pulse	Decreasing Phase A input pulse
Phase B input pulse Off	Addition count	-
Phase B input pulse On	Cutback count	-



3) PULSE/DIR 2 multiplier

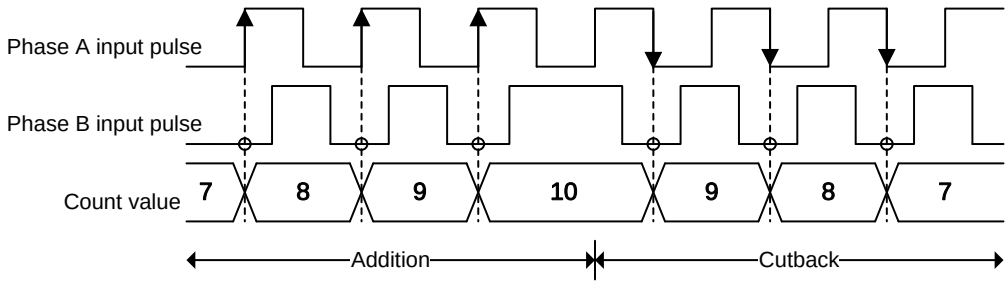
In case of increasing and decreasing Phase A input pulse, act to count. Addition/cutback was decided by Phase B.

Addition/Cutback	Increasing Phase A input pulse	Decreasing Phase A input pulse
Phase B input pulse Off	Additional count	Additional count
Phase B input pulse On	Cutback count	Cutback count



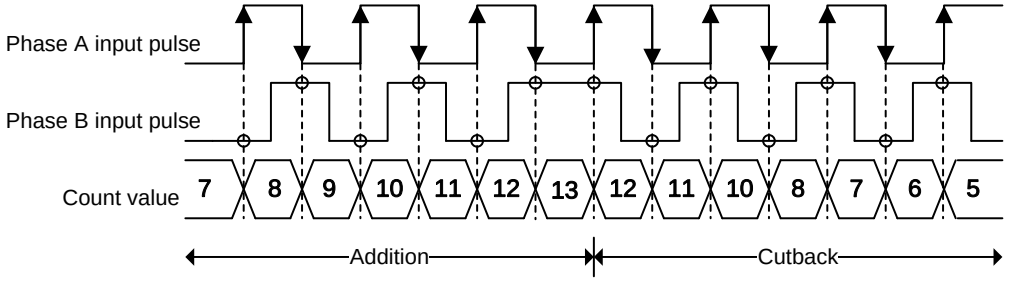
4) PHASE A/B 1 multiplier

In case of Phase A input pulse in advance of Phase B input pulse, Act to add when that Phase A increase pulse. In case of Phase B input pulse in advance of Phase A input pulse, Act to cutback when that Phase A decrease pulse.



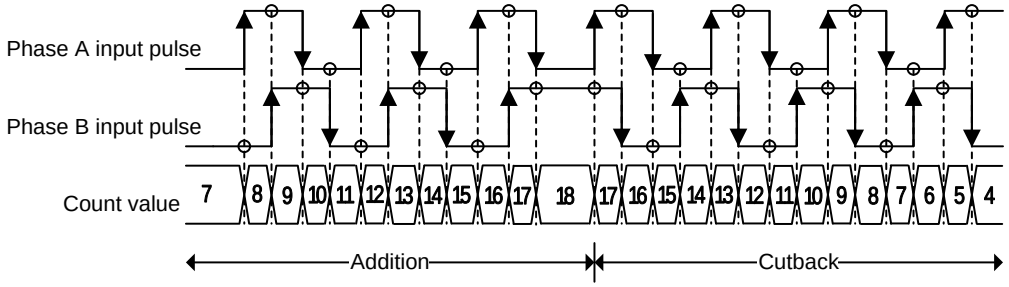
5) PHASE A/B 2 multiplier

Act to count when the Phase A increase/decrease. When Phase A input faster than Phase B at the Phase, act to decrease.



6) PHASE A/B 4 multiplier

Act to count when Phase A input pulse and Phase B input pulse is increased/decreased. In case that Phase A input faster than Phase B at the phase, act to add. In case that Phase B input faster than Phase A at the phase, act to decrease.



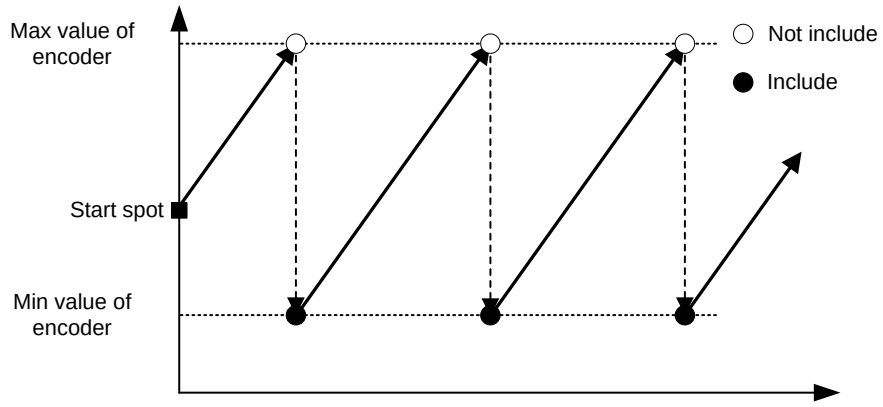
(c) The principal axis set encoder for that acting motor synchronization with manual pulse generator (MPG). Synchronization rate can take “Encoder ≤ Motor” or “Encoder ≥ Motor” what you want.

(2) Max/Min value of encoder

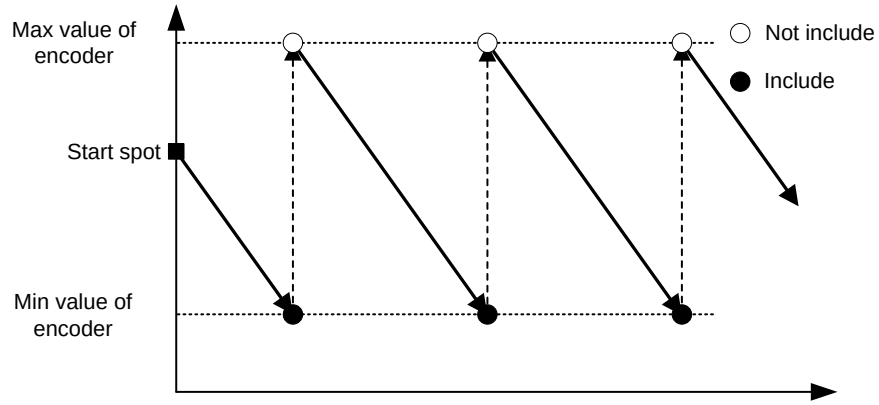
(a) When count Inputted pulse (from a hand pulse generator or encoder signal of Servo drive) and display as encoder value, the count range and range of encoder value need to be set to Max/Min value of encoder,

(b) The act follows the picture of below.

1) When encoder value increase



2) In case of decreasing encoder value



(3) Speed override

(a) When operate changing speed command (Speed override, Positioning speed override, etc), select speed(will be changed) or percentage of goal speed.

(b) In case of setting percentage (%) can set each per 0.01% from 0.01% to 655.35%.

4.6 Operation Data

Here describes Operation Data of positioning module.

Can set 400 operation data per each axis, operation of circular interpolation and Linear interpolation act in accordance with information of operation data.

4.6.1 Operation Data

<table>
<tr><th colspan="2">Operation data item</th><th>Setting range</th></tr>
<tr><td colspan="2">Target position</td><td rowspan="2">㎜ : -2147483648 ~ 2147483647 [X10^{-4} ㎜]
Inch : -2147483648 ~ 2147483647 [X10^{-5}Inch]
degree : -2147483648 ~ 2147483647 [X10^{-5}degree]
pulse : -2147483648 ~ 2147483647 [pulse]</td></tr>
<tr><td colspan="2">Circular interpolation aux. Position</td></tr>
<tr><td colspan="2">Operation speed</td><td>㎜ : 1 ~ 2,147,483,647 [X10^{-2} ㎜/min]
Inch : 1 ~ 2,147,483,647 [X10^{-3}Inch/min]
degree : 1 ~ 2,147,483,647 [X10^{-3} degree/min]
pulse : 1 ~ 2,147,483,647 [pulse/sec]</td></tr>
<tr><td colspan="2">Dwell time</td><td>0 ~ 65,535[ms]</td></tr>
<tr><td colspan="2">M Code no.</td><td>0 ~ 65,535</td></tr>
<tr><td colspan="2">Setting the sub-axis</td><td>Bit unit setting
<table><tr><td>Bit 7</td><td>Bit 6</td><td>Bit 5</td><td>it 4</td><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr><tr><td>Axis 8</td><td>Axis 7</td><td>Axis 6</td><td>Axis 5</td><td>Axis 4</td><td>Axis 3</td><td>Axis 2</td><td>Axis 1</td></tr></table></td></tr>
<tr><td colspan="2">Helical interpolation axis</td><td>0, 1 axis ~ 8 axis (Set‘0’,normal circular interpolation)</td></tr>
<tr><td colspan="2">The number of circular interpolation turns</td><td>0~65,535</td></tr>
<tr><td rowspan="9">Control Word</td><td>Coordinate (bit 0)</td><td>0:absolute, 1: incremental</td></tr>
<tr><td>Control method (bit 1~3)</td><td>0:single axis positioning, 1:Speed control reduction,
2:single axis Feed control, 3:linear interpolation,
4:Circular interpolation</td></tr>
<tr><td>Operation method (bit 4)</td><td>0:Singular, 1:Repeat</td></tr>
<tr><td>Operation pattern (bit 5~6)</td><td>0:End, 1:Keep, 2: Continuous</td></tr>
<tr><td>Circular size (bit 7)</td><td>0:Circular arc<180 1: Circular arc >=180</td></tr>
<tr><td>Acceleration No. (bit 8~9)</td><td>0 ~ 3</td></tr>
<tr><td>Deceleration No. (bit 10~11)</td><td>0 ~ 3</td></tr>
<tr><td>Circular interpolation method (bit 12~13)</td><td>0:middle point, 1:central point, 2:radius</td></tr>
<tr><td>Circular interpolating direction (bit 14)</td><td>0:CW, 1:CCW</td></tr>
</table>

Notes

In case of setting unit of each axis as degree, can’t operate circular interpolation. Therefore it is idle to set value at the circular interpolating auxiliary position item.

4.6.2 Operation Data Setting

(1) Step No.

(a) The setting range of positioning data as serial no. is 0 ~ 400.

(b) The first Starting step of operation data is no.1 step.

Notes

In case of designating step No. is '0' with indirectness maneuver, maneuver at the same time, positioning same period, it means current operation step.

(2) Coordinate

(a) Coordinate of position data includes absolute coordinate and relative coordinate.

1) Absolute Coordinate (Control by Absolute method)

a) This carries out the positioning control from the current position to the goal position (the goal position assigned by positioning data).

b) Control is carried out based on the assigned position of homing (origin address).

c) Transfer direction shall be determined by the current position and goal position.

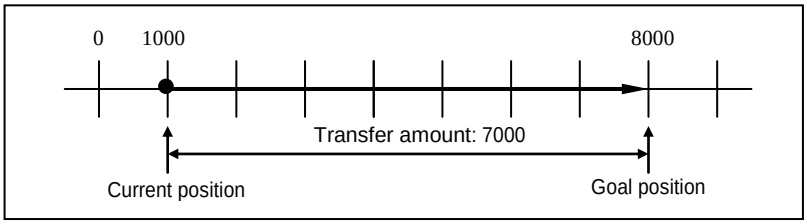
▶ Start position < Goal position : forward direction positioning

▶ Start position > Goal position : reverse direction positioning

[Example]

▷ When current position : 1000 , Goal position : 8000, forward direction transfer amount is 7000(8000-1000).

▷ Software Package Setting



Notes

Control by Absolute method (Absolute coordinate) can start only in the state that the origin is determined. If starting in the state that the origin is not determined, Error will occur.

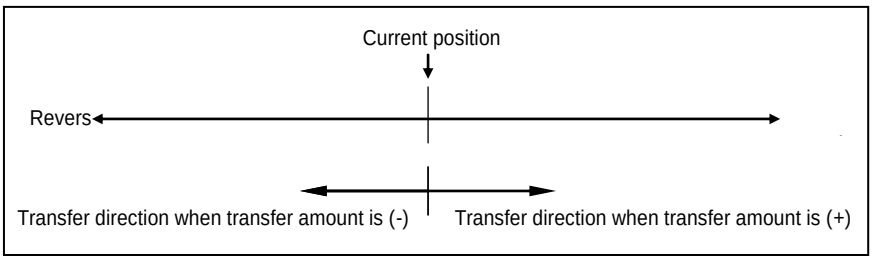
2) Incremental Coordinate (Control by Incremental method)

a) This carries out the positioning control as much as goal transfer amount from the current position.

b) Transfer direction shall be determined by the sign of transfer amount.

▶ When transfer direction is (+) or no sign: forward direction positioning (position increase direction)

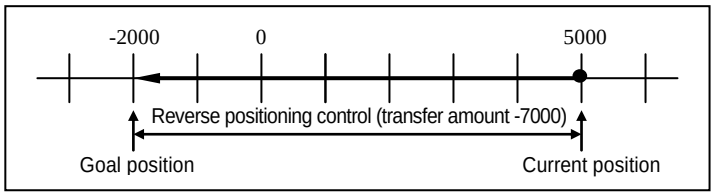
▶ When transfer direction is (-): reverse direction positioning (position decrease direction)



[Example]

▷ When current position : 5000 , Goal position : -7000, the positioning shall be done at –2000 position.

▷ Software Package Setting



(3) Control Method

(a) Select the control method: single-axis position control, single-axis Speed control, single-axis Feed control, linear interpolation, circular interpolation.

(b) For further information, please refer to 9.2 Positioning control of Chapter 9 “Function”.

Notes

Set coordinate and control method in all at the same time in “control method” item with positioning software package. And the software package “Control Method” item is as follows ;

Absolute, Single-axis Positioning Control / Absolute, Single-axis Speed Control

/Absolute, Single-axis FEED control / Absolute, linear Interpolation / Absolute, Circular Interpolation

/Incremental, Single-axis Positioning Control / Incremental, Single-axis Speed Control

/Incremental, Single-axis FEED control / Incremental, linear Interpolation / Incremental, Circular Interpolation

(4) Operation Pattern (End/Keep/Continuous)

(a) Operation pattern is setting item, how can step of operation data connect with next step and operate.

(b) Select one operation pattern from End, Keep, Continuous operation.

(c) For further information, please refer to 9.2.2 operation mode of positioning control of Chapter 9 “Function”.

(5) Operation Method (Single/Repeat)

(a) Operating Method is an option for selecting an operating step after finish operating step from the driving data setting step.

(b) In case of setting singular, it will be select next step after finish operating settled step. If you set by Repeat, It will be select settled Repeat step after finish operating settled step.

(c) Select one positioning operation pattern from Singular, Repeat operation.

(d) For further information, please refer to 9.2.2 operation mode of positioning control of Chapter 9 “Function”.

Notes

Set operation pattern and operation method at the “operation method” item with XG-PM software package. These are “operation method” item; Single,End / Single,Keep / Single,Continuous / Repeat,End / Repeat,Continuous / Repeat,Continuous.

(6) Goal Position

(a) This is the area to set the transfer amount of position data as “position value”.

(b) The setting range is –2,147,483,648 ~ 2,147,483,647[unit].

(7) M Code

(a) M code is applied to the whole axis in a bundle by M code mode set by positioning parameter and is given to each operation step no. as a Number within the setting range to use at Program.

(b) The setting range is 1 ~ 65,535

(c) M code no. can be identified by read by the operation state code

(d) For further information, please refer to M code output of 4.3.2.

(8) Acceleration/Deceleration No.

(a) The dual acceleration/deceleration time setting is available by setting the acceleration/deceleration time 1/2/3/ 4 of basic parameter as acceleration/deceleration no. 1/2/3/4 respectively.

(9) Operation Speed

(a) Operation speed is the goal speed which it is applied when it operate positioning

(b) Operation speed is set within the range that does not exceed Speed limit of basic parameter.

(10) Dwell Time

(a) This is the waiting time before carrying out the next positioning operation after completing one positioning operation.

(b) Setting range is 0 ~ 65,535 [㎳].

(c) Especially, in case of using SERVO motor, this is the data to set the waiting time by the stable stop state as positioning module is in the stop state but actual SERVO motor does not reach to the goal position or in transition state.

(d) While dwell time is active, the corresponding axis of positioning module maintains “ON” of the “in operation state” and if dwell time proceeds, “in operation state” becomes “OFF” and the positioning end signal becomes “ON”.

(11) Sub-Axis setting

(a) This is an option for axis of ordinates of driving shaft when should operate at least over 2 axis such as linear interpolation or circular interpolation.

(b) Setting each bit from 1 axis to 8 axis. Each bit is as follows ;

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Axis8	Axis7	Axis6	Axis5	Axis 4	Axis 3	Axis 2	Axis 1

(c) Can choice plural. For example, If you choice axis 2, axis 4 and axis 8 as sub-axis, set “008A’by hexadecimal in sub axis setting.

(12) Circular interpolating auxiliary position

(a) This is an option for setting auxiliary data when the circular interpolation operates.

(b) According to circular interpolation, mean of circular interpolating auxiliary position is decided.
It means midpoint which is through by circular arc in midpoint method.
It is central point of circular arc in central point method. And It is radius of circular arc in radius method.

(c) In case that circular interpolation method is radius, be valid only value of circular interpolating auxiliary position of principal axis.

(d) For further information, please refer to “Circular interpolating control” of 9.2.9 ~ 9.2.11.

(13) Circular interpolating method

(a) This is an option for method setting from circular interpolating operation.

(b) There are three method for circular interpolation; midpoint, central point, radius.

(c) For further information, please refer to “Circular interpolation control” of 9.2.9 ~ 9.2.11.

(14) Circular interpolating direction

(a) This is an option for setting direction of drawing circle from circular interpolating operation when the operation starts.

(b) Circular interpolation direction is based on drawing circular interpolation when the principal axis is axis ‘X’ and the axis of ordinates is axis ‘Y’.

(c) This option is ignored from circular interpolation of midpoint because circular interpolating direction is selected by position of midpoint.

(d) For further information, please refer to circular interpolation of 9.2.9 ~ 9.2.11.

(15) Circular arc size

(a) When circular interpolating method is set by radius method, User can select one of 2 circular arcs.

(b) Select one of over the 180-degree circular interpolation or under the 180-degree circular interpolation.

(c) This option is ignored in the circular interpolation of midpoint method and central point method.

(d) For further information, please refer to designating radius circular interpolation of 9.2.11

Notes

Positioning software package set as follows at a time; circular arc method, circular interpolating direction, circular arc size with ‘Circular interpolating mode’.

Software package ‘Circular interpolating mode’ is as follows ;

Middle point / Central point, CW / Central point, CCW / Radius, CW, Circular arc < 180-degree / Radius , CW , Circular arc >= 180-degree / Radius, CCW, Circular arc < 180-degree / Radius, CCW, Circular arc >= 180-degree

(16) The number of circular interpolating turns

(a) This is an option setting the number of rotation of circular arc when operating over the 360-degree. (b) Setting range is 1 ~ 65,535.

(17) Helical interpolation axis

(a) It is item which is setting axis for linear operation in operating helical interpolation.

(b) Settled axis from helical interpolation rectilinearly operates to settled position at the goal position.

(c) For further information, please refer to helical interpolating control of 9.2.12.

Chapter 5 Internal Memory and I/O Signal

5.1 Internal Memory

▶Here describes the internal memory used for positioning module if XGK CPU module is used.

▶ Internal memory is used when executing direct Data read/write between positioning module and PLC CPU by using PUP(PUTP), GET(GETP) command instead of using the dedicated command. For Data read/write using the dedicated command, please refer to 6.2 Dedicated Command.

5.1.1 Step Data during Point Start

(1) Memory Address of POINT Start Step Data

Memory address								Contents
1 axis	2 axis	3 axis	4 axis	5 axis	6 axis	7 axis	8 axis	
2A1	321	3A1	421	4A1	521	5A1	621	Point operation step 1
2A2	322	3A2	422	4A2	522	5A2	622	Point operation step 2
2A3	323	3A3	423	4A3	523	5A3	623	Point operation step 3
2A4	324	3A4	424	4A4	524	5A4	624	Point operation step 4
2A5	325	3A5	425	4A5	525	5A5	625	Point operation step 5
2A6	326	3A6	426	4A6	526	5A6	626	Point operation step 6
2A7	327	3A7	427	4A7	527	5A7	627	Point operation step 7
2A8	328	3A8	428	4A8	528	5A8	628	Point operation step 8
2A9	329	3A9	429	4A9	529	5A9	629	Point operation step 9
2AA	32A	3AA	42A	4AA	52A	5AA	62A	Point operation step 10
2AB	32B	3AB	42B	4AB	52B	5AB	62B	Point operation step 11
2AC	32C	3AC	42C	4AC	52C	5AC	62C	Point operation step 12
2AD	32D	3AD	42D	4AD	52D	5AD	62D	Point operation step 13
2AE	32E	3AE	42E	4AE	52E	5AE	62E	Point operation step 14
2AF	32F	3AF	42F	4AF	52F	5AF	62F	Point operation step 15
2B0	330	3B0	430	4B0	530	5B0	630	Point operation step 16
2B1	331	3B1	431	4B1	531	5B1	631	Point operation step 17
2B2	332	3B2	432	4B2	532	5B2	632	Point operation step 18
2B3	333	3B3	433	4B3	533	5B3	633	Point operation step 19
2B4	334	3B4	434	4B4	534	5B4	634	Point operation step 20

(2) POINT Start Step Data Setting

(a) The POINT start step data setting command for POINT start during POINT operation is XPWR.

(b) References for XPST (command of XGK point operating) and XPWR (command of point operating step data setting) are on ‘Chapter 6.3.43’.

(c) In PLC program, POINT operation data setting during POINT operation should be done in the step before POINT operation command is executed for normal action of POINT operation.

5.1.2 Teaching Data

(1) Memory Address of Teaching Data

Memory address								Contents
1 axis	2 axis	3 axis	4 axis	5 axis	6 axis	7 axis	8 axis	
280	300	380	400	480	500	580	600	Teaching data1(lower)
281	301	381	401	481	501	581	601	Teaching data1(upper)
282	302	382	402	482	502	582	602	Teaching data2(lower)
283	303	383	403	483	503	583	603	Teaching data2(upper)
284	304	384	404	484	504	584	604	Teaching data3(lower)
285	305	385	405	485	505	585	605	Teaching data3(upper)
286	306	386	406	486	506	586	606	Teaching data4(lower)
287	307	387	407	487	507	587	607	Teaching data4(upper)
288	308	388	408	488	508	588	608	Teaching data5(lower)
289	309	389	409	489	509	589	609	Teaching data5(upper)
28A	30A	38A	40A	48A	50A	58A	60A	Teaching data6(lower)
28B	30B	38B	40B	48B	50B	58B	60B	Teaching data6(upper)
28C	30C	38C	40C	48C	50C	58C	60C	Teaching data7(lower)
28D	30D	38D	40D	48D	50D	58D	60D	Teaching data7(upper)
28E	30E	38E	40E	48E	50E	58E	60E	Teaching data8(lower)
28F	30F	38F	40F	48F	50F	58F	60F	Teaching data8(upper)
290	310	390	410	490	510	590	610	Teaching data9(lower)
291	311	391	411	491	511	591	611	Teaching data9(upper)
292	312	392	412	492	512	592	612	Teaching data10(lower)
293	313	393	413	493	513	593	613	Teaching data10(upper)
294	314	394	414	494	514	594	614	Teaching data11(lower)
295	315	395	415	495	515	595	615	Teaching data11(upper)
296	316	396	416	496	516	596	616	Teaching data12(lower)
297	317	397	417	497	517	597	617	Teaching data12(upper)
298	318	398	418	498	518	598	618	Teaching data13(lower)
299	319	399	419	499	519	599	619	Teaching data13(upper)
29A	31A	39A	41A	49A	51A	59A	61A	Teaching data14(lower)
29B	31B	39B	41B	49B	51B	59B	61B	Teaching data14(upper)
29C	31C	39C	41C	49C	51C	59C	61C	Teaching data15(lower)
29D	31D	39D	41D	49D	51D	59D	61D	Teaching data15(upper)
29E	31E	39E	41E	49E	51E	59E	61E	Teaching data16(lower)
29F	31F	39F	41F	49F	51F	59F	61F	Teaching data16(upper)

(2) Setting

(a) The command of Teaching data setting is XTWR.

(b) References for XTEAA (command of XGK Teaching) and XTWR (command of Teaching Data Setting) are on ‘Chapter 6.3.30.

(c) In PLC program, in order to carry out the normal action of Teaching command, the Teaching data setting should be done in the step before Teaching command is executed.

5.1.3 Step Data of Simultaneous Start

(1) Step Data of Simultaneous Start Memory Address

Memory address								Contents
1 axis	2 axis	3 axis	4 axis	5 axis	6 axis	7 axis	8 axis	
2B6	336	3B6	436	4B6	536	5B6	636	Simultaneous start 1 axis step number
2B7	337	3B7	437	4B7	537	5B7	637	Simultaneous start 2 axis step number
2B8	338	3B8	438	4B8	538	5B8	638	Simultaneous start 3 axis step number
2B9	339	3B9	439	4B9	539	5B9	639	Simultaneous start 4 axis step number
2BA	33A	3BA	43A	4BA	53A	5BA	63A	Simultaneous start 5 axis step number
2BB	33B	3BB	43B	4BB	53B	5BB	63B	Simultaneous start 6 axis step number
2BC	33C	3BC	43C	4BC	53C	5BC	63C	Simultaneous start 7 axis step number
2BD	33D	3BD	43D	4BD	53D	5BD	63D	Simultaneous start 8 axis step number

(2) Setting

(a) The command for Step Data of Simultaneous Start setting is XSWR.

(b) References for XSST (command of XGK Simultaneous Start) and XSWR (Setting command for Step Data of Simultaneous Start) are on ‘Chapter 6.3.6.

(c) In PLC program, in order to carry out the normal action of Simultaneous Start, the Step data setting of Simultaneous Start should be done in the step before Simultaneous Start command is executed.

5.1.4 State Information

(1) Memory Address of State Information

XSRD device offset	Memory address								Content
	1 axis	2 axis	3 axis	4 axis	5 axis	6 axis	7 axis	8 axis	
0	2C0	340	3C0	440	4C0	540	5C0	640	Operation state bit information (Lower)
1	2C1	341	3C1	441	4C1	541	5C1	641	Operation state bit information (Upper)
2	2C2	342	3C2	442	4C2	542	5C2	642	Axis information
3	2C3	343	3C3	443	4C3	543	5C3	643	External I/O signal state
4	2C4	344	3C4	444	4C4	544	5C4	644	Current Position (LOWER)
5	2C5	345	3C5	445	4C5	545	5C5	645	Current Position (UPPER)
6	2C6	346	3C6	446	4C6	546	5C6	646	Current Speed (LOWER)
7	2C7	347	3C7	447	4C7	547	5C7	647	Current Speed (UPPER)
8	2C8	348	3C8	448	4C8	548	5C8	648	Step Number
9	2C9	349	3C9	449	4C9	549	5C9	649	M Code
10	2CA	34A	3CA	44A	4CA	54A	5CA	64A	Error information
11	2CB	34B	3CB	44B	4CB	54B	5CB	64B	Error information 1
12	2CC	34C	3CC	44C	4CC	54C	5CC	64C	Error information 2
13	2CD	34D	3CD	44D	4CD	54D	5CD	64D	Error information 3
14	2CE	34E	3CE	44E	4CE	54E	5CE	64E	Error information 4
15	2CF	34F	3CF	44F	4CF	54F	5CF	64F	Error information 5
16	2D0	350	3D0	450	4D0	550	5D0	650	Error information 6
17	2D1	351	3D1	451	4D1	551	5D1	651	Error information 7
18	2D2	352	3D2	452	4D2	552	5D2	652	Error information 8 (external input signal lower*)
19	2D3	353	3D3	453	4D3	553	5D3	653	Error information 9 (external input signal upper*)
20	2D4	354	3D4	454	4D4	554	5D4	654	Servo error information
21	2D5	355	3D5	455	4D5	555	5D5	655	Encoder1 value (lower)
22	2D6	356	3D6	456	4D6	556	5D6	656	Encoder1 value (upper)
23	2D7	357	3D7	457	4D7	557	5D7	657	Encoder2 value (lower)
24	2D8	358	3D8	458	4D8	558	5D8	658	Encoder2 value (upper)
25	2D9	359	3D9	459	4D9	559	5D9	659	Command position (lower)
26	2DA	35A	3DA	45A	4DA	55A	5DA	65A	Command position (upper)
27	2DB	35B	3DB	45B	4DB	55B	5DB	65B	Command speed (lower)
28	2DC	35C	3DC	45C	4DC	55C	5DC	65C	Command speed (upper)
29	2DD	35D	3DD	45D	4DD	55D	5DD	65D	Torque
30	2DE	35E	3DE	45E	4DE	55E	5DE	65E	Common error information

* : XGF-PN8B

(2) Setting

(a) The area of state information of internal memory is the Read only area. Thus, it is available to use only by GET, GETP command. (PUT, PUTP command is not allowed to use in this area).

(b) The command of State Information ready only is XSRD. (Refer to 6.3.42)

(c) If you use only command XSRD, the information of axis status is read at the same time.

(d) If you want to choose to read among the state information, it is available to read memory address of above table using by GET/GETP

(e) Use of State Information

1) Operation State Bit Information (Lower)

Memory address								Information
1 axis	2 axis	3 axis	4 axis	5 axis	6 axis	7 axis	8 axis	
2C0	340	3C0	440	4C0	540	5C0	640	Operation State bit Information (LOWER)

Bit 0	In Operation	[0: Stop, 1: In Operation]
Bit 1	Error State	[0: No Error, 1: Errors]
Bit 2	Positioning Completed	[0: Positioning not completed, 1: Positioning completed]
Bit 3	M Code Signal	[0: M Code Off, 1: M Code On]
Bit 4	Homing State	[0: Homing not completed 1: Homing completed]
Bit 5	Common error state	[0: No common error, 1: common error occured]
Bit 6	Stop State	[0: Stop State not by Stop Command, 1: Stop State by Stop Command]
Bit 7	Now reading/writing variable data	[0: reading/writing variable data completed, 1: now reading writing]
Bit 8	Upper limit detection	[0: No Detection, 1: Detection]
Bit 9	Lower limit detection	[0: No Detection, 1: Detection]
Bit 10	Emergency Stop State	[0: Normal, 1: Emergency Stop]
Bit 11	Forward/Reverse	[0: Forward, 1: Reverse]
Bit 12	Acceleration State	[0: No Accelerating, 1: Accelerating]
Bit 13	Constant Speed State	[0: Not Under Constant , 1: Under Constant]
Bit 14	Deceleration State	[0: No Decelerating, 1: Decelerating]
Bit 15	Dwell State	[0: No Dwelling , 1: Dwelling]

2) Operation State Bit Information (Upper)

Memory address								Information
1 axis	2 axis	3 axis	4 axis	5 axis	6 axis	7 axis	8 axis	
2C1	341	3C1	441	4C1	541	5C1	641	Operation State Bit Information (UPPER)

Bit 0	Axis 1 Position Controlling	[0: Axis 1 Position not in control, 1: Axis 1 Position in control]
Bit 1	Axis1 Speed Controlling	[0: Axis 1 Speed not in control, 1: Axis 1 Speed in control]
Bit 2	Linear Interpolation in Operation	[0: Linear Interpolation not in Operation, 1: Linear Interpolation in Operation]
Bit 3	Torque control in operation	[0: Torque control not in operation, 1: Torque control in operation]
Bit 4	Circular Interpolation in Operation	[0: Circular Interpolation not in Operation, 1: Circular Interpolation in Operation]
Bit 5	Homing Operating	[0: Homing not in Operation, 1: Homing in Operation]
Bit 6	Synchronous Start by Position in Operation	[0: Synchronous Start by position not in Operation, 1: Synchronous Start by position in Operation]
Bit 7	Synchronous Start by Speed in Operation	[0: Synchronous Start by Speed not in Operation, 1: Synchronous Start by Speed in Operation]
Bit 8	JOG in Operation	[0: JOG not in Operation, 1: JOG in Operation]
Bit 9	No Use	[0]
Bit 10	Inching in Operation	[0: Inching not in Operation, 1: Inching in Operation]
Bit 11	No Use	[0]
Bit 12	RTP[*1] in Operation	[0: RTP not in Operation, 1: RTP in Operation]
Bit 13	CAM in Operation	[0: CAM not in Operation, 1: CAM in Operation]
Bit 14	FEED in Operation	[0: FEED not in Operation, 1: FEED in Operation]
Bit 15	Circular Interpolation in Operation	[0: Circular Interpolation not in Operation, 1: Circular Interpolation in Operation]

Notes

*1

RTP: Return to Position Before Manual Operation

3) Axis Information

Memory Address								Information
1 axis	2 axis	3 axis	4 axis	5 axis	6 axis	7 axis	8 axis	
2C2	342	3C2	442	4C2	542	5C2	642	Axis information

Bit 0	Main axis information	1 ~ 8: 1axis ~ 8axis 9: Encoder1 10: Encoder2
Bit 1		
Bit 2		
Bit 3		
Bit 4	Axis status	[0: sub-axis, 1: main-axis]
Bit 5	Not used	[0]
Bit 6	Latch completed status	[0: Latch not completed, 1: Latch completed]
Bit 7	Now writing to servo driver EEPROM	[0: Not writing, 1: writing]
Bit 8	Not used	[0]
~		
Bit 13		
Bit 14	Now writing to module Flash memory	[0: Not writing, 1: writing]
Bit 15	Not used	[0]

4) External I/O Signal State

Memory Address								Information
1 axis	2 axis	3 axis	4 axis	5 axis	6 axis	7 axis	8 axis	
2C3	343	3C3	443	4C3	543	5C3	643	External I/O signal state

Bit 0	External EMG Stop	[0: External EMG stop Off, 1: External EMG stop On]
Bit 1	Not used	[0]
Bit 2		
Bit 3		
Bit 4	External upper limit signal	[0: External upper limit signal Off, 1: External upper limit signal On]
Bit 5	External lower limit signal	[0: External lower limit signal Off, 1: External lower limit signal On]
Bit 6	Home signal *2	[0: Home signal Off, 1: Home signal On]
Bit 7	DOG signal	[0: DOG signal Off, 1: DOG signal On]
Bit 8	External command signal *1	[0: External command signal Off, 1: External command signal On]
Bit 9	Servo On signal	[0: Servo Off, 1: Servo On]
Bit 10	Servo alarm signal	[0: Servo driver normal, 1: Servo driver error occurs]
Bit 11	In-position signal	[0: Not In-position section, 1: In-position section]
Bit 12	Not used	[0]
Bit 13		
Bit 14		
Bit 15	Communication error	[0: EtherCAT Comm. normal, 1: EtherCAT Comm. error]

Notes

*1

External command signal: It acts as one between “External speed/position control switching” , “External dec, stop” and “External Latch” according to “External command signal” setting in the extended parameter. In case of XGF-PN8B, D1#1 is used as external command signal only when LS MECAPION L7N servo drive is used.

*2

Home Signal: In case of XGF-PN8B, the servo drive’s HOME input signal is mapped to the home signal.

5.2 I/O Signal

Here describes the contents and functions of I/O signal for the exchange of data between Positioning module and XGK CPU module.

5.2.1 Contents of I/O Signal

(1) I/O signal of positioning module uses input: 16 bits and output: 32 bits.

(2) Positioning Module operation ready signal (Uxx.00.F) becomes “ON” only when Modules are in normal state in H/W and it always keeps “ON” regardless of PLC operation mode.

(3) For operation ready signal, if positioning module and servo driver are connected through EtherCAT communication, applicable bit of the connected axis will be on regardless of the operation mode of the PLC.

(4) Output Signal

This is the signal which transfers to positioning module from PLC CPU.

Signal Direction: PLC CPU *Positioning Module*					
Axis	Output signal	Contents	Axis	Output signal	Contents
1 axis	Uxx.01.0	1 axis forward direction JOG	5 axis	Uxx.02.0	5 axis forward direction JOG
	Uxx.01.1	1 axis reverse direction JOG		Uxx.02.1	5 axis reverse direction JOG
	Uxx.01.2	1 axis JOG low/high speed		Uxx.02.2	5 axis JOG low/high speed
	Uxx.01.3	Not used		Uxx.02.3	Not used
2 axis	Uxx.01.4	2 axis forward direction JOG	6 axis	Uxx.02.4	6 axis forward direction JOG
	Uxx.01.5	2 axis reverse direction JOG		Uxx.02.5	6 axis reverse direction JOG
	Uxx.01.6	2 axis JOG low/high speed		Uxx.02.6	6 axis JOG low/high speed
	Uxx.01.7	Not used		Uxx.02.7	Not used
3 axis	Uxx.01.8	3 axis forward direction JOG	7 axis	Uxx.02.8	7 axis forward direction JOG
	Uxx.01.9	3 axis reverse direction JOG		Uxx.02.9	7 axis reverse direction JOG
	Uxx.01.A	3 axis JOG low/high speed		Uxx.02.A	7 axis JOG low/high speed
	Uxx.01.B	Not used		Uxx.02.B	Not used
4 axis	Uxx.01.C	4 axis forward direction JOG	8 axis	Uxx.02.C	8 axis forward direction JOG
	Uxx.01.D	4 axis reverse direction JOG		Uxx.02.D	8 axis reverse direction JOG
	Uxx.01.E	4 axis JOG low/high speed		Uxx.02.E	8 axis JOG low/high speed
	Uxx.01.F	Not used		Uxx.02.F	Not used

(5) Input Signal

This is the Signal which transfers to PLC CPU from Positioning Module.

Axis	*Signal direction: PLC CPU Positioning module*	
	Input signal	Contents
1 axis	Uxx.00.0	1 axis operation ready
2 axis	Uxx.00.1	2 axis operation ready
3 axis	Uxx.00.2	3 axis operation ready
4 axis	Uxx.00.3	4 axis operation ready
5 axis	Uxx.00.4	5 axis operation ready
6 axis	Uxx.00.5	6 axis operation ready
7 axis	Uxx.00.6	7 axis operation ready
8 axis	Uxx.00.7	8 axis operation ready
-	Uxx.00.8	Not used
-	Uxx.00.9	Not used
-	Uxx.00.A	Not used
-	Uxx.00.B	Not used
-	Uxx.00.C	Not used
-	Uxx.00.D	Not used
Common	Uxx.00.E	Link up/down information
Common	UXX.00.F	Positioning module operation ready

5.2.2 Use of I/O Signal

(1) Axis operation ready signal

(a) For operation ready signal, if positioning module and servo driver are connected through EtherCAT communication, applicable bit of the connected axis will be on regardless of the operation mode of the PLC.

(b) EtherCAT communication connection is done through the instruction “XECON” or function block “XPM_DCON”.

(c) When you disconnection the communication between the positioning module and servo driver by using instruction “XDCON” or function block “XPM_DCON”, operation ready signal of all axes turn off.

(d) When giving the command to axis, check whether axis operation ready signal is on or not.

(e) For “Uxx.00.zz”, U means PLC CPU’s U device, xx means the location of the positioning module, zz means the bit of the input signal.

(2) Link up/down information

(a) Link up/down information is on when network cable is connected to the positioning module physically. And if the cable is disconnected, then it will be off.

(b) If you use it as execution condition contact point of servo connection command (XECON,

XPM_ECON), when a network cable is not connected, servo connection command will not be executed and when a network cable is connected, servo connection command will be executed. Then you can prevent the unnecessary error.

(3) JOG Operation

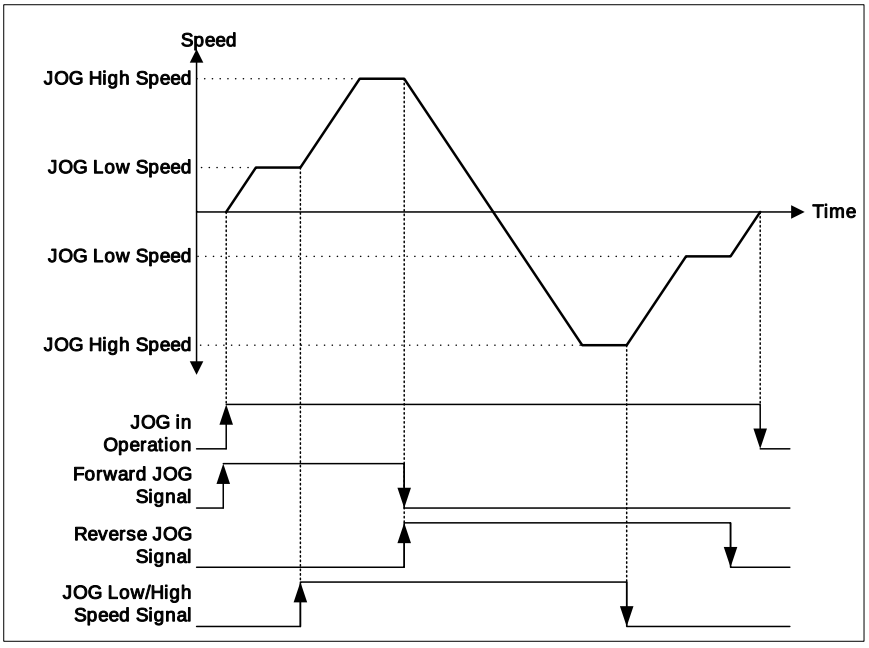
(a) Forward/Reverse Jog Signals show the direction of Jog Operation. The Jog operation shall be divided into Forward/Reverse direction according to the On/Off signals. When Forward Jog Signal is On, it starts Forward Operation and When Jog Signal is Off, it starts Reverse Operation. When both signals Off, it stops Jog Signals. When both signals On, it does Forward Jog Signal.

Forward Jog Signal	Reverse Jog Signal	Jog Operation Status
On	Off	Forward Jog Operation
Off	On	Reverse Jog Operation
Off	Off	Stop
On	On	Forward Jog Operation

(b) If Jog direction is changed during Jog operation, it slows down at first and then operates as the direction it changed.

(c) According to value of Jog low/high Signals, it could operate with low/high speed. When jog low/high signals Off, it operates with low speed and when they are ON, it operates with high speed.

(d) If you change value of low/high jog signals during Jog operation, there will be no stop and apply the speed as you changed.



Chapter 6 Command

Here describes the positioning command used in XGK CPU Module.

6.1 Contents of General Command

Command	Command description	Command condition
PUT	Internal memory write (Level)	Base, memory address, save device leading address, data number to write at one time
PUTP	Internal memory write (Edge)	Base, memory address, save device leading address, data number to write at one time
GET	Internal memory read (Level)	Base, memory address, save device leading address, data number to write at one time
GETP	Internal memory read (Edge)	Base, memory address, save device leading address, data number to write at one time

6.1.1 Internal Memory Read (GET, GETP Command)

Form	Description	Available area
n1	Base and slot No. installed with special module	Constant
n2	Leading address of special module internal memory to read a data	Constant
D	Leading address of device to save the data to read	M, P, K, L, U, N, D, R
n3	Word number of data to read	M, P, K, L, Constant

(1) Difference between GET Command and GETP Command

(a) GET Command

Always execute when operating condition is ON. (Level)

That is, when execute condition is ON, it operates continuously.

(b) GETP Command

Execute with operation start of execute condition. (Edge)

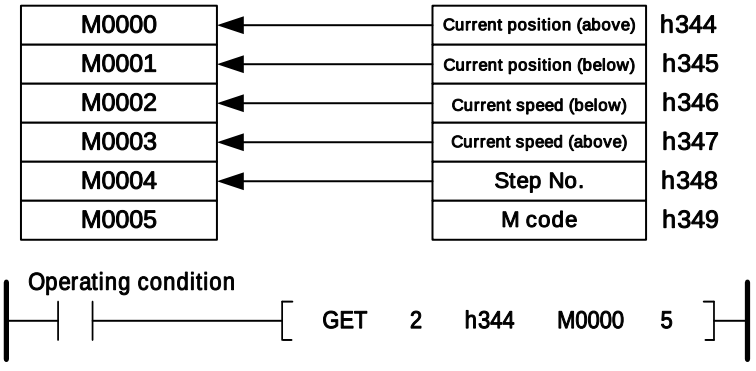
That is, when execute condition is ON, it operates only one time.

To operate again, execute condition should be off and on again.

Example

The case is that read current position, current speed and step number from axis 4 state information of positioning module which installed in No.0 base, No.2 slot to PLC CPU M0000.

Set the number of data as 5 to read 5 Word from current position to step number.



6.1.2 Internal Memory Write (PUT, PUTP Command)

Form	Description	Available area
n1	Base and slot No. installed with special module	Constant
n2	Leading address of special module internal memory to write a data	Constant
S	Leading address of device that the data to Write is saved	M, P, K, L, U, N, D, R
n3	Word number of data to write	M, P, K, L, Constant

(1) Difference between GET Command and GETP Command

(a) PUT Command

Always execute when operating condition is ON. (Level)

That is, when execute condition is ON, it operates continuously.

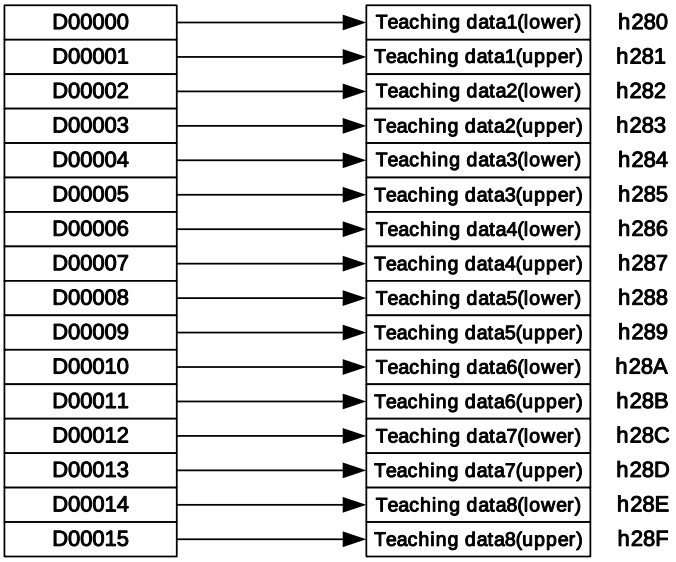
(b) PUTP Command

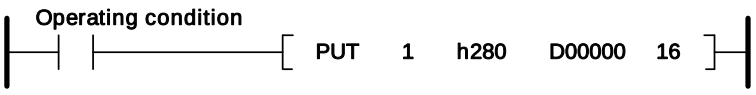
Execute with operation start of execute condition. (Edge)

That is, when execute condition is ON, it operates only one time.

To operate again, execute condition should be off and on again.

Example The case that is installed in positioning module No.0 base, slot No.1 and writes value of CPU module as axis 3 teaching value by 16 Word data of D00000~D00015.





6.2 Dedicated Commands

Command	Command description	Command condition
XORG	Homing start	Slot, command axis
XFLT	Floating origin setting	Slot, command axis
XDST	Direct start	Slot, command axis, position, speed, dwell time, M code, control word
XIST	Indirect start	Slot, command axis, step no.
XSST	Simultaneous start	Slot, command axis, Simultaneous start axis
XSWR	Simultaneous start step setting	Slot, command axis, step no., device, number of steps
XELIN	Ellipse interpolation	Slot, command axis, ratio of the ellipse, driving angle
XVTP	Speed/position switching control	Slot, command axis
XVTPP	Position specified speed/position switching control	Slot, command axis, target position
XPTV	Position/speed switching control	Slot, command axis
XPTT	Position/torque switching control	Slot, command axis, torque value
XSTP	Deceleration stop	Slot, command axis, deceleration time
XSKP	Skip operation	Slot, command axis
XSSP	Position synchronous start	Slot, command axis, step no., main axis position, main axis setting
XSSS	Speed synchronous start	Slot, command axis, main axis rate, subordinate axis rate, main axis setting
XSSSP	Position assigned Speed synchronous start	Slot, command axis, main axis rate, subordinate axis rate, main axis setting, goal position
XCAM	CAM Operation	Slot, command axis, main axis setting, CAM block no.
XCAMO	Main axis offset-specified CAM operation	Slot, command axis, main axis setting, CAM block no., main axis offset
XPOR	Position override	Slot, command axis, position
XSOR	Speed override	Slot, command axis, speed
XPSO	Position assigned speed override	Slot, command axis, position, speed
XNMV	Continuous operation	Slot, command axis
XINCH	Inching operation	Slot, command axis, inching amount
XRTP	Return to the position before manual operation	Slot, command axis
XSNS	Start step No. change	Slot, command axis, step no.
XSRS	Repeat step No. change	Slot, command axis, step no.
XMOF	M code release	Slot, command axis
XPRS	Current position preset	Slot, command axis, position
XEPRS	Encoder preset	Slot, command axis, position, Encoder No.(=0)
XTEAA	Teaching Array	Slot, command axis, step no., RAM/ROM, position/speed, Teaching no.
XTWR	Teaching array data setting	Slot, command axis, teaching data device, no. of teaching
XSBP	Basic parameter teaching	Slot, command axis, basic parameter change value, item to change, RAM/ROM
XSEP	Extended parameter setting	Slot, command axis, extended parameter change value, item to change, RAM/ROM
XSMP	Manual operation parameter setting	Slot, command axis, manual operation parameter change value, item to change, RAM/ROM
XSCP	Common parameter setting	Slot, command axis, common parameter change value, item to change, RAM/ROM
XSMD	Operation data teaching	Slot, command axis, operation data value, operation data item, step no., RAM/ROM
XVRD	Variable data reading	Slot, command axis, read address, block offset, block size, block count
XVWR	Variable data writing	Slot, command axis, data device, write address, block offset, block size, block count
XWRT	Parameter/operation data save	Slot, command axis, axis information

Command	Command description	Command condition
XEMG	Emergency stop	Slot, command axis
XCLR	Error reset	Slot, command axis, common error reset
XECLR	Error history reset	Slot, command axis
XPST	Point Start	Slot, command axis, step no.
XPWR	Point start step data setting	Slot, command axis, step data device, step no.
XSRD	Operation state reading	Slot, command axis, operation state save, device no.
XECON	Servo connection	Slot, command axis
XDCON	Servo disconnection	Slot, command axis
XSVON	Servo On	Slot, command axis
XSVOFF	Servo Off	Slot, command axis
XSCLR	Servo error reset	Slot, command axis
XSECLR	Servo error history reset	Slot command axis
XRSTR	Restart	Slot, command axis
XSVPRD*	Servo parameter read	Slot,Command axis, Index, Sub-Index, data size
XSVPWR*	Servo parameter write	Slot, command axis, Index, Sub-Index, data size, data, RAM/ROM
XSVSAVE*	Servo parameter save	Slot, command axis, saving axis
XTRQ	Torque control	Slot, command axis, torque value, gradient
XLRD	Latch position data read	Slot, command axis, device number
XLCLR	Latch reset	Slot, command axis, latch reset item
XLSET*	Latch setting	Slot, command axis, latch enable/disable, latch mode

Note

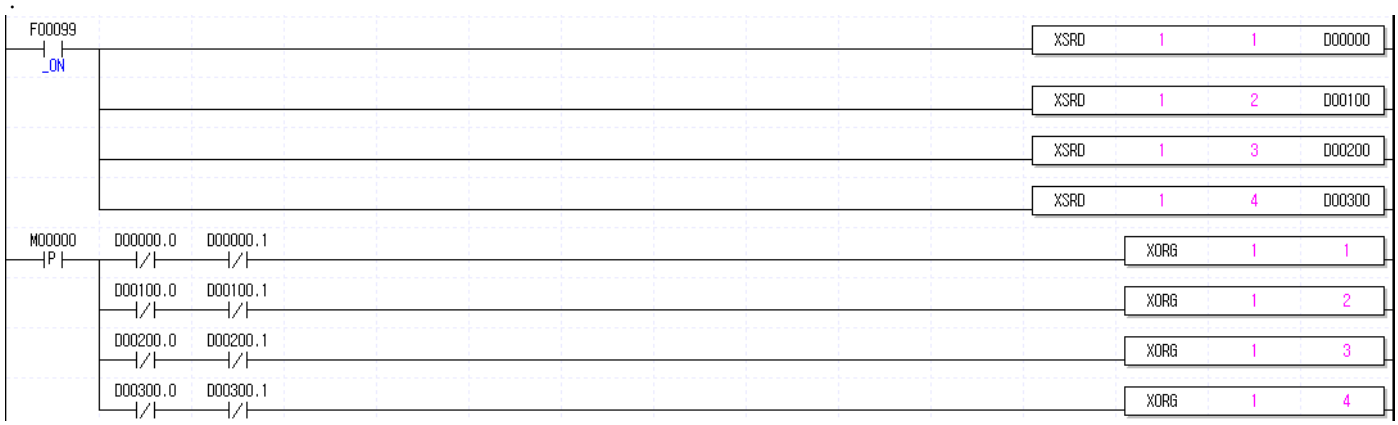
1. The dedicated command acts at Rising edge. That is, it executed the first action once when input condition is “ON.” To execute the action again, It should be “OFF” and then “ON” again. SRD just execute High level action. When input condition is “On,” it keeps operating and it doesn’t operate when it’s “Off.”
2. Command execution time is as below.
   (1) XWRT : 15ms (per axis1)
   (2) Commands except XWRT :
      1) XGF-PN8A: 1.6ms (when using 2 axes) ~ 4.8ms (when using 8 axes)
      2) XGF-PN8B: 2ms (when using 3 axes) ~ 4ms (when using 8 axes)
3. Commands with * mark are applied to only XGF-PN8B

6.3 Use of Dedicated Command

Here describes the command usage based on 1 axis when the positioning module is inserted into slot 1 of XGK CPU module. The position and speed use the units of pulse and pulse/sec [pps], respectively.

알아두기

▶ This is the method used with the operation state bit(in operation, error state) read by using SRD as the program operation condition



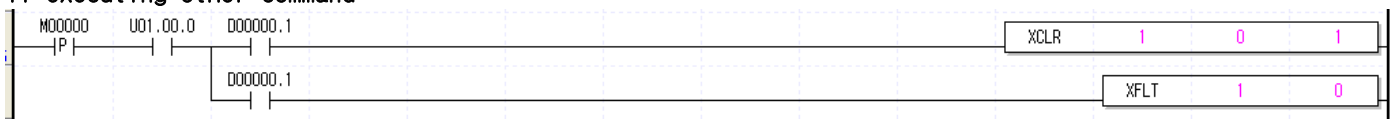
※ D00000.0: 1 axis in operation, D00000.1: 1 axis error state
D00100.0: 2 axis in operation, D00100.1: 2 axis error state
D00200.0: 3 axis in operation, D00200.1: 3 axis error state
D00300.0: 4 axis in operation, D00300.1: 4 axis error state

▶ The example program for command in this Chapter 6 also uses the operation state bit as the program operation condition as the above.

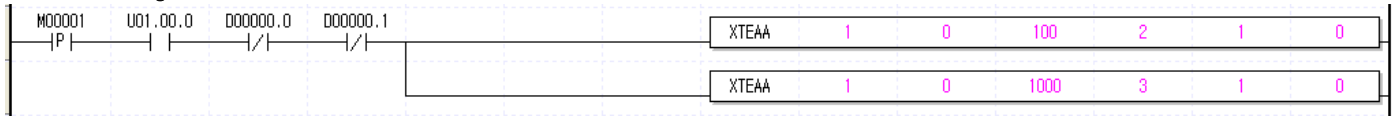
알아두기

▶ All dedicated commands except XSRD, XPWR, XSWR, XLRD and XTWR are not allowed to use together for one command execution axis (if it is used like the below example program, a command does not work properly).

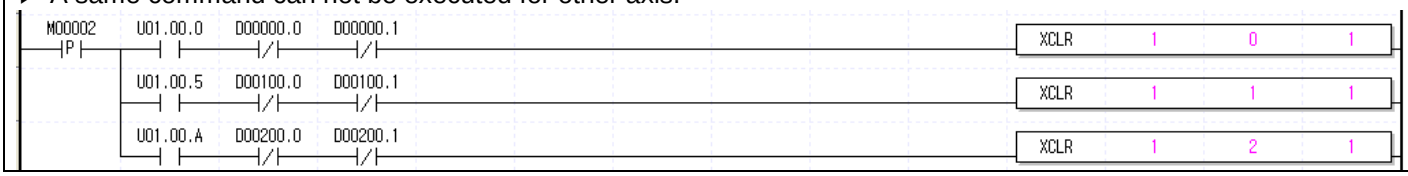
If executing other command



If executing same command

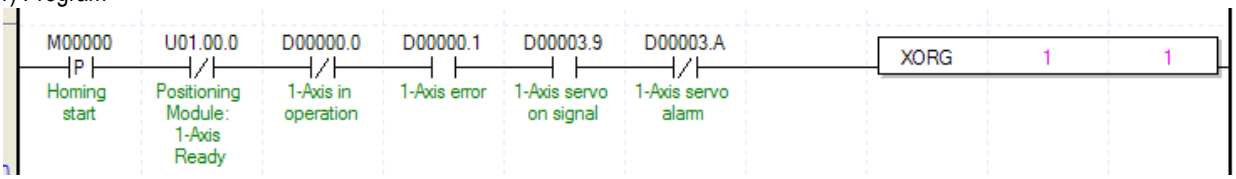


▶ A same command can not be executed for other axis.



6.3.1 Homing start (Command : XORG)

(1) Program



(2) Description

Device	Description
M00000	axis1 homing start input
U01.00.0	axis1 ready
D00000.0	axis1 operation
D00000.1	axis1 error
D00003.9	axis1 servo on signal
D00003.A	axis1 servo error

Command	XORG				Homing start
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK, constant, D, Z, R, ZR	WORD	Command axis (1~8 : axis1 ~ axis8)

※ PMLK means P, M, L and K areas.

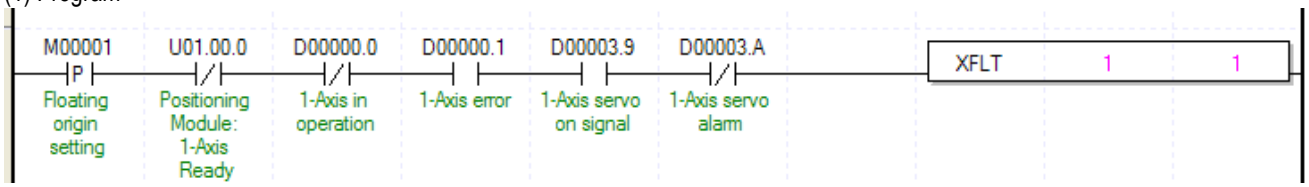
(a) If homing start command is executed, it carries out homing operation by the setting homing parameter and if homing is complete by external input signal, the origin determination end signal is “ON”.

(b) Please refer to "9.1 Homing Start” about detailed explanation of Homing Start.

(c) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.2 Floating origin setting (Command : XFLT)

(1) Program



(2) Description

Device	Description
M00001	axis1 floating origin setting input
U01.00.0	axis1 ready
D00000.0	axis1 in operation
D00000.1	axis1 error state
D00003.9	axis1 servo on signal
D00003.A	axis1 servo error

Command	XFLT				Floating origin setting
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1~8 : axis1 ~axis8)

※ PMLK means P, M, L and K areas.

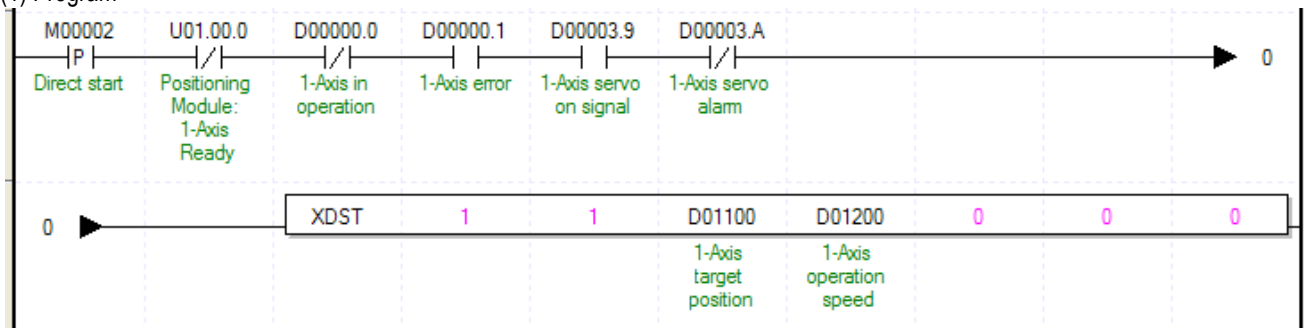
(a) If the floating origin setting command is executed, the current position is changed to the origin address, “0” and the origin determination signal (bit) is ON.

(b) Floating origin setting that different from homing origin is set at the current position and can not be set in operation.

(c) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.3 Direct start (Command : XDST)

(1) Program



(2) Description

Device	Description
M00002	axis1 direct start input
U01.00.0	axis1 ready
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D00003.9	axis1 servo on
D00003.A	axis1 servo error

Command	XDST				Direct start
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Goal position	PMLK,constant,D,Z,R,ZR	DINT	Goal position (-2,147,483,648 ~ 2,147,483,647)
	OP4	Goal speed	PMLK,constant,D,Z,R,ZR	DWORD	Goal speed
	OP5	Dwell time	PMLK,constant,D,Z,R,ZR	WORD	Dwell time (0~65535)
	OP6	M code	PMLK,constant,D,Z,R,ZR	WORD	M code (0~65535)
	OP7	Control word	PMLK,constant,D,Z,R,ZR	WORD	

※ PMLK means P, M, L and K areas.

(a) Details of Control word (OP7) for each Bit are as follows.

15 ~ 12	11 ~ 10	9 ~ 8	7 ~ 5	4	3 ~ 2	1 ~ 0
-	Dec. Time	Acc. Time	-	0:Absolute 1:Incremental	-	0:Position Control 1:Speed control 2:Feed Control 3: Shortest Position Control

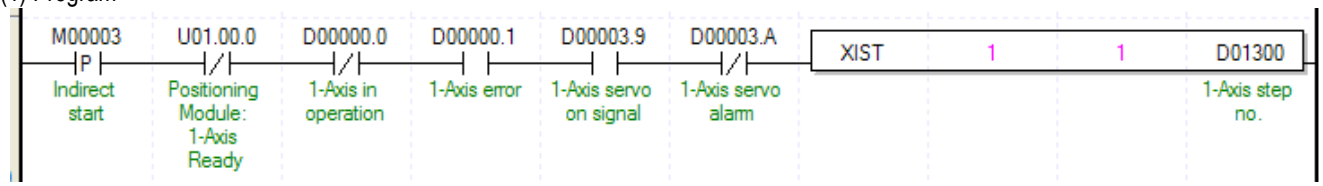
(b) If control word is h0012, it shall be set by Feed control, incremental, acc./dec. time 1.

(c) No.2~3, 5~7, 12~15 Bit of control word is the unused area and does not affect the setting.

(d) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.4 Indirect start (Command : XIST)

(1) Program



(2) Description

Device	Description
M00003	axis1 indirect start input
U01.00.0	axis1 ready
D00000.0	axis1 in operation
D00000.1	axis1 error state
D01300	axis1 step no.
D00003.9	axis1 servo on signal
D00003.A	axis1 servo error

Command	DST				Indirect start
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Operation step	PMLK,constant,D,Z,R,ZR	WORD	Step No. to operate (0~400)

※ PMLK means P, M, L and K areas.

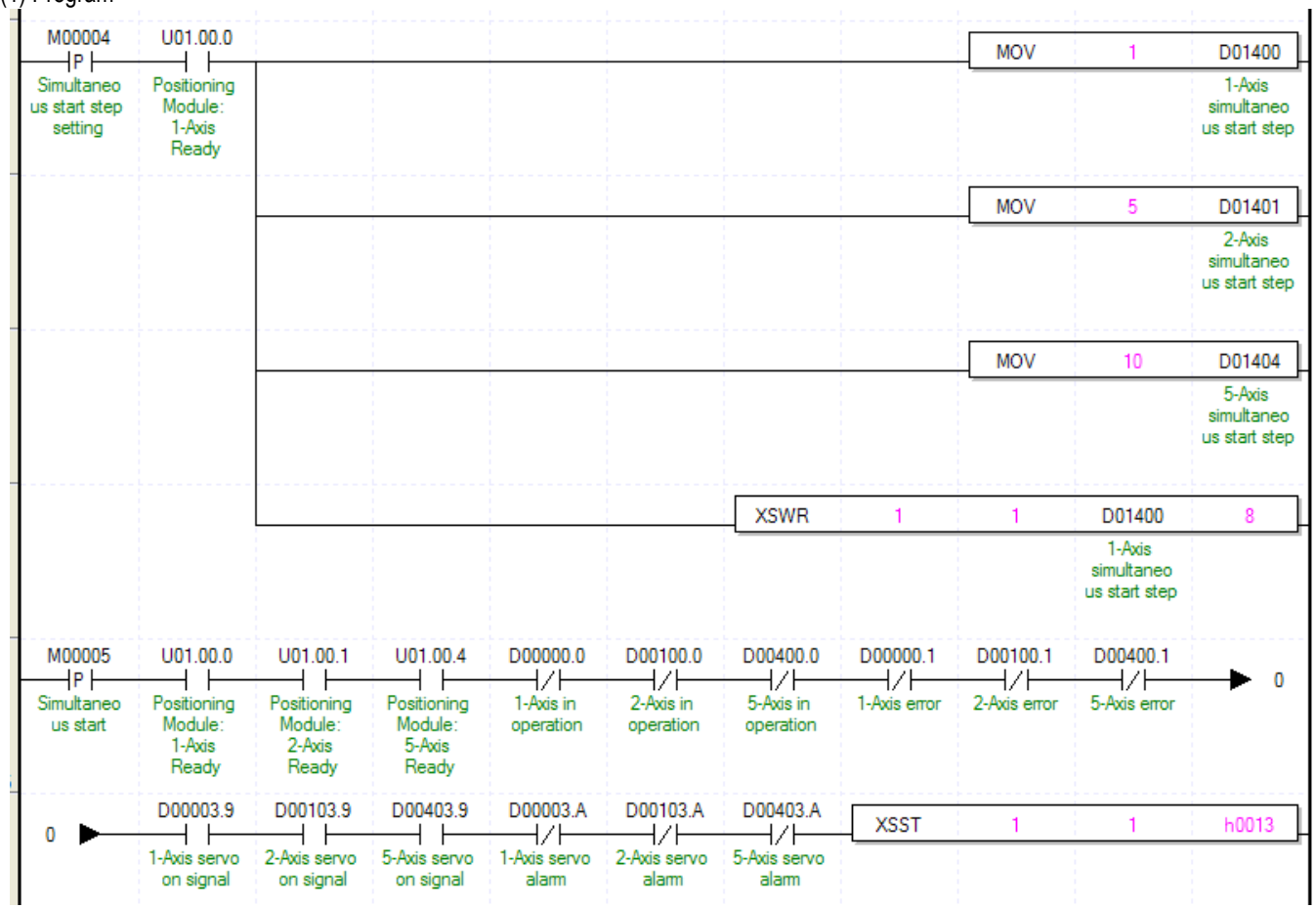
(a) If operation step No. is set as “0” in indirect start, it will be operated as current step No. If other number except 0 is set as the operation step number, it operates only for step no. set.

(b) If operation pattern is set as Continuous or Keep, several steps can be operated by an indirect start command.

(c) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.5 Simultaneous Start (Command : XSST)

(1) Program



(2) Description

Device	Description
M00004	Simultaneous start step setting
M00005	Simultaneous start input
U01.00.0	axis1 ready
U01.00.1	axis2 ready
U01.00.4	axis5 ready
D00000.0	axis1 in operation
D00000.1	axis1 error state
D00003.9	axis1 servo on signal
D00003.A	axis1 servo error
D00100.0	axis2 in operation
D00100.1	axis2 error state
D00103.9	axis2 servo on signal
D00103.A	axis2 servo error
D00400.0	axis5 in operation
D00400.1	axis5 error state
D00403.9	axis5 servo on signal
D00403.A	axis5 servo error
D01400	axis1 simultaneous start step
D01401	axis2 simultaneous start step
D01404	axis5 simultaneous start step

Command	XSST				Linear interpolation
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Operation axis	PMLK,constant,D,Z,R,ZR	WORD	Operating axis setting

※ PMLK means P, M, L and K areas.

(a) Simultaneous command is the command operates simultaneous steps saved in 'operation axis(OP3)' at a time.

(b) Axis setting is set by setting the bits to the axis

15 ~ 8 Bit	7Bit	6Bit	5Bit	4Bit	3Bit	2Bit	1Bit	0Bit
Not use	Axis8	Axis7	Axis6	Axis5	Axis4	Axis3	Axis2	Axis1

That is, axis5, axis2, axis1 will be set if set as h0023

But, the axis which command simultaneous start is basically included without being set in operating axis.

(c) In the example program above, axis1 operates step no.1, axis2 operates step no.5, 5 axes operates step no.10.

(d) To set steps of axis for simultaneous start, use XSWR command or PUT/PUTP command to set simultaneous start step no. on simultaneous start step memory address. This must be complete before simultaneous start executes.

(e) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.6 Simultaneous Start Step Setting (Command : XSWR)

(1) Program

Refer to the chapter 6.3.5 for example program.

(2) Description

Refer to the chapter 6.3.5 for example program.

Command	XSWR				Simultaneous start step setting
Operand	OP1	Slot	Constant	WORD	Slot no. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis to command (1 ~ 8 : axis1 ~ axis8)
	OP3	Device	PMLK,constant,D,Z,R,ZR	WORD	The device leading no. has simultaneous start step no.
	OP4	Number of step	PMLK,constant,D,Z,R,ZR	WORD	The number of step to use.

※ PMLK means P, M, L and K areas.

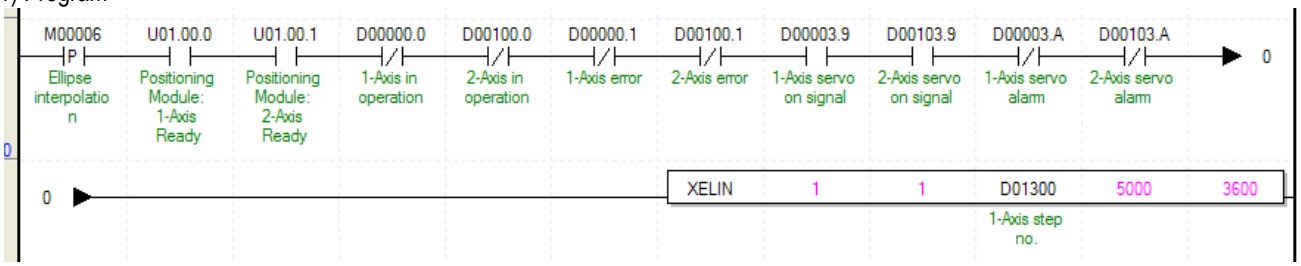
(a) In the example program, axis 1, axis 2, axis5 operate no.1 step, no.5 step, no.10 step respectively.

(c) To set steps of axis for simultaneous start, use XSWR command or PUT/PUTP command to set simultaneous start step no. on simultaneous start step memory address. This must be complete before simultaneous start executes.

(c) When using PUT command to set simultaneous start, refer to the memory address of “5.1.3 Simultaneous start step data” and “6.1.2 internal memory writing”.

6.3.7 Ellipse Interpolation (Command : XELIN)

(1) Program



(2) Description

Device	Description
M00006	axis1/axis2 ellipse interpolation input
U01.00.0	axis1 ready
U01.00.1	axis1 ready
D00000.0	axis1 in operation
D00000.1	axis1 error state
D00003.9	axis1 servo on signal
D00003.A	axis1 servo error
D00100.0	axis2 in operation
D00100.1	axis2 error state
D00103.9	axis1 servo on signal
D00103.A	axis1 servo error
D01300	axis1 operation step

Command	XSST				Simultaneous start
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	operation step	PMLK,constant,D,Z,R,ZR	WORD	Step no. to execute ellipse interpolation
	OP4	Ellipse ratio	PMLK,constant,D,Z,R,ZR	WORD	Ellipse ratio (%)
	OP5	Operation degree	PMLK,constant,D,Z,R,ZR	WORD	Degree for ellipse interpolation

※ PMLK means P, M, L and K areas.

(a) Ellipse interpolation distorts operation data which set as circular arc interpolation by ratio set on ellipse ratio and executes ellipse operation by set degree on OP5. Therefore, step of operation data set on operation step (OP3) must be set as circular arc interpolation control.

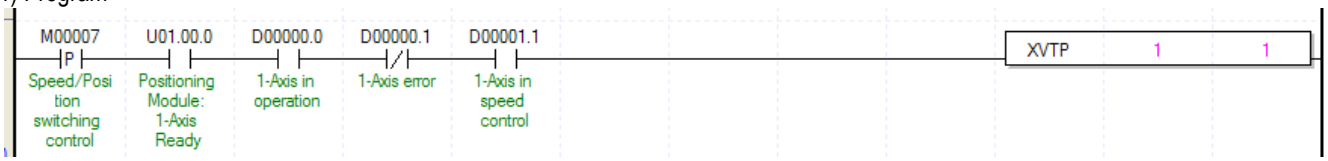
(b) Ellipse ratio is able to be set from 1 to 65535, has [$X10^{-2}$ %] unit. That is, 65535 will be 655.35%.

(c) Operation degree is able to be set from 1 to 65535, has [$X10^{-1}$ degree] unit. That is, 3650 will be 365.0 degree.

(d) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.8 Speed/Position Switching Control (Command : XVTP)

(1) Program



(2) Description

Device	Description
M00007	axis1 speed/position switching control input
U01.00.0	axis1 ready
D00000.0	axis1 in operation
D00000.1	axis1 error state
D00001.1	axis1 in speed control

Command	XVTP				Speed/position switching control
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)

※ PMLK means P, M, L and K areas.

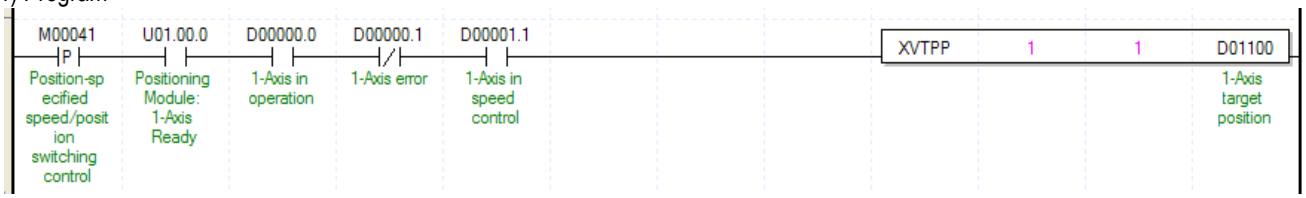
(a) If speed/position switching control is executed in the state of speed control operation, it shall be switched to position control and positioning operation is executed with the position set in the speed control.

(b) For detail description about speed/position switching control, refer to “9.2.14 Speed/Position Switching Control”

(c) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.9 Position specified Speed/Position Switching Control (Command : XVTPP)

(1) Program



(2) Description

Device	Description
M00007	1-axis position-specified speed/position switching control input
U01.00.0	1-axis ready
D00000.0	1-axis in operation
D00000.1	1-axis error state
D00001.1	1-axis in speed control
D01100	1-axis target position

Command	XVTPP				Speed/position switching control
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Target position	PMLK,constant,D,Z,R,ZR	DINT	Transfer amount after position control switching

※ PMLK means P, M, L and K areas.

(a) If speed/position switching control is executed in the state of speed control operation, it shall be switched to position control and positioning operation is executed with the position set in the speed control.

(b) For detail description about speed/position switching control, refer to “9.2.15 Position-specified Speed/Position Switching Control”

(c) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.10 Position/Speed Switching Control (Command : XPTV)

(1) Program

(2) Description

Device	Description
M00008	axis1 position/speed switching control input
U01.00.0	axis1 ready
D00000.0	axis1 in operation
D00000.1	axis1 error state
D00001.0	axis1 in position control

Command	PTV				Position/speed switching control
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)

※ PMLK means P, M, L and K areas.

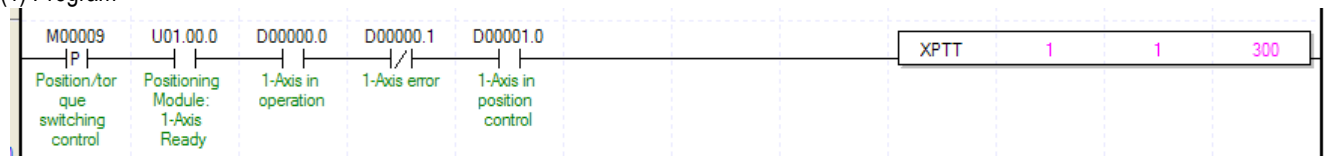
(a) If position/speed switching control is executed during position control operation, it is converted to speed control, operates at the speed set during position control and stops by executing deceleration stop.

(b) For the detail description about position/speed switching control, refer to “9.2.16 Position/Speed Switching Control”.

(c) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.11 Position/Torque Switching Control (Command : XPTT)

(1) Program



(2) Description

Device	Description
M00009	axis1 position/torque switching control input
U01.00.0	axis1 ready
D00000.0	axis1 in operation
D00000.1	axis1 error state
D00001.0	axis1 in position control

Command	PTV				Position/speed switching control
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	torque	PMLK,constant,D,Z,R,ZR	INT	Torque value (-32768 ~ 32767)

※ PMLK means P, M, L and K areas.

(a) If position/torque switching control is executed during position control operation, it is converted to torque control with torque value of OP3, and keeps torque operation until stop by executing deceleration stop.

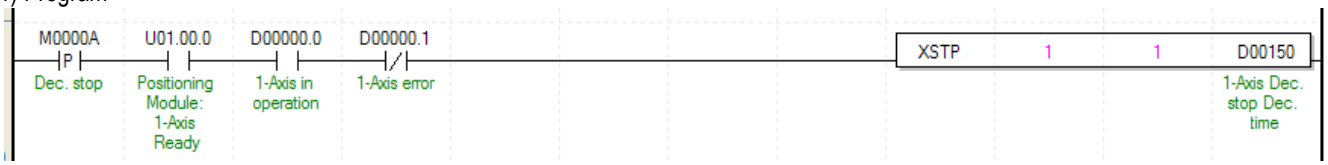
(b) Range of Torque value is -32768 ~ 32767 and unit is [%]. The allowable range of torque value may vary according to the connected servo drive. In general, target torque value is limited to the maximum torque setting.

(c) For the detail description about position/torque switching control, refer to “9.2.17 Position/Toruqe Switching Control”.

(d) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that it saves the axis state value in D device area with XSRD command.

6.3.12 Deceleration Stop (Command : XSTP)

(1) Program



(2) Description

Device	Description
M0000A	axis1 deceleration stop input
U01.00.0	axis1 ready
D00000.0	axis1 in operation
D00000.1	axis1 error state
D01500	axis1 deceleration stop time setting

Command	STP				Deceleration stop
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Deceleration time	PMLK,constant,D,Z,R,ZR	WORD	deceleration time (0 ~ 2,147,483,647 ms)

※ PMLK means P, M, L and K areas.

(a) Deceleration stop carry out the command in deceleration, acceleration and equal speed areas.

(b) Deceleration time means the time required from deceleration start to stop and it is available to set from 0 ~ 2,147,483,647ms. But if setting as “0”, it stops only by deceleration time set at the beginning of operation.

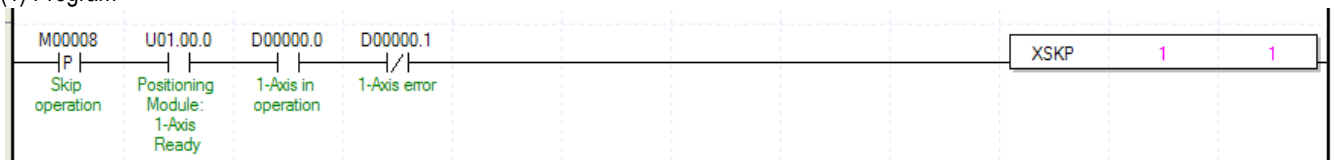
(c) Deceleration time means the time required from the speed limit of basic parameter on operation axis to stop.

(d) If deceleration stop command is executed in speed sync., position sync. or CAM operation, it stops speed sync., position sync. or CAM operation depending on current operation control state.

(e) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.13 Skip Operation (Command : XSKP)

(1) Program



(2) Description

Device	Description
M0000B	axis1 skip operation input
U01.00.0	axis1 ready
D00000.0	axis1 in operation
D00000.1	axis1 error state

Command	SKP				Skip operation
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)

※ PMLK means P, M, L and K areas.

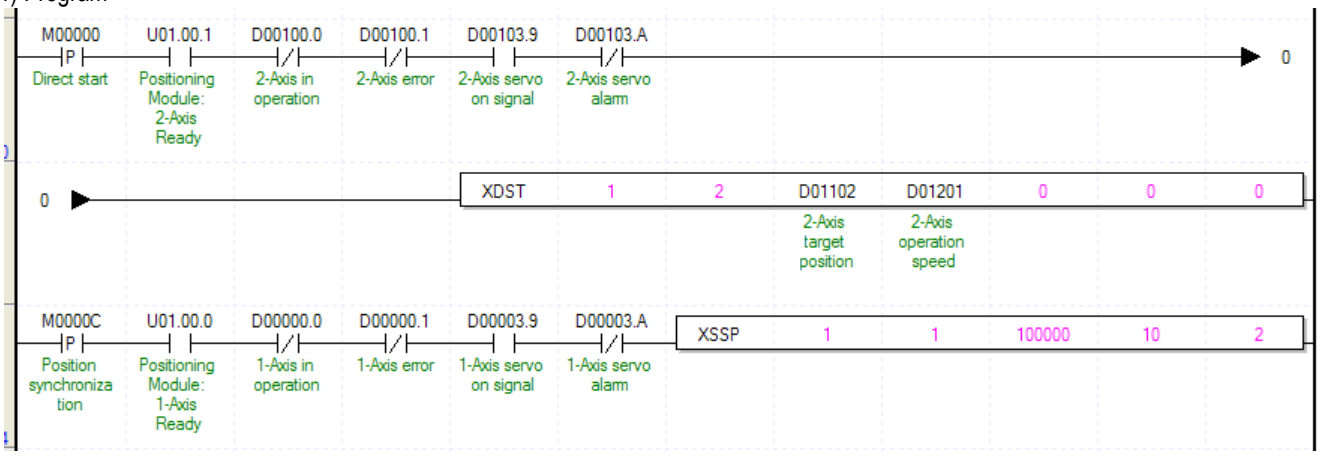
(a) This ends and stops the operation of step which is in operation currently and then continues to operate the next step.

(b) For the details description of skip operation, refer to “9.5.3 Skip Operation.

(c) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.14 Synchronous Start by Position (Command : XSSP)

(1) Program



(2) Description

Device	Description
M0000C	axis1 synchronous start by position input
M0000D	axis1 direct start input
U01.00.0	axis1 ready
U01.00.0	Axis2 ready
D00000.0	axis1 in operation
D00000.1	axis1 error
D00003.9	axis1 servo on signal
D00003.A	axis1 servo error
D00100.0	axis2 in operation
D00100.1	axis2 error state
D00103.9	axis2 servo on signal
D00103.A	axis2 servo error

Command	XSSP				Synchronous start by position
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Main axis position	PMLK,constant,D,Z,R,ZR	DINT	Position of sub axis to operate
	OP4	Operation step	PMLK,constant,D,Z,R,ZR	WORD	Sub axis operation step No. (0~ 400)
	OP5	Main axis	PMLK,constant,D,Z,R,ZR	WORD	Main axis (1 ~ 10 : axis1 ~ axis8, Encoder1, Encoder2)

※ PMLK means P, M, L and K areas.

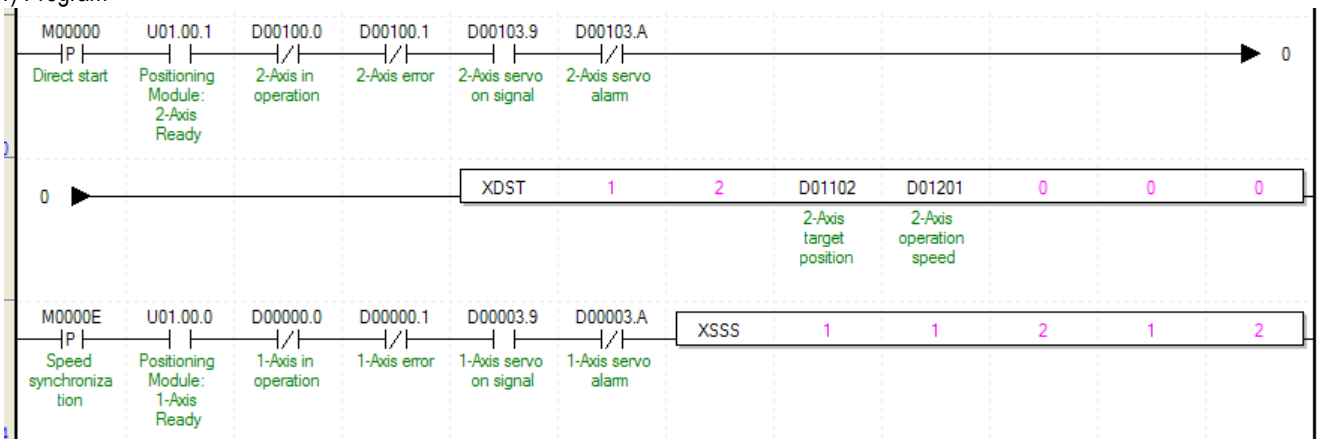
(a) If the command of synchronous start by position is executed, it becomes in operation state but motor does not operate actually. At the point that axis2 as main axis setting starts and its current position is 1000, axis1 will start and the motor will operate.

(b) For the detail description about position synchronous start, refer to “9.4.2 position synchronous start control”

(c) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.15 Speed Sync (Command : XSSS)

(1) Program



(2) Description

Device	Description
M0000E	axis1 speed sync start input
M0000D	axis2 direct start input
U01.00.0	axis1 in operation
U01.00.1	axis2 in operation
D00000.0	axis1 in operation
D00000.1	axis1 error state
D00003.9	axis1 servo on signal
D00003.A	axis1 servo error
D00100.0	axis2 in operation
D00100.1	axis2 error state
D00103.9	axis2 servo on signal
D00103.A	axis2 servo error

Command	XSSS				Synchronous start by speed
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Main axis ratio	PMLK,constant,D,Z,R,ZR	WORD	Speed sync. main axis ratio (-32768 ~ 32767)
	OP4	Subordinate axis ratio	PMLK,constant,D,Z,R,ZR	WORD	Speed sync. sub axis ratio (-32768 ~ 32767)
	OP5	Main axis	PMLK,constant,D,Z,R,ZR	WORD	Main axis(1 ~ 8 : axis1 ~ axis8, 9 : Encoder1, 10 : Encoder2)

※ PMLK means P, M, L and K areas.

(a) In the example program above, if the command of synchronous start by speed is executed, axis1 (subordinate axis) is indicated as 'in operation' but the motor does not operate. If operating axis2 set as the main axis, axis1 (subordinate axis) is operated depending on the designated ratio between main axis (OP3) and sub axis(OP4).

(b) If speed sync. ratio (sub axis ratio / main axis ratio) is positive integer, sub axis operation turns main axis direction, if not positive integer, it turns the opposite of main axis direction.

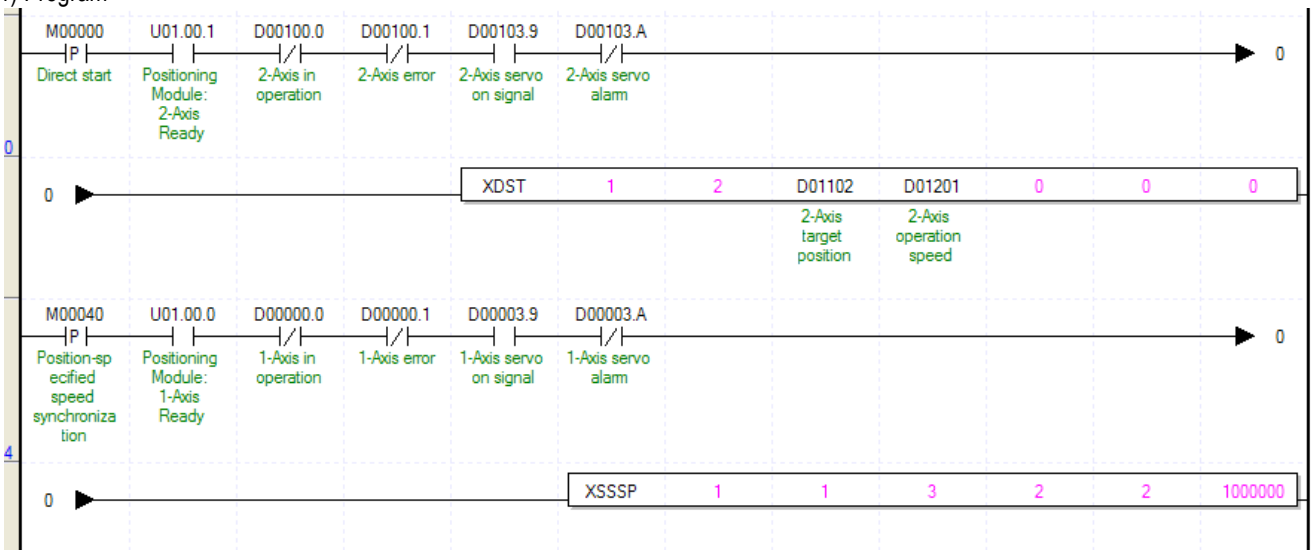
(c) For example, if main axis ratio is 3, sub axis ratio is 2, when main axis moves by 3000, sub axis moves 2000.

(d) For the detail description about speed sync., refer to "9.4.1 Speed Synchronous Start Control".

(e) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.16 Position-specified Speed synch (Command: XSSSP)

(1) Program



(2) Description

Device	Description
M00040	axis1 position-specified speed synch input
M0000D	axis2 direct start input
U01.00.0	axis1 ready
U01.00.1	axis2 ready
D00000.0	axis1 in operation
D00000.1	axis1 error state
D00003.9	axis1 servo on signal
D00003.A	axis1 servo error
D00100.0	axis2 in operation
D00100.1	axis2 error state
D00103.9	axis2 servo on signal
D00103.A	axis2 servo error

Command	XSSSP				Speed synchronous start by position
Operand	OP1	Slot	Constant	WORD	Slot no. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Main axis ratio	PMLK,constant,D,Z,R,ZR	INT	Speed sync. main axis ratio (-32768 ~ 32767)
	OP4	Sub axis ratio	PMLK,constant,D,Z,R,ZR	INT	Speed sync. sub axis ratio (-32768 ~ 32767)
	OP5	Main axis	PMLK,constant,D,Z,R,ZR	WORD	Main axis (1 ~ 8 : axis1 ~ axis8, 9 : Encoder1, 10 Encoder2)
	OP6	Target position	PMLK,constant,D,Z,R,ZR	DINT	Target position of position-specified speed synch

※ PMLK means P area, M area, L area, K area.

(a) In the example program above, if the command of synchronous start by speed is executed, axis1 (subordinate axis) is indicated as 'in operation' but the motor does not operate. If operating axis2 set as the main axis, axis1 (subordinate axis) is operated depending on the designated ratio between main axis (OP3) and sub axis(OP4).

(b) If speed sync. ratio (sub axis ratio / main axis ratio) is positive integer, sub axis operation turns main axis direction, if not positive integer, it turns the opposite of main axis direction.

(c) For example, if main axis ratio is 3, sub axis ratio is 2 and target position is 1,000,000, when main axis moves by 3000, sub axis

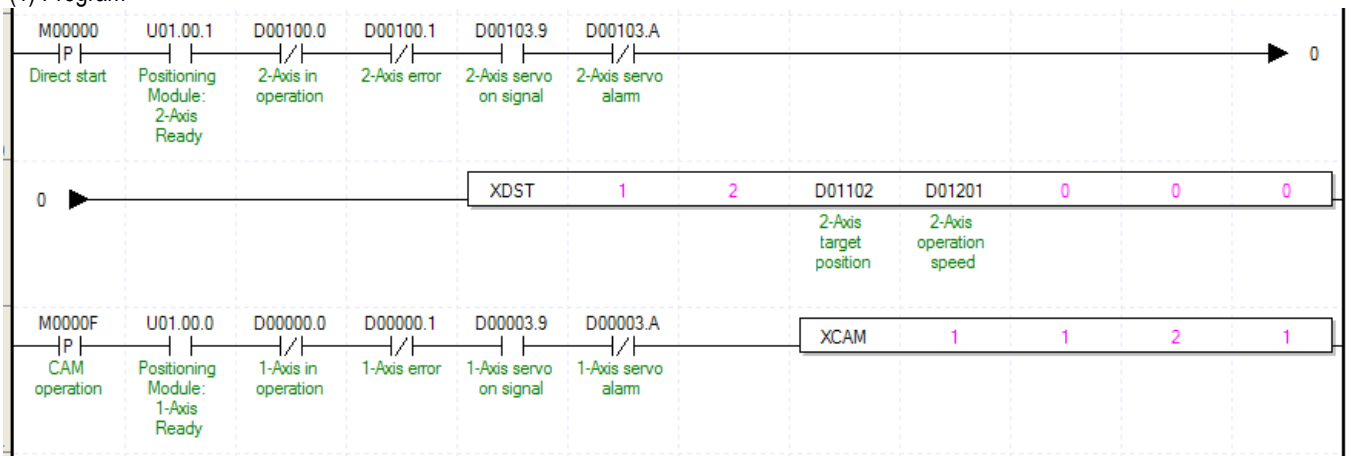
moves 2000. It stops by where position of main axis is at 1,000,000.

(d) For the detail description about speed sync., refer to “9.4.1 Speed Synchronous Start Control”.

(e) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.17 CAM Operation (Command : XCAM)

(1) Program



(2) Description

Device	Description
M0000F	axis1 cam operation input
M0000D	axis1 direct start input
U01.00.0	axis1 ready
U01.00.1	axis2 ready
D00000.0	axis1 in operation
D00000.1	axis1 error state
D00003.9	axis1 servo on signal
D00003.A	axis1 servo error
D00100.0	axis2 in operation
D00100.1	axis2 error state
D00103.9	axis2 servo on signal
D00103.A	axis2 servo error

Command	XCAM				Cam Operation
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Main axis	PMLK,constant,D,Z,R,ZR	WORD	Main axis (1 ~ 8 : axis1 ~ axis8, 9 : Encoder1, 10:Encoder2)
	OP4	Cam Block	PMLK,constant,D,Z,R,ZR	WORD	Cam data block to apply to operation (1 ~ 9)

※ PMLK means P, M, L and K areas.

(a) In the example program above, if cam operation command is executed, axis1 (sub axis) is indicated as “In operation” but the motor does not operate actually. When axis2 starts operating as a main axis, motor of axis1 starts operating toward sub axis location depending on data which set on cam block (OP4).

(b) Maximum number of cam data block is 8.

(c) Cam data is set on positioning package but has to be downloaded at positioning module before cam operation.

(d) For the detail description about cam operation, refer to “9.4.3 Cam Operation (XCAM).

(e) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

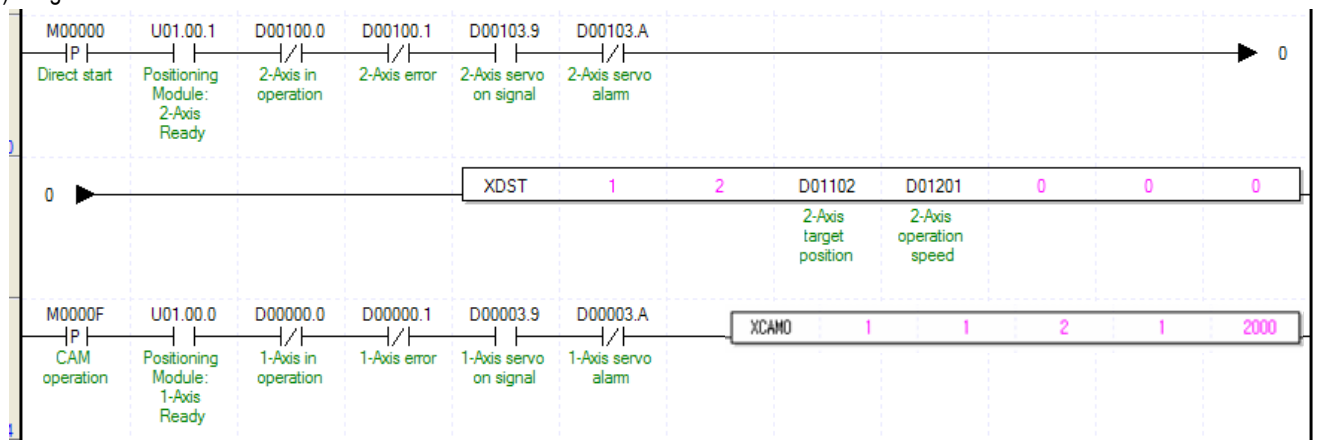
(f) In order to use user CAM operation, you have to set CAM block number as 9.

(g) During the user CAM operation, it is possible to change the user CAM data with the Write Variable Data command.

(h) For detailed information on user CAM operation, refer to “94.4. user CAM operation”.

6.3.18 Main axis offset-designated CAM Operation (Command : XCAMO)

(1) Program



(2) Description

Device	Description
M0000F	axis1 cam operation input
M0000D	axis1 direct start input
U01.00.0	axis1 ready
U01.00.1	axis2 ready
D00000.0	axis1 in operation
D00000.1	axis1 error state
D00003.9	axis1 servo on signal
D00003.A	axis1 servo error
D00100.0	axis2 in operation
D00100.1	axis2 error state
D00103.9	axis2 servo on signal
D00103.A	axis2 servo error

Command	XCAMO				Cam Operation
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Main axis	PMLK,constant,D,Z,R,ZR	WORD	Main axis (1 ~ 8 : axis1 ~ axis8, 9 : Encoder1, 10:Encoder2)
	OP4	Cam Block	PMLK,constant,D,Z,R,ZR	WORD	Cam data block to apply to operation (1 ~ 9)
	OP5	Main axis offset	PMLK,constant,D,Z,R,ZR	DINT	Main axis position to start CAM operation

※ PMLK means P, M, L and K areas.

(a) In the example program above, if cam operation command is executed, axis1 (sub axis) is indicated as “In operation” but the motor does not operate actually. When axis2 starts operating as a main axis and transfer amount becomes 2000, motor of axis1 starts operating toward sub axis location depending on data which set on cam block (OP4).

(b) Maximum number of cam data block is 8.

(c) Cam data is set on positioning package but has to be downloaded at positioning module before cam operation.

(d) For the detail description about cam operation, refer to “9.4.3 Cam Operation (XCAM).

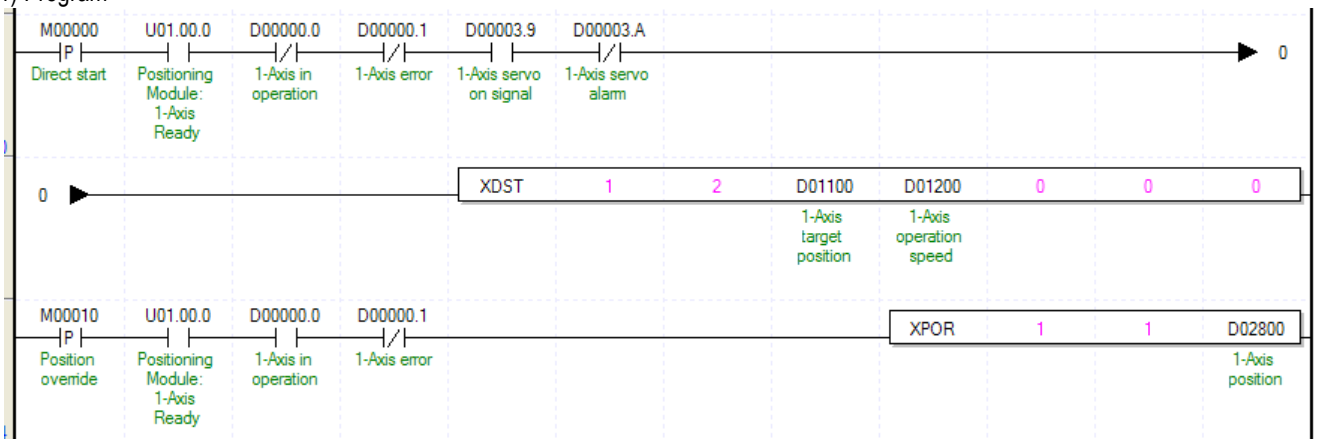
(e) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

(f) In order to use user CAM operation, you have to set CAM block number as 9.

(g) For detailed information on user CAM operation, refer to “9.4.4. user CAM operation”.

6.3.19 Position Override (Command : XPOR)

(1) Program



(2) Description

Device	Description
M00010	axis1 position override input
M00011	axis1 direct start input
U01.00.0	axis1 ready
D00000.0	axis1 in operation
D00000.1	axis1 error state
D00003.9	axis1 servo on signal
D00003.A	axis1 servo error
D01100	Goal position value
D02800	Position override value

Command	XPOR				Position override
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Position value	PMLK,constant,D,Z,R,ZR	DINT	Goal position value to change (Absolute coordinate)

※ PMLK means P, M, L and K areas.

(a) If position override is executed before reaching goal position, goal position shall be changed with D02800 for positioning operation. If executing positioning position override after passing a position to execute position override, it stops at the current position.

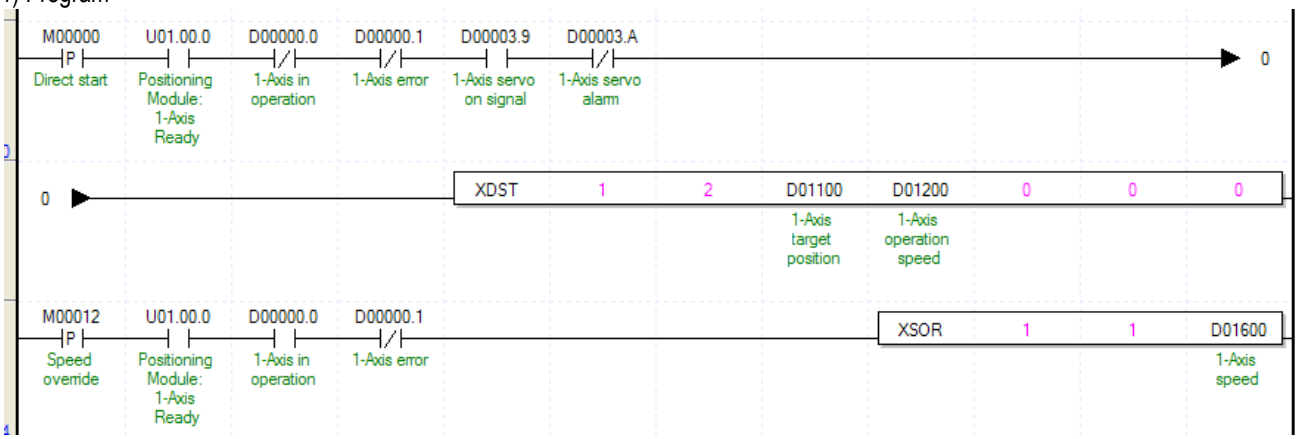
(b) Position override set on position override value is absolute coordinate position.

(c) For the detail description about position override, refer to “9.5.4 Position Override”.

(d) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.20 Speed Override (Command : XSOR)

(1) Program



(2) Description

Device	Description
M00012	axis1 speed override input
M00011	axis1 direct start input
U01.00.0	axis1 ready
D00000.0	axis1 in operation
D00000.1	axis1 error state
D00003.9	axis1 servo on signal
D00003.A	axis1 servo error
D01200	Goal speed value
D01600	Speed override value

Command	XSOR				Speed override
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Speed value	PMLK,constant,D,Z,R,ZR	DWORD	Goal speed value to change

※ PMLK means P, M, L and K areas.

(a) Speed override value (OP3) will be set as “%” or “Speed value” depending on the value which set on “speed override” in common parameter.

(b) If unit of speed override value is %, the setting area is from 1 to 65,535, it means 0.01% ~ 655.35%.

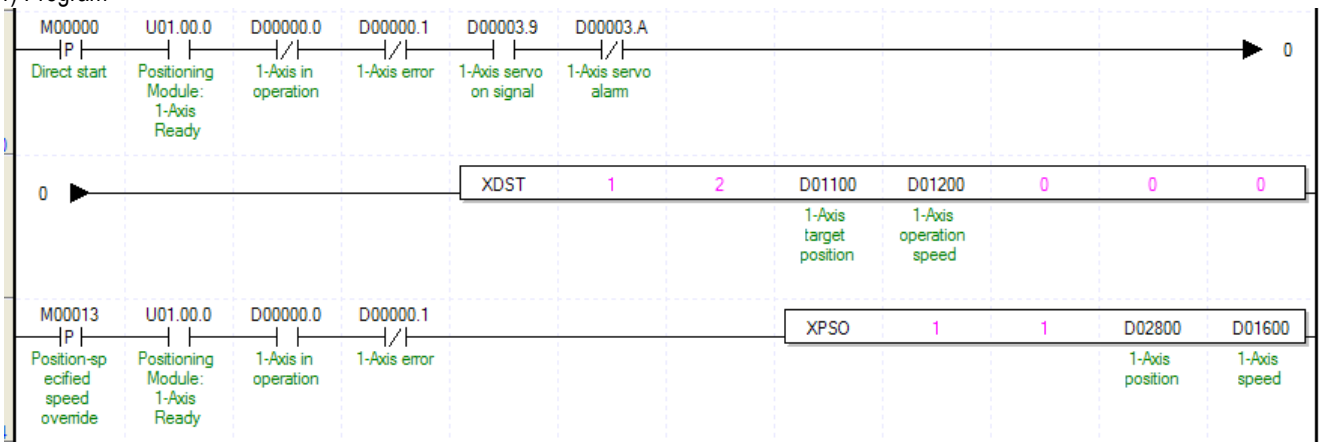
(c) If unit of speed override value is speed value, setting area is from 1 to speed limit value. The speed limit value is set on “Speed limit value” of basic parameter and unit of speed override value depends on unit of axis.

(d) For the detail description about speed override operation, refer to “9.5.5 Speed Override”.

(e) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.21 Position-specified Speed Override (Command : XPSO)

(1) Program



(2) Description

Device	Description
M00013	axis1 position assigned speed override input
M00011	axis1 direct start input
U01.00.0	axis1 ready
D00000.0	axis1 in operation
D00000.1	axis1 error state
D00003.9	axis1 servo on signal
D00003.A	axis1 servo error
D01200	Goal speed value
D01600	Speed override value
D02800	Position value to execute speed change

Command	XPSO				Position specified speed override
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Position value	PMLK,constant,D,Z,R,ZR	DINT	Position value to change the speed
	OP4	Speed value	PMLK,constant,D,Z,R,ZR	DWORD	Goal speed value to change

※ PMLK means P, M, L and K areas.

(a) Speed override value (OP3) will be set as “%” or “Speed value” depending on the value which set on “speed override” in common parameter.

(b) If unit of speed override value is %, the setting area is from 1 to 65,535, it means 0.01% ~ 655.35%.

(c) If unit of speed override value is speed value, setting area is from 1 to speed limit value. The speed limit value is set on “Speed limit value” of basic parameter and unit of speed override value depends on unit of axis.

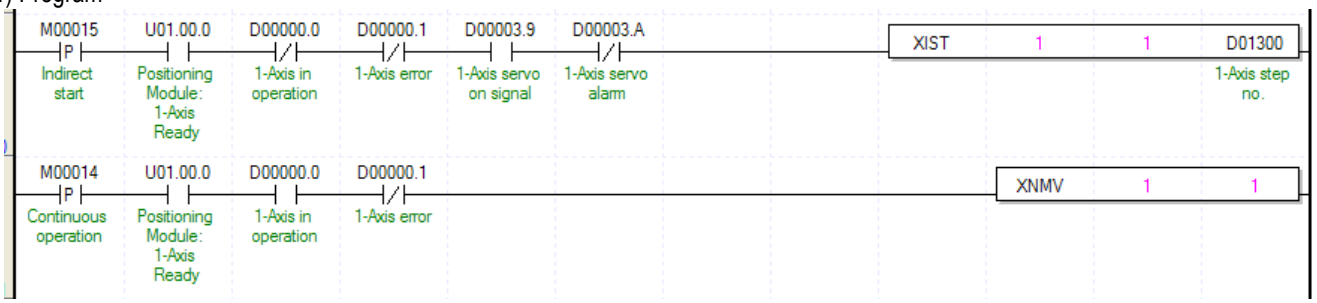
(d) In the example program above, axis1 position assigned speed override input(M00013) become “on” to execute position assigned speed override after axis1 direct start input (M00011) become “on”. When the position of axis1 is located at the position where set at D02800, the speed will be changed to the value set at D01600.

(e) For the detail description about position assigned speed override operation, refer to “9.5.6 Position Assigned Speed Override”.

(f) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.22 Continuous Operation (Command : XNMV)

(1) Program



(2) Description

Device	Description
M00014	axis1 continuous operation input
M00015	axis1 indirect start input
U01.00.0	axis1 ready
D00000.0	axis1 in operation
D00000.1	axis1 error state
D00003.9	axis1 servo on signal
D00003.A	axis1 servo error
D01300	1axus operation step

Command	XNMV				Continuous operation
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)

※ PMLK means P, M, L and K areas.

(a) If continuous operation command is executed, the step No. is changed from the step in current operation to the next step No. and continues positioning operation to the speed of the next step and goal position. Connection with the next step is executed by continuous operation pattern.

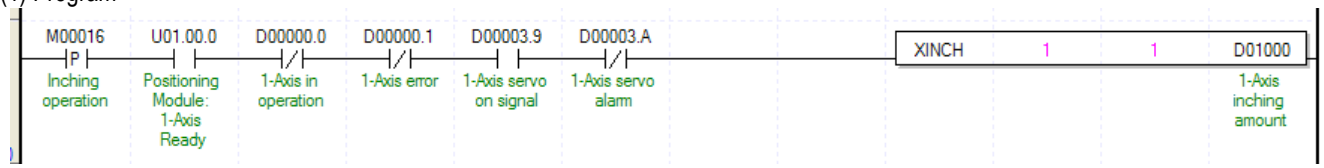
(b) Continuous operation command changes the only current operation pattern in operation, not the operation data.

(c) For the detail description about continuous operation, refer to “9.5.2 Continuous Operation”.

(d) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.23 Inching Operation (Command : XINCH)

(1) Program



(2) Description

Device	Description
M00016	axis1 inching operation input
U01.00.0	axis1 ready
D00000.0	axis1 in operation
D00000.1	axis1 error state
D00003.9	axis1 servo on signal
D00003.A	axis1 servo error
D01000	axis1 inching value

Command	XINCH				Inching operation
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Position value	PMLK,constant,D,Z,R,ZR	DINT	Position value to move for inching operation

※ PMLK means P, M, L and K areas.

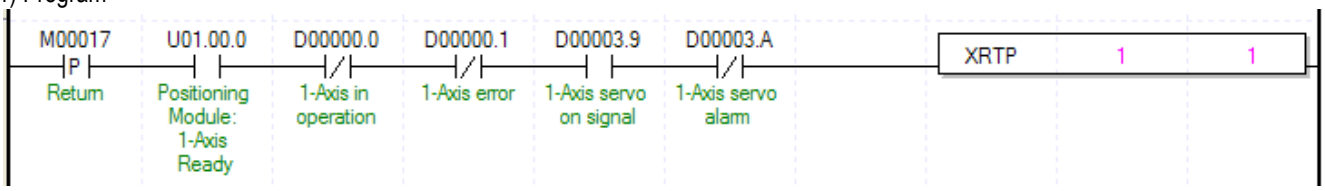
(a) It carries out the relative coordinate operation by inching operation speed set in manual operation parameter as much as position value (OP3).

(b) For the detail description about inching operation, refer to “9.3.2 Inching Operation”.

(c) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.24 Return to the Position before Manual Operation (Command : XRTP)

(1) Program



(2) Description

Device	Description
M00017	axis1 return to the position before manual operation start input
U01.00.0	axis1 ready
D00000.0	axis1 in operation
D00000.1	axis1 error state
D00003.9	axis1 servo on signal
D00003.A	axis1 servo error

Command	XRTP				Return to the position before manual operation
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)

※ PMLK means P, M, L and K areas.

(a) If the current position is changed as external axis speed sync. operation, inching operation, Jog operation after completing the positioning, it returns to the previous position of manual operation.

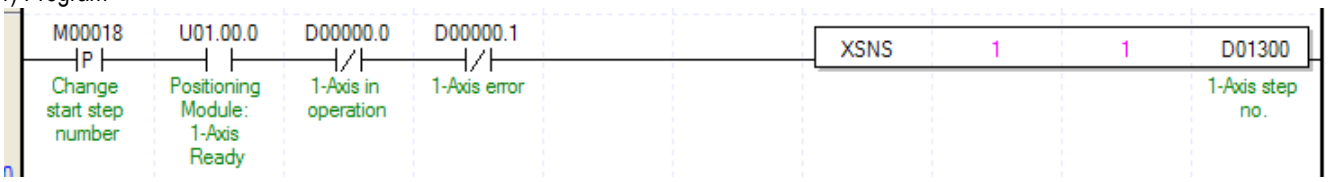
(b) Return to the position before manual operation command will be ignored if it is not in manual operation.

(c) The detail description about return to the previous position of manual operation, refer to “9.3.3 Return to the Previous Position of Manual Operation”

(d) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.25 Start Step No. Change (Command : XSNS)

(1) Program



(2) Description

Device	Description
M00018	axis1 start step No. change input
U01.00.0	axis1 ready
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D01300	axis1 start step no. to change

Command	XSNS				Change start step No.
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Step No.	PMLK,constant,D,Z,R,ZR	WORD	step No. to change with start step (1~400)

※ PMLK means P, M, L and K areas.

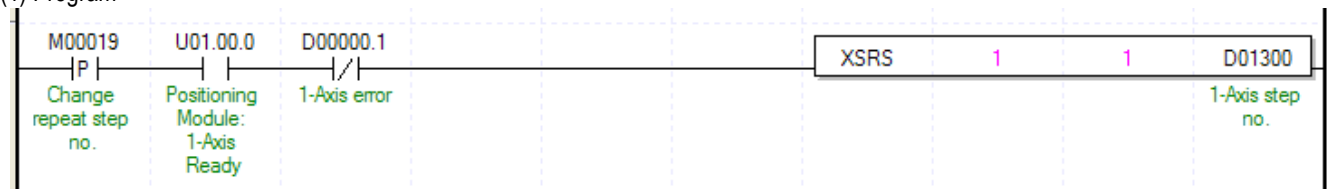
(a) Change the current step into the step value which set on step no.(OP3)

(b) It is not available to be executed in operation.

(c) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.26 Repeat Step No. Change (Command : XSRS)

(1) Program



(2) Description

Device	Description
M00019	axis1 start step No. change input
U01.00.0	axis1 ready
D00000.1	axis1 error state
D01300	axis1 repeat step no. to change

Command	XSRS				Repeat step No. change
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Step No.	PMLK,constant,D,Z,R,ZR	WORD	step No. to change into repeat step (0~400)

※ PMLK means P, M, L and K areas.

(a) Change repeat step into the step value which set on step no.(OP3).

(b) Repeat step No. change is available for command execution even during positioning operation.

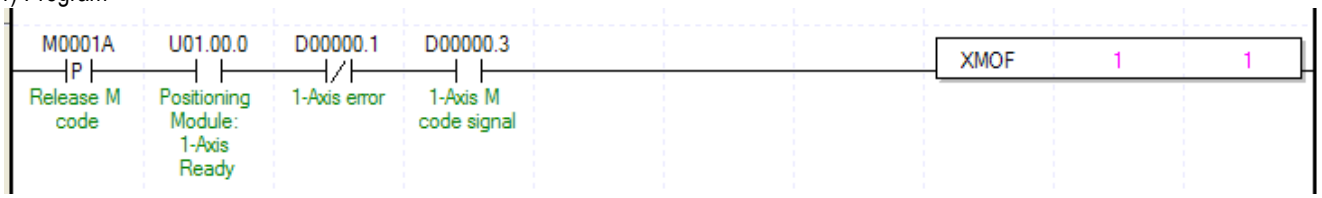
(c) Set the next step after finish operating designated repeat step.

(d) The detail description about “9.5.10 Repeat Operation Step no. Change”.

(e) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.27 M code Release (Command : XMOF)

(1) Program



(2) Description

Device	Description
M0001A	axis1 M code release input
U01.00.0	axis1 ready
D00000.1	axis1 error state
D00000.3	axis1 M code signal

Command	XMOF				M code release
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)

※ PMLK means P, M, L and K areas.

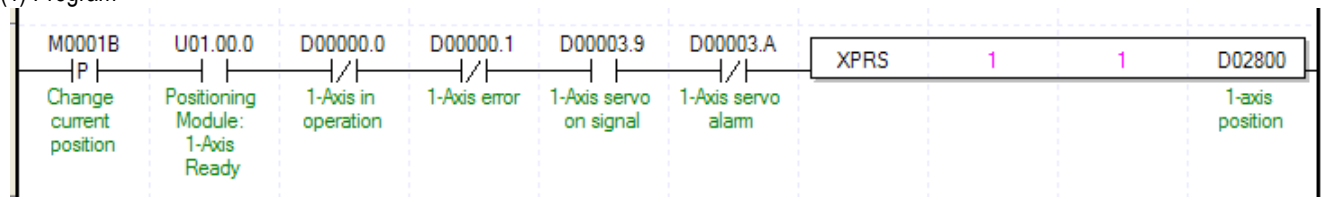
(a) When M code occurs, M code signal and M code No. are released at the same time (M code and M code No. are changed to OFF and 0, respectively).

(b) It is available to be executed in operation.

(c) D device signal (axis1 Signal in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.28 Current Position Preset (Command : XPRS)

(1) Program



(2) Description

Device	Description
M0001B	axis1 current position preset input
U01.00.0	axis1 ready
D00000.0	axis1 in operation
D00000.1	axis1 error state
D00003.9	axis1 servo on signal
D00003.A	axis1 error
D02800	axis1 preset position value

Command	XPRS				Current position preset
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Position value	PMLK,constant,D,Z,R,ZR	DINT	Current position value to change

※ PMLK means P, M, L and K areas.

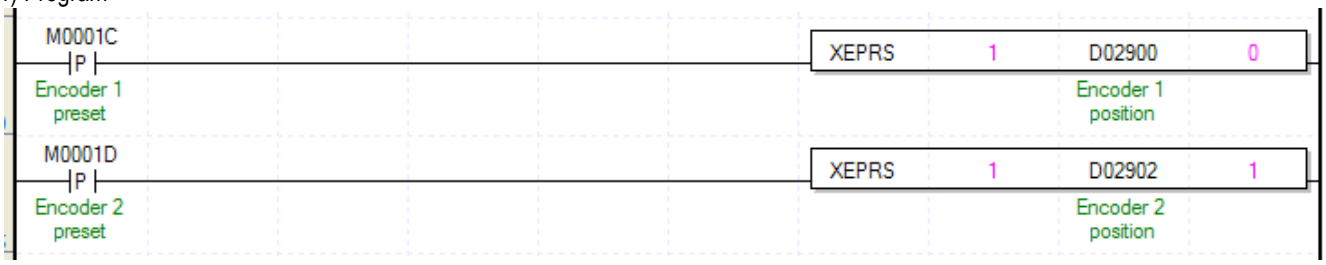
(a) The command that change the current position value to the designated position (OP3).

(b) If current position preset command is executed in the origin unsettled state, positioning state signal (bit) is ON and the current position is changed by setting value (OP3).

(c) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.29 Encoder Preset (Command : XEPRS)

(1) Program



(2) Description

Device	Description
M0001C	encoder preset input (Encoder1)
M0001D	encoder preset input (Encoder2)
D02900	encoder1 preset position value
D2902	encoder2 preset position value

Command	XEPRS				Encoder preset
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Position value	PMLK,constant,D,Z,R,ZR	DINT	Current position value to change
	OP3	Encoder	PMLK,constant,D,Z,R,ZR	WORD	Encoder to change (0:encoder1, 1:encoder2)

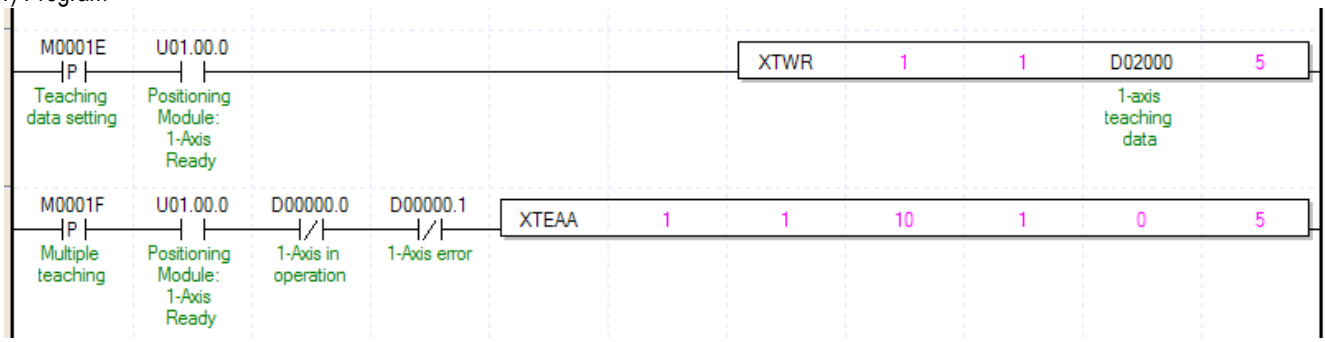
※ PMLK means P, M, L and K areas.

(a) This is the command that changes the current position to the designated position.

(b) Encoder selection has to be set by 0.

6.3.30 Teaching Array (Command : XTEAA)

(1) Program



(2) Description

Device	Description
M0001E	axis1 teaching data setting input
M0001F	axis1 teaching array input
U01.00.0	axis1 ready
D00000.0	axis1 in operation
D00000.1	axis1 error state
D02000	axis1 teaching array data leading address

Command	XTEAA				Teaching Array
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Teaching step	PMLK,constant,D,Z,R,ZR	WORD	leading step No. for teaching (0~400)
	OP4	Teaching method	PMLK,constant,D,Z,R,ZR	WORD	0:RAM Teaching, 1:ROM Teaching
	OP5	Teaching item	PMLK,constant,D,Z,R,ZR	WORD	0:Position teaching 1:Speed teaching
	OP6	Number of Teaching	PMLK,constant,D,Z,R,ZR	WORD	Number of step for Teaching (1~16)

※ PMLK means P, M, L and K areas.

(a) This is the command that change the goal position or goal speed (OP5) among the operation data to the number as many as from the designated step (OP3) to the number of teaching (OP6). In the case of operating RAM teaching according to the teaching method (OP3), the changed value is maintained during positioning module is connected to power. In the case of operating ROM teaching, it is maintained without power connection of positioning module.

(b) Even though teaching can be performed even when the axis subject to teaching is being operated but, only the current step's data is reflected after the current step operation is completed if the step that is currently running is within the step area while other steps' data are immediately changed.

(c) The number of times for ROM teaching is not limited because operation data of positioning module is saved on FRAM.

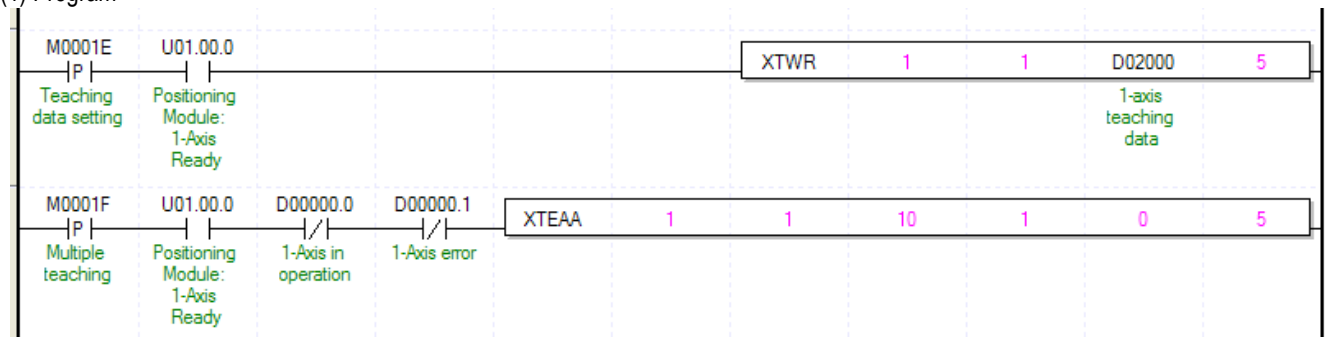
(d) Before executing teaching array, teaching data should be set in the teaching array setting area. For teaching array data setting, refer to TWR command.

(e) In the example program above, execute ROM teaching for position data between no.10 step and no.14 step of axis1 operation data using 5 axis1 teaching data.

(f) D device signal (axis1 Signal in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.31 Teaching Array Data Setting (Command: XTWR)

(1) Program



(2) Description

Device	Description
M0001E	axis1 Teaching array data setting input
M0001F	axis1 Teaching array input
U01.00.0	axis1 ready
D00000.0	axis1 in operation
D00000.1	axis1 error state
D02000	axis1 Teaching array data leading address

Command	XTWR				Teaching Array Data Setting
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Device	PMLK,D,Z,R,ZR	WORD	Leading device No. with teaching array data
	OP3	Number of data	PMLK,constant,D,Z,R,ZR	WORD	Number of data to save

※ PMLK means P, M, L and K areas.

(a) Teaching data must be set in teaching array data setting area before teaching array is executed.

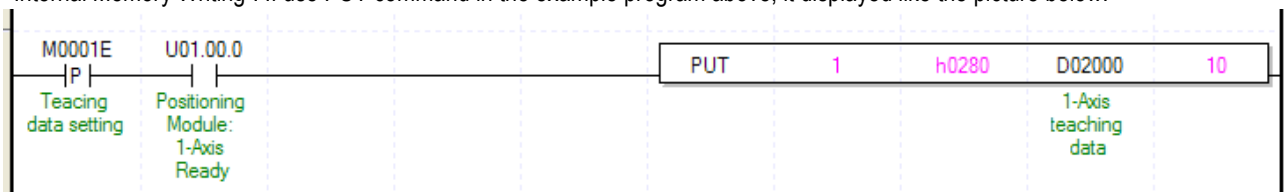
(b) Teaching array is not executed only by executing teaching array data setting command. Please refer to teaching array command (TEAA).

(c) In the example program above, execute ROM teaching for position data between no.10 step and no.14 step of axis1 operation data using 5 axis1 teaching data.

(d) According to the leading No. of device, the data are set in teaching array data area as follows.

No.	Device NO.	Teaching array data
1	Device + 0	Teaching array data 1
2	Device + 2	Teaching array data 2
3	Device + 4	Teaching array data 3
4	Device + 6	Teaching array data 4
5	Device + 8	Teaching array data 5
6	Device + 10	Teaching array data 6
7	Device + 12	Teaching array data 7
8	Device + 14	Teaching array data 8
9	Device + 16	Teaching array data 9
10	Device + 18	Teaching array data 10
11	Device + 20	Teaching array data 11
12	Device + 22	Teaching array data 12
13	Device + 24	Teaching array data 13
14	Device + 26	Teaching array data 14
15	Device + 28	Teaching array data 15
16	Device + 30	Teaching array data 16

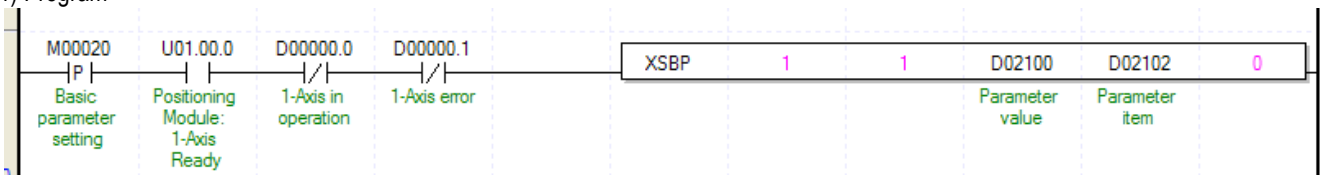
(e) Teaching array data can be set by using PUT command. For this, refer to memory address of “5.1.2 Teaching data” and “6.1.2 Internal Memory Writing”. If use PUT command in the example program above, it displayed like the picture below.



(f) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.32 Basic Parameter Teaching (Command : XSBP)

(1) Program



(2) Description

Device	Description
M00020	axis1 basic parameter setting input
U01.00.0	axis1 ready
D00000.0	axis1 in operation
D00000.1	axis1 error state
D02100	Parameter value
D02102	Parameter items

Command	XSBP				Basic parameter Teaching
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis(1 ~ 8 : axis1 ~ axis8)
	OP3	Parameter value	PMLK,constant,D,Z,R,ZR	DWORD	Parameter value to change
	OP4	Parameter item	PMLK,constant,D,Z,R,ZR	WORD	PN8A: Parameter item to change (1~15, 17, 255) PN8B: Parameter item to change (1~17, 255)
	OP5	Setting method	PMLK,constant,D,Z,R,ZR	WORD	0: RAM setting, 1: ROM setting

※ PMLK means P, M, L and K areas.

(a) This is the command that changes the value of the item (OP4) which already set among basic parameter items to setting value (OP3). In the case of RAM setting by the setting method (OP5), the changed value is maintained during positioning module is being connected to power. In the case of ROM setting, it is maintained without the power connection of positioning module.

(b) The number of ROM setting operating is unlimited because basic parameter of positioning module is saved on FRAM.

(c) Basic parameter setting command is unavailable to be executed when the axis is operating.

(d) Basic parameter items

Setting Value	Items	Setting Range
1	Speed limit value	mm : 1 ~ 2,147,483,647 [X10^{-2} ㎜/min] Inch : 1 ~ 2,147,483,647 [X10^{-3}Inch/min] degree : 1 ~ 2,147,483,647 [X10^{-3} degree/min] pulse : 1 ~ 2,147,483,647 [pulse/sec]
2	Acc. Time 1	1 ~ 2,147,483,647 [ms]
3	Acc. Time 2	
4	Acc. Time 3	
5	Acc. Time 4	
6	Dec. Time 1	1 ~ 2,147,483,647 [ms]
7	Dec. Time 2	
8	Dec. Time 3	
9	Dec. Time 4	
10	Emg. Stop Dec. Time	1 ~ 2,147,483,647 [ms]
11	Pulse per rotation	1 ~ 200,000,000
12	Travel per rotation	
13	Unit	0:Pulse, 1:mm, 2:Inch, 3:Degree
14	Unit multiplier	0: x 1, 1: x 10, 2: x 100, 3: x 1000
15	Speed command unit	0: Unit/Time, 1: rpm
16	Encoder select*	0: Incremental encoder, 1:Absolute encoder
17	Current position display correction	0 ~ 255

*: only for XGF-PN8B

(e) For the change value (OP3) setting range of each basic parameter item (OP4) which already set, refer to “4.1.1 Basic Parameter Content”

(f) In the example program above, it changes the item that saved on D02102 of axis1 basic parameter to the value that saved on D02100 using RAM setting method. In the case of D02102=10, D02100=100, it sets sudden stop time as “100ms” using RAM setting method.

(g) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

(h) If you want to set up all items of basic parameter with one XSBP command, you have to set up hFF(255) at OP4 parameter item. At this time, first, items of basic parameter should be saved at multiple teaching memory address below. You can set up data with PUT instruction or XTWR instruction.

Memory address								Contents
1axis	2axis	3axis	4axis	5axis	6axis	7axis	8axis	
280	300	380	400	480	500	580	600	Speed limit
281	301	381	401	481	501	581	601	
282	302	382	402	482	502	582	602	Acc. time1
283	303	383	403	483	503	583	603	
284	304	384	404	484	504	584	604	Acc. time2
285	305	385	405	485	505	585	605	
286	306	386	406	486	506	586	606	Acc. time3
287	307	387	407	487	507	587	607	
288	308	388	408	488	508	588	608	Acc. time4
289	309	389	409	489	509	589	609	
28A	30A	38A	40A	48A	50A	58A	60A	Dec. time1
28B	30B	38B	40B	48B	50B	58B	60B	
28C	30C	38C	40C	48C	50C	58C	60C	Dec. time2
28D	30D	38D	40D	48D	50D	58D	60D	
28E	30E	38E	40E	48E	50E	58E	60E	Dec. time3
28F	30F	38F	40F	48F	50F	58F	60F	
290	310	390	410	490	510	590	610	Dec. time4
291	311	391	411	491	511	591	611	
292	312	392	412	492	512	592	612	Dec. time when EM. Stop
293	313	393	413	493	513	593	613	
294	314	394	414	494	514	594	614	Pulses per rotation
295	315	395	415	495	515	595	615	
296	316	396	416	496	516	596	616	Travel distance per rotation
297	317	397	417	497	517	597	617	
298	318	398	418	498	518	598	618	Unit
299	319	399	419	499	519	599	619	Unit multiply
29A	31A	39A	41A	49A	51A	59A	61A	Speed unit
29B	31B	39B	41B	49B	51B	59B	61B	Encoder select (for PN8B)
29C	31C	39C	41C	49C	51C	59C	61C	Current position display correction
29D	31D	39D	41D	49D	51D	59D	61D	-
29E	31E	39E	41E	49E	51E	59E	61E	-
29F	31F	39F	41F	49F	51F	59F	61F	-

The following is example chaning all items of basic parameter with one XSBP command.

If M00000 is on, data set up at D00000 ~ D00026 will be saved at teaching data memory and basic parameter entire setup command will be executed.

Note

1. When using a couple of parameter setup command to change a couple of parameter item, make the interval of execution of each command to be more than time needed to execute the setup command. If a couple of commands are executed by one condition, it may not work properly.

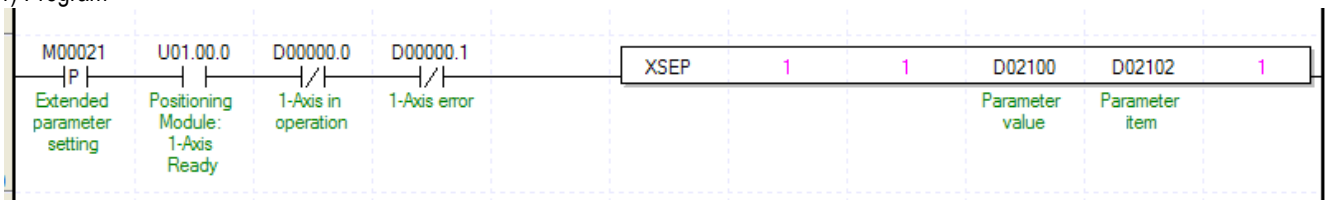
※ Parameter setup command execution time
- XGF-PN8A : 1.6ms (when using 2 axes) ~ 4.8ms (when using 8 axes)
- XGF-PN8B : 2ms (when using 3 axes) ~ 4ms (when using 8 axes)

※ [Example] You can change acc. time 1 ~ acc. time 4 as follows.

Basic parameter setup commands are executed sequentially from basic parameter no.2 item to basic parameter no.5 item after M00100 is on.

6.3.33 Extended Parameter Setting (Command : XSEP)

(1) Program



(2) Description

Device	Description
M00021	axis1 extended parameter setting input
U01.00.0	axis1 ready
D00000.0	axis1 in operation
D00000.1	axis1 error state
D02100	Parameter value
D02102	Parameter items

Command	XSEP				Extended parameter Teaching
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Parameter value	PMLK,constant,D,Z,R,ZR	DINT	Parameter value to change
	OP4	Parameter item	PMLK,constant,D,Z,R,ZR	WORD	Parameter item to change (1~2, 4~19)
	OP5	Setting Method	PMLK,constant,D,Z,R,ZR	WORD	0: RAM setting, 1: ROM setting

※ PMLK means P, M, L and K areas.

(a) This is the command that changes the value of the item (OP4) which already set among basic parameter items to setting value (OP3). In the case of RAM setting by the setting method (OP5), the changed value is maintained during positioning module is being connected to power. In the case of ROM setting, it is maintained without the power connection of positioning module.

(b) The number of ROM setting operating is unlimited because basic parameter of positioning module is saved on FRAM.

(c) Basic parameter setting command is unavailable to be executed when the axis is operating.

(d) Extended parameter items

Setting value	Items	Setting value
1	S/W upper limit	㎜:-2147483648 ~ 2147483647[X10^{-4} ㎜] Inch:-2147483648 ~ 2147483647[X10^{-5}Inch] degree:-2147483648~2147483647[X10^{-5}degree] pulse:-2147483648 ~ 2147483647[pulse]
2	S/W lower limit	
3	-	-
4	Positioning complete time	0 ~ 65,535[ms]
5	S-Curve ratio	1 ~ 100
6	In-position width	mm: 0 ~ 65,535[X10^{-4} ㎜] inch: 0 ~ 65,535[X10^{-5}Inch] degree: 0 ~ 65,535[X10^{-5}degree] pulse: 0 ~ 65,535[pulse]
7	axis2 Linear interpolation continuous operation circular arc insertion position	mm: 0 ~ 2147483647[X10^{-4} ㎜] Inch: 0 ~ 2147483647[X10^{-5}Inch] degree: 0 ~ 2147483647[X10^{-5}degree] pulse: 0 ~ 2147483647[pulse]
8	Acc./dec. pattern	0: Trapezoid operation, 1: S-Curve operation
9	M code mode	0: None, 1: With, 2: After
10	Upper&Lower limit detection during speed control	0: Don't detect, 1: Detect
11	Positioning complete condition	0: Dwell Time 1: In position 2: Dwell Time AND In position 3: Dwell Time OR In position
12	Interpolation continuous operation type	0: pass target pos, 1: pass near pos
13	Arc insertion	0: Insert arc, 1: Don't insert.
14	External command selection	0: external VTP, 1: external stop, 2: External latch*1
15	External command	0:disable, 1: enable
16	Position-specified speed override coordinate	0: Absolute, 1: Incremental
17	Infinite running repeat pos	mm: 1 ~ 2147483647[X10^{-4} ㎜] Inch: 1 ~ 2147483647[X10^{-5}Inch] degree: 1 ~ 2147483647[X10^{-5}degree] pulse: 1 ~ 2147483647[pulse]
18	Infinite running repeat	0: disable, 1: enable
19	Speed/position switching coordinate	0: incremental, 1:absoulute
20	Interpolation speed selection	0: main axis speed, 1: synthetic speed

*1: only for XGF-PN8A

(e) For the change value (OP3) setting range of each extended parameter item (OP4) which already set, refer to "4.2.1 Extended Parameter Content"

(f) In the example program above, it changes the item that saved on D02102 of axis1 basic parameter to the value that saved on D02100 using RAM setting method. In the case of D02102=8, D02100=1, it sets sudden stop time as "With" using RAM setting method.

(g) D device signal (axis1 in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

(h) If you want to set up all items of extended parameter with one XSEP command, you have to set up hFF(255) at OP4 parameter item. At this time, first, items of extended parameter should be saved at multiple teaching memory address below. You can set up data with PUT instruction or XTWR instruction.

Memory address								Contents
1axis	2axis	3axis	4axis	5axis	6axis	7axis	8axis	
280	300	380	400	480	500	580	600	Soft upper limit
281	301	381	401	481	501	581	601	
282	302	382	402	482	502	582	602	Soft lower limit
283	303	383	403	483	503	583	603	
284	304	384	404	484	504	584	604	-
285	305	385	405	485	505	585	605	Positioning complete time
286	306	386	406	486	506	586	606	S-curve ratio
287	307	387	407	487	507	587	607	Command in-position width
288	308	388	408	488	508	588	608	
289	309	389	409	489	509	589	609	2- axis linear interpolation continuous operation arc insertion position
28A	30A	38A	40A	48A	50A	58A	60A	
28B	30B	38B	40B	48B	50B	58B	60B	Acc/Dec pattern
28C	30C	38C	40C	48C	50C	58C	60C	M code mode
28D	30D	38D	40D	48D	50D	58D	60D	Detect upper/lower limit during speed control
28E	30E	38E	40E	48E	50E	58E	60E	Positioning complete condition
28F	30F	38F	40F	48F	50F	58F	60F	Interpolation continuous operation positioning method
290	310	390	410	490	510	590	610	2-axis linear interpolation continuous operation arc insertion
291	311	391	411	491	511	591	611	External command select
292	312	392	412	492	512	592	612	External command
293	313	393	413	493	513	593	613	Position specified speed override coordinate
294	314	394	414	494	514	594	614	Infinite running repeat position
295	315	395	415	495	515	595	615	
296	316	396	416	496	516	596	616	Infinite running repeat
297	317	397	417	497	517	597	617	Speed/Position switching coordinate
298	318	398	418	498	518	598	618	Interpolation speed selection
299	319	399	419	499	519	599	619	-
29A	31A	39A	41A	49A	51A	59A	61A	-
29B	31B	39B	41B	49B	51B	59B	61B	-
29C	31C	39C	41C	49C	51C	59C	61C	-
29D	31D	39D	41D	49D	51D	59D	61D	-
29E	31E	39E	41E	49E	51E	59E	61E	-
29F	31F	39F	41F	49F	51F	59F	61F	-

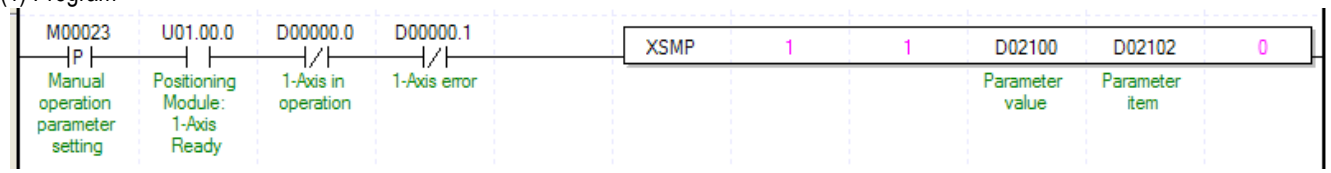
#: only for XGF-PN8A

The following is example chaning all items of extended parameter with one XSEP command.

If M00000 is on, data set up at D00000 ~ D00024 will be saved at teaching data memory and extended parameter entire setup command will be executed.

6.3.34 Manual Operation Parameter Teaching (Command :XSMP)

(1) Program



(2) Description

Device	Description
M00023	axis1 manual operation parameter setting input
U01.00.0	axis1 ready
D00000.0	axis1 in operation
D00000.1	axis1 error state
D02100	Parameter value
D02102	Parameter items

Command	XSMP				Manual operation parameter setting
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Parameter value	PMLK,constant,D,Z,R,ZR	DWORD	parameter value to change
	OP4	Parameter item	PMLK,constant,D,Z,R,ZR	WORD	parameter item to change (1~5, 255)
	OP5	Setting method	PMLK,constant,D,Z,R,ZR	WORD	0: RAM setting, 1: ROM setting

※ PMLK means P, M, L and K areas.

(a) This is the command that changes the value of the item (OP4) which already set among manual operation parameter items to setting value (OP3). In the case of RAM setting by the setting method (OP5), the changed value is maintained during APM module is being connected to power. In the case of ROM setting, it is maintained without the power connection of APM module.

(b) The number of ROM setting operating is unlimited because manual operation parameter of APM module is saved on FRAM.

(c) Manual operation parameter setting command is unavailable to be executed when the axis is operating.

(d) Manual operation parameter items are as follows.

Setting value	Items	Setting value
1	Jog high speed	㎜ : 1 ~ 2,147,483,647 [X10^{-2} ㎜/min] Inch : 1 ~ 2,147,483,647 [X10^{-3}Inch/min] degree : 1 ~ 2,147,483,647 [X10^{-3} degree/min] pulse : 1 ~ 2,147,483,647 [pulse/sec]
2	Jog low speed	
3	Jog acc. time	0 ~ 2,147,483,647 [ms]
4	Jog dec. time	
5	Inching speed	㎜ : 1 ~ 65,535[X10^{-2} ㎜/min] Inch : 1 ~ 65,535[X10^{-3}Inch/min] degree : 1 ~ 65,535[X10^{-3} degree/sec] pulse : 1 ~ 65,535[pulse/sec]

(e) For the change value (OP3) setting range of each manual operation parameter item (OP4) which already set, refer to “4.3.1 Manual Operation Parameter Content”

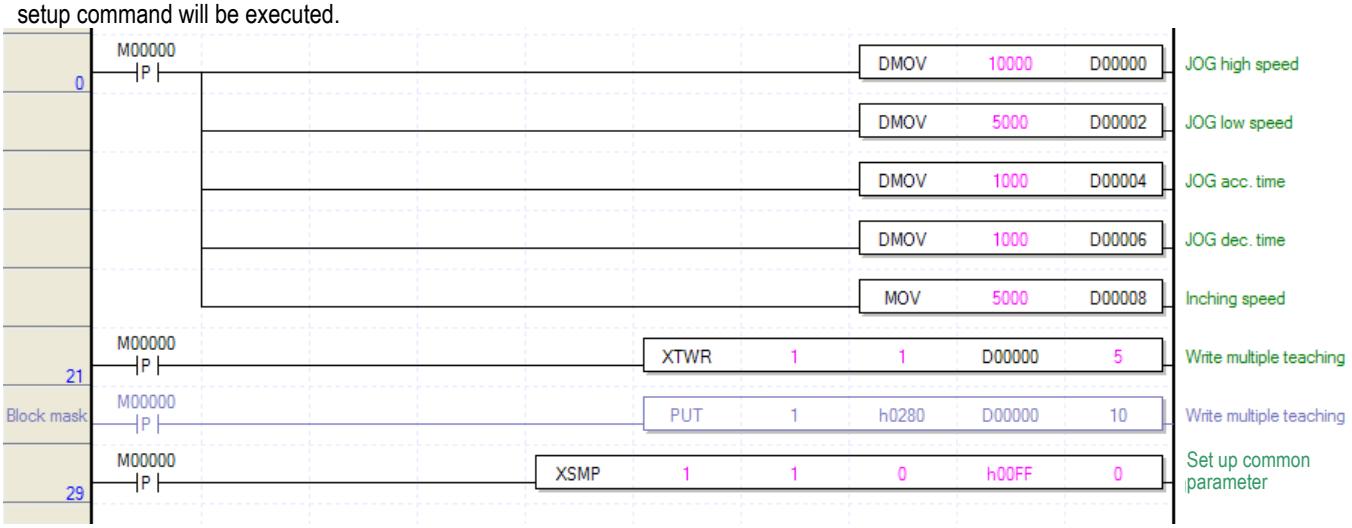
(f) In the example program above, it changes the item that saved on D02102 of axis1 manual operation parameter to the value that saved on D02100 using RAM setting method. In the case of D02102=3, D02100=500, it sets jog acc. time as “500ms” using RAM setting method.

(g) If you want to set up all items of manual operation parameter with one XSMP command, you have to set up hFF(255) at OP4 parameter item. At this time, first, items of manual operation parameter should be saved at multiple teaching memory address below. You can set up data with PUT instruction or XTWR instruction.

Memory address								Contents
1axis	2axis	3axis	4axis	5axis	6axis	7axis	8axis	
280	300	380	400	480	500	580	600	JOG high speed
281	301	381	401	481	501	581	601	
282	302	382	402	482	502	582	602	JOG low speed
283	303	383	403	483	503	583	603	
284	304	384	404	484	504	584	604	JOG acc. time
285	305	385	405	485	505	585	605	
286	306	386	406	486	506	586	606	JOG dec. time
287	307	387	407	487	507	587	607	
288	308	388	408	488	508	588	608	Inching speed
289	309	389	409	489	509	589	609	-
28A	30A	38A	40A	48A	50A	58A	60A	-
28B	30B	38B	40B	48B	50B	58B	60B	-
28C	30C	38C	40C	48C	50C	58C	60C	-
28D	30D	38D	40D	48D	50D	58D	60D	-
28E	30E	38E	40E	48E	50E	58E	60E	-
28F	30F	38F	40F	48F	50F	58F	60F	-
290	310	390	410	490	510	590	610	-
291	311	391	411	491	511	591	611	-
292	312	392	412	492	512	592	612	-
293	313	393	413	493	513	593	613	-
294	314	394	414	494	514	594	614	-
295	315	395	415	495	515	595	615	-
296	316	396	416	496	516	596	616	-
297	317	397	417	497	517	597	617	-
298	318	398	418	498	518	598	618	-
299	319	399	419	499	519	599	619	-
29A	31A	39A	41A	49A	51A	59A	61A	-
29B	31B	39B	41B	49B	51B	59B	61B	-
29C	31C	39C	41C	49C	51C	59C	61C	-
29D	31D	39D	41D	49D	51D	59D	61D	-
29E	31E	39E	41E	49E	51E	59E	61E	-
29F	31F	39F	41F	49F	51F	59F	61F	-

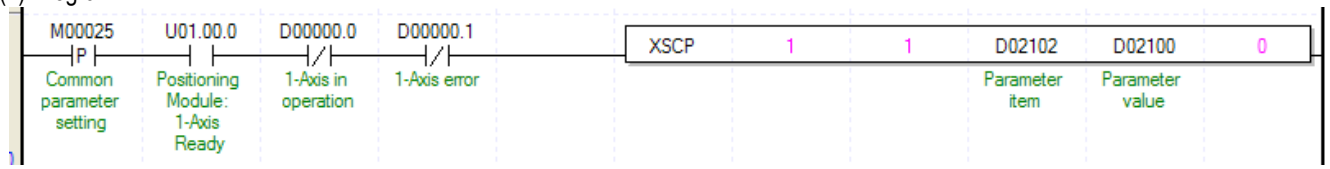
The following is example chaning all items of manual operation parameter with one XSMP command.

If M00000 is on, data set up at D00000 ~ D00008 will be saved at teaching data memory and manual operation parameter entire setup command will be executed.



6.3.35 Common Parameter Setting (Command : XSCP)

(1) Program



(2) Description

Device	Description
M00025	Common parameter setting input
U01.00.0	axis1 ready
D02100	Parameter value
D02102	Parameter items

Command	XSCP				Common parameter Setting
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Parameter value	PMLK,constant,D,Z,R,ZR	DINT	parameter value to change
	OP4	Parameter item	PMLK,constant,D,Z,R,ZR	WORD	Parameter item to change (1~9, 255)
	OP5	Setting Method	PMLK,constant,D,Z,R,ZR	WORD	0: RAM setting, 1: ROM setting

※ PMLK means P, M, L and K areas.

(a) This is the command that changes the value of the item (OP4) which already set among common parameter items to setting value (OP3). In the case of RAM setting by the setting method (OP5), the changed value is maintained during positioning module is being connected to power. In the case of ROM setting, it is maintained without the power connection of positioning module.

(b) The number of ROM setting operating is unlimited because common parameter of APM module is saved on FRAM.

(c) The value to be set in parameter item is as follows.

Setting value	Items	Setting value
1	Speed override method	0: % setting 1: Speed setting
2	Encoder1 pulse input mode	0:CW/CCW 1X 1:PULSE/DIR 1X 2:PULSE/DIR 2X 3:PHASE A/B 1X 4:PHASE A/B 2X 5:PHASE A/B 4X
3	Encoder1 max. value	-2147483648 ~ 2147283647
4	Encoder1 min. value	
5	Encoder1 Z phase clear	0: disable, 1:enable
6	Encoder2 pulse input mode	0:CW/CCW 1X 1:PULSE/DIR 1X 2:PULSE/DIR 2X 3:PHASE A/B 1X 4:PHASE A/B 2X 5:PHASE A/B 4X
7	Encoder2 max. value	-2147483648 ~ 2147283647
8	Encoder2 min. value	
9	Encoder2 Z phase clear	0: disable, 1:enable

(d) For the change value (OP3) setting range of each common parameter item (OP4) which already set, refer to “4.6.1 Common Parameter Content”

(e) In the example program above, it changes the item that saved on D02102 of common parameter to the value that saved on D02100 using RAM setting method. In the case of D02102=1, D02100=1, it sets speed override method time as “1: speed setting” using RAM setting method.

(f) If you want to set up all items of common parameter with one XSCP command, you have to set up hFF(255) at OP4 parameter item. At this time, first, items of common parameter should be saved at multiple teaching memory address below. You can set up data with PUT instruction or XTWR instruction.

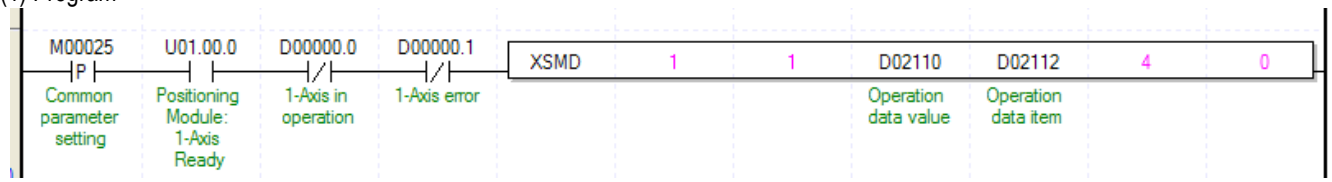
Memory address								Contents
1axis	2axis	3axis	4axis	5axis	6axis	7axis	8axis	
280	300	380	400	480	500	580	600	Speed override
281	301	381	401	481	501	581	601	Encoder1 pulse input
282	302	382	402	482	502	582	602	Encoder1 max. value
283	303	383	403	483	503	583	603	
284	304	384	404	484	504	584	604	Encoder1 min. value
285	305	385	405	485	505	585	605	
286	306	386	406	486	506	586	606	Encoder1 Z-phase clear
287	307	387	407	487	507	587	607	Encoder2 pulse input
288	308	388	408	488	508	588	608	Encoder2 max. value
289	309	389	409	489	509	589	609	
28A	30A	38A	40A	48A	50A	58A	60A	Encoder2 min. value
28B	30B	38B	40B	48B	50B	58B	60B	
28C	30C	38C	40C	48C	50C	58C	60C	Encoder2 Z-phase clear
28D	30D	38D	40D	48D	50D	58D	60D	-
28E	30E	38E	40E	48E	50E	58E	60E	-
28F	30F	38F	40F	48F	50F	58F	60F	-
290	310	390	410	490	510	590	610	-
291	311	391	411	491	511	591	611	-
292	312	392	412	492	512	592	612	-
293	313	393	413	493	513	593	613	-
294	314	394	414	494	514	594	614	-
295	315	395	415	495	515	595	615	-
296	316	396	416	496	516	596	616	-
297	317	397	417	497	517	597	617	-
298	318	398	418	498	518	598	618	-
299	319	399	419	499	519	599	619	-
29A	31A	39A	41A	49A	51A	59A	61A	-
29B	31B	39B	41B	49B	51B	59B	61B	-
29C	31C	39C	41C	49C	51C	59C	61C	-
29D	31D	39D	41D	49D	51D	59D	61D	-
29E	31E	39E	41E	49E	51E	59E	61E	-
29F	31F	39F	41F	49F	51F	59F	61F	-

The following is example chaning all items of common parameter with one XSCP command.

If M00000 is on, data set up at D00000 ~ D00008 will be saved at teaching data memory and common parameter entire setup command will be executed.

6.3.36 Operation Data Teaching (Command: XSMD)

(1) Program



(2) Description

Device	Description
M00026	axis1 Operation data setting input
U01.00.0	axis1 ready
D00000.0	axis1 l in operation
D00000.1	axis1 error state
D02110	Operation data value
D02112	Operation data items

Command	XSMD				Operation data setting
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis(1 ~ 8 : axis1 ~ axis8)
	OP3	Operation data value	PMLK,constant,D,Z,R,ZR	DINT	Operation data value to change
	OP4	Operation data item	PMLK,constant,D,Z,R,ZR	WORD	Operation data item (1~17, 255)
	OP5	Step No.	PMLK,constant,D,Z,R,ZR	WORD	Operation data step No. to change (0~400)
	OP6	Step method	PMLK,constant,D,Z,R,ZR	WORD	0: RAM setting, 1: ROM setting

※ PMLK means P, M, L and K areas.

(a) This is the command that changes the item (OP4) of a step which already set on OP5 among operation data items to setting value (OP3). In the case of RAM setting by the setting method (OP6), the changed value is maintained during XGF-PN8A module is being connected to power. In the case of ROM setting, it is maintained without the power connection of XGF-PN8A module.

(b) The number of ROM setting operating is unlimited because operation data of XGF-PN8A module is saved on FRAM.

(c) Operation data setting command is available to be executed when the axis is operating. However, if operation data of the step that is currently operated are changed, those changes are reflected after the current step is completed.

(d) The values to be set in operation data item are as follows

Setting value	Items	Setting value
1	Target position	㎜ : -2147483648 ~ 2147483647 [X10^{-4} ㎜] Inch : -2147483648 ~ 2147483647 [X10^{-5}Inch] degree : -2147483648 ~ 2147483647 [X10^{-5}degree] pulse : -2147483648 ~ 2147483647 [pulse]
2	Circular interpolation auxiliary position	
3	Operation speed	㎜ : 1 ~ 2,147,483,647 [X10^{-2} ㎜/min] Inch : 1 ~ 2,147,483,647 [X10^{-3}Inch/min] degree : 1 ~ 2,147,483,647 [X10^{-3} degree/min] pulse : 1 ~ 2,147,483,647 [pulse/sec]
4	Dwell time	0 ~ 65,535[ms]
5	M code No.	0 ~ 65,535
6	Sub axis setting	Bit unit setting Bit 7 / Bit 6 / Bit 5 / Bit 4 / Bit 3 / Bit 2 / Bit 1 / Bit 0 8axis / 7axis / 6axis / 5axis / axis4 / axis3 / axis2 / axis1
7	Helical interpolation axis	0, axis1 ~ axis8 (0: General circular arc interpolation)
8	Circular interpolation turns	0~65,535
9	Coordinate	0:absolute, 1:incremental
10	Control method	0:Single axis position control, 1:,Single axis speed control 2:Single-axis Feed control, 3:Linear interpolation, 4:Circular arc interpolation
11	Operation method	0:Single, 1:Repeat
12	Operation Pattern	0:End, 1:Keep, 2:Continuous
13	Circular arc size	0:Circular arc<180 1:Circular arc>=180
14	Acc. No.	0 ~ 3
15	Dec. No.	0 ~ 3
16	Circular arc interpolation method	0:Middle point, 1:Center point, 2:Radius
17	Circular arc interpolation direction	0:CW, 1:CCW

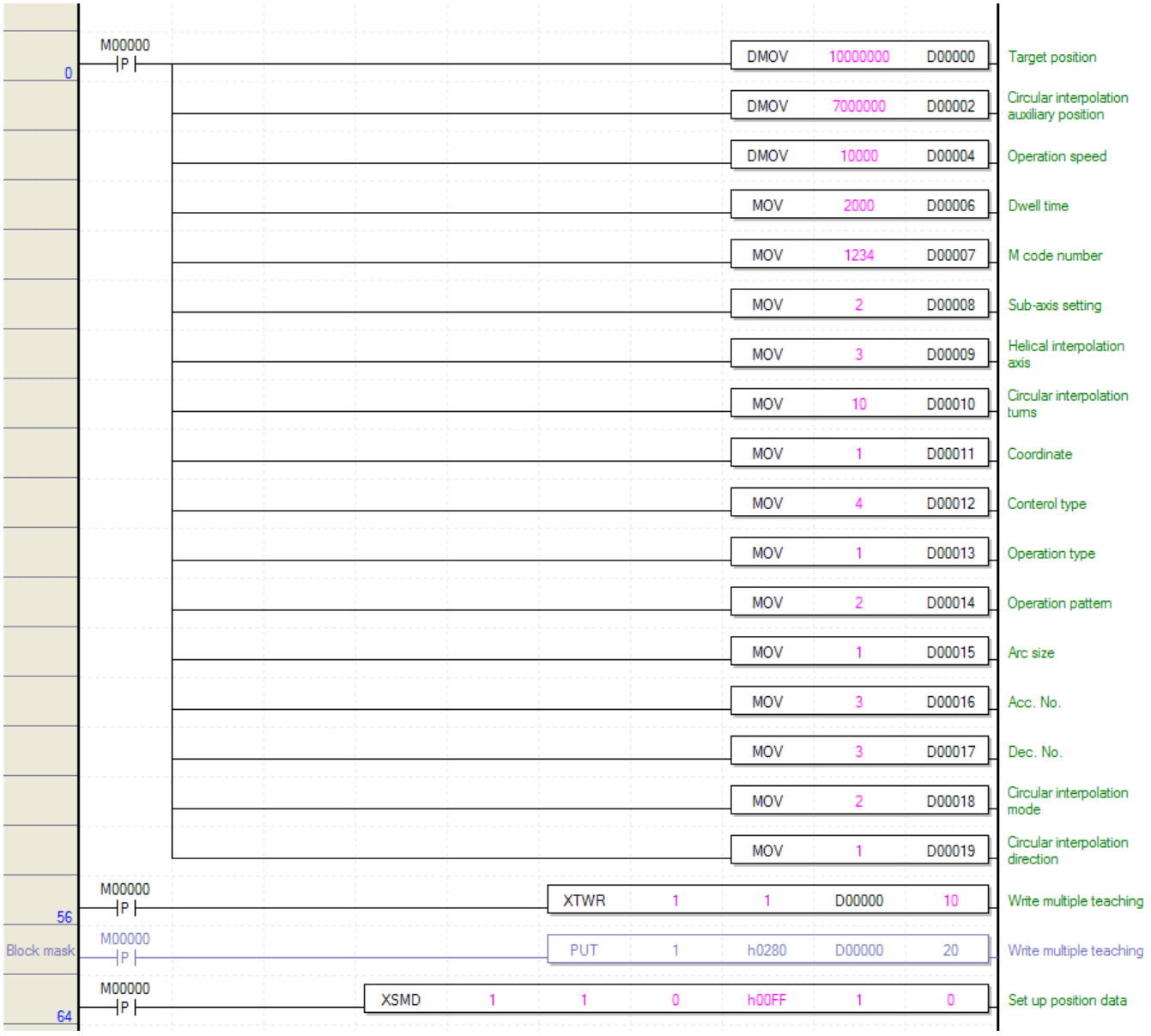
(e) For the change value (OP3) setting range of each position data item (OP4) which already set, refer to “4.7.1 Operation Data Content”

(f) In the example program above, it changes the item that saved on D02112 of axis1 operation to the value that saved on D02100 using RAM setting method. In the case of D02112=5, D02100=125, it changes M code no. of step no.4 to “125” using RAM setting method.

(g) If you want to set up all items of position data with one XSCP command, you have to set up hFF(255) at OP4 parameter item. At this time, first, items of position data should be saved at multiple teaching memory address below. You can set up data with PUT instruction or XTWR instruction.

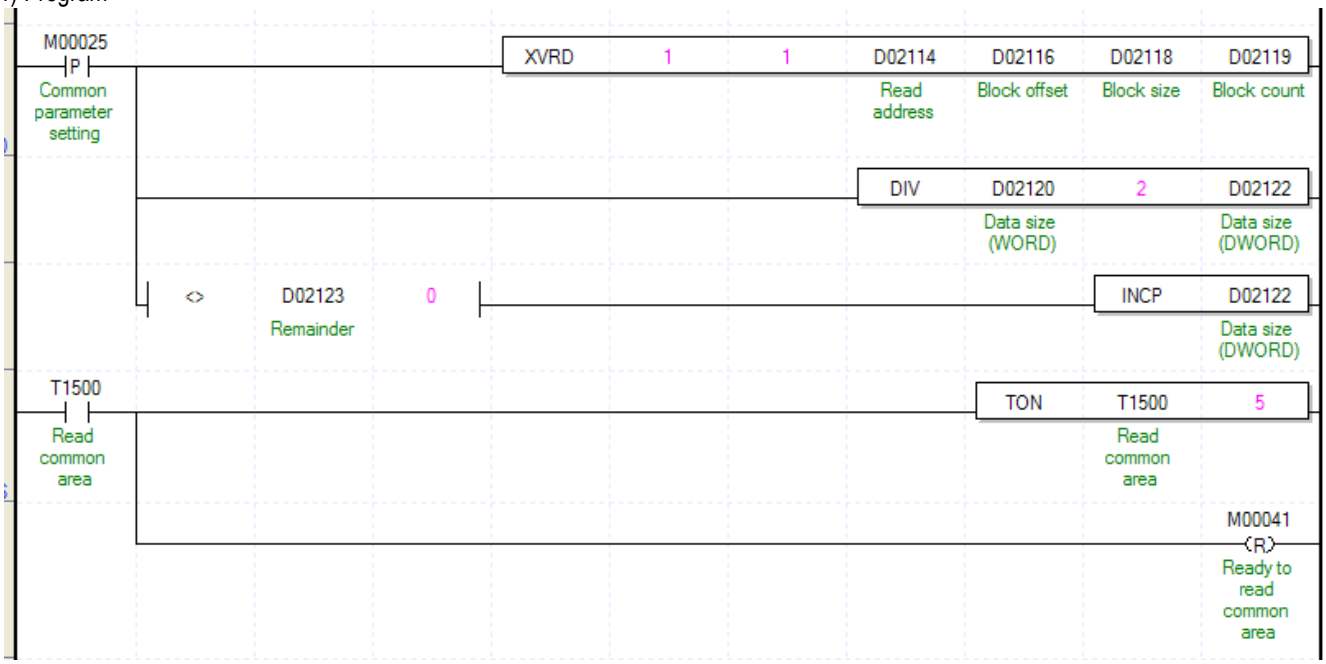
Memory address								Contents
1axis	2axis	3axis	4axis	5axis	6axis	7axis	8axis	
280	300	380	400	480	500	580	600	Target position
281	301	381	401	481	501	581	601	
282	302	382	402	482	502	582	602	Circular interpolation auxiliary position
283	303	383	403	483	503	583	603	
284	304	384	404	484	504	584	604	Operation speed
285	305	385	405	485	505	585	605	
286	306	386	406	486	506	586	606	Dwell time
287	307	387	407	487	507	587	607	M code number
288	308	388	408	488	508	588	608	Sub-axis setting
289	309	389	409	489	509	589	609	Helical interpolation axis
28A	30A	38A	40A	48A	50A	58A	60A	Circular interpolation turns
28B	30B	38B	40B	48B	50B	58B	60B	Coordinate
28C	30C	38C	40C	48C	50C	58C	60C	Control type
28D	30D	38D	40D	48D	50D	58D	60D	Operation type
28E	30E	38E	40E	48E	50E	58E	60E	Operation pattern
28F	30F	38F	40F	48F	50F	58F	60F	Arc size
290	310	390	410	490	510	590	610	Acc. No.
291	311	391	411	491	511	591	611	Dec. No.
292	312	392	412	492	512	592	612	Circular interpolation mode
293	313	393	413	493	513	593	613	Circular interpolation direction
294	314	394	414	494	514	594	614	-
295	315	395	415	495	515	595	615	-
296	316	396	416	496	516	596	616	-
297	317	397	417	497	517	597	617	-
298	318	398	418	498	518	598	618	-
299	319	399	419	499	519	599	619	-
29A	31A	39A	41A	49A	51A	59A	61A	-
29B	31B	39B	41B	49B	51B	59B	61B	-
29C	31C	39C	41C	49C	51C	59C	61C	-
29D	31D	39D	41D	49D	51D	59D	61D	-
29E	31E	39E	41E	49E	51E	59E	61E	-
29F	31F	39F	41F	49F	51F	59F	61F	-

The following is example chaning all items of first step of position data with one XSMD command.
If M00000 is on, data set up at D00000 ~ D00008 will be saved at teaching data memory and position data entire setup command will be executed.



6.3.37 Read Variable Data (Command: XVRD)

(1) Program



(2) Description

Device	Description
M00040	Input to read variable data
M00041	Ready flag to read common area (ready flag to save in internal device by GETM after executing command reading variable data)
D02114	Head address to read internal memory data of module
D02116	Block offset
D02118	Block size
D02119	Number of block
D02120	Size of data to read (WORD)
D02122	Size of data to read (DWORD)
D02123	Remaining (after changing WORD to DWORD)
D02200	Head device to save data

Command	XVRD				Read variable data
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is equipped
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis to command (1 ~ 8: 1 axis ~ 8 axis)
	OP3	Read address	PMLK,constant,D,Z,R,ZR	DWORD	Head address of data in module internal memory to read (0 ~72793)
	OP4	Block offset	PMLK,constant,D,Z,R,ZR	DWORD	Offset between blocks (0 ~72793)
	OP5	Block size	PMLK,constant,D,Z,R,ZR	WORD	Size of one block (1 ~ 128)
	OP6	No. of block	PMLK,constant,D,Z,R,ZR	WORD	No. of block to read (1 ~ 128)

※ PMLK indicates P area, M area, L area, K area.

(a) This is command that reads data among parameter, operating data, CAM data by WORD unit from “Read address” into CPU. The number of data is set in “Block size”. In case “No. of block” set in OP6 is more than 2, it reads multiple blocks. At this time, head address of next block is “Block offset” apart from head address of current block.

(b) Max data size (Block size X No. of block) can be read with one command is 128 WORD.

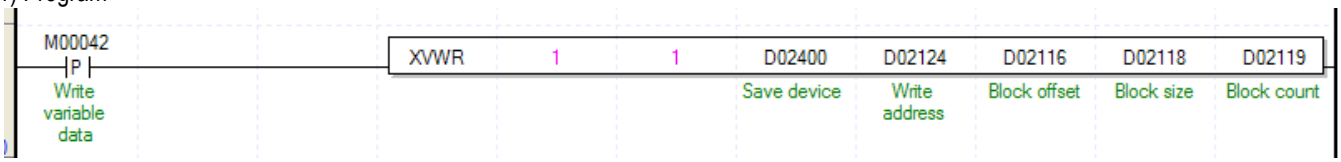
(c) “Read variable data” can be executed in operation.

(d) If you execute “Read variable data”, the data read from positioning module will be saved in common area. In order to save in device for using in program, use GETM command [Read address: h280, data size: read data size (DWORD) as program example after executing “Read variable data” command

(e) In the above program, it reads data starting “Read address” set in D02114 by WORD unit into CPU. The number of data is “D02118”. In case “No. of block set in D02119 is more than 2, it reads multiple blocks starting “Read address” D02114 in order. In the above program, saves the read data in D02200 5ms after executing “Read variable data: command. You have to execute GETM command minimum 4ms after executing “Read variable data” to save the read data in common area.

6.3.38 Write Variable Data (Command: XVWR)

(1) Program



(2) Comment

Device	Description
M00042	Input to write variable data
D2400	Head address where data for writing is saved
D2124	Write address
D2116	Block offset
D2118	Block size
D2119	No. of block

Command	XVWR				Write variable data
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is equipped
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis to command (1 ~ 8: 1 axis ~ 8 axis)
	OP3	Data device	PMLK,constant,D,Z,R,ZR	WORD	Head address where data to write is saved.
	OP4	Write address	PMLK,constant,D,Z,R,ZR	DWORD	Head address to write module internal memory data (0 ~72768)
	OP5	Block offset	PMLK,constant,D,Z,R,ZR	DWORD	Offset between blocks (0 ~ 72768)
	OP6	Block size	PMLK,constant,D,Z,R,ZR	WORD	Size of one block (1 ~ 128)
	OP7	No. of block	PMLK,constant,D,Z,R,ZR	WORD	No. of block to read (1 ~ 128)

※ PMLK indicates P area, M area, L area, K area.

(a) This is command that writes data starting “Write address” set in OP4 among parameter of positioning module internal memory, operation data, CAM data to internal memory address starting OP3. The number of data to write is “Block size” OP6. In case “No. of block” is more than 2, writes multiple blocks. At this time, head address of next block is “Block offset” OP5 apart from head address of current block.

(b) Max data size (Block seze X No. of block) that can be written with one command is 128 WORD.

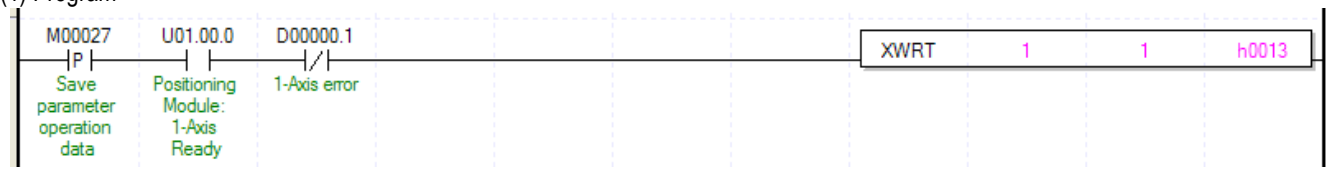
(c) Even “Write variable data” command can be executed even when the axis subject to teaching is being operated but, only the current step’s data is reflected after the current step operation is completed if the step that is currently running is within the step area while other steps’ data are immediately changed.

(d) In case you execute “Write variable data”, the changed value is kept during power on. So, to save the data, execute “Save Parameter/Operation data (XWRT) command.

(e) In the above program example, writes data starting from D02400 to internal memory address starting form “D2124” in order by WORD unit. The number of data is “Block size”. In case “No. of Block” set in D02119 is larger than 2, writes multiple blocks. At this time, head address of next block is “Block offset” OP5 apart from head address of current block.

6.3.39 Parameter/Operation Data Save (Command : XWRT)

(1) Program



(2) Description

Device	Description
M00027	axis1 parameter/operation data save input
U01.00.0	axis1 ready
D00000.1	axis1 error state

Command	XWRT				Parameter/operation Data save
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Selection axis	PMLK,constant,D,Z,R,ZR	WORD	Axis to save data

※ PMLK means P, M, L and K areas.

(a) This is the command that saves the parameter data & operation data of selected axis on FRAM.

(b) The current parameter & operation data of selected axis will be saved on FRAM, it is also maintained when the power is off.

(c) The number of parameter/operation data save command is unlimited.

(d) Parameter/operation data save command is available to be executed when the axis is operating. Execute it when all axes are not in operation.

(e) Set the selection axis by setting each bit of axis.

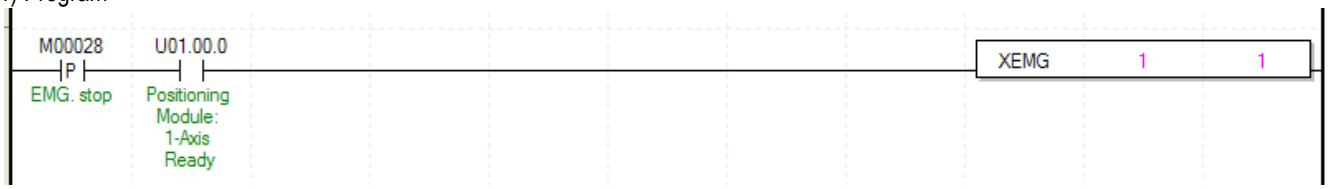
15 ~ 8 Bit	7Bit	6Bit	5Bit	4Bit	3Bit	2Bit	1Bit	0Bit
Not use	Axis8	Axis7	Axis6	Axis5	Axis4	Axis3	Axis2	axis1

That is, if set h0003, axis2, axis1 will be set to execute parameter/operation data save.

(f) In the example program above, save parameter/operation data of 1, axis2 on FRAM.

6.3.40 Emergency Stop (Command : XEMG)

(1) Program



(2) Description

Device	Description
M00028	axis1 internal emergency stop input
U01.00.0	axis1 ready

Command	XEMG				Emergency stop
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)

※ PMLK means P, M, L and K areas.

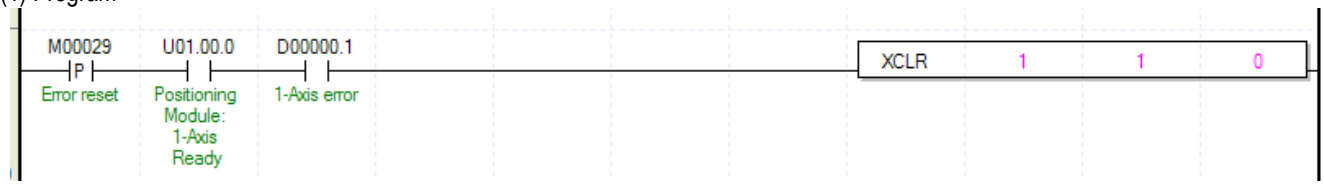
(a) Execute internal emergency stop command to command axis.

(b) Dec. time in emergency stop become the time which set on “Emergency stop dec. time” item of each basic parameter.

(c) The example program above is the command stop axis1 emergently.

6.3.41 Error Reset (Command : XCLR)

(1) Program



(2) Description

Device	Description
M00029	axis1 error reset input
U01.00.0	axis1 ready
D00000.1	axis1 error state

Command	XCLR				Error reset
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Common error	PMLK,constant,D,Z,R,ZR	WORD	0: reset axis error, 1: reset common error

※ PMLK means P, M, L and K areas.

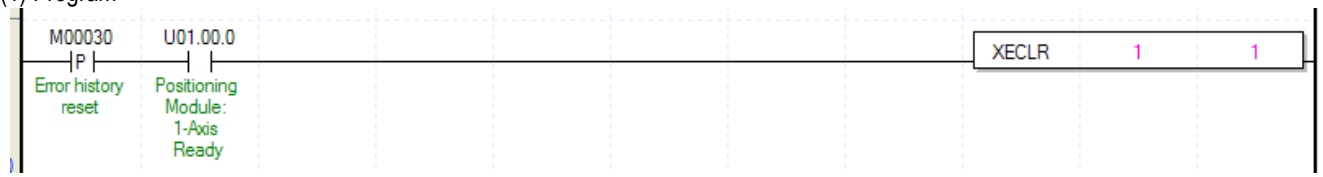
(a) This is the command that reset the error occurred on command axis.

(b) In case of common error, not axis error, execute the command while common error item (OP3) is 1.

(c) The example program above is that reset the error occurred on axis1.

6.3.42 Error History Reset (Command : XECLR)

(1) Program



(2) Description

Device	Description
M00030	axis1 error history reset input
U01.00.0	axis1 ready

Command	XECLR				Error History Reset
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)

※ PMLK means P, M, L and K areas.

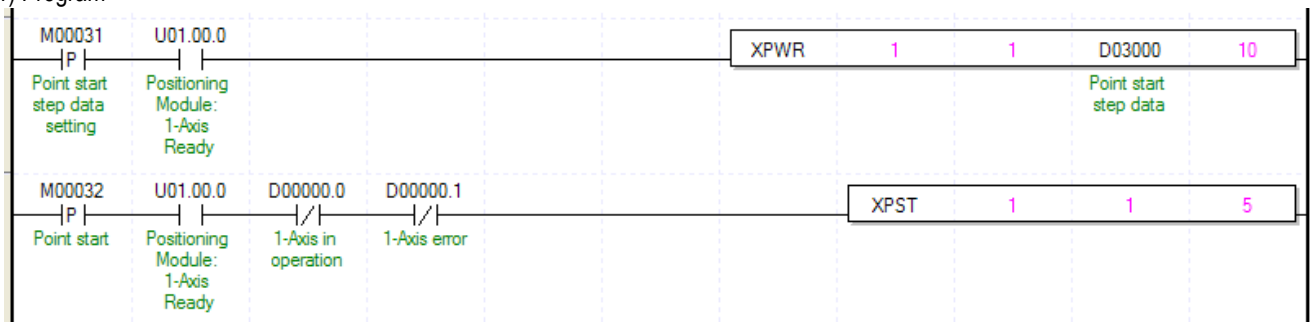
(a) This is the command that reset the error history about command axis.

(b) The module in each axis saves 10 (Maximum) error histories.

(c) The example program above is that reset errors occurred on axis1.

6.3.43 Point Start (Command : XPST)

(1) Program



(2) Description

Device	Description
M00031	axis1 point start step data setting input
M00032	axis1 point start input
U01.00.0	axis1 ready
D00000.0	axis1 operating state
D00000.1	axis1 error state
D03000	Point start step data setting leading device

Command	XPST				Point operation
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Point operation No.	PMLK,constant,D,Z,R,ZR	WORD	Point operation step No. (1~20)

※ PMLK means P, M, L and K areas.

(a) This is the command that execute point start of command axis.

(b) It is unavailable to be executed when the axis is operating.

(c) It is able to set maximum 20 point start step.

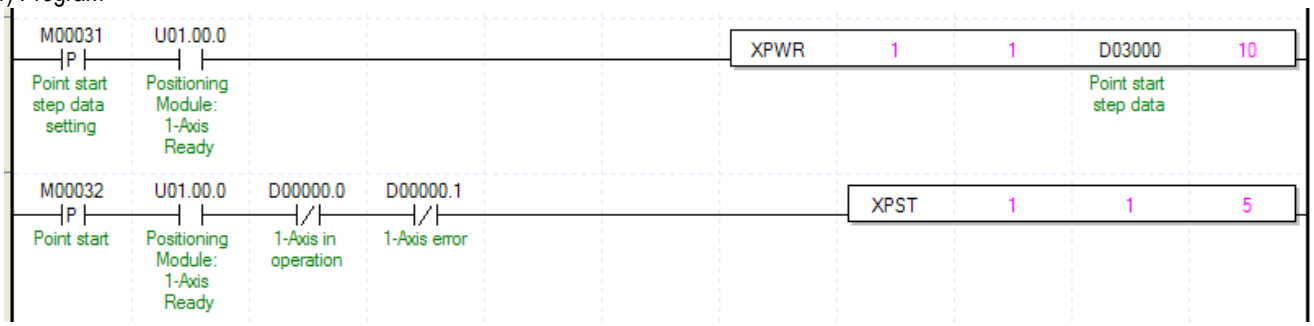
(d) Step data must be set in point start data area before execute point start. For the point start step data setting, refer to the next page about XPWR command.

(d) For the detail description about operation of point start, refer to “9.2.18 positioning start (4) Point start”.

(f) The example program sets 10 point steps from D03000 on axis1 and executes point start to 5 point step which already set.

6.3.44 POINT Start Step Data Setting (Command: XPWR)

(1) Program



(2) Description

Device	Description
M00031	axis1 Point Start Step Data Setting Input
M00032	axis1 Point Start Input
U01.00.0	axis1 ready
D00000.0	axis1 Operating State
D00000.1	axis1 Error State
D03000	Point Start Step Data Setting Leading Device No.

Command	XPWR				POINT Start Step Data Setting
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1 ~ 8 : axis1 ~ axis8)
	OP3	Device	PMLK,D,Z,R,ZR	WORD	Leading No. of device with POINT Start Step Data
	OP3	Data No.	PMLK,constant,D,Z,R,ZR	WORD	Data No. to save (1 ~ 20)

※ PMLK means P, M, L and K areas.

(a) This is the command that sets step which set on device of point step area of command axis.

(b) Point start won't be executed by only point start step data setting command. Refer to the previous page about PST command.

(c) It is able to set maximum 20 point start step.

(d) Point start step data will be set like item below depending on the leading no. of device.

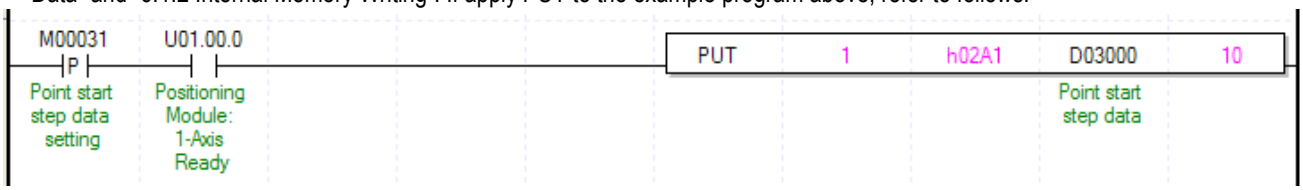
No.	Device No.	POINT start step data
1	Device + 0	POINT start step data 1
2	Device + 1	POINT start step data 2
3	Device + 2	POINT start step data 3
4	Device + 3	POINT start step data 4
5	Device + 4	POINT start step data 5
6	Device + 5	POINT start step data 6
7	Device + 6	POINT start step data 7
8	Device + 7	POINT start step data 8
9	Device + 8	POINT start step data 9
10	Device + 9	POINT start step data 10
11	Device + 10	POINT start step data 11
12	Device + 11	POINT start step data 12
13	Device + 12	POINT start step data 13
14	Device + 13	POINT start step data 14
15	Device + 14	POINT start step data 15
16	Device + 15	POINT start step data 16
17	Device + 16	POINT start step data 17
18	Device + 17	POINT start step data 18
19	Device + 18	POINT start step data 19
20	Device + 19	POINT start step data 20

(e) Step data must be set in point start data area before execute point start.

(f) For detail description of point start operation, refer to “9.2.18 Positioning Start (4) Point Start”.

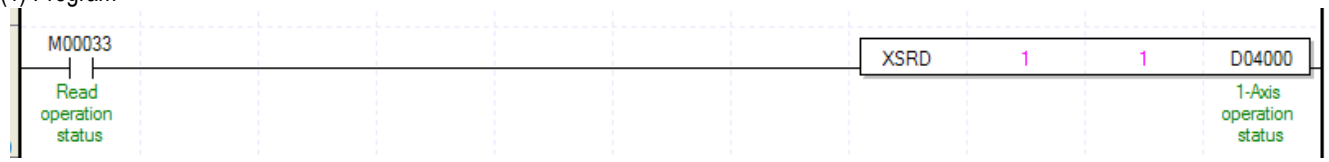
(g) The example program above sets 10 point steps from D03000 on axis1 and executes point start to 5 point steps which already set.

(h) It is possible to set point operation step with PUT command. At that time, refer to memory address of “5.1.1 Point Operation Step Data” and “6.1.2 Internal Memory Writing”. If apply PUT to the example program above, refer to follows.



6.3.45 Operation State Reading (Command: XSRD)

(1) Program



(2) Description

Device	Description
M0033	axis1 operation state reading input
D04000	Head address to save the operation status of axis 1

Command	XSRD				Operation state reading
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1~8: 1axis ~ 8axis)
	OP3	Device	PMLK,D,Z,R,ZR	WORD	Leading No. of device to save the current state value

※ PMLK means P, M, L and K areas.

(a) This is the command that checks the operation state of command axis and save it on designated device.

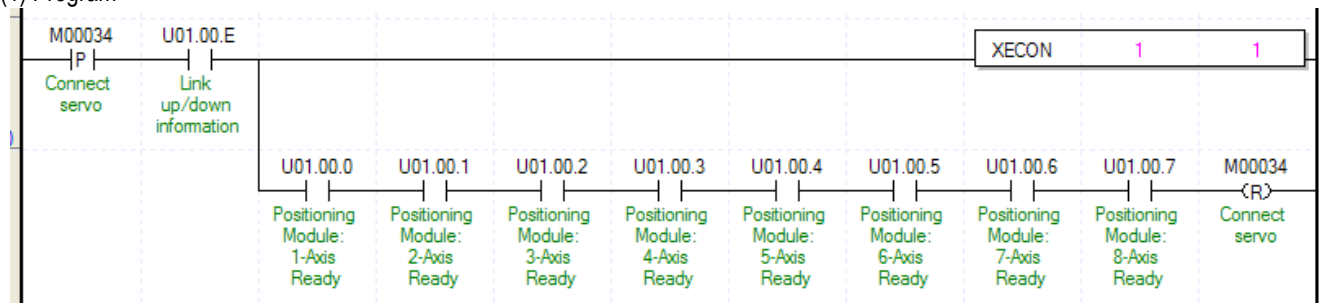
(b) The current state will be saved like items below depending on leading no. of device.

Device No.	Size	State	
		XGF-PN8A	XGF-PN8B
Device	WORD	Operation State Information (Up)	
Device + 1	WORD	Operation State Information (Down)	
Device + 2	WORD	Axis Information	
Device + 3	WORD	External Input/Output Signal State	
Device + 4	DINT	Current Position	
Device + 6	DWORD	Current Speed	
Device + 8	WORD	Step No.	
Device + 9	WORD	M Code No.	
Device + 10	WORD	Error state	
Device + 11 ~ Device + 17	WORD	Error History 1 ~ 7	
Device + 18	WORD	Error History 8	External input signal low
Device + 19	WORD	Error History 9	External input signal high
Device + 20	WORD	Servo error information	
Device + 21	DINT	Encoder1 value	
Device + 23	DINT	Encoder2 value	
Device + 25	DINT	Command position	
Device + 27	DWORD	Command speed	
Device + 29	WORD	Torque	
Device + 30	WORD	Common error information	

(c) It is able to read the current state of axis with GET command. At this time, refer to memory address of “5.1.4 State Information” and “6.1.1 Internal Memory Reading”. If use GET command in the example above, it is as follows. In addition, it is able to read the states that you need with GET command.

6.3.46 Servo Connection (Command: XECON)

(1) Program



(2) Description

Device	Description
M0034	Servo connection input
U01.00.E	Link up/down information

Command	XECON				Servo Connection
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1~8: 1axis ~ 8axis)

※ PMLK means P, M, L and K areas.

(a) This is the command that connects the communication between the positioning module and the servo driver connected to that module through Ethernet cable.

(b) If servo drive is connected normally, a bit corresponding to the connected axis of U device will be set.

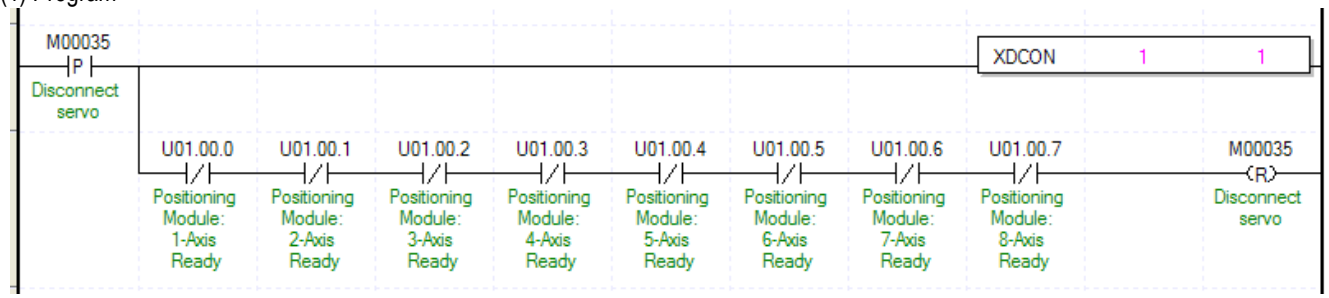
Axis	Signal direction: PLC CPU ← Positioning module	
	Input signal	Contents
1-axis	Uxx.00.0	1-axis ready
2-axis	Uxx.00.1	2-axis ready
3-axis	Uxx.00.2	3-axis ready
4-axis	Uxx.00.3	4-axis ready
5-axis	Uxx.00.4	5-axis ready
6-axis	Uxx.00.5	6-axis ready
7-axis	Uxx.00.6	7-axis ready
8-axis	Uxx.00.7	8-axis ready

(c) If you use “Link up/down” information as input condition of servo connection command, you can execute the command only when network cable is actually connected.

(d) Don’t give the command to each axis and give the command to the one axis among 1-axis~8-axis

6.3.47 Servo Disconnection (Command: XDCON)

(1) Program



(2) Description

Device	Description
M0035	Servo disconnection input

Command	XDCON				Servo Disconnection
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1~8: 1axis ~ 8axis)

※ PMLK means P, M, L and K areas.

(a) This is the command that disconnects the communication between the positioning module and the servo driver connected to that module through Ethernet cable.

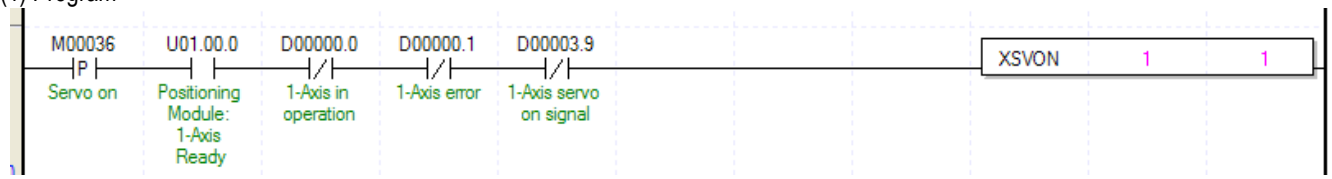
(b) If servo drive is disconnected normally, a bit corresponding to the connected axis of U device will be cleared.

Axis	Signal direction: PLC CPU ← Positioning module	
	Input signal	Contents
1-axis	Uxx.00.0	1-axis ready
2-axis	Uxx.00.1	2-axis ready
3-axis	Uxx.00.2	3-axis ready
4-axis	Uxx.00.3	4-axis ready
5-axis	Uxx.00.4	5-axis ready
6-axis	Uxx.00.5	6-axis ready
7-axis	Uxx.00.6	7-axis ready
8-axis	Uxx.00.7	8-axis ready

(c) Don't give the command to each axis and give the command to the one axis among 1-axis~8-axis

6.3.48 Servo On (Command: XSVON)

(1) Program



(2) Description

Device	Description
M00036	Servo On input
U01.00.0	Axis1 ready
D00000.0	Axis1 in operation
D00000.1	Axis1 error
D00003.9	Axis1 servo on signal

Command	XSVON				Servo Disconnection
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1~8: 1axis ~ 8axis)

※ PMLK means P, M, L and K areas.

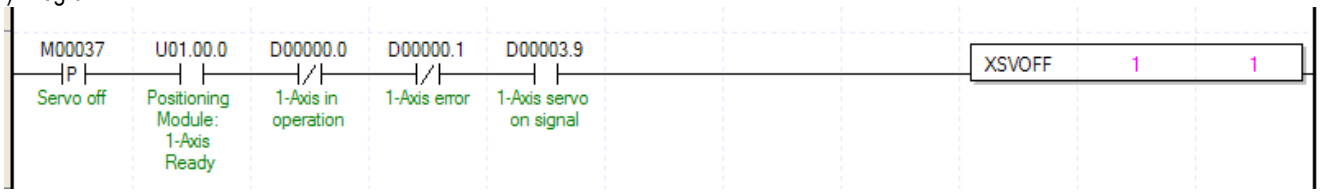
(a) This is the command that turns on the designated servo driver among servo drivers connected to the positioning module

(b) In order to start the motor, “Servo On” signal should be on.

(c) In the above example, it gives “Servo On” command to 1-axis.

6.3.49 Servo Off (Command: XSVOFF)

(1) Program



(2) Description

Device	Description
M00037	Servo Off input
U01.00.0	Axis1 ready
D00000.0	Axis1 in operation
D00000.1	Axis1 error
D00003.9	Axis1 servo on signal

Command	XSVOFF				Servo Disconnection
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1~8: 1axis ~ 8axis)

※ PMLK means P, M, L and K areas.

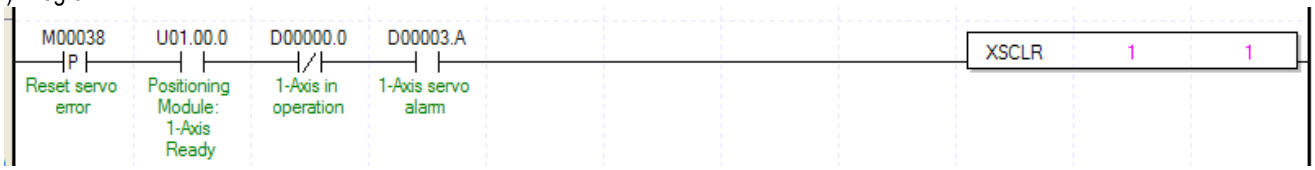
(a) This is the command that turns off the designated servo driver among servo drivers connected to the positioning module

(b) In order to start the motor, “Servo On” signal should be on.

(c) In the above example, it gives “Servo Off” command to 1-axis.

6.3.50 Servo Error Reset (Command: XSCLR)

(1) Program



(2) Description

Device	Description
M00038	Servo Error Reset input
U01.00.0	Axis1 ready
D00000.0	Axis1 in operation
D00003.A	Axis1 servo alarm signal

Command	XSVOFF				Servo Disconnection
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1~8: 1axis ~ 8axis)

※ PMLK means P, M, L and K areas.

(a) This is the command that clears servo driver alarm occurred at the specific axis among servo drivers connected to the positioning module.

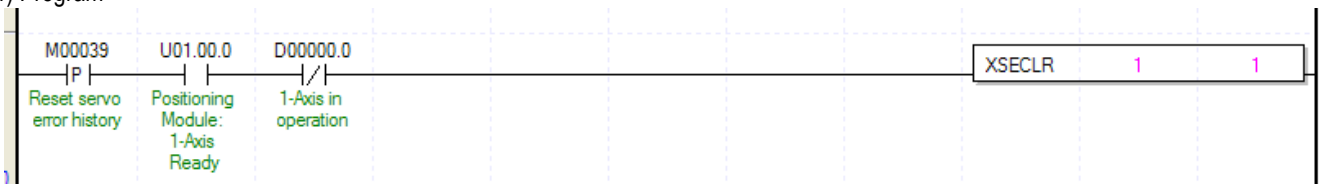
(b) If you reset the servo driver alarm without removing reason, it may not be cleared. So before resetting the servo driver alarm, remove the reason why alarm occurs.

(c) In the above example, it resets servo alarm occurred at the axis1.

(d) In case of XGF-PN8B, there may be servo error which can't be reset according to error type among EtherCAT servo drivers. So refer to servo driver manual.

6.3.51 Servo Error History Reset (Command: XSECLR)

(1) Program



(2) Description

Device	Description
M00039	Servo Error History Reset input
U01.00.0	Axis1 ready
D00000.0	Axis1 in operation

Command	XSVOFF				Servo Disconnection
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1~8: 1axis ~ 8axis)

※ PMLK means P, M, L and K areas.

(a) This is the command that clears servo driver alarm history occurred at the specific axis among servo drivers connected to the positioning module.

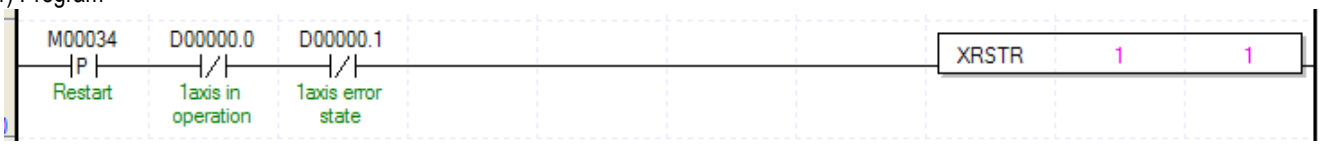
(b) Servo driver is saving up to 10 servo alarm history.

(c) You can see alarm history of the servo driver at the XG-PM. For further information, refer to XG-PM manual.

(d) In case of XGF-PN8B, servo error history reset is not supported.

6.3.52 Restart (Command: XRSTR)

(1) Program



(2) Description

Device	Description
M00034	1axis restart command input

Command	XRSTR				Restart
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1~8: 1axis ~ 8axis)

※ PMLK means P, M, L and K areas.

(a) This is the command that makes the servo restart with position data set up at previous operation after it stops with DEC. stop

(b) You can't execute this command while axis is in operation.

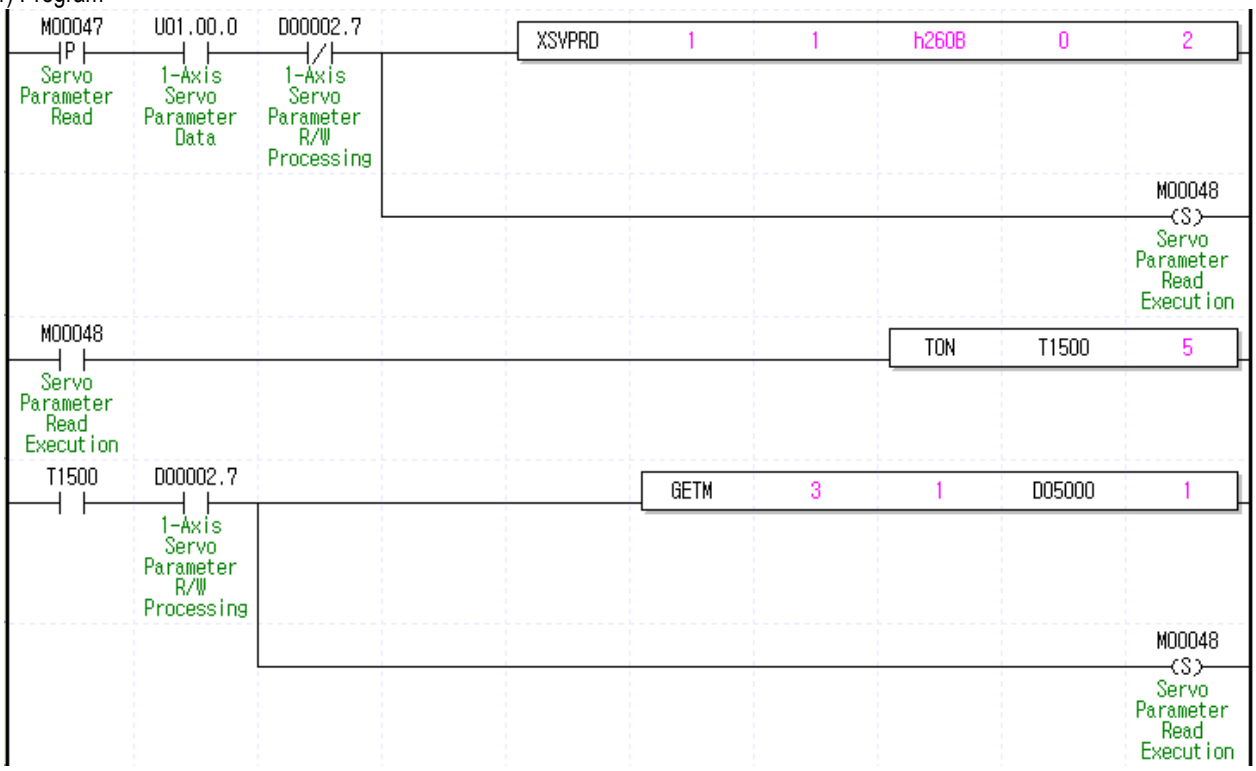
(c) If you start the axis with commands other than "Restart" after it stops with DEC. stop, "Restart" will not be executed

(d) In example above, it gives the command to 1-axis

(d) For detailed information on "Restart", refer to "9.2.20. Restart".

6.3.53 Servo Parameter Read (Command: XSVPRD)

(1) Program



(2) Description

Device	Description
M00047	1axis servo parameter read command input
D00002.7	1axis servo parameter R/W processing
D05000	1axis servo parameter read data

Command	XSVPRD				Servo Parameter Read
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1~8: 1axis ~ 8axis)
	OP3	Index	PMLK,constant,D,Z,R,ZR	WORD	Servo parameter Index (0x1000 ~ 0x9FFF)
	OP4	Sub-Index	PMLK,constant,D,Z,R,ZR	WORD	Servo parameter Subindex (0x00 ~ 0xFF)
	OP5	Data size	PMLK,constant,D,Z,R,ZR	WORD	Servo parameter Length (Byte unit) (1~4)

※ PMLK means P, M, L and K areas.

(a) This is the command that reads parameters (CoE object) of the servo driver connected to positioning module.

(b) It reads the object specified by OP3, OP4 and OP5 among servo parameter data(CoE Object).

(c) You can execute this command while axis is in operation.

(d) OP3 can be set as follows.

Setting value	Contents
0x1000 ~ 0x1FFF	Communication Profile Area
0x2000 ~ 0x5FFF	Manufacturer Specific Profile Area
0x6000 ~ 0x9FFF	Standardized Device Profile Area

(e) OP4 can be set as follows.

Setting value	Contents
0x0 ~ 0xFF	Servo parameter Object Sub-index

(f) OP5 can be set as follows.

Setting value	Contents
1 ~ 4	Servo parameter Object Byte Length

(g) If you execute “Servo parameter read”, the data read from positioning module will be saved in common area. In order to save in device for using in program, use GETM or GETMP command as program example after executing “Servo parameter read” command. Data common area address can be used to GETM or GETMP command as follows.

Address	Description
0	1axis servo parameter Index (high) / SubIndex (low)
1	1axis servo parameter data value
2	2axis servo parameter Index (high) / SubIndex (low)
3	2axis servo parameter data value
4	3axis servo parameter Index (high) / SubIndex (low)
5	3axis servo parameter data value
6	4axis servo parameter Index (high) / SubIndex (low)
7	4axis servo parameter data value
8	5axis servo parameter Index (high) / SubIndex (low)
9	5axis servo parameter data value
10	6axis servo parameter Index (high) / SubIndex (low)
11	6axis servo parameter data value
12	7axis servo parameter Index (high) / SubIndex (low)
13	7axis servo parameter data value
14	8axis servo parameter Index (high) / SubIndex (low)
15	8axis servo parameter data value

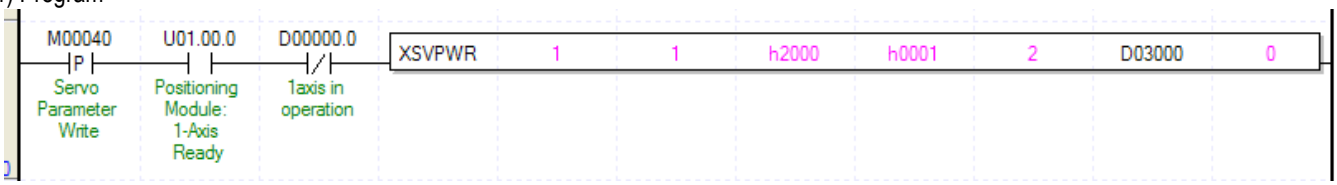
(h) In the above program, saves in D05000 device to read data of h260B (DC link voltage) parameter. In the above program, saves the read data in d05000 5ms after executing "Read servo parameter" command when “1-Axis Servo Parameter R/W Processing” is off state. You have to execute GETM command minimum 4ms after executing “Read servo parameter” to save the read data in common area.

(i) In the above example, if you want to find Index and SubIndex of read parameter, GETMP address set 0 and number of data set 2.

(j) This action may be completed within several scans.

6.3.54 Servo Parameter Write (Command: XSVPWR)

(1) Program



(2) Description

Device	Description
M00040	1axis servo parameter write input
D00000.0	1axis in operation
D03000	Device saving servo parameter data

Command	XSVPWR				Servo Parameter Write
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1~8: 1axis ~ 8axis)
	OP3	Index	PMLK,constant,D,Z,R,ZR	WORD	Servo parameter Index (0x2000 ~ 0x9FFF)
	OP4	Sub-index	PMLK,constant,D,Z,R,ZR	WORD	Servo paramter subindex (0x00 ~ 0xFF)
	OP5	Data size	PMLK,constant,D,Z,R,ZR	WORD	Servo parameter Length (byte unit) (1~4)
	OP6	Data	PMLK,constant,D,Z,R,ZR	DINT	Write data (target value of objects to be changed among servo parameters)
	OP7	Write method	PMLK,constant,D,Z,R,ZR	WORD	Write method (0: RAM teaching, 1: ROM teaching)

※ PMLK means P, M, L and K areas.

(a) This is the command that changes parameters (CoE object) of the servo driver connected to positioning module

(b) It changes the object specified by OP3, OP4 and OP5 among servo parameter to OP6.

(c) You can't execute this command while axis is in operation

(d) OP3 can be set as follows.

Setting value	Contents
0x2000 ~ 0x5FFF	Manufacturer Specific Profile Area
0x6000 ~ 0x9FFF	Standardized Device Profile Area

(e) OP4 can be set as follows.

Setting value	Contents
0x0 ~ 0xFF	Servo parameter Object Sub-index

(f) OP5 can be set as follows.

Setting value	Contents
1 ~ 4	Servo parameter Object Byte Length

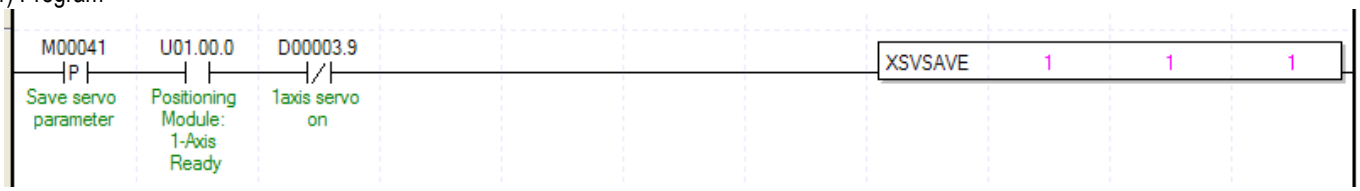
(g) OP7 can be set as follows.

Setting value	Teaching method
0	RAM teaching
1	ROM teaching

(h) This action may be completed within several scans.

6.3.55 Servo Parameter EEPROM Save (Command: XSVSAVE)

(1) Program



(2) Description

Device	Description
M00041	1axis servo parameter save input
U01.00.0	1axis ready
D00003.9	1axis servo on signal

Command	XSVSAVE				Servo Parameter EEPROM Save
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1~8: 1axis ~ 8axis)
	OP3	Save axis	PMLK,constant,D,Z,R,ZR	WORD	Axis to save servo parameters

※ PMLK means P, M, L and K areas.

(a) This is the command that saves parameter of the servo driver connected to the positioning module at the EEPROM in the servo driver.

(b) OP2, command axis, is different with the axis to save the servo driver. So in order to save the servo parameter, you have to set bit of corresponding axis at OP3.

(c) It saves servo parameter of the axis set in OP3.

(d) You can't execute this command while axis is in operation

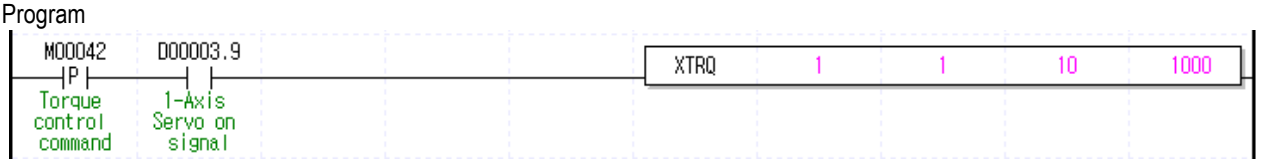
(e) Each bit of OP3 means each axis as follows. To select the axis, set the corresponding bit.

15 ~ 8 Bit	7Bit	6Bit	5Bit	4Bit	3Bit	2Bit	1Bit	0Bit
Not used	8axis	7axis	6axis	5axis	4axis	3axis	2axis	1axis

(f) This action may be completed within several scans.

6.3.56 Torque control (Command: XTRQ)

(1) Program



(2) Description

Device	Description
M00042	1axis torque control command input
D00003.9	1axis servo on signal

Command	XTRQ				Torque Control Command
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1~8: 1axis ~ 8axis)
	OP3	Save axis	PMLK,constant,D,Z,R,ZR	INT	Torque value (unit: %, -32768 ~ 32767)
	OP4	Gradient	PMLK,constant,D,Z,R,ZR	WORD	Torque gradient (unit: ㎳, 0 ~ 65535 ㎳)

※ PMLK means P, M, L and K areas.

(a) This is the command that executes torque control to positioning module. Torque control executes if torque value and torque gradient are set and a command is issued.

(b) Set torque value (%) to OP3. Torque values work in % rated torque. (1 = 1% of rated torque)

For example, set 200 if the user wants to control torque in 200% of torque.

※ The allowable range of torque value may vary according to the connected servo drive. In general, target torque value is limited to the maximum torque setting.

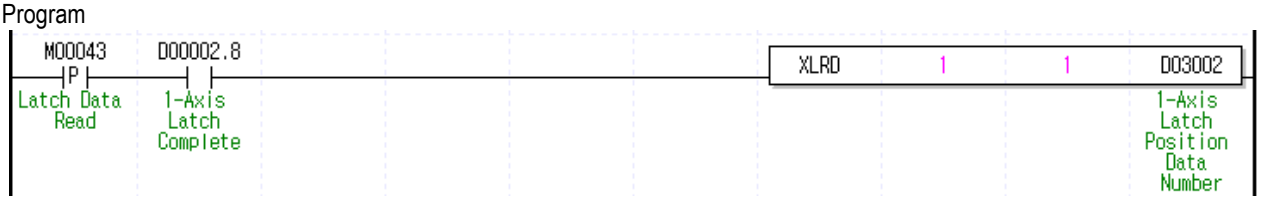
(c) Set time to take in reaching the target torque to OP4. If a command is executed, torque increases in this gradient until it reaches the set torque value.

(d) Any command cannot be executed, the relevant axis is being operated for functions other than torque control.

(e) This action may be completed within several scans.

6.3.57 Latch position data read (Command: XLRD)

(1) Program



(2) Description

Device	Description
M00043	1axis latch data read command input
D00002.8	1axis latch complete
D03002	1axis latch position data number

Command	XLRD				Latch position data read Command
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1~8: 1axis ~ 8axis)
	OP3	Device	PMLK,constant,D,Z,R,ZR	WORD	Leading No. of device to save the latch data

※ PMLK means P, M, L and K areas.

(a) This command is used to read data count and latch position data saved and latched by the positioning module's external latch command.

(b) Read latch data of an axis designated to OP2 of the positioning module designated to OP1 (the positioning module's slot number) and save the device designated to OP3.

(c) The following values are saved on the device area designated to OP3.

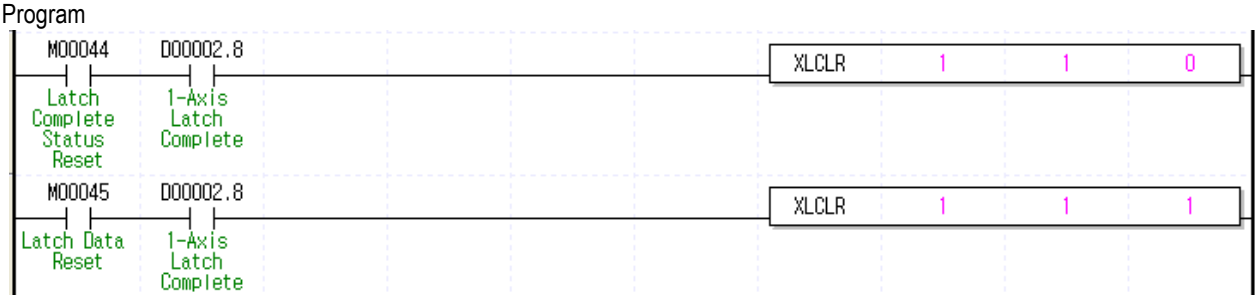
Device No.	Size	Description
Device	WORD	Number of latch position data
Device +1	WORD	-
Device +2	DINT	Latch position data 1
Device +4	DINT	Latch position data 2
Device +6	DINT	Latch position data 3
Device +8	DINT	Latch position data 4
Device +10	DINT	Latch position data 5
Device +12	DINT	Latch position data 6
Device +14	DINT	Latch position data 7
Device +16	DINT	Latch position data 8
Device +18	DINT	Latch position data 9
Device +20	DINT	Latch position data 10

(d) The Read Latch Position Data command is executed at every scan if the contact of input conditions as level command is On.

(e) This action may be completed within several scans.

6.3.58 Latch reset (Command: XLCLR)

(1) Program



(2) Description

Device	Description
M00044	1axis latch complete status reset command input
M00045	1axis latch data reset command input
D00002.8	1axis latch complete

Command	XLCLR				Latch reset Command
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1~8: 1axis ~ 8axis)
	OP3	Device	PMLK,constant,D,Z,R,ZR	WORD	Latch reset item

※ PMLK means P, M, L and K areas.

(a) This command is used to initialize the data count and latch position data saved and latched on the positioning module or the state when latch is completed.

(b) Reset latch data of an axis designated to OP2 of the positioning module designated to OP1 (the positioning module's slot number).

(c) The following items are reset according to the Reset Latch items designated to OP3.

0: Reset the state when latch is completed

1: Reset latch position data and the state when latch is completed

(Values high than "1" are processed equally with "1")

(d) If latch position data are read through the Read Latch Position Data command (XLRD) after 1 is set to OP3 and the Reset Latch command is executed, all of data become 0.

(e) This action may be completed within several scans.

Note

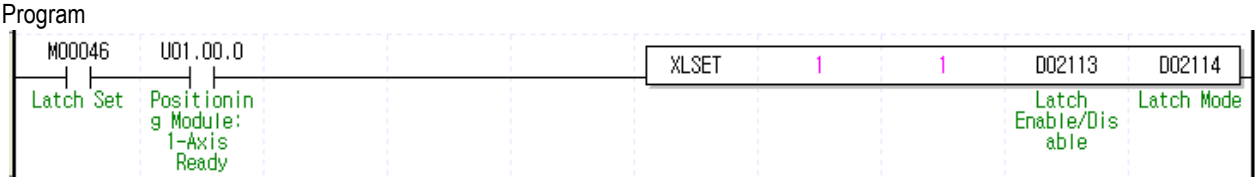
Two latch modes are supported for XGF-PN8B module. In case that a single trigger from two latch modes is set, ensure latch function to perform through the second touch probe 1 signal after the first touch probe 1 signal is inputted and latched.

That is, in XGF-PN8B module's latch single trigger mode, the Reset Latch command will execute a function to activate the next latch trigger after the touch probe 1 signal is inputted and the latch location is saved.

(Even if the Set Latch command is re-executed after it is set as latch permission, it will work in the same way)

6.3.59 Latch set (Command: XLSET)

(1) Program



(2) Description

Device	Description
M00046	1axis latch set command input
U01.00.0	1axis ready
D02113	Latch enable/disable
D02114	Latch mode

Command	XLSET				Latch set Command
Operand	OP1	Slot	Constant	WORD	Slot No. installed with positioning module
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Command axis (1~8: 1axis ~ 8axis)
	OP3	Device	PMLK,constant,D,Z,R,ZR	WORD	Latch reset item

※ PMLK means P, M, L and K areas.

(a) This command is used to enable/disable the positioning module's external latch function or to set latch mode.

(b) Enable/Disable the latch function of an axis designated to OP2 of the positioning module designated to OP1 (the positioning module's slot number) or set latch mode.

(c) Actions according to the Enable/Disable Latch item designated to OP3 are as following.

0: latch prohibition 1: latch permission

(Values high than "1" are processed equally with "1")

(d) Actions according to the latch mode item designated to OP4 are as following.

0: Single trigger (The current position latch is available only the touch probe 1 signal inputted at first after latch is enabled)

1: Continuous trigger (The current position latch is available at every touch probe 1 signal after latch is enabled)

(Values high than "1" are processed equally with "1")

(e) This action may be completed within several scans.

Chapter 7 Function Block

7.1 Common Issues of Function Block

(1) The functions and directions of the following I/O parameter are common for positioning function block.

Category	Parameter	Data Type	Description
Input	REQ	BOOL	Execution request of function block - Function block is executed if "0→1"(edge or level) as long as the connection condition is met during the program.
	BASE	USINT	Base position number - This is the area where the base number on which positioning module is installed is set. - Setting range: 0 ~ 7
	SLOT	USINT	Base position number - This is the area where the slot number on which positioning module is installed is set. - Setting range: 0 ~ 7
	AXIS	USINT	Axis number - 1 ~ 8 : axis1 ~ axis8 "Error 6" is generated if a value out of the setting range is set
Output	DONE	BOOL	Indicates function block execution end state - "1" is outputted if function block is executed completely without error and maintained until the next execution; if an error occurs, it outputs "0"
	STAT	USINT	Error state indication - If an error occurs during function block execution, it generates the error number.

Error code of STAT of Positioning Function Block is as follows.

STAT	Description	Detailed description
0	Normal	In case function block is executed normally, DONE=1 and STAT=0.
1	Base number setting error	Base number is out of range Setting range according to CPU is as follows. XGI-CPU/H : 0 ~ 7 XGI-CPUS : 0 ~ 3 XGR-CPUH : 0 ~ 31
3	Slot number setting error	Slot number is out of range (0 ~ 11).
4	Empty slot error	There is no module at the position specified with BASE, SLOT.
5	Positioning module mismatch	There is a module other than positioning module at the position specified with BASE, SLOT.
6	Axis number error	AXIS is out of range (1 ~ 8).
10	Function Block overlap execution error	This error occurs when previously executed function block is not yet read by positioning module before executing new function block. Execute new function block after previously executed function block is read by positioning module. It needs up to 2ms to read the function block after executing function block.
11	Input variable setting error	Variable other than BASE, SLOT, AXIS is out of range. Check the input variable
22	Base skip error	Check the base skip setting
24	Slot skip error	Check the base skip setting
101 : 801	Positioning module error	Error that occurred at positioning module as a result of executing the function block

(2) The position and speed setting ranges of positioning function block are as follows and the ranges are based on pulse for position or pulse/sec for speed.

Category	Setting unit	Setting range
Position	pulse	-2,147,483,648 ~ 2,147,483,647[pulse]
	mm	-2,147,483,648 ~ 2,147,483,647[x 10^{-4}mm]
	inch	-2,147,483,648 ~ 2,147,483,647[x 10^{-5}inch]
	degree	-2,147,483,648 ~ 2,147,483,647[x 10^{-5}degree]
Speed	pulse/sec	1 ~ 2,147,483,647 [pulse/sec]
	mm/min	1 ~ 2,147,483,647 [X10^{-2}㎜/min]
	inch/min	1 ~ 2,147,483,647 [X10^{-3}Inch/min]
	degree/min	1 ~ 2,147,483,647 [X10^{-3} degree/min]

(3) For the data types which usually used on function block are as follows.

No.	Initial	Data Types	Size(Bit)	Range
1	BOOL	Boolean	1	0, 1
2	SINT	Short Integer	8	-128 ~ 127
3	USINT	Unsigned Short Integer	8	0 ~ 255
4	INT	Integer	16	-32768 ~ 32767
5	UINT	Unsigned Integer	16	0 ~ 65535
6	DINT	Double Integer	32	-2147483648 ~ 2147483647
7	UDINT	Unsigned Double Integer	32	0 ~ 4294967295

7.2 Function Block of Positioning Module

Here describes the positioning function blocks used in XGI CPU Module.

No.	Name	Description	Operation condition
1	XPM_ORG	Homing start	Edge
2	XPM_FLT	Floating origin setting	Edge
3	XPM_DST	Direct start	Edge
4	XPM_IST	Indirect start	Edge
5	XPM_SST	Simultaneous start	Edge
6	XPM_VTP	Speed/position switching control	Edge
7	XPM_VTPP	Position specified peed/position switching control	Edge
8	XPM_PTV	Position/speed switching control	Edge
9	XPM_PTT	Position/torque switching control	Edge
10	XPM_STP	Deceleration stop	Edge
11	XPM_SKP	Skip operation	Edge
12	XPM_SSP	Position synchronization	Edge
13	XPM_SSS	Speed synchronization	Edge
14	XPM_SSSP	Positioning Speed Synchronous	Edge
15	XPM_POR	Position override	Edge
16	XPM_SOR	Speed override	Edge
17	XPM_PSO	Positioning speed override	Edge
18	XPM_NMV	Continuous operation	Edge
19	XPM_INC	Inching operation	Edge
20	XPM_RTP	return to the previous position of manual operation	Edge
21	XPM_SNS	Start step No. change	Edge
22	XPM_SRS	Repeat step No. change	Edge
23	XPM_MOF	M code release	Edge
24	XPM_PRS	Current position preset	Edge
25	XPM_EPRE	Encoder value preset	Edge
26	XPM_ATEA	Teaching array	Edge
27	XPM_SBP	Basic parameter teaching	Edge
28	XPM_SEP	Extended parameter teaching	Edge
29	XPM_SMP	Manual operation parameter teaching	Edge
30	XPM_SCP	Common parameter teaching	Edge
31	XPM_SMD	Operation data teaching	Edge
32	XPM_VRD	Variable data read	Edge
33	XPM_VWR	Variable data write	Edge
34	XPM_EMG	Emergency stop	Edge
35	XPM_RST	Error reset/output disabled release	Edge
36	XPM_HRST	Error History Reset	Edge
37	XPM_PST	Point start	Edge
38	XPM_WRT	Parameter/operation data save	Edge
39	XPM_CRD	Operation information read	Level
40	XPM_SRD	Operation state read	Level
41	XPM_ENCRD	Encoder value read	Level
42	XPM_SERVO	Servo error information read	Level
43	XPM_JOG	JOG operation	Level
44	XPM_CAM	Cam Start	Edge
45	XPM_CAMO	Main axis offset-specified CAM start	Edge
46	XPM_ELIN	Circular Interpolation Operation	Edge
47	XPM_ECON	Servo communication connect	Edge

No.	Name	Description	Operation condition
48	XPM_DCON	Servo communication disconnect	Edge
49	XPM_SVON	Servo On	Edge
50	XPM_SVOFF	Servo Off	Edge
51	XPM_SRST	Servo error reset	Edge
52	XPM_SHRST	Servo error history reset	Edge
53	XPM_RSTR	Restart	Edge
54	XPM_SVIRD*	Servo external input information read	Level
55	XPM_SVPRD*	Servo driver parameter read	Edge
56	XPM_SVPWR*	Servo driver parameter write	Edge
57	XPM_SVSAVE*	Servo driver parameter save	Edge
58	XPM_PTT	Torque control	Edge
59	XPM_LRD	Latch position data read	Level
60	XPM_LCLR	Latch reset	Edge
61	XPM_LSET*	Latch set	Edge

Note

1. Dedicated commands of positioning module are executed in rising edge. Therefore, it operates when the input condition is “On”. If you want it to operate again, the input condition has to be “Off” first, then be “On”. But, XPM_SRD will be operated by high level. Therefore, it continues to operate during the input condition is “On”. If the input condition become “Off”, it does not operate.
2. Duration time of XPM command is as follows.
   (1) XPM_WRT : 15ms (per each axis)
   (2) The commands excepting XPM_WRT
      1) XGF-PN8A: 1.6ms (when using 2 axes) ~ 4.8ms (when using 8 axes)
      2) XGF-PN8B: 2ms (when using 3 axes) ~ 4ms (when using 8 axes)
3. *: only for XGF-PN8B

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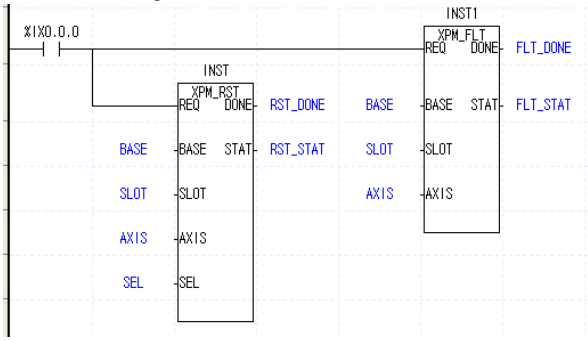
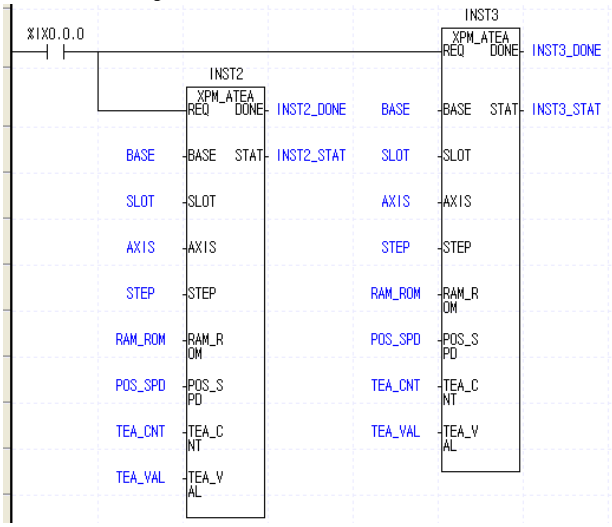
▷ For the positioning block except XPM_SRD, XPM_CRD, XPM_ENCRD, XPM_SVERD(XGF-PN8A/B), XPM_SVIRD(XGF-PN8B) and XPM_LRD(XGF-PN8A/B), only one should be executed for one function block execution axis within a scan. If using it as presented in the following example program, the function block does not work properly.

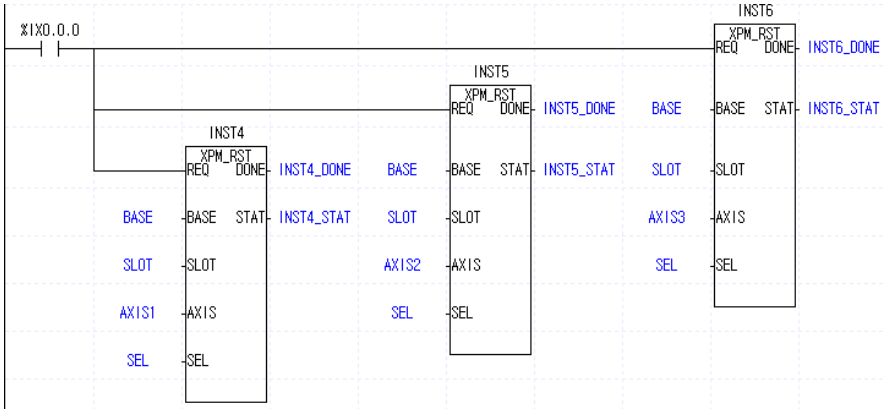
If executing a different function block



If executing a same function block

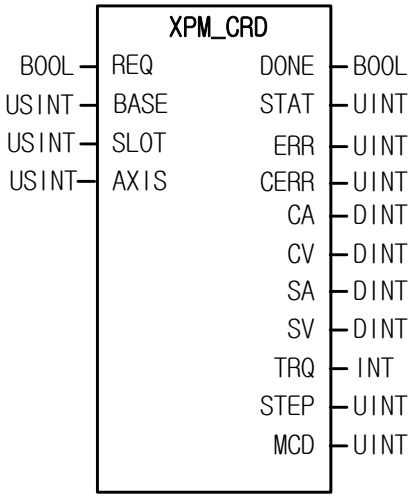


▷ Same block can be executed on a different axis.



7.3 Function Block related to Module Information Read

7.3.1 Operation Information Read (XPM_CRD)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation ERR : Display axis error CERR : Display common error CA : Display the command position CV : Display the command speed SA : Display the current position SV : Display the current speed TRQ: Display the current torque STEP : Display step no. of the current operation data MCD : Display the current M code value

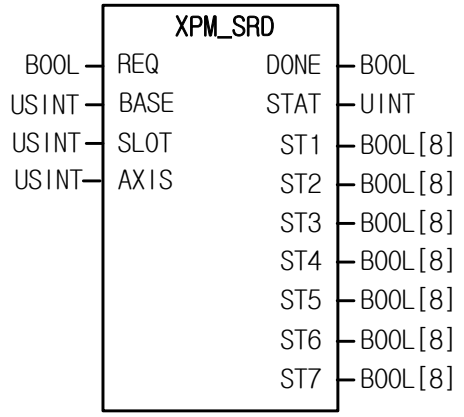
(1) Read the axis state of current operation designated in the axis of designated positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) The operation information is saved in parameter set on output of function block.

(3) Set an axis to command and the value like followings are available to be set. If you set wrongly, “Error6” arises.
1 ~ 8 : axis1 ~ axis8

(4) You can monitor command position, command speed, current position, current speed, torque, operation data no. and M code value of axis already set through reading them or use them as a condition in user’s program.

7.3.2 Operation State Read (XPM_SRD)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: axis1 ~ axis8 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation ST1 : State 1 ST2 : State 2 ST3 : State 3 ST4 : State 4 ST5 : State 5 ST6 : State 6 ST7 : State 7

(1) Give “Bit Information of Current operation reading” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

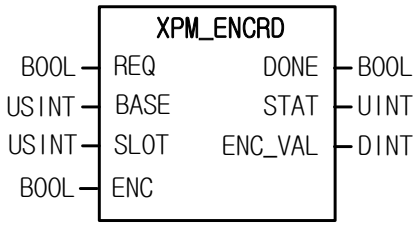
(2) The bit information about the state of current operation is saved in parameter set on ST1 ~ ST7.

(3) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

(4) The contents of output parameters, ST1 ~ ST7 are important information necessarily applied in the program.

	Bit	Description	Bit	Description
ST1	[0]	Operating(0:STOP, 1:BUSY)	[4]	Origin fix state(0:Uncompletion, 1:Completion)
	[1]	Error state	[5]	Common error state
	[2]	Positioning completion	[6]	Stop
	[3]	M code On signal(0:Off, 1:On)	[7]	In reading/writing variable data
ST2	[0]	Upper limit detection	[4]	In acceleration
	[1]	Lower limit detection	[5]	In constant speed
	[2]	Emergent Stop	[6]	In deceleration
	[3]	Direction(0:Forward, 1:Reverse)	[7]	In dwell
ST3	[0]	Axis1 in positioning control	[4]	In circular interpolation operation
	[1]	Axis1 in speed control	[5]	In homing operation
	[2]	In linear interpolation	[6]	In position synchronous start operation
	[3]	-	[7]	In speed synchronous start operation
ST4	[0]	In jog operation	[4]	In returning to position before manual operation
	[1]	-	[5]	In CAM control operation
	[2]	In inching operation	[6]	In Feed control operation
	[3]	-	[7]	In ellipse interpolation operation
ST5	[0]	Main axis information 1 ~ 8: axis1 ~ axis8 9: Encoder1 10: Encoder2	[4]	Axis state(0:Main axis, 1: sub axis)
	[1]		[5]	-
	[2]		[6]	-
	[3]		[7]	Now processing Servo parameter R/W (0: not processing R/W, 1: processing R/W)
ST6	[0]	Emergent stop/Dec. stop signal	[4]	Upper limit signal
	[1]	-	[5]	Lower limit signal
	[2]	-	[6]	Home signal
	[3]	-	[7]	DOG signal
ST7	[0]	External command signal	[4]	In-position signal
	[1]	Servo on signal	[5]	Declination counter clear output signal
	[2]	Servo alarm signal	[6]	-
	[3]	In-position signal	[7]	Communication error state (0:normal, 1: error)

7.3.3 Encoder Value Read (XPM_ENCRD)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module ENC : Encoder no. 0: Encoder 1 1: Encoder 2 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation ENC_VAL : Current value of encoder

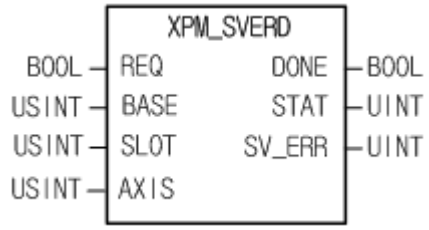
(1) Give “Encoder Reading” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) The current encoder value is displayed on ENC_VAL

(3) Set the encoder you want to read in ENC.

0: Encoder1, 1: Encoder2

7.3.4 Servo Error Information Read (XPM_SVERD)

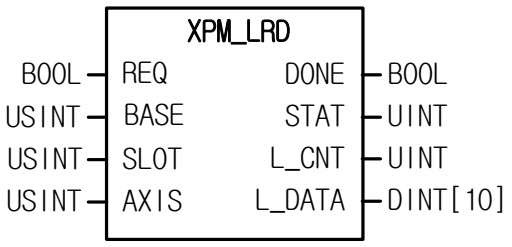
Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: axis1 ~ axis8 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation SV_ERR: Servo error information

(1) It reads servo error information corresponding to the designated axis of positioning module designated by BASE (Base number of positioning module) and SLOT (Slot number of positioning module)

(2) The current servo error information is saved in the variable designated by SV_ERR.

(3) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

7.3.5 Latch Position Data Read (XPM_LRD)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: axis1 ~ axis8 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation L_CNT: Number of latch position data L_DATA: Latch position data 1 ~ 10

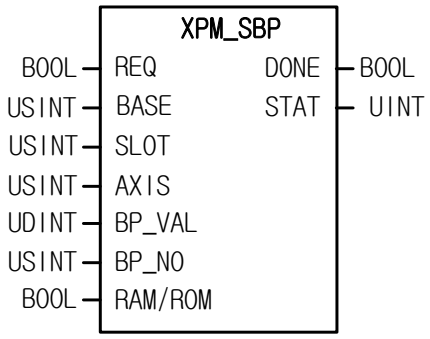
(1) This command is used to read data count and latch position data saved and latched by the positioning module's external latch command.

(2) Save the position data count read and latched the latch data of the axis designated as the positioning module's AXIS(Command axis) designated as BASE(Base number of the positioning module) and SLOT(Slot number of the positioning module) to L_CNT and save the latch position data to L_DATA.

(3) Set an axis to which Command is issued to Axis and one among 1 through 8 can be set. If any other value except the setting value is set, "Error 6" arises.

7.4 Parameter/Operation Data Teaching Function Block

7.4.1 Basic Parameter Teaching (XPM_SBP)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 BP_VAL : Basic parameter to change BP_NO : Item no. of basic parameter to change RAM/ROM : Method of parameter save 0: save on RAM 1: save on ROM **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “Basic Parameter Teaching” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) Parameter value modified by basic parameter teaching command and setting RAM/ROM to “0” is valid within power connection. If you want to keep the parameter without power connection, execute basic parameter teaching command with setting RAM/ROM as “1” or save the modified parameter value on FRAM with XPM_WRT (Parameter/Operation Data Saving command) after basic parameter teaching.

(3) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8: axis1 ~ axis8

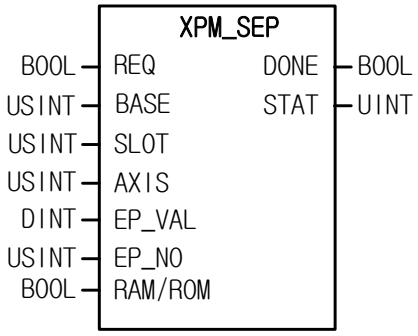
(4) Basic parameter setting command is unavailable to be executed when the axis is operating.

(4) The value that needs to be set in basic parameter is as follows.

Value	Items	Setting Range
1	Speed Limit	mm : 1 [10^{-2} mm] ~ 2,147,483,647 [X Inch : 1 [10^{-3} Inch] ~ 2,147,483,647 [X degree : 1 [10^{-3} degree] ~ 2,147,483,647 [X pulse : 1 ~ 2,147,483,6
2	Acc. Time 1	1 ~ 2,147,483,647 [ms]
3	Acc. Time 2	
4	Acc. Time 3	
5	Acc. Time 4	
6	Dec. Time 1	1 ~ 2,147,483,647 [ms]
7	Dec. Time 2	
8	Dec. Time 3	
9	Dec. Time 4	
10	Emergency stop Dec. Time	1 ~ 2,147,483,647 [ms]
11	Pulse/rotation	1 ~ 200,000,000
12	Transfer /rotation	
13	Unit	0:Pulse, 1:mm, 2:Inch, 3:Degree
14	Unit mutiplier	0: x 1, 1: x 10, 2: x 100, 3: x 1000
15	Unit for speed command	0: unit/time, 1: rpm
16	Encoder selection *	0: Incremental encoder, 1: Absolute encoder
17	Current position display correction	0 ~ 255

*: only for XGF-PN8B

7.4.2 Extended Parameter Teaching (XPM_SEP)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: axis1 ~ axis8 EP_VAL : Parameter value to modify EP_NO : Item no. of parameter to modify RAM/ROM : Method for saving parameter 0: Save at RAM 1: Save at ROM **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “Extended Parameter Teaching” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) Parameter value modified by extended parameter teaching command and setting RAM/ROM to “0” is valid within power connection. If you want to keep the parameter without power connection, execute extended parameter teaching command with setting RAM/ROM as “1” or save the modified parameter value on FRAM with XPM_WRT (Parameter/Operation Data Saving command) after extended parameter teaching.

(3) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

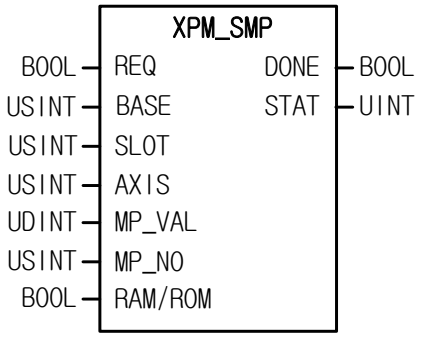
(4) Basic parameter setting command is unavailable to be executed when the axis is operating.

(4) The extended parameter items and setting values are as follows.

Value	Item	Setting Range
1	Software upper limit	㎜ :-2147483648 ~ 2147483647[X10^{-4}㎜] Inch:-2147483648 ~ 2147483647[X10^{-5}Inch] degree:-2147483648 ~ 2147483647[X10^{-5}degree] pulse:-2147483648 ~ 2147483647[pulse]
2	Software lower limit	
3	-	-
4	Positioning completion time	0 ~ 65,535[ms]
5	S-Curve ratio	1 ~ 100
6	In-position width	mm: 0 ~ 65,535[X10^{-4}㎜] inch: 0 ~ 65,535[X10^{-5}Inch] degree: 0 ~ 65,535[X10^{-5}degree] pulse: 0 ~ 65,535[pulse]
7	Arc insertion position	mm: 0 ~ 2147483647[X10^{-4}㎜] Inch: 0 ~ 2147483647[X10^{-5}Inch] degree: 0 ~ 2147483647[X10^{-5}degree] pulse: 0 ~ 2147483647[pulse]
8	Acc./dec. pattern	0: Trapezoid operating, 1: S-curve operating
9	M code mode	0: None, 1: With, 2: After
10	ion Upper/Lower limit detect	0: Not detect, 1: Detect
11	Condition for positioning completion	0: Dwell time 1: In-position 2: Dwell time AND In-position 3: Dwell time OR In-position
12	Interpolation continuous operation type	0: Pass target position, 1: pass near position
13	2 axes linear interpolation continuous operation circular arc insertion	0: Don't insert, 1: Insert arc
14	External command selection	0: External VTP, 1: External stop, 2: External latch command#
15	External command	0: Disable, 1: Enable
16	Position-specified speed override coordinate	0: Absolute, 1: Incremental
17	Infinite running repeat position	mm: 1 ~ 2147483647[X10^{-4}㎜] Inch: 1 ~ 2147483647[X10^{-5}Inch] degree: 1 ~ 2147483647[X10^{-5}degree] pulse: 1 ~ 2147483647[pulse]
18	Infinite running repeat	0: disable, 1:enable
19	Speed/position switching coordinate	0: Incremental, 1: Absolute
20	Interpolation speed selection	0: main axis speed, 1: synthetic speed

#: only for XGF-PN8A

7.4.3 Manual Operation Parameter Teaching (XPM_SMP)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: axis1 ~ axis8 MP_VAL : Manual operation parameter value to modify MP_NO : Item no. of manual operation parameter to modify RAM/ROM : Method for saving parameter 0: Save on RAM 1: Save on ROM **Output** DONE : Maintain 1 after first operation STAT : Output the error no in operation

(1) Give “Manual Operation Parameter Setting” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) Parameter value modified by manual operation parameter teaching command and setting RAM/ROM to “0” is valid within power connection. If you want to keep the parameter without power connection, execute manual operation parameter teaching command with setting RAM/ROM as “1” or save the modified parameter value on FRAM with XPM_WRT (Parameter/Operation Data Saving command) after manual operation parameter teaching.

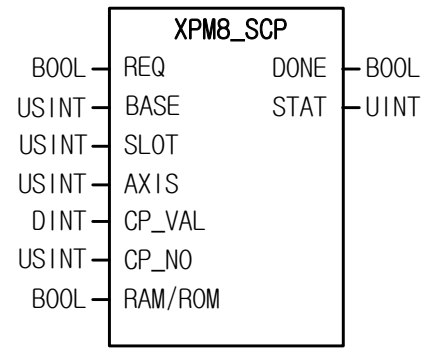
(3) Set an axis to command from 1 ~ 4. If you set wrongly, “Error6” arises.
1 ~ 8 : axis1 ~ axis8

(4) Manual operation parameter setting command is unavailable to be executed when the axis is operating.

(5) The manual operation parameter items and setting values are as follows.

Setting Value	Items	Setting Range
1	JOG high speed	㎜ : 1 2,147,483,647 [X10^{-2} ㎜/min] Inch : 1 2,147,483,647 [X10^{-3}Inch/min] degree : 1 2,147,483,647 [X10^{-3} degree/min] pulse : 1 2,147,483,647 [pulse/sec]
2	JOG low speed	
3	JOG acc. time	0 ~ 2,147,483,647 [ms]
4	JOG dec, time	
5	Inching speed	㎜ : 1 ~ 65,535[X10^{-2} ㎜/min] Inch : 1 ~ 65,535[X10^{-3} Inch/min] degree : 1 ~ 65,535[X10^{-3} degree/min] pulse : 1 ~ 65,535[pulse/sec]

7.4.4 Common Parameter Teaching (XPM_SCP)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: axis1 ~ axis8 CP_VAL : Common parameter value to modify CP_NO : Item no. of common parameter to modify RAM/ROM : Method for saving parameter 0: Save on RAM 1: Save on ROM **Output** DONE : Maintain 1 after first operation STAT : Output the error no in operation

(1) Give “Common Parameter Setting” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

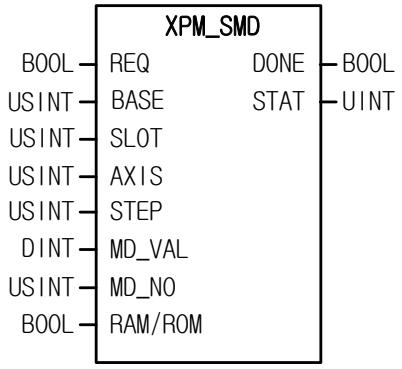
(2) Parameter value modified by common parameter teaching command and setting RAM/ROM to “0” is valid within power connection. If you want to keep the parameter without power connection, execute common parameter teaching command with setting RAM/ROM as “1” or save the modified parameter value on FRAM with XPM_WRT (Parameter/Operation Data Saving command) after common parameter teaching.

(3) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.
1 ~ 8 : axis1 ~ axis8

(4) The common parameter items and setting values are as follows.

Setting Value	Items	Setting values
1	Speed override	0 : % designation, 1 : speed designation
2	Mode for encoder1 pulse input	0:CW/CCW 1 multiplication 1:PULSE/DIR 1 multiplication 2:PULSE/DIR 2 multiplication 3:PHASE A/B 1 multiplication 4:PHASE A/B 2 multiplication 5:PHASE A/B 4 multiplication
3	Maximum value of encoder1	-2147483648 ~ 2147283647
4	Minimum value of encoder1	
5	Encoder1 Z phase clear	0 : disable, 1 : enable
6	Mode for encoder2 pulse input	0:CW/CCW 1 multiplication 1:PULSE/DIR 1 multiplication 2:PULSE/DIR 2 multiplication 3:PHASE A/B 1 multiplication 4:PHASE A/B 2 multiplication 5:PHASE A/B 4 multiplication
7	Maximum value of encoder2	-2147483648 ~ 2147283647
8	Minimum value of encoder2	
9	Encoder2 Z phase clear	0: disable, 1: enable

7.4.5 Operation Data Teaching (XPM_SMD)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: axis1 ~ axis8 STEP : Step no. to modify 0 ~ 400 MD_VAL : Operation data value to modify MD_NO : Item no. of operation data to modify RAM/ROM : Method for saving parameter 0: Save on RAM 1: Save on ROM **Output** DONE : Maintain 1 after first operation STAT : Output the error no in operation

(1) Give “Operation Data Teaching” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) Parameter value modified by operation data teaching command and setting RAM/ROM to “0” is valid within power connection. If you want to keep the parameter without power connection, execute operation data teaching command with setting RAM/ROM as “1” or save the modified parameter value on FRAM with XPM_WRT (Parameter/Operation Data Saving command) after operation data teaching.

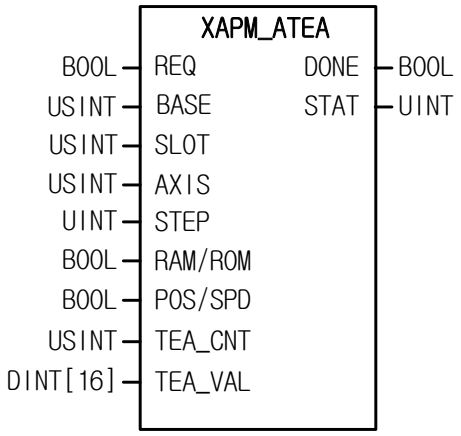
(3) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.
1 ~ 8 : axis1 ~ axis8

(4) Operation data setting command is available to be executed when the axis is operating. However, if operation data of the step that is currently operated are changed, those changes are reflected after the current step is completed.

(4) The operation data items and setting values are as follows.

Setting value	Items	Setting Range
1	Goal position	㎜ : -2147483648 ~ 2147483647 [X10^{-4}㎜] Inch : -2147483648 ~ 2147483647 [X10^{-5} Inch] degree : -2147483648 ~ 2147483647 [X10^{-5} degree] pulse : -2147483648 ~ 2147483647 [pul
2	Auxiliary position for circular interpolation	-2147483648 ~ 2147483647
3	Operating speed	㎜ : 1 ~ 2,147,483,647 [X10^{-2} ㎜/min] Inch : 1 ~ 2,147,483,647 [X10^{-3}Inch/min] degree : 1 ~ 2,147,483,647 [X10^{-3} degree/min] pulse : 1 ~ 2,147,483,647 [pulse/sec]
4	Dwell time	0 ~ 65,535[ms]
5	M code no.	0 ~ 65,535
6	Sub axis setting	Bit unit setting Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 axis8 | axis7 | axis6 | axis5 | axis4 | axis3 | axis2 | axis1
7	Helical interpolation axis	0, axis1 ~ axis8 (0: General circular interpolation)
8	Circular interpolation turns	0~65,535
9	Coordinate	0: absolute, 1: incremental
10	Control method	0:single-axis position control, 1:single axis speed control, 2:single- axis Feed control, 3:linear interpolation, 4:circular interpolation
11	Operating method	0:single, 1:repeat
12	Operating pattern	0:end, 1:keep, 2:continue
13	Size of circular arc	0:circular arc<180 1:circular arc>=180
14	Acc. No.	0 ~ 3
15	Dec. No.	0 ~ 3
16	Circular interpolation mode	0:middle point, 1:center point, 2:radius
17	Direction of circular interpolation	0:CW, 1:CCW

7.4.6 Teaching Array (XPM_ATEA)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: axis1 ~ axis8 STEP : Set the step no. to do teaching 0 ~ 400 RAM/ROM : Selection of RAM/ROM teaching 0 : RAM teaching, 1 : ROM teaching POS/SPD : Selection of position/speed teaching 0 : Position, 1 : Speed TEA_CNT : Set the no. of data to do teaching 1 ~ 16 TEA_VAL : Set the teaching value **Output** DONE : Maintain 1 after first operation STAT : Output the error no in operation

(1) Give “Teaching Array” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) Speed teaching is for user to use random speed value in a operation data of specified step and position teaching is for user to use random position value in a operation data of specified operation step.

(3) This command is for modifying maximum 16 goal positions/speed value at once with teaching array function block.

(4) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.
1 ~ 8 : axis1 ~ axis8

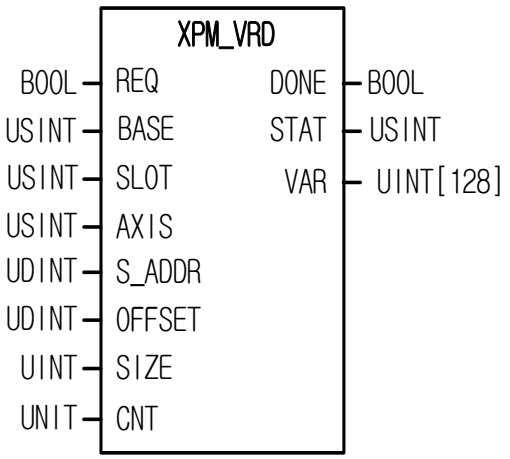
(5) Even “Write variable data” command can be executed even when the axis subject to teaching is being operated but, only the current step’s data is reflected after the current step operation is completed if the step that is currently running is within the step area while other steps’ data are immediately changed.

(6) You may set step no.(0~400) of operation data on STEP. If you set wrongly, “Error11” arises.

(7) You may set the no. of data to do teaching on TEA_CNT and do teaching max. 16. If you set wrongly, “Error11” arises.

(8) Parameter value modified by teaching command and setting RAM/ROM as “0” is valid within power connection. If you want to keep the parameter without power connection, execute teaching command with setting “1” on RAM/ROM or save the modified parameter value on FRAM with XPM_WRT (Parameter/Operation Data Saving command) after teaching.

7.4.7 Read Variable Data (XPM_VRD)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: axis1 ~ axis8 S_ADDR : Module internal memory head address of Read Data 0 ~ 72793 OFFSET : Offset between Read Data blocks 0 ~ 72793 SIZE : Block size of Read data 1 ~ 128 CNT : No. of Read Data block 1 ~ 128 **Output** DONE : Maintain 1 after first operation STAT : Output the error no. in operation VAR : PLC device where Read Data is saved

(1) Gives “Read parameter, operation data, CAM data directly” command to positioning module.

(2) You read data you want by designating module internal memory address of parameter, operation data, CAM data directly.

(3) It reads the positioning module internal memory from the position set by “S_ADDR” by WORD unit and save them in the device set by “VAR”. The number of data to read is the number set by “Size”. In case “CNT” is larger than 2, it reads multiple data blocks and save them in the device set by “VAR” in order. At this time, head address of next block is “Offset” apart from head address of current block.

(4) Max. data size (SIZE x CNT) you can read with one command is 128 WORD.

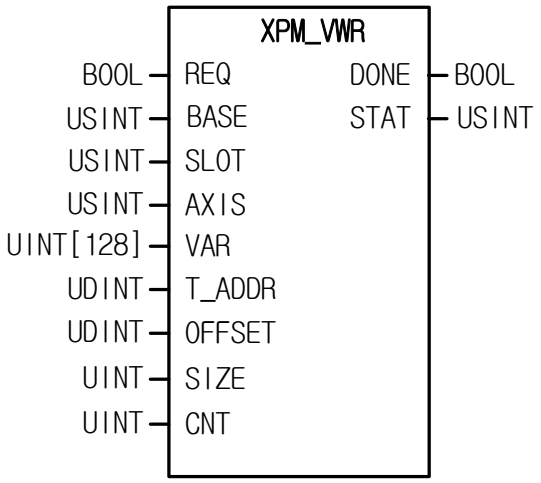
(5) “Read Variable Data” command can be executed in operation.

(6) You can set axis to command in “AXIS” and the following value is available. If you set other values, error code “6” appears.

1 ~ 8: axis 1 ~ axis 8

(7) In case Read Data size (SIZE x CNT) is 0 or higher than 128 WORD, error code “11” appears in STAT.

7.4.8 Write Variable Data (XPM_VWR)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: axis 1 ~ axis 8 VAR : PLC device where Write Data is saved T_ADDR : Module internal memory head address where data is written 0 ~ 72793 OFFSET : Offset between Write data blocks 0 ~ 72793 SIZE : Size of block to write 1 ~ 128 CNT : No. of Write data block 1 ~ 128 **Output** DONE : Maintain 1 after first operation STAT : Output the error no. in operation

(1) Gives “Write parameter, operation data, CAM data directly” command to positioning module.

(2) You can write data you want by designating module internal memory address of parameter, operation data, CAM data directly.

(3) It writes the WORD data in “VAR” to module internal memory. The data are saved from internal memory position set by “T_ADDR” and the number of data is the number set by “Size”. In case the number of block “CNT” is larger than 2, multiple blocks are made. At this time, head address of next block is “Offset” apart from head address of current block.

(4) Max. data size (SIZE x CNT) you can write with one command is 128 WORD.

(5) “Write Variable Data” command can’t be executed in operation.

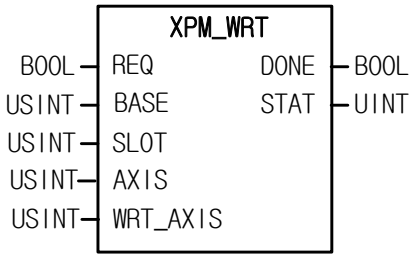
(6) You can set axis to command in “AXIS” and the following value is available. If you set other values, error code “6” appears.

1 ~ 8: axis 1 ~ axis 8

(7) In case Read Data size (SIZE x CNT) is 0 or higher than 128 WORD, error code “11” appears in STAT

(8) In case no. of block (CNT) is higher than 2, and block offset is smaller than block size, error code “11” appears in STAT because module internal memory block to write is overlapped each other.

7.4.9 Saving Parameter/Operation Data (XPM_WRT)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: axis1 ~ axis8 XPM_WRT_AXIS : Saving axis setting (by setting bit) 0bit ~ 7bit: axis1 ~ axis8 **Output** DONE : Maintain 1 after first operation STAT : Output the error no in operation

(1) Give “Basic Parameter Setting” command to the axis designated as the axis of positioning module with BASE (Base no. of positioning module) and SLOT (Slot no. of positioning module).

(2) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.
1 ~ 8 : axis1 ~ axis8

(3) If function block is executed normally, the current operation parameter and data which saved on WRT_AXIS are saved on FRAM and maintain the data without the power connection.

(4) For setting WRT_AXIS, set each Bit

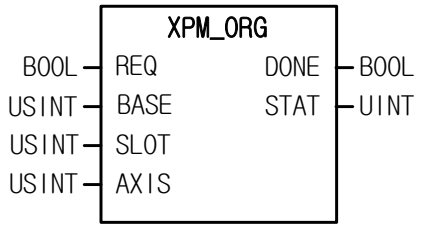
15 ~ 8 Bit	7Bit	6Bit	5Bit	4Bit	3Bit	2Bit	1Bit	0Bit
Not Used	Axis 8	Axis 7	Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1

If you want to select axis3, axis5 and axis6, just set to “16#34”

(5) In case of modifying the CAM data with XPM_VWR instruction, when you execute XPM_WRT, the modified data will be saved in FLASH.

7.5 Start/Stop Function Block

7.5.1 Homing Start (XPM_ORG)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: axis1 ~ axis8 **Output** DONE : Maintain 1 after first operation STAT : Output the error no in operation

(1) This is the command that give homing command to APM module.

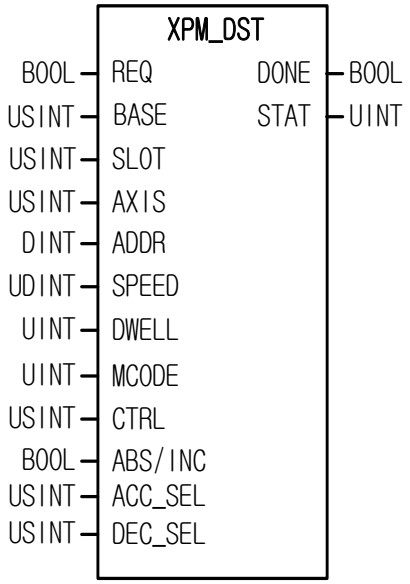
(2) This is the command to find the origin of machine by Direction, Correction, Speed, Address and Dwell set on parameter of each axis for homing according to the homing access.

(3) Give “Homing” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(4) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.
1 ~ 8 : axis1 ~ axis8

(5) If homing command is executed normally, it starts homing according to “homing method” of “homing parameter”.

7.5.2 Direct Start (XPM_DST)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: axis1 ~ axis8 ADDR : Goal position address setting -2147483648 ~ +2147483647 SPEED : Goal speed setting DWELL : Dwell time setting 0 ~ 65535[ms] M code : M code value setting CTRL : Control method setting 0: Position, 1: Speed, 2: Feed 3: Shortest Position ABS/INC: Coordinate setting 0: Absolute, 1: Incremental ACC_SEL: Acc.time no. setting 0: Acc. Time 1, 1: Acc. Time 2 2: Acc. Time 3, 3: Acc. Time 4 DCC_SEL: Dec.time no. setting 0: Dec. time 1, 1: Dec. time 2 2: Dec. time 3, 3: Dec. time 4 **Output** DONE : Maintain 1 after first operation STAT : Output the error no in operation

(1) Give “Direct Start” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

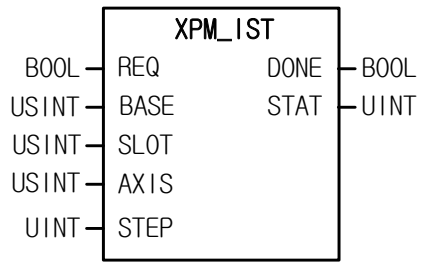
(2) This is for operating by setting goal position address, operation speed, dwell time, M code, control method, coordinates setting and no. of Acc./Dec time, not by operation data.

(3) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

(4) If the value set on SPEED, CTRL, TIME_SEL is out of setting range, “Error11” will occur on STAT.

7.5.3 Indirect Start (XPM_IST)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: axis1 ~ axis8 STEP : Set the step no. to do teaching 0 ~ 400 **Output** DONE : Maintain 1 after first operation STAT : Output the error no in operation

(1) Give “Indirect Start” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) This is for operating by setting operation step no. of axis which set as an operation data.

(3) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

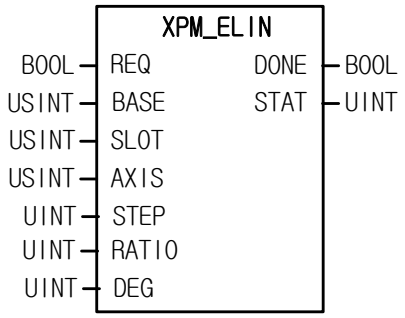
1 ~ 8 : axis1 ~ axis8

(4) If the value set on STEP is out of the setting range (0~400), “Error11” arises on STAT.

(5) If set STEP to 0, it operates the current step.

(6) Linear interpolation, circular interpolation and helical interpolation are executed in indirect start by setting the control method.

7.5.4 Ellipse Interpolation (XPM_ELIN)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: axis1 ~ axis8 STEP : Step no. to operate RATIO : Ellipse ratio(%) DEG : Operating angle **Output** DONE : Maintain 1 after first operation STAT : Output the error no in operation

(1) Give “Ellipse Interpolation” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) This is the command that execute ellipse interpolation to the designated step as much as the angle set on DEG in the ratio of it which set on RATIO.

(3) Ellipse interpolation is that distort operation data of the step already set at the rate already set on RATIO to execute ellipse interpolation. Therefore, the step of operation data set on STEP has to be set in accordance with circular interpolation control.

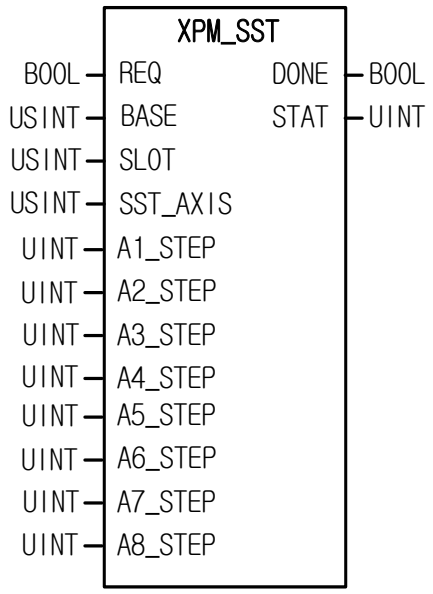
(4) Ellipse rate range from 1 to 65535, it has [$X10^{-2}$ %] as its unit. If you set 65535, the rate will be 655.35%.

(5) Operation angle range from 1 to 65535, it has [$X10^{-1}$ degree] as its unit. If you set 3650, the angle will be 365.0

(6) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

7.5.5 Simultaneous Start (XPM_SST)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module SST_AXIS : Simultaneous axis setting 0bit ~ 7bit: axis1 ~ axis8 Set bit of each axis to select A1_STEP : step no. of axis1 to start A2_STEP : step no. of axis2 to start A3_STEP : step no. of axis3 to start A4_STEP : step no. of axis4 to start A5_STEP : step no. of axis5 to start A6_STEP : step no. of axis6 to start A7_STEP : step no. of axis7 to start A8_STEP : step no. of axis8 to start **Output** DONE : Maintain 1 after first operation STAT : Output the error no in operation

(1) Give “Simultaneous Start” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

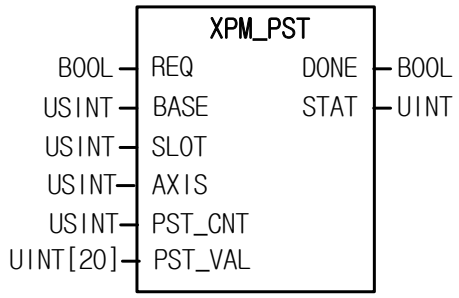
(2) This is for starting more than 2 axes at once.

(3) If you set a value out of setting range, “Error6” arises. Set with each bit as follows.

7bit	6bit	5bit	4bit	3bit	2bit	1bit	0bit
Axis8	Axis7	Axis6	Axis5	Axis4	Axis3	Axis2	Axis1

(4) Set the step no. of each axis to execute simultaneous start on A1_STEP ~ A8_STEP.

7.5.6 Point Start (XPM_PST)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: axis1 ~ axis8 PST_CMT : Set the no. of step for point operation 1 ~ 19 PST_VAL : Set the step no. for point operation 0 ~ 400 **Output** DONE : Maintain 1 after first operation STAT : Output the error no in operation

(1) Give “Point start” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

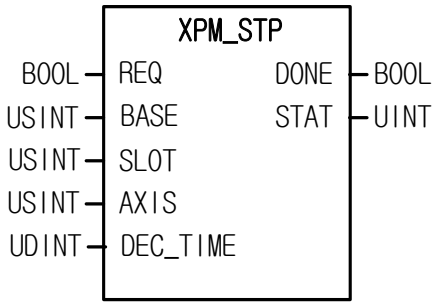
(2) Set the axis to command and it may be set as follows. If you set a value out of range, “Error6” arises.

1 ~ 8: axis1~axis8

(3) This is for when operating PTP(Point to Point), operate continuously by setting max. 20 operation steps.

(4) Point operation may be executed with max. 20 point steps. Therefore, you may use the parameter which has 20 elements and like UNIT arrangement.

7.5.7 Deceleration Stop (XPM_STP)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: axis1 ~ axis8 DEC_TIME : Decelerating stop time 0: Acc./Dec. time applied when start operating 1 ~ 2147483647: 1 ~ 2147483647ms **Output** DONE : Maintain 1 after first operation STAT : Output the error no in operation

(1) Give “Decelerating Stop” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) If receive the stop command by operation data, it will stop operating and continue to operate by start command.

(3) If “Decelerating Stop” is executed in speed/position synchronization or CAM operation, speed/position synchronization or CAM operation will stop depending on the state of the current operation control.

(4) “Decelerating Stop” may be executed in not only acc./dec. area but also steady speed area.

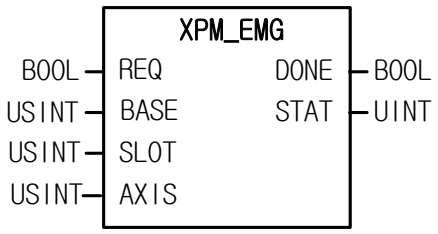
(5) Deceleration time means the time between the point of start decelerating and the point of stop and may be set to 0 ~ 2,147,483,647ms. But, if it is set to “0”, it will stop by the time set at the starting of operation.

(6) Deceleration time means the time between the speed limit of basic parameter and stop.

(7) Set an axis to command from 1 ~ 4. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

7.5.8. Emergency Stop (XPM_EMG)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “Emergency Stop” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

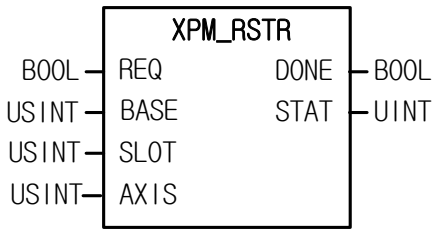
(2) This command is for immediate stop. The axis to execute this command will stop.

(3) Dec. time of emergent stop is the time set on “Dec. time of Emergent stop” of basic parameter.

(4) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8: axis1 ~ axis8

7.5.9. Restart (XPM_RSTR)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “Restart” command to the axis of positioning module designated by BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) This command is used when restarting the axis which stops by EMG stop command. If this command is executed, the axis operates again with previous operating information.

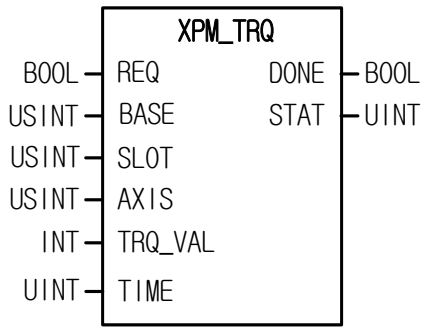
(3) If you start the axis with commands other than “Restart” after it stops with DEC. stop, “Restart” will not be executed

(4) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8: axis1 ~ axis8

(5) For detailed information on “Restart”, refer to “9.2.20. Restart”.

7.5.10. Torque Control (XPM_TRQ)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 TRQ_VAL: Torque value (unit: %, -32768 ~ 32767) TIME: Torque gradient (unit: ㎳, 0 ~ 65535 ㎳) **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “Torque Control” command to the axis of positioning module designated by BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) Torque control executes if torque value and torque gradient are set and a command is issued.

(3) Set torque value (%) to TRQ_VAL. Torque values work in % rated torque. (1 = 1% of rated torque)
For example, set 200 if the user wants to control torque in 200% of torque.

※ The allowable range of torque value may vary according to the connected servo drive. In general, target torque value is limited to the maximum torque setting.

(4) Set time to take in reaching the target torque to TIME. If a command is executed, torque increases in this gradient until it reaches the set torque value.

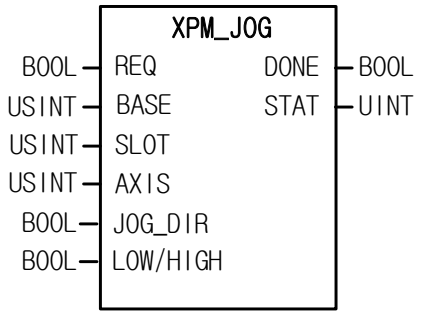
(5) Any command cannot be executed, the relevant axis is being operated for functions other than torque control.

(6) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.
1 ~ 8: axis1 ~ axis8

(7) For detailed information on “Torque Control”, refer to “9.2.21. Torque Control”.

7.6 Manual Operation Function Block

7.6.1 JOG Operation (XPM_JOG)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 JOG_DIR : Set the direction of JOG operation 0:Forward, 1:Reverse LOW/HIGH : Set the speed of JOG operation 0:Low speed, 1:High speed **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “JOG Operation” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

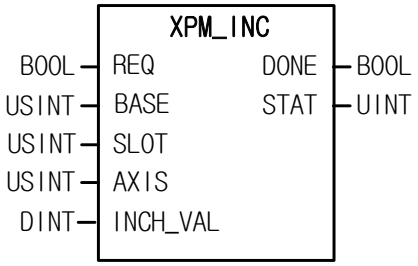
(2) This command is for checking operation of system, wiring and address for teaching. It may be used in High/Low speed.

(3) The operating condition of JOG operation function block is Level type. That is, when the condition of input parameter (REQ) is ON, pulse is outputted by setting value.

(4) If the value of LOW/HIGH is changed, the speed will be changed without stop and if the value of JOG_DIR is changed, it will change the direction after decelerating stop.

(5) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.
1 ~ 8 : axis1 ~ axis8

7.6.2 Inching Operation (XPM_INC)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 INCH_VAL: Amount of movement by Inching Operation -2,147,483,648 ~ 2,1 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

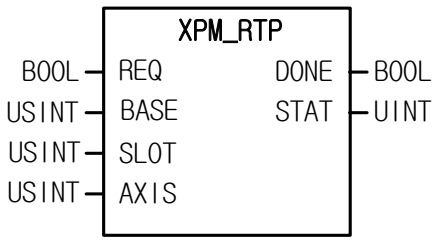
(1) Give “Inching Operation” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) This command is a kind of manual operation for process a minute movement as an operation of fixed amount.

(3) Speed of inching operation is set on manual operation parameter.

(4) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.
1 ~ 8 : axis1 ~ axis8

7.6.3 Returning to Position before Manual Operation (XPM_RTP)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

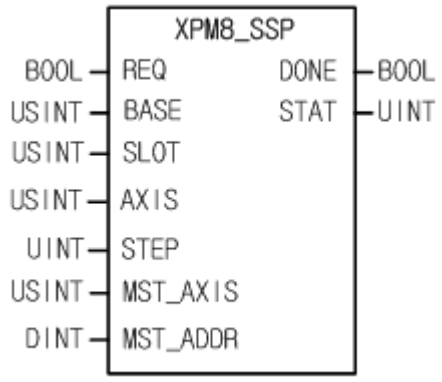
(1) Give “Returning to position before manual operation” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) When the position is changed by manual operation, this command may move the axis to previous manual operation position.

(3) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.
1 ~ 8 : axis1 ~ axis8

7.7 Synchronization Start Function Blocks

7.7.1 Position Synchronization (XPM_SSP)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 STEP : Step no. to operate 0 ~ 400 MST_AXIS : Set the main axis 1 ~ 8: axis1 ~ axis8, 9: Encoder1, 10:Encoder2 MST_ADDR : Set the position of main axis -2,147,483,648 ~ 2,147,4 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

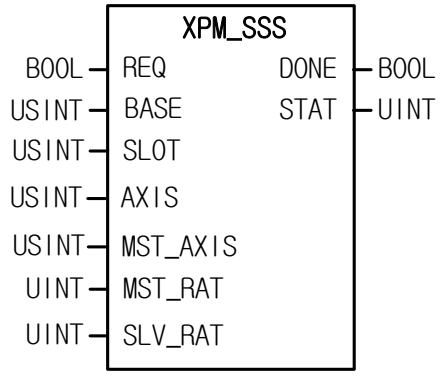
(1) Give “Synchronization Start” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) Operate operation step set by command axis after main axis comes to the position of synchronization.

(3) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.
1 ~ 8 : axis1 ~ axis8

(4) You may set the main axis on MST_AXIS with following values. If you set wrongly, “Error6” arises.
1 ~ 8 : axis1 ~ axis8, 9 : Encoder1, 10: Encoder2

7.7.2 Speed Synchronization (XPM_SSS)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 MST_AXIS : Set main axis 1 ~ 8: axis1 ~ axis8, 9: Encoder1, 10:Encoder2 MST_RAT : Set speed rate of main axis -32768 ~ 32767 SLV_RAT : Set speed rate of sub axis -32768 ~ 32767 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “Speed Synchronization” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) This command is for operating at the operation speed ratio between main axis and subordinate axis.

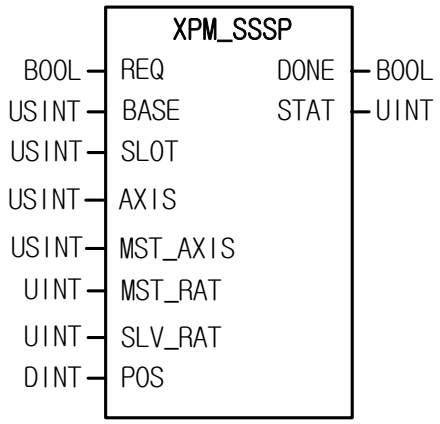
(3) There is no rule about size of the speed ratio between main/sub axis. If the speed ratio of main axis is bigger than sub’s, the main axis will move faster than sub axis. If the speed ratio of sub axis is bigger than main’s, the sub axis moves faster than main.

(4) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.
1 ~ 8 : axis1 ~ axis8

(5) You may set the main axis on MST_AXIS with following values. If you set wrongly, “Error6” arises.
1 ~ 8 : axis1 ~ axis8, 9 : Encoder1, 10: Encoder2

(6) The operating direction of subordinate depends on speed synchronization ratio $(\frac{Sub}{Main})$. If it is positive, operate in direction of main axis. If it is negative, operate in reverse direction of main axis.

7.7.3 Position Assigned Speed Synchronization (XPM_SSSP)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 MST_AXIS : Set main axis 1 ~ 8: axis1 ~ axis8, 9: Encoder1, 10: Encoder2 MST_RAT : Set speed rate of main axis -32768 ~ 32767 SLV_RAT : Set speed rate of sub axis -32768 ~ 32767 POS : Goal position -2,147,483,648 ~ 2,147,483,647 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “Position Assigned Speed Synchronization” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) This command is for operating at the operation speed ratio between main axis and subordinate axis. It stops operating when the position of sub axis come to the position set on POS.

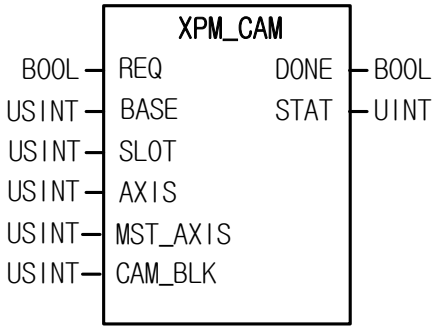
(3) There is no rule about size of the speed ratio between main/sub axis. If the speed ratio of main axis is bigger than sub’s, the main axis will move faster than sub. If the speed ratio of sub axis is bigger than main’s, the sub axis moves faster than main.

(4) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.
1 ~ 8 : axis1 ~ axis8

(5) You may set the main axis on MST_AXIS with following values. If you set wrongly, “Error6” arises.
1 ~ 8 : axis1 ~ axis8, 9 : Encoder1, 10: Encoder2

(6) The operating direction of subordinate depends on speed synchronization ratio $(\frac{Sub}{Main})$. If it is positive, operate in direction of main axis. If it is negative, operate in reverse direction of main axis.

7.7.4 CAM Operation (XPM_CAM)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 MST_AXIS : Set main axis 1 ~ 8: axis1 ~ axis8, 9: Encoder1, 10: Encoder2 CAM_BLK : Set CAM block 1 ~ 9: Block1 ~ Block9 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “CAM Operation” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) Execute CAM operation with CAM main axis and CAM data block.

(3) When executing CAM operation, sub axis is indicated that it is in operation but it does not work actually. When main axis starts, the motor starts working according to the data value of CAM data block which already set on CAM block (CAM_BLK)

(4) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

(5) Set main axis of CAM operation at MST_AXIS and available value is as follows. In case other values are set, “Error 11” occurs.

1 ~ 8 : axis1 ~ axis8, 9: Encoder1, 10: Encoder2

(6) Set CAM block number in CAM_BLK and available value is as follows. In case other values are set, “Error 11” occurs.

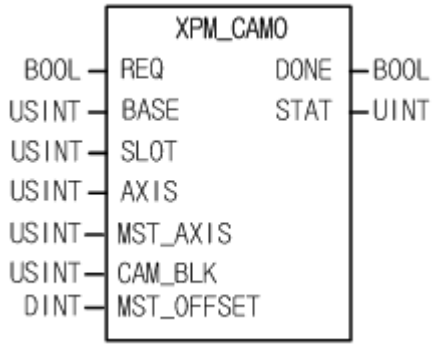
1 ~ 9 : block1 ~ block9

(7) CAM data may be set on positioning package and you may set max. 8 blocks (block1~block8).

(8) In order to use user CAM operation, you have to set CAM block number as 9.

(9) For detailed information on user CAM operation, refer to “94.4. user CAM operation”.

7.7.5 Main Axis Offset-specified CAM Operation (XPM_CAMO)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 MST_AXIS : Set main axis 1 ~ 8: axis1 ~ axis8, 9: Encoder1, 10: Encoder2 CAM_BLK : Set CAM block 1 ~ 9: Block1 ~ Block9 MST_OFFSET: main offset transfer amount setting -2147483648 ~ 2147483647 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “Main Axis Offset-specified CAM Operation” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) Execute CAM operation with CAM main axis and CAM data block.

(3) When executing CAM operation, sub axis is indicated that it is in operation but it does not work actually. If main axis starts and moves as far as transfer amount set in the MST OFFSET, the motor starts working according to the data value of CAM data block which already set on CAM block (CAM_BLK)

(4) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

(5) Set main axis of CAM operation at MST_AXIS and available value is as follows. In case other values are set, “Error 11” occurs.

1 ~ 8 : axis1 ~ axis8, 9: Encoder1, 10: Encoder2

(6) Set CAM block number in CAM_BLK and available value is as follows. In case other values are set, “Error 11” occurs.

1 ~ 9 : block1 ~ block9

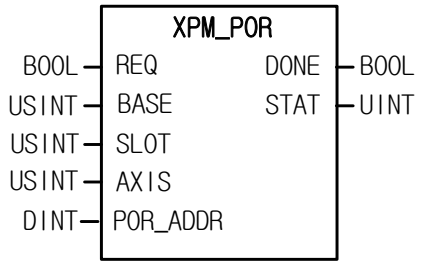
(7) CAM data may be set on positioning package and you may set max. 8 blocks (block1~block8).

(8) In order to use user CAM operation, you have to set CAM block number as 9.

(9) For detailed information on user CAM operation, refer to “94.4. user CAM operation”.

7.8 Modification Function Block

7.8.1 Position Override (XPM_POR)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 POR_ADDR : Set a new goal position -2,147,483,648 ~ 2,147,4 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “Position Override” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) This command is for changing the goal position in operation.

(3) If execute position override after pass the position to execute position override, it will stop at the current position and turn back to the position set on POR_ADDR.

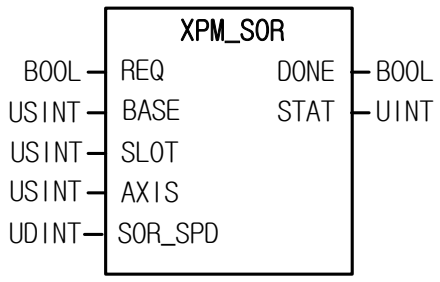
(4) Set the goal position to modify on POR_ADDR.’

(5) Override position set on position override is absolute coordinates.

(6) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

7.8.2 Speed Override (XPM_SOR)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 SOR_SPD : Set a new operaion speed value **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “Speed Override” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) This command is for changing the operating speed in operation.

(3) It may be set to “%” or “Speed value (unit/time)” according to “Speed Override” value of common parameter.

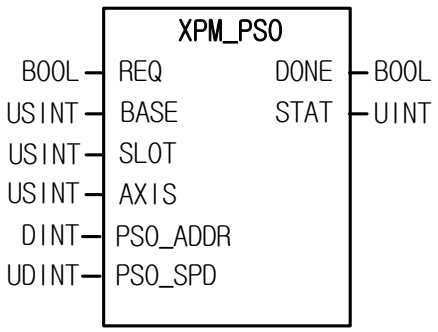
(4) If unit of Speed override is %, setting range is from 1 to 65,535. It means 0.01% ~ 655.35%.

(5) If unit of speed override is speed value, the setting range is from 1 to speed limit. The speed limit is the value set on “Speed Limit” item of basic parameter and the unit of speed override is the same as unit of axis.

(6) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

7.8.3 Position Assigned Speed Override (XPM_PSO)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 PSO_ADDR : The position to change speed -2,147,483,648 ~ 2,147,4 PSO_SPD : Set new speed value **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “Position Assigned Speed Override” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) This command is for changing operating speed in operation after command axis arrive at definite position.

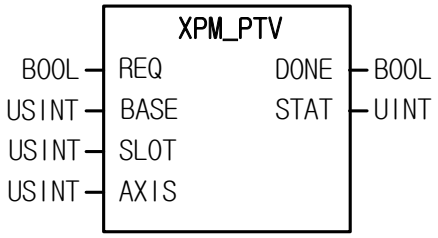
(3) The speed value set on PSO_SPD will be “% Designation” or “Speed value Designation” depending on the value set on “Speed Override” of common parameter.

(4) If unit of speed value is %, the setting range is from 1 ~ 65,535 and it means 0.01% ~ 655.35%.

(5) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

7.8.4 Position/Speed Switching Control (XPM_PTV)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “Position/Speed Switching Control” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

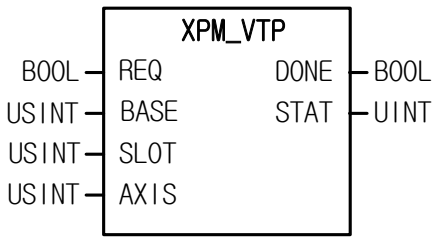
(2) When the designated axis is in positioning control operation, if it receives position/speed control switching command, positioning control operation will be changed into speed control operation and continues to operate until stop command.

(3) Once the command is executed, origin would not be assigned and then operate in speed control.

(4) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

7.8.5 Speed/Position Switching Control (XPM_VTP)

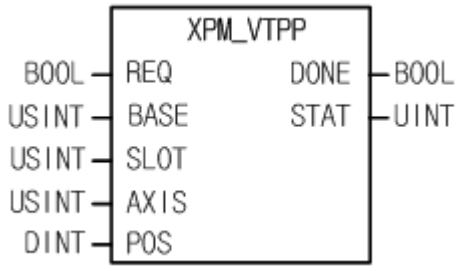
Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “Speed/Position Switching Control” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) When the designated axis receives speed/position control switching command in speed control operation, speed control will be changed to position control and keep operating by the position value at the beginning.

(3) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.
1 ~ 8 : axis1 ~ axis8

7.8.6 Position-specified Speed/Position Switching Control (XPM_VTPP)

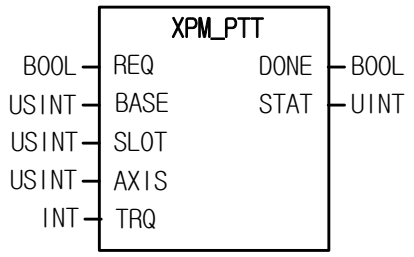
Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 POS: transfer amount -2,147,483,648 ~ 2,147,483,647 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “Position-specified Speed/Position Switching Control” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) When the designated axis receives speed/position control switching command in speed control operation, speed control will be changed to position control and moves by transfer amount set in POS.

(3) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.
1 ~ 8 : axis1 ~ axis8

7.8.7 Position/Torque Switching Control (XPM_PTT)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 TRQ: torque value **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “Position/Torque Switching Control” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

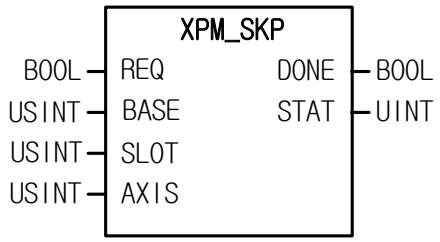
(2) When the designated axis receives position/torque switching control command in position control operation, position control will be changed to torque control and keep moving until stop command.

(3) The range of Torque value is -32768~32767 and unit is [%]. The allowable range of torque value may vary according to the connected servo drive. In general, target torque value is limited to the maximum torque setting.

(4) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

7.8.8 Skip Operation (XPM_SKP)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

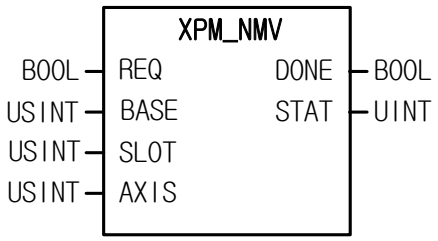
(1) Give “Skip Operation” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) This command is for operating the next step. That is, stop operating of the current step and then start operating the next step.

(3) Skip a step at once.

(4) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.
1 ~ 8 : axis1 ~ axis8

7.8.9 Continuous Operation (XPM_NMV)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “Continuous Operation” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) This command is for command axis to continue to operate the next step without stop.

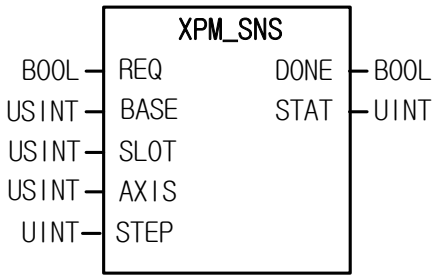
(3) If this command is executed, the current step no. would be changed to the next step no. and continue to execute positioning operation at the next step speed to the goal position.

(4) Continuous Operation command only changes the current operation pattern, not changes operation data.

(5) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

7.8.10 Start Step Number Change (XPM_SNS)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 STEP : Set the operation step no. to operate 1 ~ 400 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

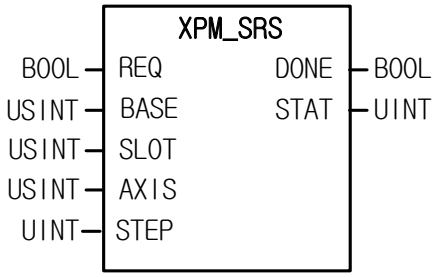
(1) Give “Start Step no. Change” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) This command is for changing the operation step of command axis.

(3) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.
1 ~ 8 : axis1 ~ axis8

(4) Set the step no. on STEP. The setting range is 1 ~ 400, if you set the setting value wrongly, “Error11” arises.

7.8.11 Repeat Step No. Change (XPM_SRS)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 STEP : Set the repeat step no. to change 1 ~ 400 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “Repeat Step no. Change” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

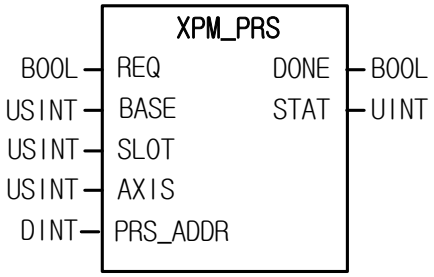
(2) This command is for designating the starting step no. of repeat operation and operating from the designated operation step.

(3) Set an axis to command from 1 ~84. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

(4) Set the step no. to operate repeatedly on STEP. The setting range is 1 ~ 400, if you set the setting value wrongly, “Error11” arises.

7.8.12 Current Position Change (XPM_PRS)

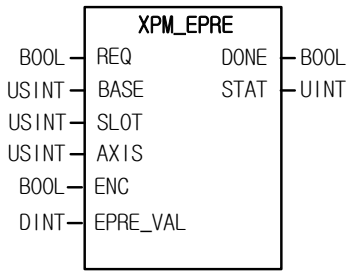
Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 PRS_ADDR : Set the current position value to change. -2,147,483,648 ~ 2,1 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “Basic Parameter Setting” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) This command is for changing the current position to random position. If it is executed in the state of non-origin, the origin signal would be On and the current position would be set as setting value (PRS_ADDR).

(3) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.
1 ~ 8 : axis1 ~ axis8

7.8.13 Encoder Value Preset (XPM_EPRE)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 ENC : Encoder no. 0: Encoder1, 1: Encoder2 EPRE_VAL : Set the value of encoder preset -2147483648 ~ 2147483647 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “Encoder Preset” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) This command is for changing the current value of encoder to the value set on EPRE_VAL

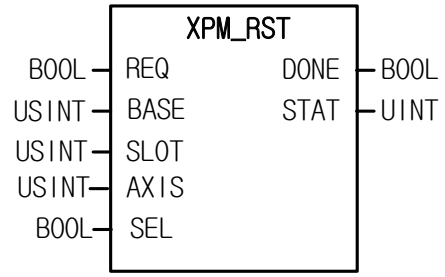
(3) Set the encoder to preset on ENC. When that is 1, it changes current position of encoder2

(4) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

7.9 Error Function blocks

7.9.1 Error Reset (XPM_RST)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 SEL : Select axis error/common error 0:axis error 1: common error **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

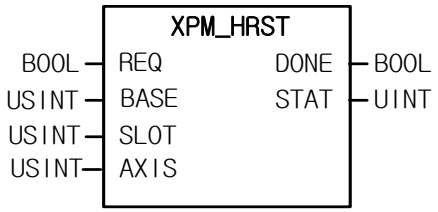
(1) Give “Error Reset” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.
1 ~ 8 : axis1 ~ axis8

(3) This is for resetting the errors.

(4) Select the kind of error to reset on SEL. If SEL is set to 0, it will reset the errors of the designated axis. And if that is set to 1, it will reset the errors affecting entire module, not axis error.

7.9.2 Error History Reset (XPM_HRST)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “Error History Reset” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

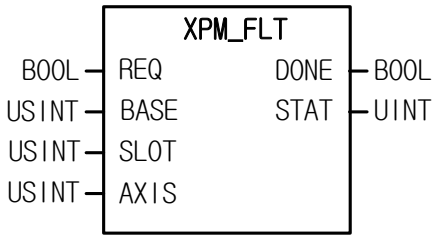
(2) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

(3) If errors arise, Max.10 errors are saved on module. This command is for resetting error history.

7.10 Other Function Blocks related with the Module

7.10.1 Floating Origin Setting (XPM_FLT)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

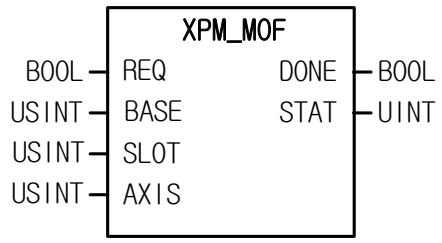
(1) Give “Floating Origin” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) This command is for setting the current position as the origin by compulsion. The address value saved on homing address will be the current position.

(3) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

7.10.2 M code Release (XPM_MOF)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

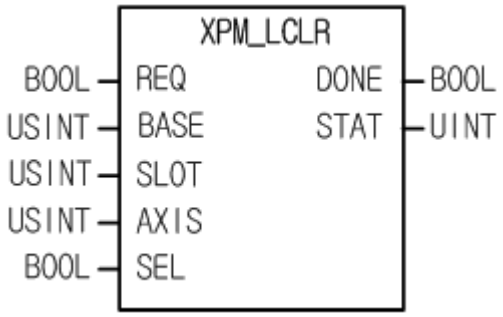
(1) Give “M code Release” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) In the case that M code of parameter of each axis is set as “With” of “After”, you may turn the M code off with this command. That is, M code signal will be OFF, M code no. will be 0.

(3) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

7.10.3 Latch Reset (XPM_LCLR)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 SEL: Latch reset item selection **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) This command is used to initialize the data count and latch position data saved and latched on the positioning module or the state when latch is completed.

(2) Give “Latch Reset” command to the positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(3) The following items are reset according to the Reset Latch items designated to SEL.

0: Reset the state when latch is completed

1: Reset latch position data and the state when latch is completed

(Values high than “1” are processed equally with “1”)

(4) If latch position data are read through the “Read Latch Position Data (XPM_LRD)” command after 1 is set to SEL and the “Reset Latch” command is executed, all of data become 0.

(5) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

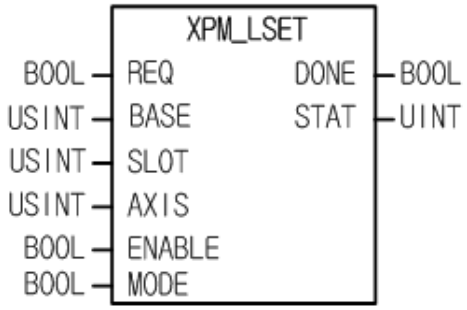
Note

Two latch modes are supported for XGF-PN8B module. In case that a single trigger from two latch modes is set, ensure latch function to perform through the second touch probe 1 signal after the first touch probe 1 signal is inputted and latched.

That is, in XGF-PN8B module’s latch single trigger mode, the Reset Latch command will execute a function to activate the next latch trigger after the touch probe 1 signal is inputted and the latch location is saved.

(Even if the Set Latch command is re-executed after it is set as latch permission, it will work in the same way)

7.10.4 Latch set (XPM_LSET)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 ENABLE: Latch enable/disable MODE: Latch mode **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) This command is used to initialize the data count and latch position data saved and latched on the positioning module or the state when latch is completed.

(2) Give “Latch Set” command to the positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(3) Actions according to the Enable/Disable Latch item designated to ENABLE are as following.

0: latch prohibition 1: latch permission

(Values high than “1” are processed equally with “1”)

(4) Actions according to the latch mode item designated to MODE are as following.

0: Single trigger (The current position latch is available only the touch probe 1 signal inputted at first after latch is enabled)

1: Continuous trigger (The current position latch is available at every touch probe 1 signal after latch is enabled)

(Values high than “1” are processed equally with “1”)

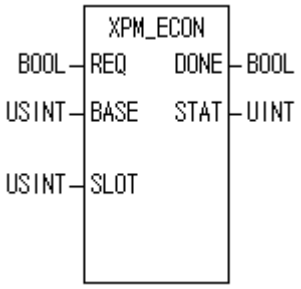
(5) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

(6) “Latch Set” command is applied to only XGF-PN8B.

7.11 Other Function Blocks related with the Servo Driver

7.11.1 Servo Communication Connect (XPM_ECON)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

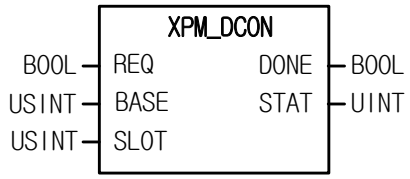
(1) Give “Servo Communication Connect” command to the positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) If servo driver is connected normally, the bit corresponding to the connected axis among automatic registration variables will be set.

	Automatic registration variable	Contents
1-axis	_xxyy_A1_RDY	1-axis ready
2-axis	_xxyy_A2_RDY	2-axis ready
3-axis	_xxyy_A3_RDY	3-axis ready
4-axis	_xxyy_A4_RDY	4-axis ready
5-axis	_xxyy_A5_RDY	5-axis ready
6-axis	_xxyy_A6_RDY	6-axis ready
7-axis	_xxyy_A7_RDY	7-axis ready
8-axis	_xxyy_A8_RDY	8-axis ready

(* “xx” means base number of the module and “yy” means slot number.)

7.11.2 Servo Communication Disconnect (XPM_DCON)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

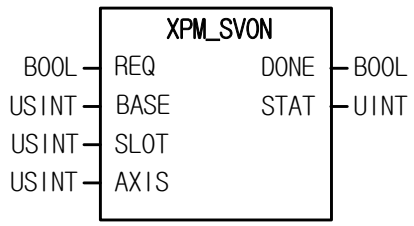
(1) Give “Servo Communication Disconnect” command to the positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) If servo driver is disconnected normally, the bit corresponding to the connected axis among automatic registration variables will be cleared.

	Automatic registration variable	Contents
1-axis	_xxyy_A1_RDY	1-axis ready
2-axis	_xxyy_A2_RDY	2-axis ready
3-axis	_xxyy_A3_RDY	3-axis ready
4-axis	_xxyy_A4_RDY	4-axis ready
5-axis	_xxyy_A5_RDY	5-axis ready
6-axis	_xxyy_A6_RDY	6-axis ready
7-axis	_xxyy_A7_RDY	7-axis ready
8-axis	_xxyy_A8_RDY	8-axis ready

(* “xx” means base number of the module and “yy” means slot number.)

7.11.3 Servo On (XPM_SVON)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “Servo Ont” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

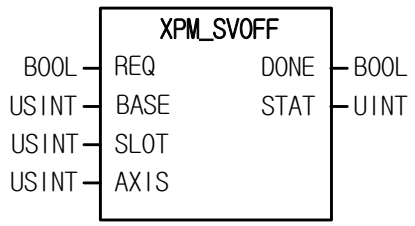
(2) Give “Servo On” Command to the servo corresponding to the selected axis among the servos connected to the module.

(3) In order to operate a motor, Servo On signal have to be on.

(4) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

7.11.4 Servo Off (XPM_SVOFF)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

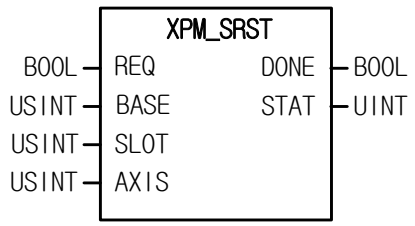
(1) Give “Servo On” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) Give “Servo Off” Command to the servo corresponding to the selected axis among the servos connected to the module.

(3) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

7.11.5 Servo Error Reset (XPM_SRST)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “Servo Error Reset” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) Give the command that clears servo driver alarm occurred at the specific axis among servo drivers connected to the positioning module.

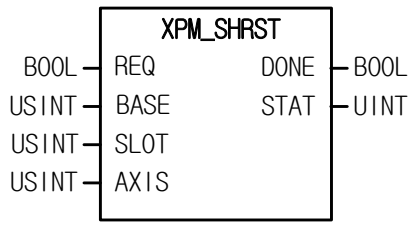
(3) If you reset the servo driver alarm without removing reason, it may not be cleared. So before resetting the servo driver alarm, remove the reason why alarm occurs.

(4) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

(5) In case of XGF-PN8B, there may be servo error which can’t be reset according to error type among EtherCAT servo drivers. So refer to servo driver manual.

7.11.6 Servo Error History Reset (XPM_SHRST)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) Give “Servo Error Reset” command to the axis designated as the axis of positioning module with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(2) Give the command that clears servo driver alarm history occurred at the specific axis among servo drivers connected to the positioning module.

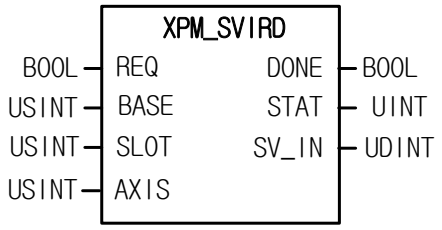
(3) Servo drive can save up to 10 servo alarm history.

(4) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

(5) In case of XGF-PN8B, servo error history reset is not supported.

7.11.7 Servo External Input Information Read (XPM_SVIRD)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation SV_IN: Servo input signal information

(1) Give “Servo External Input Information Read” command to the axis of positioning module designated with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

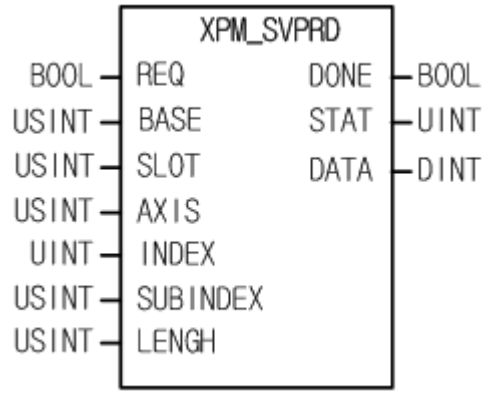
(2) This is command reading input signal state of the servo driver corresponding to the selected axis among servos connected to the module

(3) Input signal state is outputted at SV_IN.

(4) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

7.11.8 Servo Parameter Read (XPM_SVPRD)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 INDEX: SUBINDEX: LENGTH: **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation DATA: Read servo parameter data

(1) Only for XGF-PN8B, this is the command that reads parameters (CoE object) of the servo driver connected to positioning module.

(2) Give “Servo Parameter Read” command to the axis of positioning module designated with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(3) Save in DATA to read value of LENGTH size at the servo parameter object designated with INDEX, SUBINDEX, at the axis designated with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(4) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

(5) INDEX can be set as follows. If you set wrongly, “Error11” arises at STATE.

Set value	Description
0x1000 ~ 0x1FFF	Communication Profile Area
0x2000 ~ 0x5FFF	Manufacturer Specific Profile Area
0x6000 ~ 0x9FFF	Standardized Device Profile Area

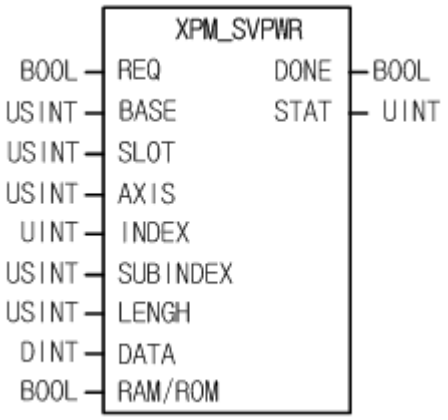
(6) SUBINDEX can be set as follows. If you set wrongly, “Error11” arises at STATE.

Set value	Description
0x0 ~ 0xFF	Object Subindex of servo parameter

(7) LENGTH can be set as follows. If you set wrongly, “Error11” arises at STATE.

Set value	Description
1 ~ 4	Object Byte Length of servo parameter

7.11.9 Servo Parameter Write (XPM_SVPWR)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 INDEX : Servo parameter object Index SUBINDEX : Servo paramter object subindex LENGTH : Servo parameter object size DATA: Servo parameter value RAM/ROM : how to save parameter 0: save at RAM, 1: save at ROM **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) This is the function block only for XGF-PN8B and that changes parameters (CoE object) of the servo driver connected to positioning module

(2) Give “Servo Parameter Write” command to the axis of positioning module designated with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(3) If you want to save at the internal ROM of the servo driver with “Servo parameter write” command, set up 1 at RAM/ROM and execute the command, or set up 0 at RAM/ROM and execute the command and later save them at servo driver EEPROM with XPM_SVSAVE command.

(4) Save DATA of LENGTH size at the servo parameter object designated with INDEX, SUBINDEX, at the axis designated with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(5) Set an axis to command from 1 ~ 8. If you set wrongly, “Error6” arises.

1 ~ 8 : axis1 ~ axis8

(6) You can set INDEX as follows. If you set wrongly, “Error11” arises

Setting value	Description
0x2000 ~ 0x5FFF	Manufacturer Specific Profile Area
0x6000 ~ 0x9FFF	Standardized Device Profile Area

(7) You can set SUBINDEX as follows. If you set wrongly, “Error11” arises

Setting value	Description
0x0~0xFF	Servo parameter Object Subindex

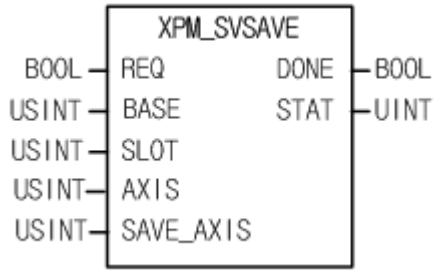
(8) You can set SUBINDEX as follows. If you set wrongly, “Error11” arises

Setting value	Description
1~4	Servo parameter Object Byte Length

(9) You can set SUBINDEX as follows.

Setting value	Teaching method
0	RAM teaching
1	ROM teaching

7.11.10 Servo Parameter Save (XPM_SVSAVE)

Form of Function Block	Description
	**Input** REQ : Request for execution of function block BASE : Set the base no. with module SLOT : Set the slot no. with module AXIS : Axis to command 1 ~ 8: aixs1 ~ axis8 SAVE_AXIS: Set the axis to save by setting each bit (bit 0~7: 1-axis~8-axis) **Output** DONE : Maintain 1 after first operating STAT : Output the error no. in operation

(1) This is the function block only for XGF-PN8B and that saves parameters of the servo driver connected to positioning module at the EEPROM of the servo driver.

(2) Give “Servo Parameter Save” command to the axis of positioning module designated with BASE (Base no. of Positioning module) and SLOT (Slot no. of Positioning module).

(3) Set up the axis to give a command at AXIS and you can set as follows. If you set wrongly, “Error6” arises. Command axis is different with the axis for saving servo parameter. If you want to save servo parameter of the command axis, set the corresponding bit at SAVE_AXIS.

1 ~ 8: 1-axis ~ 8-axis

(4) Set up the servo driver axis at SAVE_AXIS. If you set wrongly, “Erro11” arises

Bit 0 ~ 7 : 1-axis ~ 8-axis

Chapter 8 Program

Here describes the basic program that operate positioning module case by using its commands.

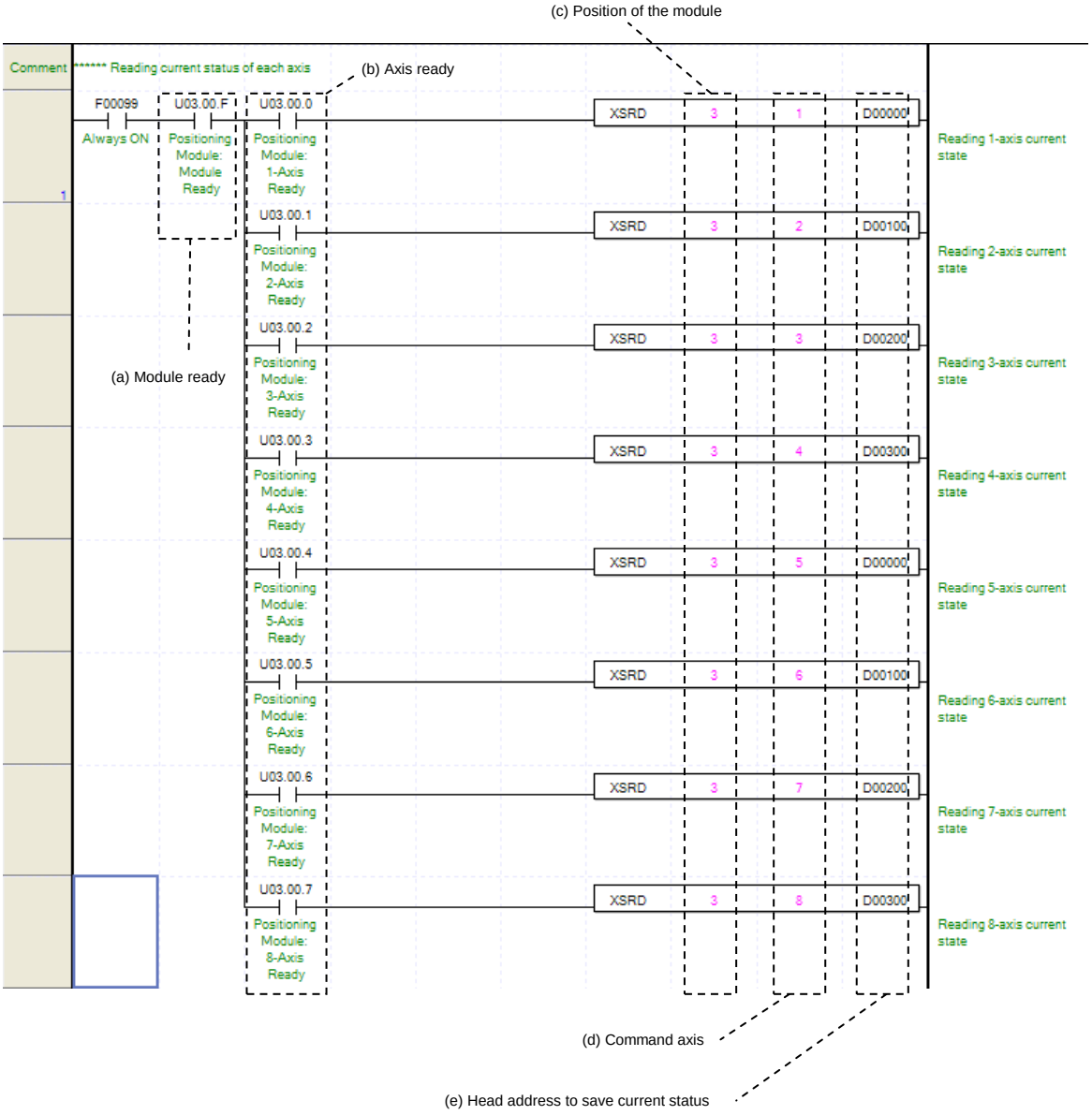
8.1 Example of XGK Programming

8.1.1 General description

Here we supposed the positioning module installed at the slot no.3 of the 0 base. In the real usage, you need to change its value according to your actual set up.

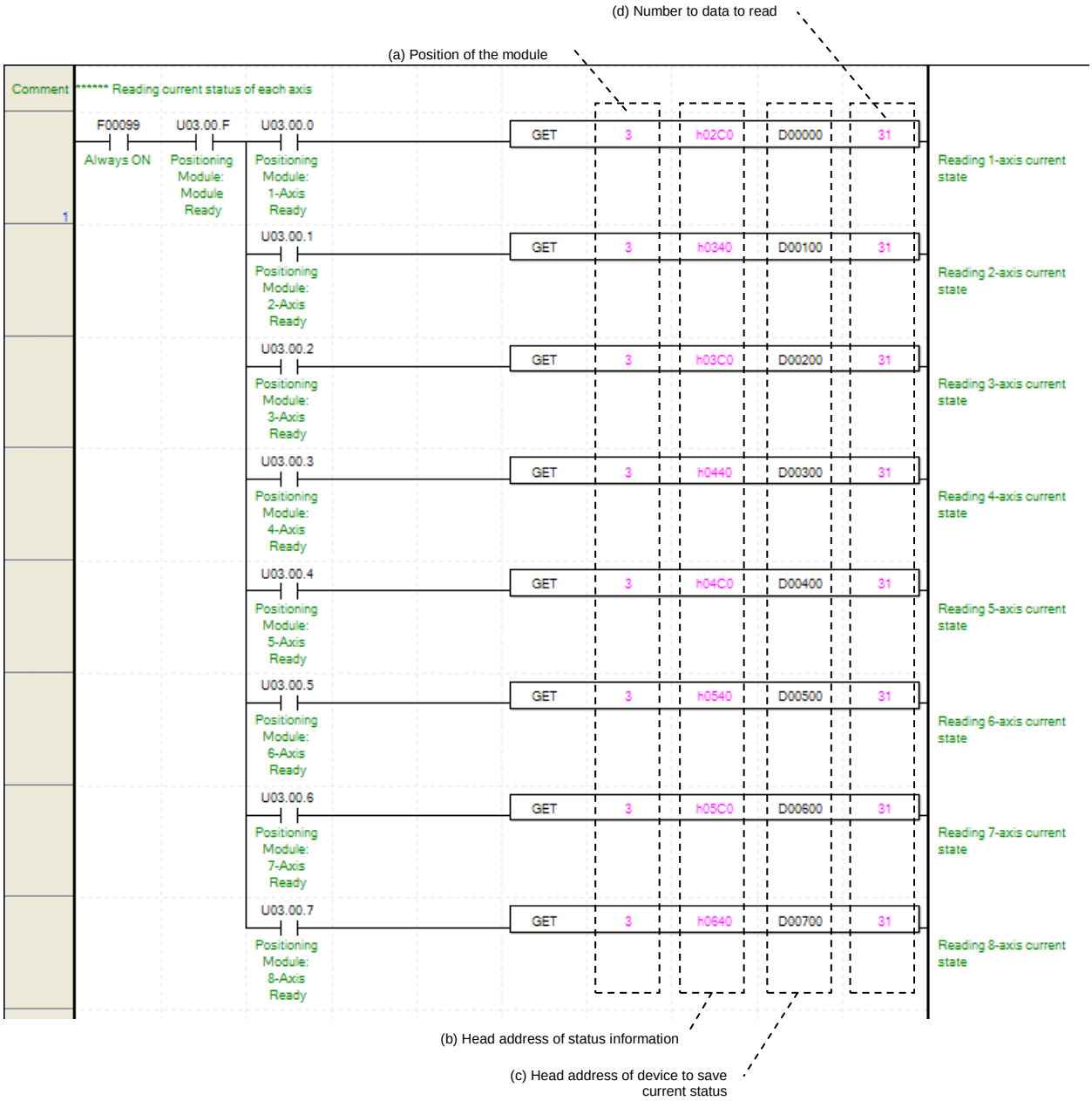
8.1.2 Current State Read

(1) Using XSRD command



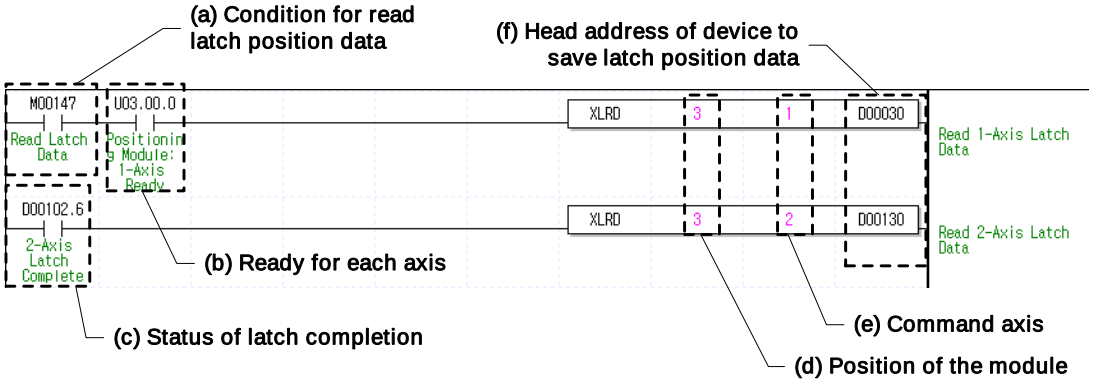
(a) Module's ready
After Turn On, if there is no error occurred in Positioning Module, it is "ON," meaning that modules are ready to operate.
(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on. In the example program, since F00099 (Always ON), positioning module ready (Uxx.00.F) and axis ready (Uxx.00.0 ~ Uxx.00.7) are used, if there is no error in the module, it reads the current status every scan.
(c) Address of Positioning Module
Before operation, you need to configure its position by numbers. In this example, Positioning Module installed at the slot no.3.
(d) Axis of operation
Positioning module operate as 4 axes. In this example, number 1 through 4 means axis 1 through axis 4.
(e) Address of first device where those conditions of current axis are saved
This D00000 tells the address of first device which already register from the configuration of sequence program. For example, in this program above, the condition of axis 1 will be saved from D00000 to D00030. How to setup a device function would be explained at the "Chapter 6.3.42 Reading Driving Condition."
(f) Also you can use the bit information from saved data in the device for as a condition of another operation. For example, in this program above, according to use axis 1 driving signal, you need to setup a data as D00000.0, and to check error condition of axis 2, you need to configure as D0000.1.

(2) Using command Get



(a) The address of Positioning Module.
(b) The first memory address of operating Axis.
You can setup the memory address of condition information case by axis. For example, in this program above, “h0200” refers that condition information of 3axis. How to setup a memory address by axis would be explained at “Chapter 5.1.5 Condition Information.”
(c) The first address of device which can save the condition of axis
(d) Number of reading data by WORD
Using command GET to read condition information, can save number of data by WORD, hence you only chosen data will be saved.
(e) Also you can use the bit information from saved data in the device for as a condition of another operation. For example, in this program above, according to use axis 1 driving signal, you need to setup a data as D00000.0, and to check error condition of axis 2, you need to configure as D0000.1.

(3) Latch Position Data Read



(a) Conditions for Latch Position Data Read

Conditions to implement the Latch Position Data Read command (XLRD). Fox Axis 1, the Latch Position Data Read command is always implement if M00147 is On after the axis is connected with the network.

(b) Axis ready

If communication between the positioning module and the servo driver is normal, corresponding signal will be on. In the example program, latch position data are read if M00147 (Conditions to read latch data) is On after the axis is connected with the module since Axis 1 ready state (Uxx.00.0) is used.

(c) Latch Completion state

It is the state of “Latch Completion” when an example program of“8.1.2 Read the Current Sate is used. ”It is on when latch is completed once external latch command signal of the relevant axis is inputted. In case of Axis 2, the Latch Position Data Read command of Axis 2 is implemented as soon as D00102.6 (Latch Completion state) is On.

(d) Position of the module

In order to give a command, you have to specify the position of the positioning module to give a command. In the example, the positioning module is mounted on the slot 3..

(e) Command axis

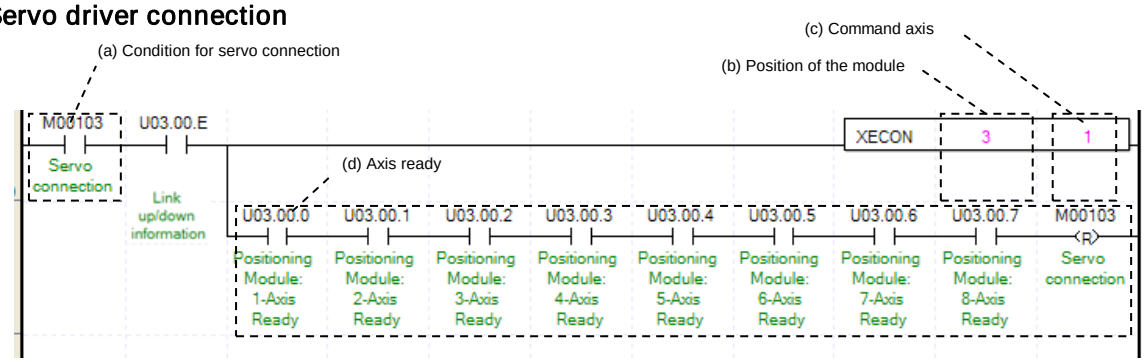
When giving a command to each axis, you have to specify an axis to give a command. XGF-PN8A/B supports up to 8 axes, 1~8 in command means 1-axis ~ 8-axis.

(f) Leading address of the device to save Axis’s latch position data

It is the leading address of the device to save the axis’s latch data value read from the positioning module by using XLRD. This device can be used on sequence programs. For example, Axis 1’s data count of latch position is saved on D00030 and latch position data 1 ~ 10 are saved on D10032 through D00050 the example program above. For further information on the saved device, refer to 6.3.56 Latch Position Data Read command (Command: XLRD).”

8.1.3 Operation Ready

(1) Servo driver connection



(a) Condition for servo connection
Condition to execute Servo connection command (XECON)

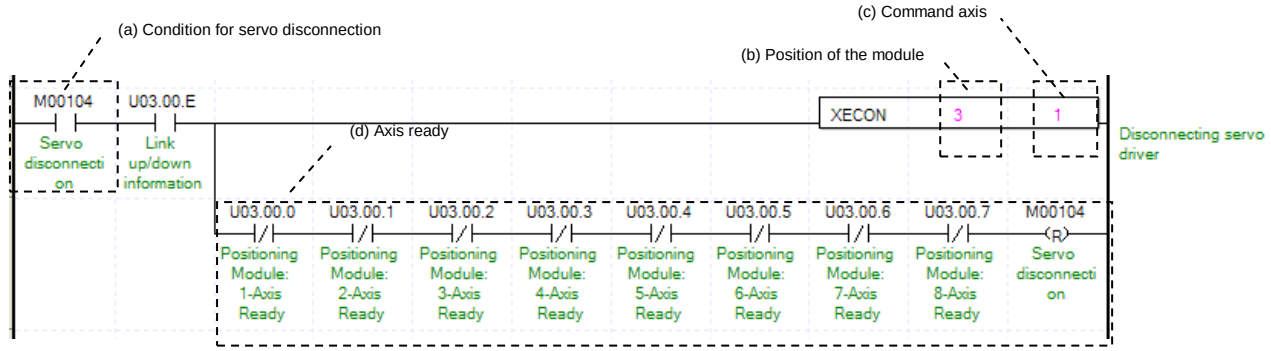
(b) Position of the module
In order to give a command, you have to specify the position of the positioning module to give a command. In the example, the positioning module is mounted on the slot 3.

(c) Command axis
When giving a command to each axis, you have to specify an axis to give a command. XGF-PN8A/B supports up to 8 axes, 1~8 in command means 1-axis ~ 8-axis.

(d) Axis ready
If connection with servo driver is complete, the signal corresponding to each axis will be on. In the example, we assume that 8 axes are connected to the module. Set the only connected axis according to the system. If connection is complete and all signals corresponding to each axis is on, it resets servo connection condition.

(e) If you use Link up/down information as input condition of servo connection command, you can execute servo connection command only when the network cable is actually connected.

(2) Servo driver disconnection



(a) Condition for servo disconnection
Condition to execute Servo disconnection command (XDCON)

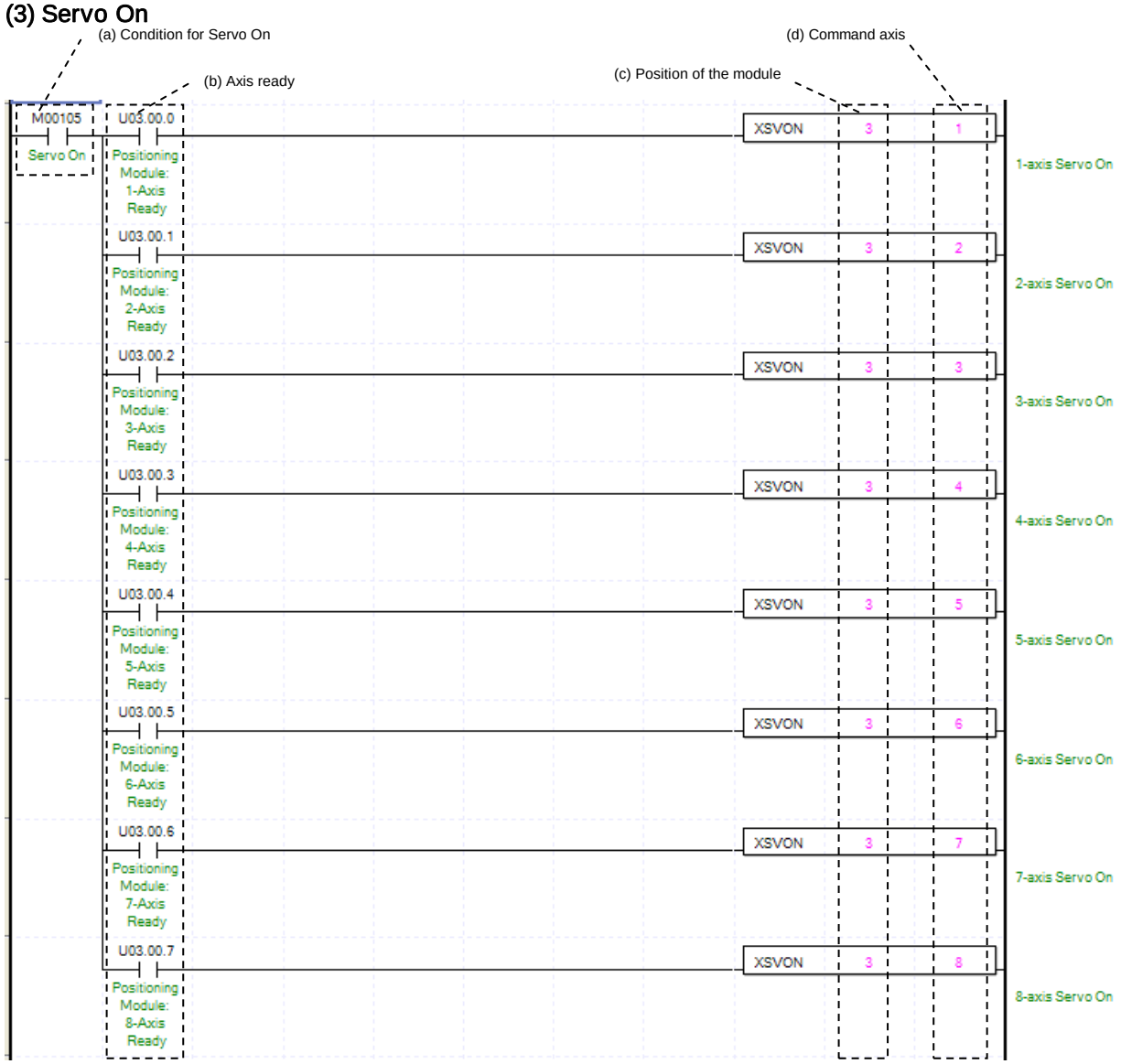
(b) Position of the module

(c) Command axis
When giving a command to each axis, you have to specify an axis to give a command. XGF-PN8A/B supports up to 8 axes, 1~8 in command means 1-axis ~ 8-axis.

(d) Axis ready
If disconnection with servo driver is complete, the signal corresponding to each axis will be off. In the example, we assume that 8 axes are connected to the module. Set the only connected axis according to the system. If connection is complete and all signals corresponding to each axis is off, it resets servo disconnection condition.

(e) If you use Link up/down information as input condition of servo disconnection command, you can execute servo disconnection command only when the network cable is actually connected.

(3) Servo On



(a) Condition for Servo On command
Condition for Servo On command (XSVON)

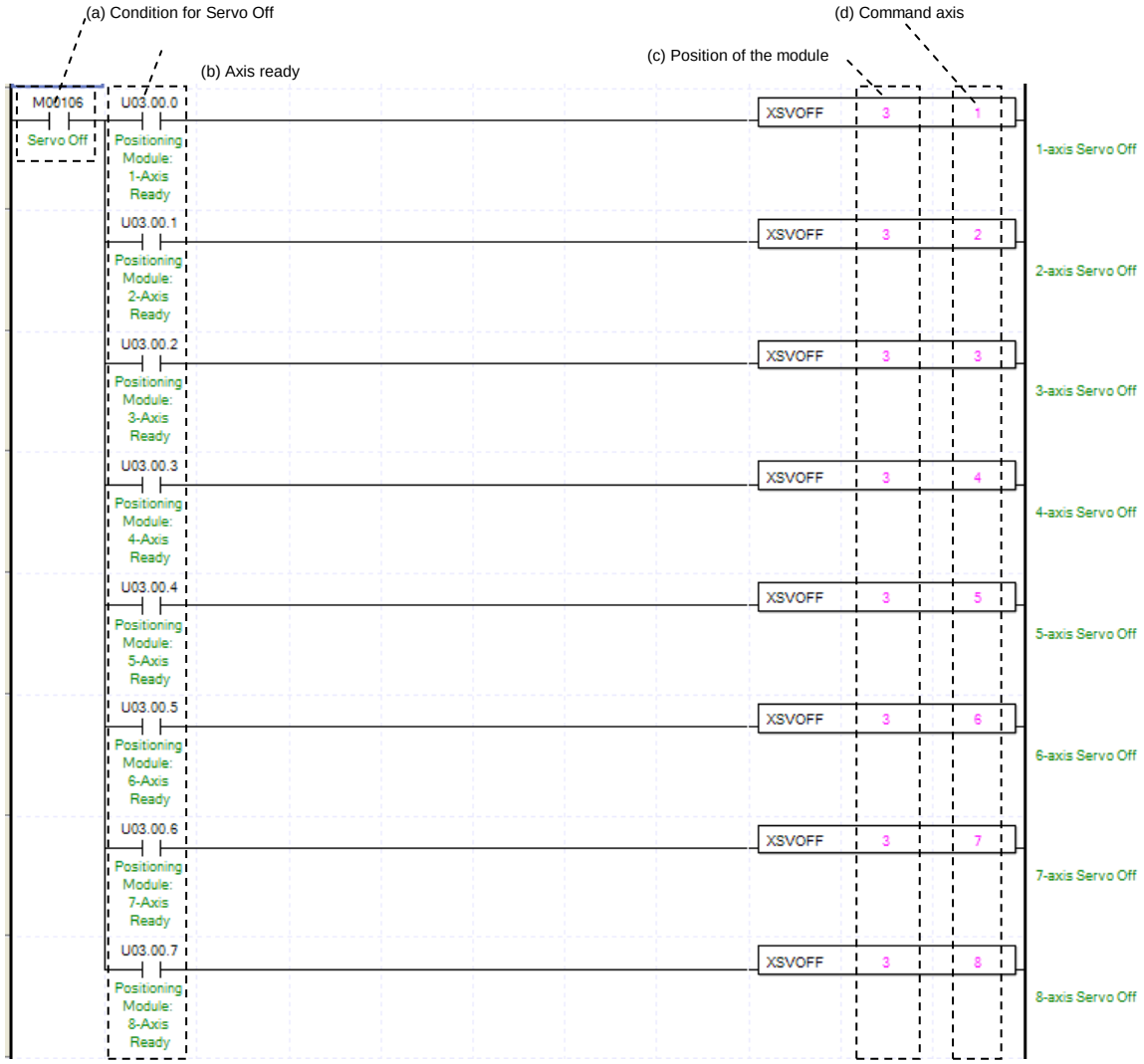
(b) Axis ready
If communication between the positioning module and the servo driver is normal, the signal corresponding to the connected axis will be on. In the example, if condition for Servo On command is on, it will give a Servo On command to the connected axis. You can remove the command of the axis not connected according to the system.

(c) Position of the positioning module
In the example, we assume that the module is equipped on Base 0, Slot 3.

(d) Command axis
When giving a command to each axis, you have to specify an axis to give a command. XGF-PN8A/B supports up to 8 axes, 1~8 in command means 1-axis ~ 8-axis.

(e) If Servo On command is executed, the servo driver of each axis will be “Servo On” status.

(4) Servo Off



(a) Condition for Servo Off command
Condition for Servo Off command (XSVOFF)

(b) Axis ready
If communication between the positioning module and the servo driver is normal, the signal corresponding to the connected axis will be on. In the example, if condition for Servo Off command is on, it will give a Servo Off command to the connected axis. You can remove the command of the axis not connected according to the system.

(c) Position of the positioning module
In the example, we assume that the module is equipped on Base 0, Slot 3.

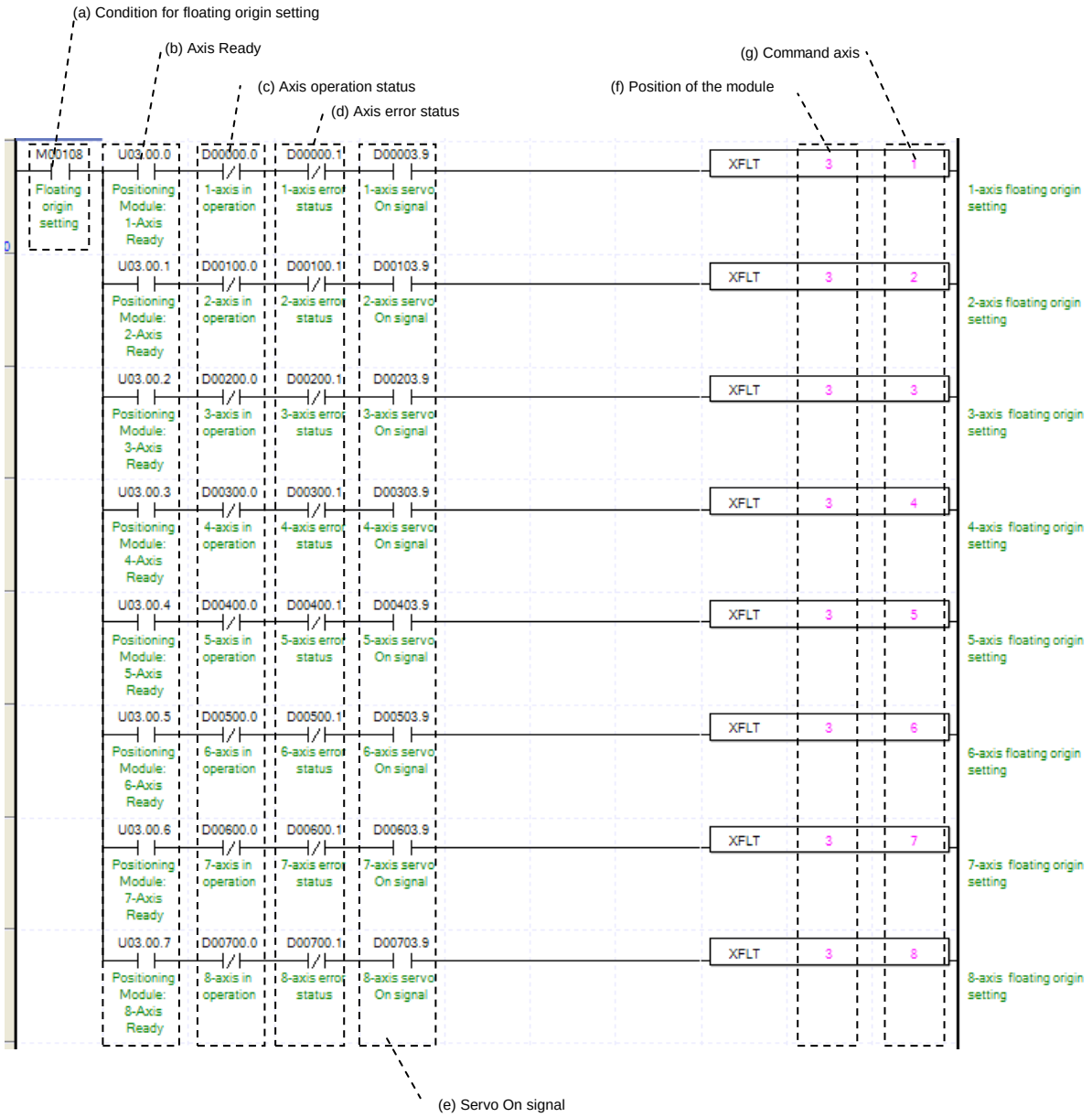
(d) Command axis
When giving a command to each axis, you have to specify an axis to give a command. XGF-PN8A/B supports up to 8 axes, 1~8 in command means 1-axis ~ 8-axis.

(e) If Servo Off command is executed, the servo driver of each axis will be “Servo Off” status.

8.1.4 Operation Test

(1) Floating Origin Setting

Decide origin of current motor's position without set a machinery origin.



(a) Condition of running a Floating Origin Setting
It only works with XFLT command.

(b) Axis Ready
If communication between the positioning module and the servo driver is normal, the signal corresponding to each axis will be on.

(c) Operating state by axis
According to exercise from "Chapter 8.1.2 Current State Reading," it is a signal of "Operating" for each axis.

(d) Error state for each axis
According to exercise from "Chapter 8.1.2 Current State Reading," it is a signal of "Error state" for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo On signal

When applying the example program of “8.1.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since floating origin setting command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state. If you execute floating origin setting command when axis is not Servo On state, the error 212 occurs.

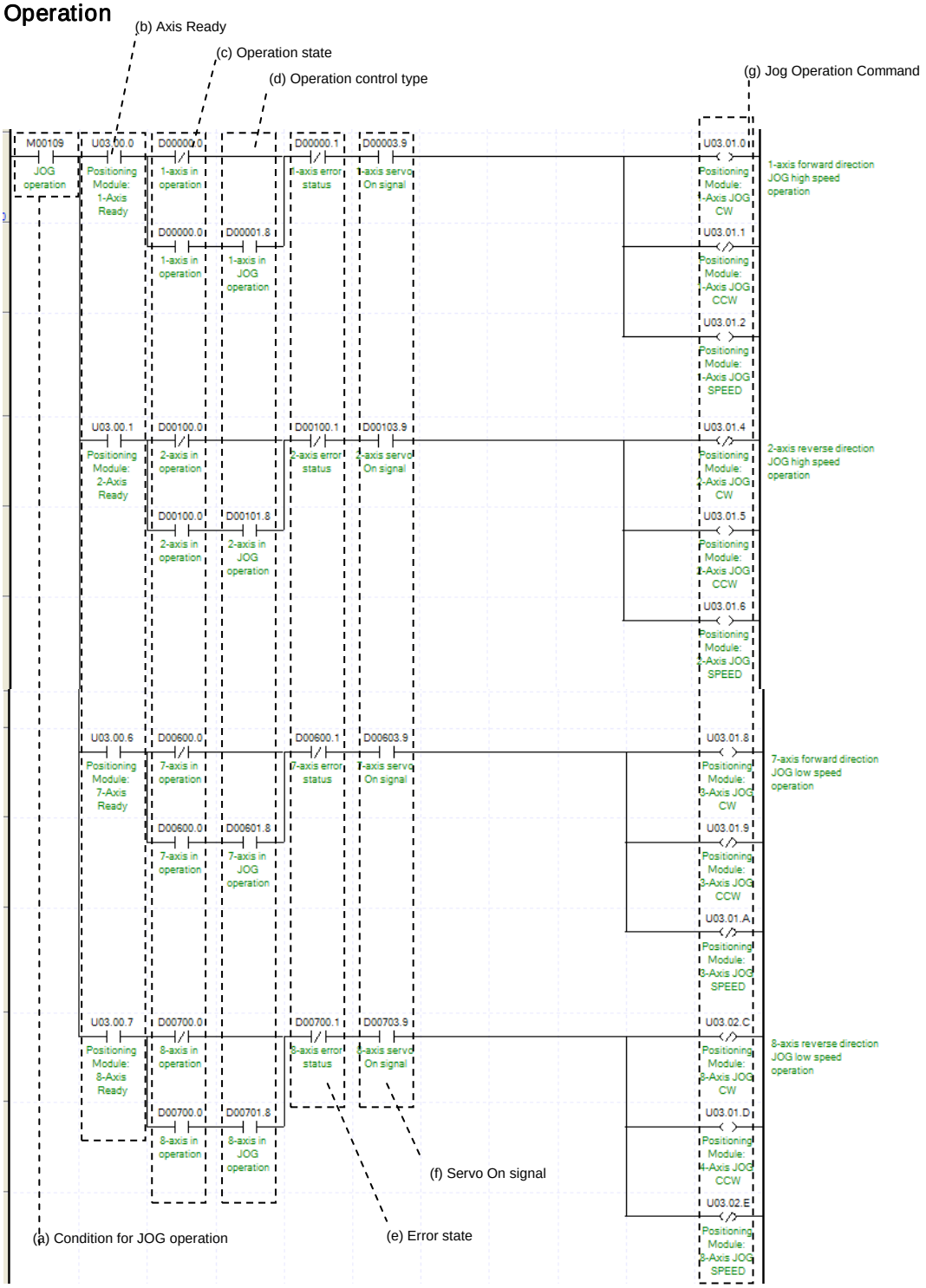
(f) Address of Positioning Module

In this example, Positioning Module installed at the slot no.3 of 0 bases.

(g) Axis of command execution

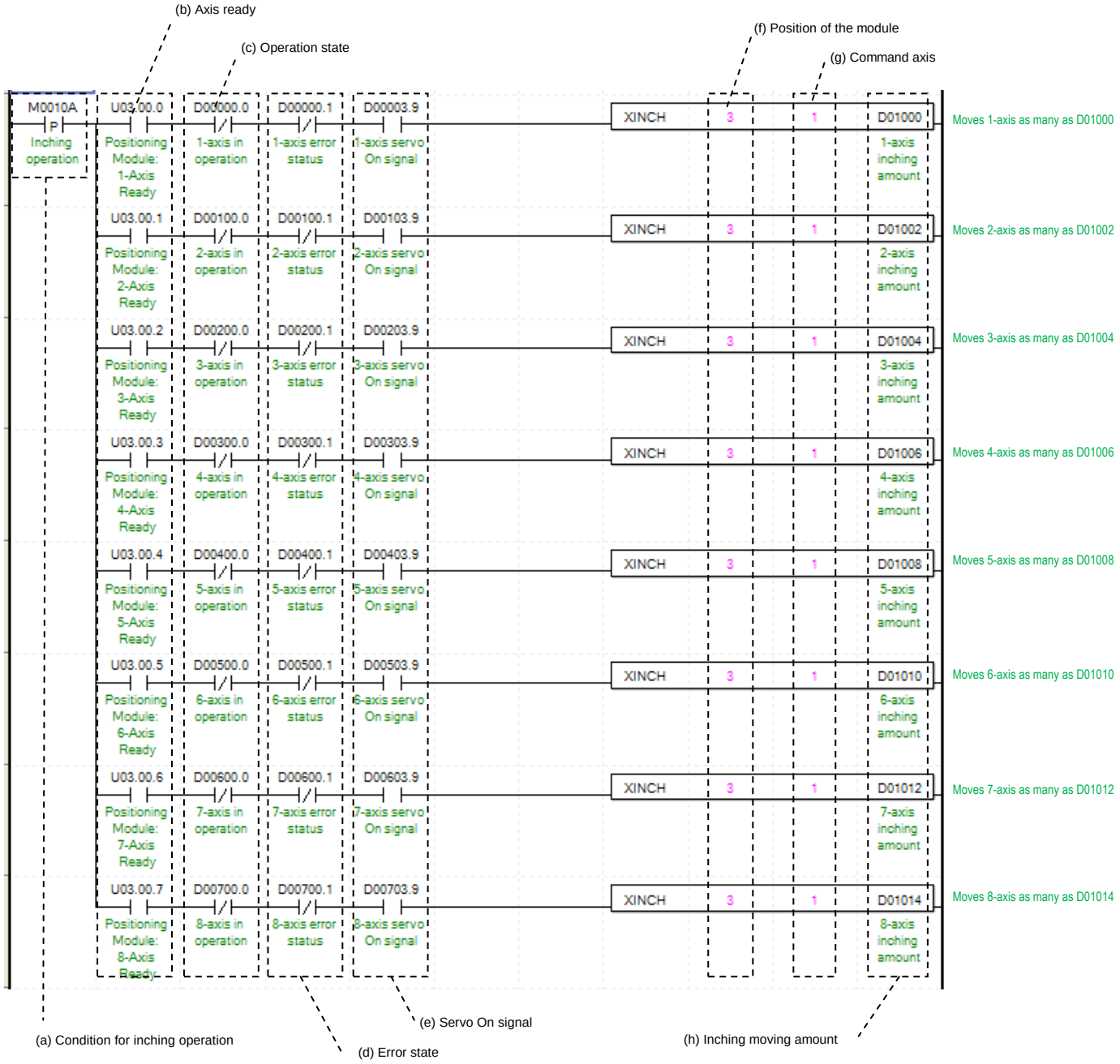
You can set an axis for Floating Origin Setting. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Floating Origin Setting, you can set a value for axis 1 through 8 axes

(2) Jog Operation



(a) Condition of Jog Operation
Condition of Jog Operation Command
(b) Axis Ready
If communication between the positioning module and the servo driver is normal, the signal corresponding to each axis will be on.
(c) Operating state by axis
Jog Operation can only be working when the state of axis set as Jog Operation. In this example above, specific axis set as Jog Operation otherwise it is not operating.
(d) State of driving control by axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Jog Operating” for each axis. It turns on when it is operating. Jog Operation configuration can be changed while it is operating.
(e) Error state for each axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.
(f) Servo On signal
When applying the example program of “8.1.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since “Jog operation” command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state. If you execute “Jog operation” command when axis is not Servo On state, the error 413 occurs.
(g) Jog Operation Command for each axis
Jog Operation works by setting or clearing directly its considered bit from U device not by a command. In this example above, look at the axis 1, once Jog Operation conditions are satisfied, clockwise jog bit becomes ”On,’ count clockwise jog bit becomes “Off’,” and jog speed bit becomes “On.” Everything together Jog Operation works clock wisely with high speed. Reference for detail information about Bit of U device is from “Chapter 5.2.1.”
The value of U device renewed from Scan End of sequence program.

(3) Inching Operation



(a) Condition of Inching Operation

Condition of Inching Operation Command (XINCH)

(b) Axis Ready

If communication between the positioning module and the servo driver is normal, the signal corresponding to each axis will be on.

(c) Operating state by axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Inching Operating” for each axis. It turns on when it is operating. Inching Operation can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Inching Operation while it is running, the “error 401” would be appeared.

(d) Error state for each axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo On signal
When applying the example program of “8.1.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since “Inching operation” command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state. If you execute “Inching operation” command when axis is not Servo On state, the error 403 occurs.

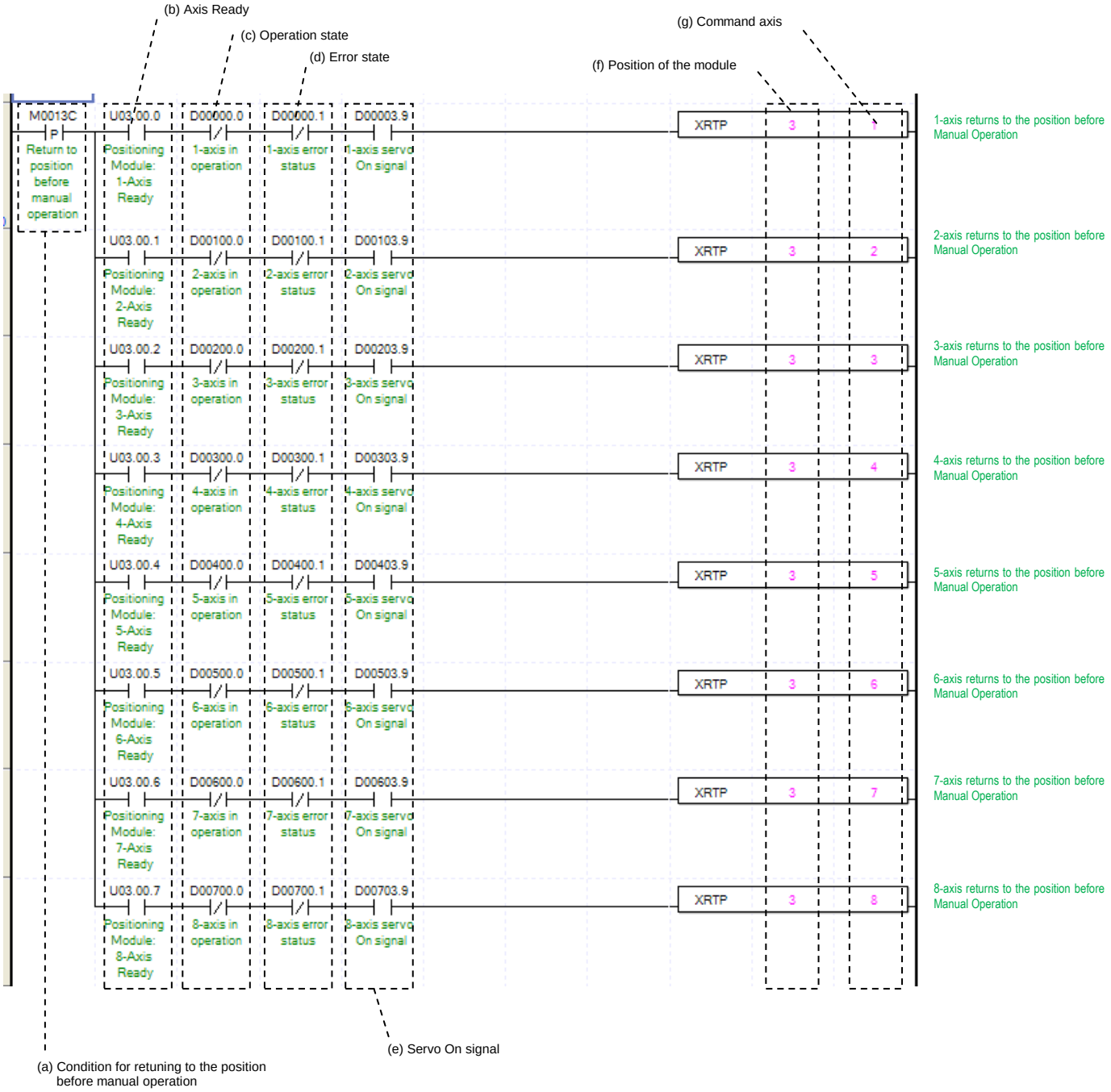
(f) Address of Positioning Module
In this example, Positioning Module installed at the slot no.3 of 0 bases.

(g) Axis of command execution
You can set an axis for Inching Operation. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Inching Operation, you can set a value for axis 1 through 8 axes.

(h) Amount of Inching Operation Movement
Measure the amount of moving range by Inching Operation.

(i) Reference for Inching Operation is from “Chapter 9.3.2.”

(4) Return to the position before Manual Operation



(a) Condition of Return to the position before Manual Operation

Condition of Return to the position before Manual Operation Command (XRTP)

(b) Axis Ready

If communication between the positioning module and the servo driver is normal, the signal corresponding to each axis will be on.

(c) Operating state by axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Manual Operating” for each axis. It turns on when it is operating. Inching Operation can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Manual Operation while it is running, the “error 431” would be appeared.

(d) Error state for each axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo On signal

When applying the example program of “8.1.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since “Return to the manual operation” command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state. If you execute “Return to the manual operation” command when axis is not Servo On state, the error 434 occurs.

(f) Address of Positioning Module

In this example, Positioning Module installed at the slot no.3 of 0 bases.

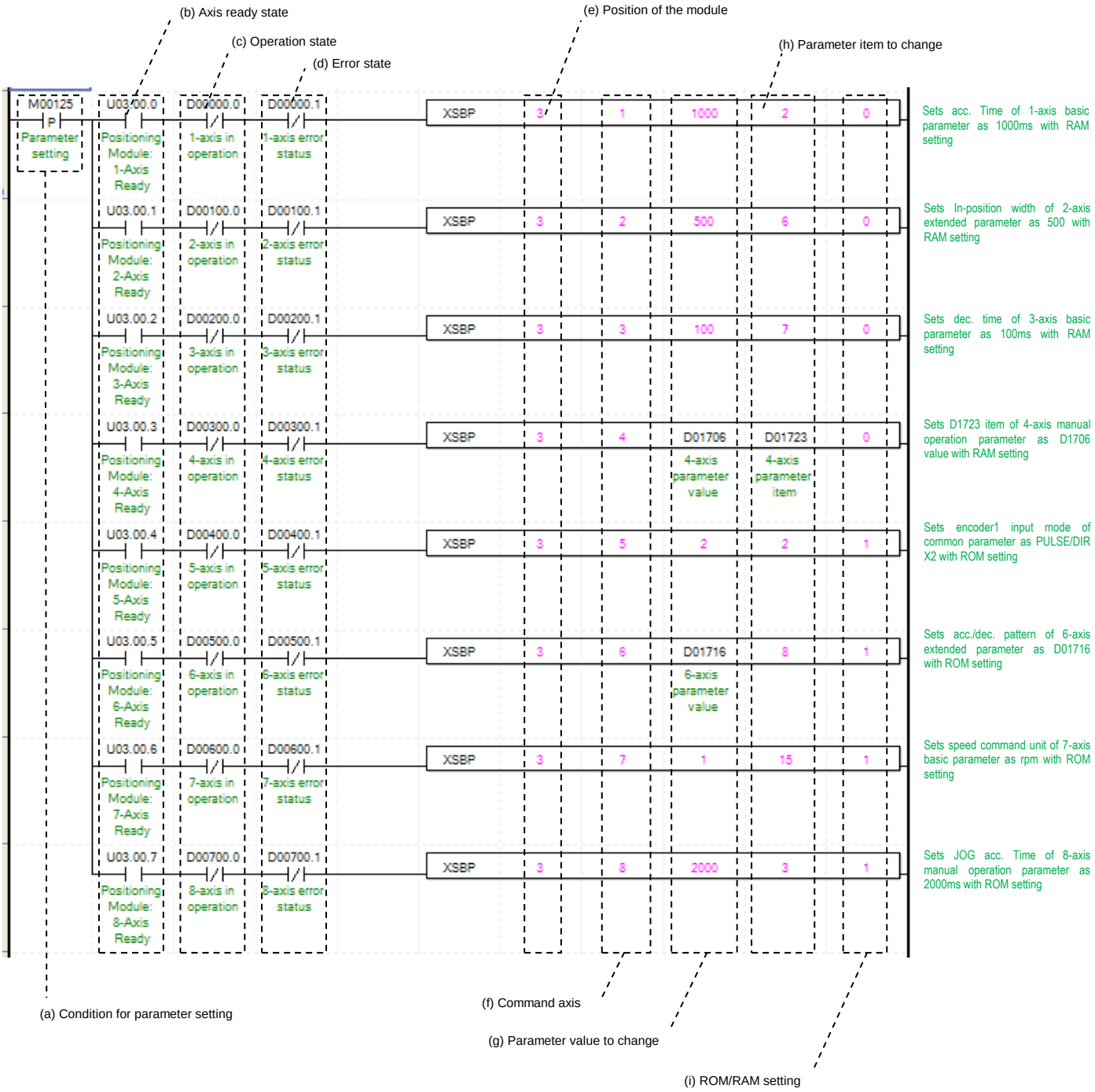
(g) Axis of command execution

You can set an axis for Manual Operation. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Manual Operation, you can set a value for axis 1 through 8 axes.

(h) When manual operation is running, the other operations are going back to its original position such as Jog Operation and Inching Operation. Reference for Manual Operation is from “Chapter 9.3.2.”

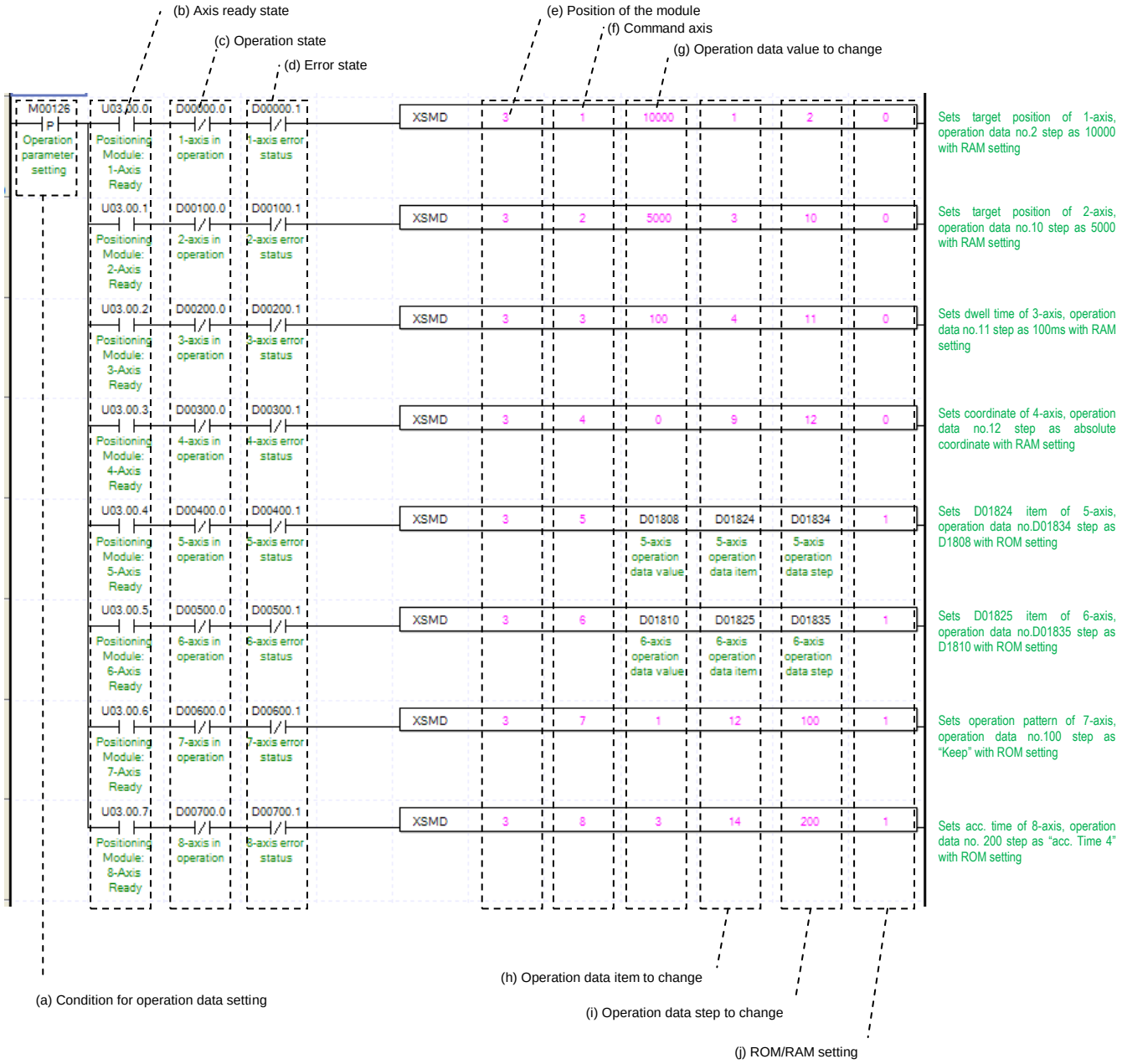
8.1.5 Parameter and Operation Data Setting

(1) Parameter Setting



(a) Condition of Parameter Setting Command
Condition of Parameter Setting Command (XSEP, XSHP, XSMP, XSES, XSCP)
(b) Axis ready state
If communication between the positioning module and the servo driver is normal, the signal corresponding to each axis will be on.
(c) Operating state by axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Except common parameter setting, parameter setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Parameter Setting while it is running, the “error 471” would be appeared.
(d) Error state for each axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.
(e) Address of Positioning Module
In this example, Positioning Module installed at the slot no.3 of 0 bases.
(f) Axis of command execution
You can set an axis for Parameter Setting. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis 1 through 8 axes.
(g) Value of Changing Parameter
You can set a value of changing parameter. For more information about Parameter Value Changing look for “Chapter 6. Command.” In case of setting I/O parameter, the value would be parameter value itself.
(h) List of Changing Parameter
You need to set a list for parameter (f) changing from set command. Once operating is working, this value will change to parameter (f). For more information of list of changing parameter look for “Chapter 6. Command.” In case of setting I/O parameter, the value would be parameter value itself. Therefore changing of list would not be necessary.
(i) ROM/RAM Setting
This function sets whether you save value of changing parameter to Rom or Ram. If you choose Rom the data will be saved regardless of power and if you save in the ram the data will be vanished when powers off. This parameter sets as 1 means Rom saved, and sets as 0 means Ram saved. There is no limitation of saving parameters in the Rom since parameter of Positioning Module saved in the FRAM.

(2) Operating Data Setting



(a) Condition of Operating Data Command

Condition of Operating Data Command (XSMD)

(b) Axis ready state

If communication between the positioning module and the servo driver is normal, the signal corresponding to each axis will be on.

(c) Operating state by axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. Operation data setting command is available to be executed when the axis is operating. However, if operation data of the step that is currently operated are changed, those changes are reflected after the current step is completed.

(d) Error state for each axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Address of Positioning Module

In this example, Positioning Module installed at the slot no.3 of 0 bases.

(f) Axis of command execution

You can set an axis for Operating Data Setting. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Operating Data Setting, you can set a value for axis 1 through 8 axes.

(g) Value of Changing Parameter

You can set a value of changing parameter.

(h) List of Changing Parameter

You need to set a list for parameter (f) changing from set command. Once operating is working, this value will change to parameter (f). Each value of Operating Data is listed below. For example if you put 1000 for value of Changing Operating Data and 4 for Operating data then the value of Dwell is going to be set as 1000ms.

Setting Value	Items
1	Goal Position
2	Circular interpolation auxiliary position
3	Operating speed
4	Dwell Time
5	M code No.
6	Auxiliary axis setting
7	Helical interpolation axis
8	The number of circular interpolation turn
9	Coordinates
10	Control method
11	Operating method
12	Operting pattern
13	Size of Circular arc
14	Acc. No.
15	Dec. No.
16	Circular interpolation method
17	Circular interpolation direction

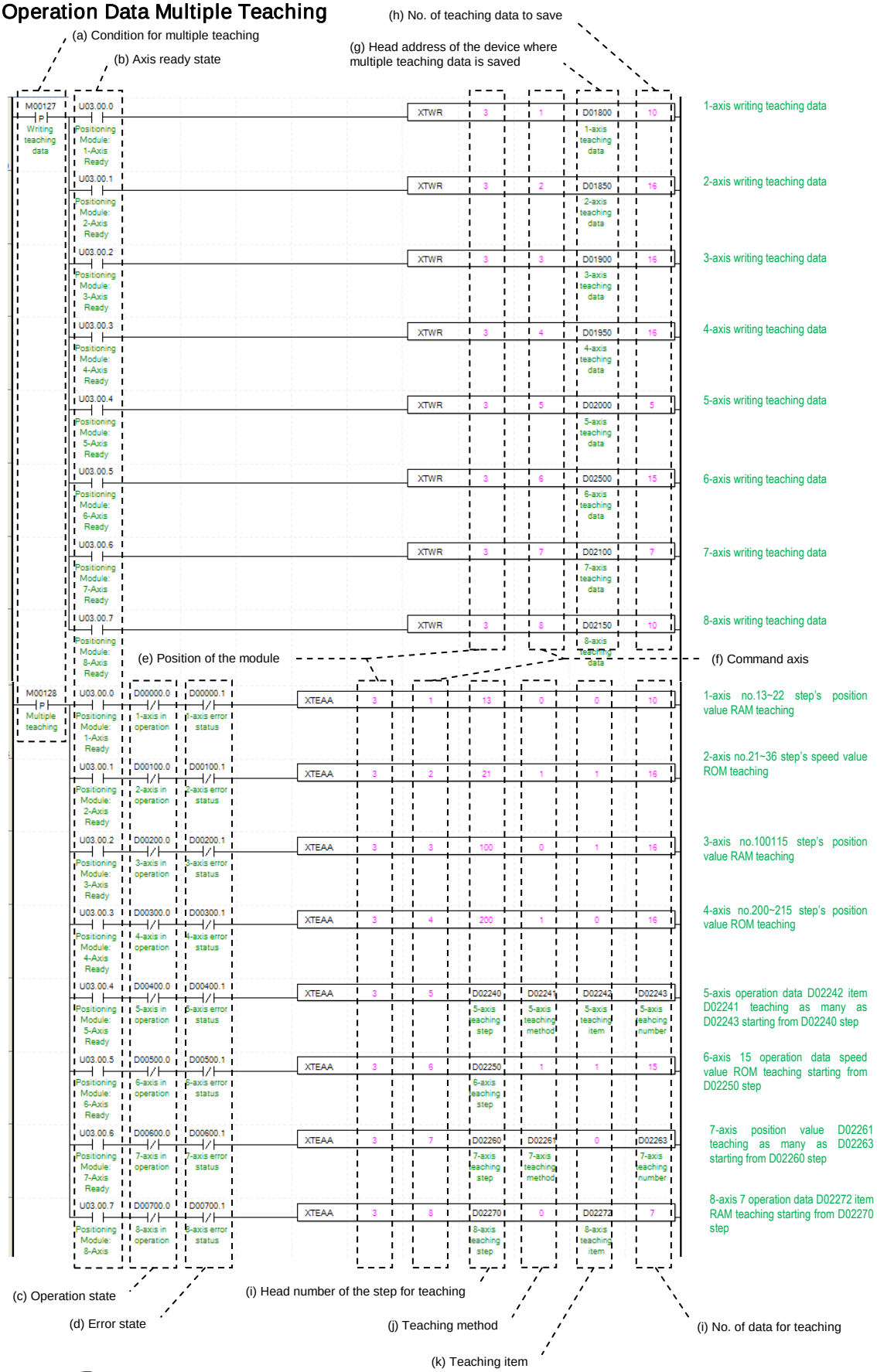
(i) Changing Operating Data Step

You can configure the changing operating data step number by using the operating data step command. XGF-PN8A/B supports 400 steps for each axis. This value supports from number 0 to 400. The numbers are considered as a step meaning number 1~400 are same as 1~400 steps. When you set this value as 0 means that you will stay put with current value.

(j) ROM/RAM Setting

This function sets whether you save value of changing parameter to Rom or Ram. If you choose Rom the data will be saved regardless of power and if you save in the ram the data will be vanished when powers off. This parameter sets as 1 means Rom saved, and sets as 0 means Ram saved. There is no limitation of saving parameters in the Rom since parameter of Positioning Module saved in the FRAM.

(3) Operation Data Multiple Teaching



(a) Condition of Teaching Array
Condition Teaching Array Command (XTWR, XTEAA)

(b) Axis ready state
If communication between the positioning module and the servo driver is normal, the signal corresponding to each axis will be on.

(c) Operating state by axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Teaching Array can not be configured while it is running hence configuration will only be configured when it is not running. Even though teaching array can be performed even when the axis subject to teaching is being operated but, only the current step’s data is reflected after the current step operation is completed if the step that is currently running is within the step area while other steps’ data are immediately changed.

(d) Error state for each axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Address of Positioning Module
In this example, Positioning Module installed at the slot no.3 of 0 bases.

(f) Axis of command execution
You can set an axis for Teaching Array. XGF-PN8A/B series supports for 8 axes. In the “execution of axis” from the configuration of Teaching Array, you can set a value for axis 1 through 8 axes.

(g) Address of first device where those data for Teaching Array are saved
To execute a Teaching Array, you need to set a specific value first. TWR commands are using for set up those Teaching Array data. It has to be done before actual Teaching Array operation. Teaching Data will be set up depends on number of first device as below table.

No.	Device No.	Teaching array data
1	Device + 0	Teaching array data1
2	Device + 2	Teaching array data2
3	Device + 4	Teaching array data3
4	Device + 6	Teaching array data4
5	Device + 8	Teaching array data5
6	Device + 10	Teaching array data6
7	Device + 12	Teaching array data7
8	Device + 14	Teaching array data8
9	Device + 16	Teaching array data9
10	Device + 18	Teaching array data10
11	Device + 20	Teaching array data11
12	Device + 22	Teaching array data12
13	Device + 24	Teaching array data13
14	Device + 26	Teaching array data14
15	Device + 28	Teaching array data15
16	Device + 30	Teaching array data16

(h) Amount of Saving Teaching data
Decide how many data will be saved by using XTWR command. Maximum 16 data can be saved. In this example above, 10 Teaching data saved in the axis 1. Therefore those Teaching data from D01800~D01818 saved in the module.

(i) First number of Teaching Step
You can setup the first number of Teaching Step among the Operating Data step. In this example above, Teaching Array of axis 1 will be operate from 22^{th} step, which is 10^{th} step away from 13^{th} step, hence it will be operate between 13^{th} step and 22^{th} step.

(j) Teaching Method
This function sets whether you save value of changed Teaching data to Rom or Ram. If you choose Rom the data will be saved regardless of power and if you save in the ram the data will be vanished when powers off. This parameter sets as 1 means Rom saved, and sets as 0 means Ram saved. There is no limitation of saving parameters in the Rom since parameter of Positioning Module saved in the FRAM.

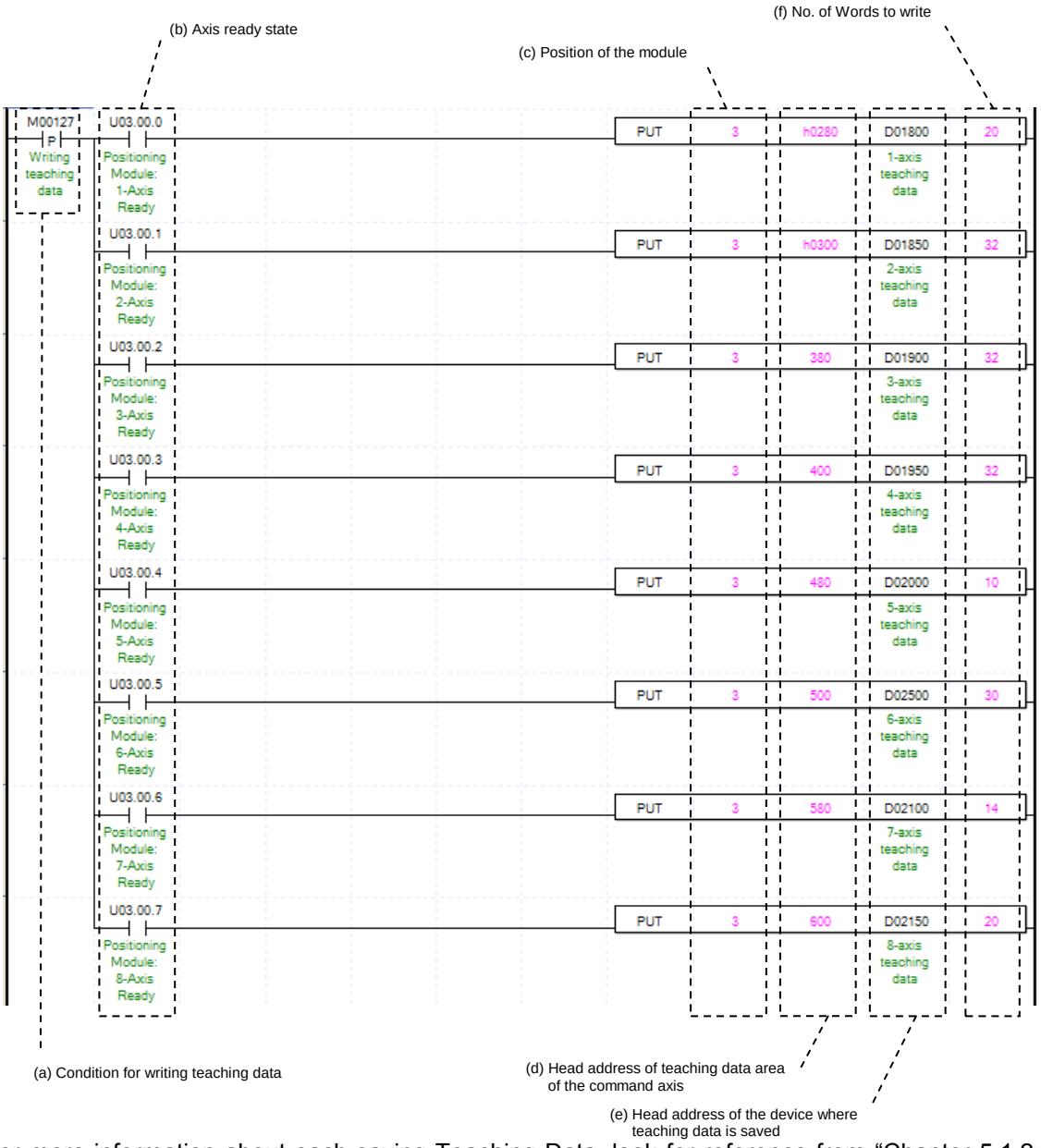
(k) List of Teaching

You can set a data with Teaching Method among the Operating Data. Both “Goal Position” and “Operating Speed” can be changed by Teaching Array. When its value set “0” means set a Goal Position and “1” means set an Operating Speed.

(l) Amount of Teaching Method

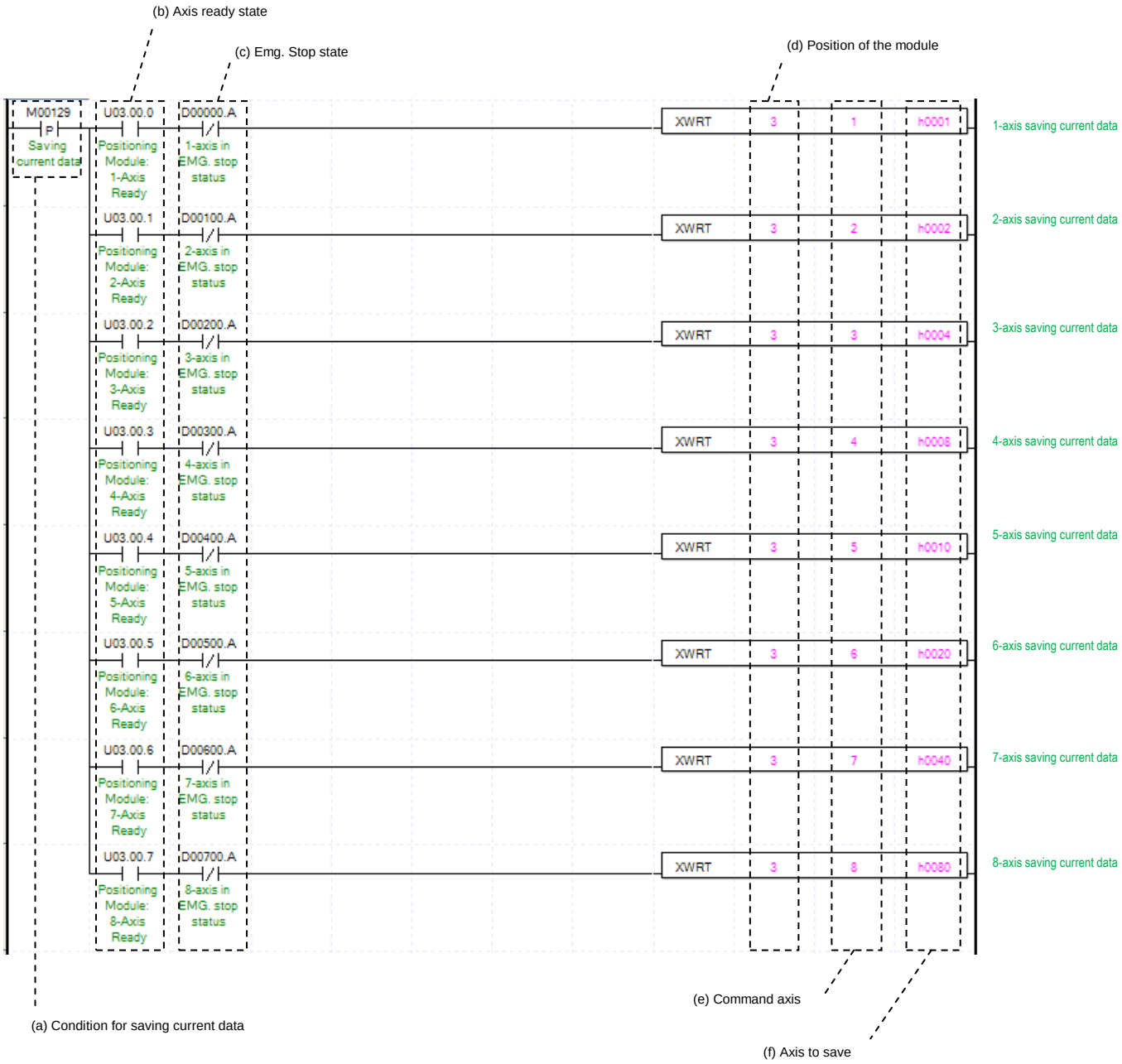
Decide how many steps will be operated using by Teaching Method. Maximum 16 Teaching Array data can be used. For more information about Teaching Array Operation, look for reference from “Chapter 9.7.1”

(m) This example above can also be operated, using command PUT from XTWR as below.



For more information about each saving Teaching Data, look for reference from “Chapter 5.1.2.” When you are using a command “PUT,” you need to setup a type of data as a “WORD” not a “DINT” considered its size.

(4) Saving Current Data



(a) Condition of Saving Current Data

Condition of Saving Current Data Command (XWRT). When current saving data operated, those values of module parameter and operating data would be saved in FRAM. Therefore configuration of Ram or Ram Teaching would be constantly saved whether power is on or not.

(b) Axis ready state

If communication between the positioning module and the servo driver is normal, the signal corresponding to each axis will be on.

(c) Emergency Stop by each axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “State of Emergency Stop” for each axis. It turns on when it is Emergency Stop. Emergency Stop can not be configured while it is running hence configuration will only be configured when it is not running.

(d) Address of Positioning Module

In this example, Positioning Module installed at the slot no.3 of 0 bases.

(e) Axis of command execution

You can set an axis for Saving Current Data. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Saving Current Data, you can set a value for axis 1 through 8 axes.

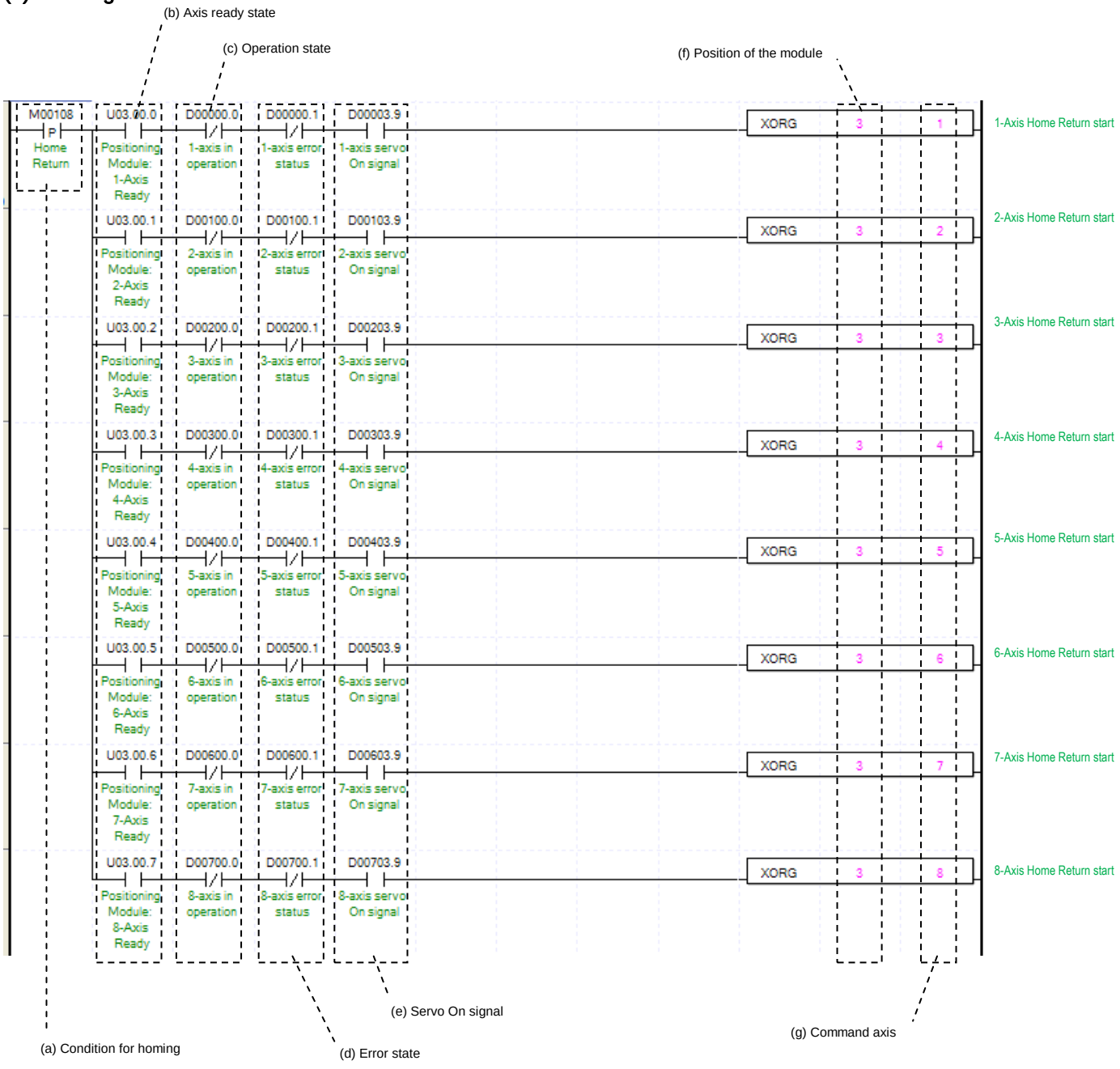
(f) Saving by axes

Configure current data operation setting. Choosing axes are configured follow by below table. Therefore even if those axis are not operated as it programmed, saving axis can be saved in Array. The data of operated axis saved in FRAM, which make constantly stable whether its power is on or not.

15 ~ 8 Bit	7Bit	6Bit	5Bit	4Bit	3Bit	2Bit	1Bit	0Bit
N/A	8-axis	7-axis	6-axis	5-axis	4-axis	3-axis	2-axis	1-axis

8.1.6 Positioning Operation

(1) Homing



(a) Condition of Homing
Condition of Homing Command (XORG)

(b) Axis ready state
If communication between the positioning module and the servo driver is normal, the signal corresponding to each axis will be on.

(c) Operating state by axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Homing command can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Homing while it is running, the “error 201” would be appeared.

(d) Error state for each axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo On signal

When applying the example program of “8.1.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since “Homing” command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state. If you execute “Homing” command when axis is not Servo On state, the error 203 occurs.

(f) Address of Positioning Module

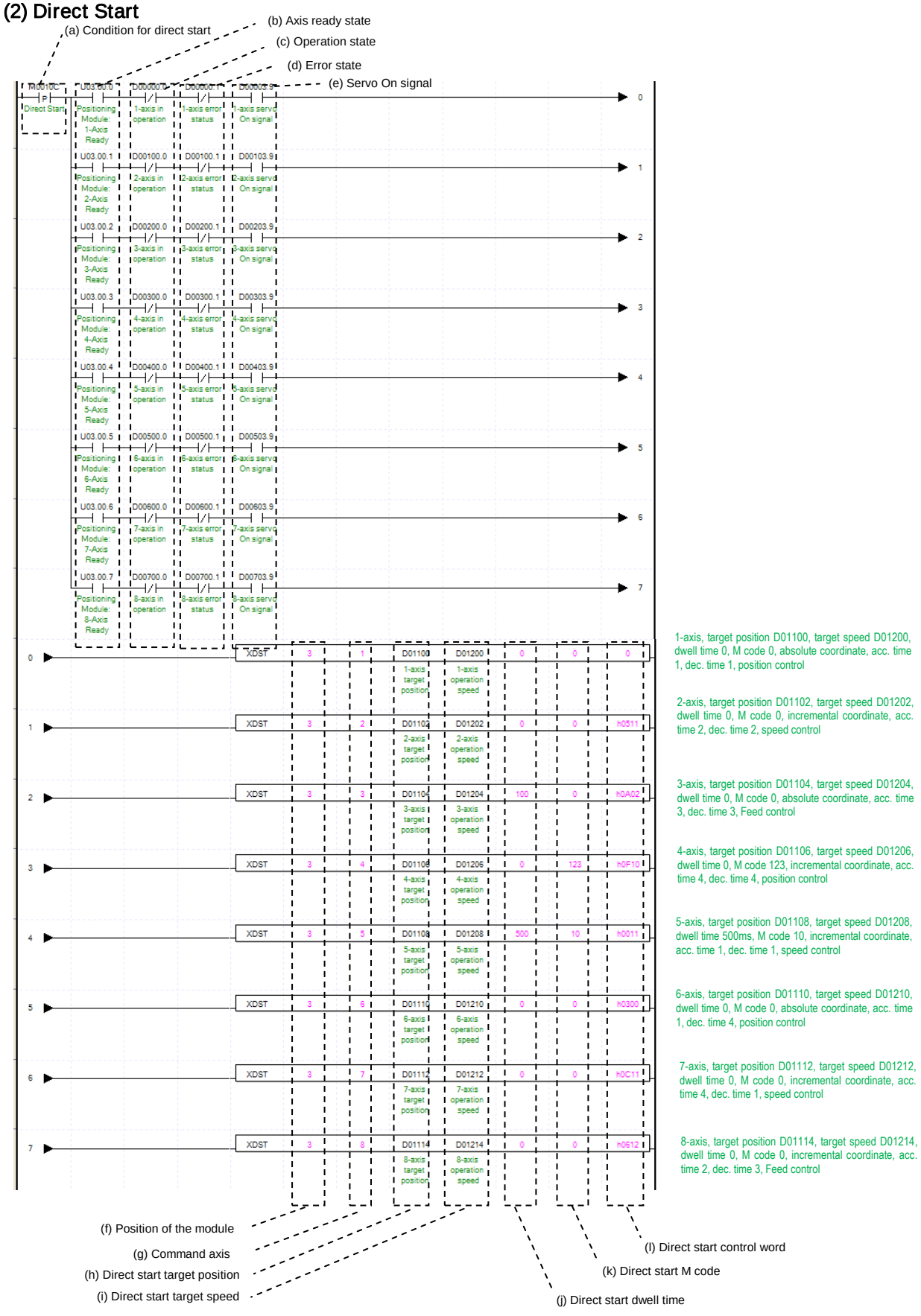
In this example, Positioning Module installed at the slot no.3 of 0 bases.

(g) Axis of command execution

You can set an axis for Homming Operation. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Homming Operation, you can set a value for axis 1 through 8 axes.

(h) For more information, reference for Homing is in the “Chapter 9.1.”

(2) Direct Start



(a) Condition of Direct Start
Condition of Direct Start Command (XDST)

(b) Axis ready state
If communication between the positioning module and the servo driver is normal, the signal corresponding to each axis will be on.

(c) Operating state by axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Direct Start command can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Direct Start while it is running, the “error 221” would be appeared.

(d) Error state for each axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo On signal
When applying the example program of “8.1.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since “Direct start” command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state. If you execute “Direct start” command when axis is not Servo On state, the error 225 occurs

(f) Address of Positioning Module
In this example, Positioning Module installed at the slot no.3 of 0 bases.

(g) Axis of command execution
You can set an axis for Direct Start. XGF-PN8A/B series supports for 8 axes. In the “execution of axis” from the configuration of Direct Start, you can set a value for axis 1 through 8 axes.

(h) Goal of Direct Start
Decide changing position of Direct Start command. In this example above, the initialized value is “device,” but you can also change it with “real numbers,” which data type is “DINT.”

(i) Speed of Direct Start
Decide goal speed of Direct Start. In this example above, the initialized value is “device,” but you can also change it with “real numbers,” which data type is “UDINT.”

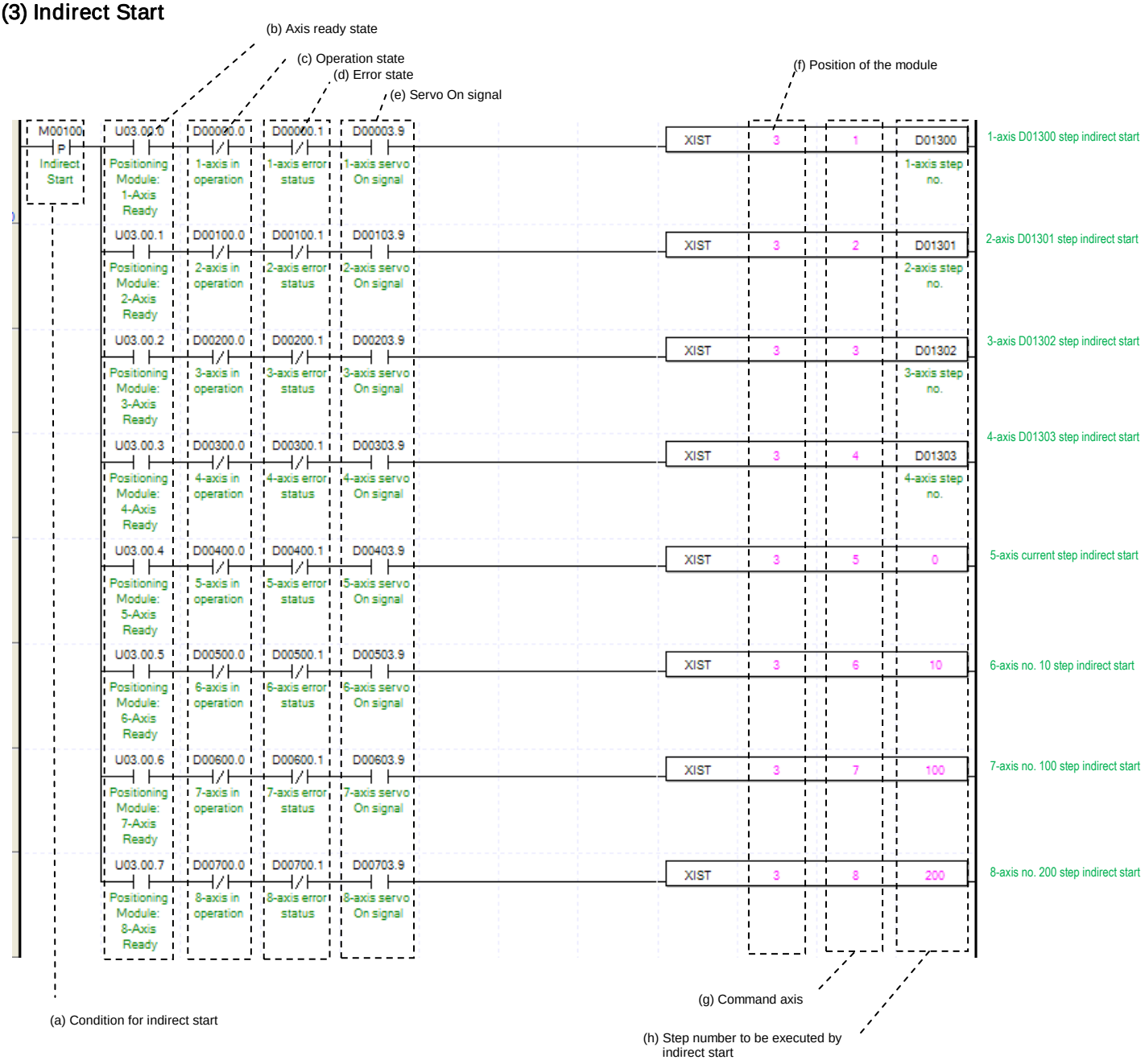
(j) Dwell Time of Direct Start
Dwell Time consider as a total amount of time from beginning of Direct Start operation that reach to the goal position and make output of Positioning Done Signal. That means after done its operation, direct Start will make a Positioning done signal. Its unit is “ms,” and type is “UINT”

(k) Direct Start M code
You can set a value of M code which are displaying of Operating Parameter by Direct Start. The way of M code outputs are “Parameter Expansion, M code Mode,” within the “None, With, After.” It will make an M code besides you choose “None” for its parameter. For more information, reference for M code is in the “Chapter 4.2.2”

(l) Direct Start Control Word
These are list of setting values in a form of Word by Bit for Direct Start. The details of Bits are in the table below.

15 ~ 12	11 ~ 10	9 ~ 8	7 ~ 5	4	3 ~ 2	1 ~ 0
-	Dec. Time	Acc. Time	-	0:Absolute 1: Incremental	-	0:Position control 1:Speed control 2:Feed control 3: Shortest position control

(3) Indirect Start



(a) Condition of Indirect Start

Condition of Indirect Start Command (XIST)

(b) Axis ready state

If communication between the positioning module and the servo driver is normal, the signal corresponding to each axis will be on.

(c) Operating state by axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Indirect Start while it is running, the “error 231” would be appeared.

(d) Error state for each axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo On signal

When applying the example program of “8.1.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since “Indirect start” command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state. If you execute “Indirect start” command when axis is not Servo On state, the error 235 occurs.

(f) Address of Positioning Module

In this example, Positioning Module installed at the slot no.3 of 0 bases.

(g) Axis of command execution

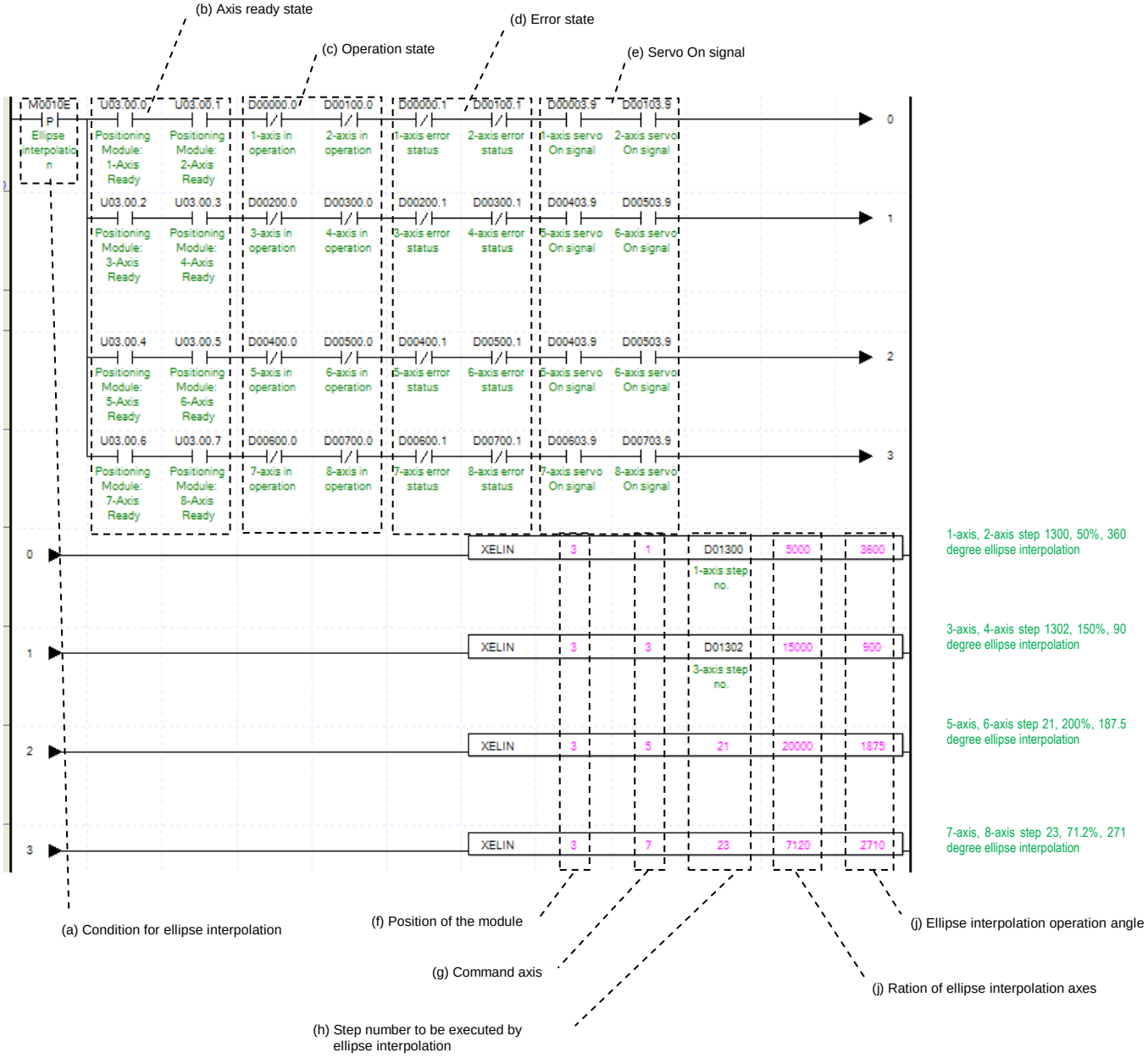
You can set an axis for Indirect Start. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Indirect Start, you can set a value for axis 1 through 8 axes.

(h) Operating step number by Indirect Start

Set the operating step number by indirect start for main command axis.

(i) Indirect start operates by appointing step of position data for each axis. Therefore it could run those commands of Positioning control, Speed control, Feed control, Linear circular interpolation depends on setting of positioning data. For more information, reference for Setting of Operating Data is in the “Chapter4.7.”

(4) Ellipse Interpolation



(a) Condition of Ellipse Interpolation

Condition of Ellipse Interpolation Command (XELIN)

(b) Operating state by axis

If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on. Since ellipse interpolation operates two axes, main axis and sub axis have to be ready status.

(c) Error state for each axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(d) Ready signal for each axes

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Drive Ready” for each axis. This command only works when the condition of Drive Ready is on. If a Drive Ready of main axis is not set as “ON,” the “error 549” would be appeared and If a Drive Ready of subordinate axis is not set as “ON,” the “error 550” would be appeared and

(e) Servo On signal
When applying the example program of “8.1.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since “Indirect start” command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state. If you execute “Indirect start” command when axis is not Servo On state, the error 235 occurs.

(f) Address of Positioning Module
In this example, Positioning Module installed at the slot no.3 of 0 bases.

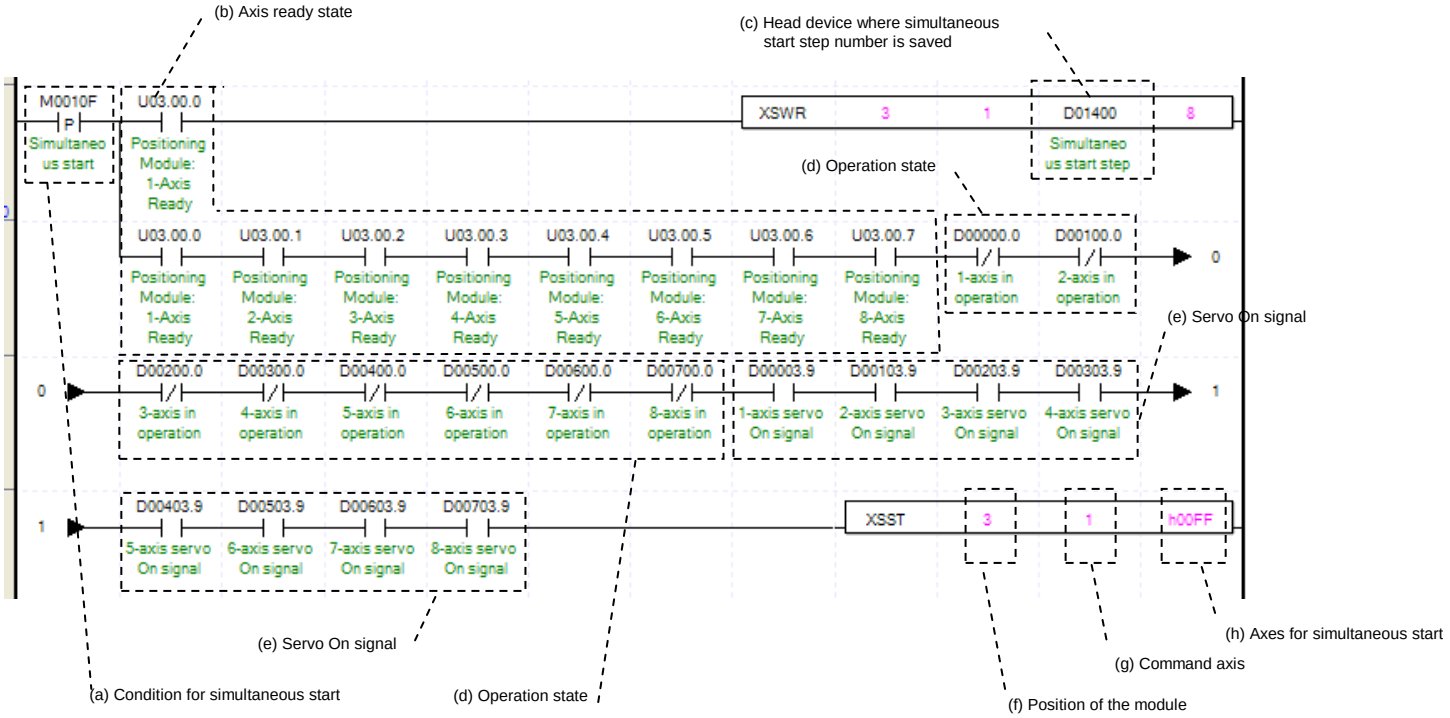
(g) Axis of command execution
You can set an axis for Ellipse Interpolation. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Ellipse Interpolation, you can set a value for axis 1 through 8 axes.

(h) Operating step number by Ellipse Interpolation
Set the operating step number by Ellipse Interpolation. The setting of main operating step and subordinate step is the same.

(i) Ratio of Ellipse Interpolation Axis
Set both ratio values for main and subordinate axis of set operates data from circular interpolation locus. It is to change circular locus into ellipse locus by using ratio of main and subordinate axis.

(j) Degree of Ellipse Interpolating Operation
Set the degree for Ellipse Interpolating Operation. Unit is [$X10^{-1}$ degree]. For more information, reference for Ellipse Interpolation is in the “Chapter9.213.”

(5) Simultaneous Start



(a) Condition of Simultaneous Start
Condition of Simultaneous Start Command

(b) Axis ready state for each axis
If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on. Since simultaneous start operates more than two axes simultaneously, all axes to operate have to be ready status.

(c) Address of first device where those step numbers for Simultaneous Start of each axis are saved
To execute a Simultaneous Start, set data steps for each axis. XSWR commands are using for set up those step data for Simultaneous Start. It has to be done before actual Simultaneous Start operation. Simultaneous Start will be set up depends on number of first device as below table.

Value	Device No.	Teaching Array Data
1	Device + 0	Axis1 Simultaneous Start Step
2	Device + 1	Axis2 Simultaneous Start Step
3	Device + 2	Axis3 Simultaneous Start Step
4	Device + 3	Axis4 Simultaneous Start Step
5	Device + 4	Axis5 Simultaneous Start Step
6	Device + 5	Axis6 Simultaneous Start Step
7	Device + 6	Axis7 Simultaneous Start Step
8	Device + 7	Axis8 Simultaneous Start Step

(d) Operating state by axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Axis1 Synchronous Start while it is running, the “error 291” would be appeared.

(e) Servo On signal

When applying the example program of “8.1.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since “Simultaneous start” command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state. If you execute “Simultaneous start” command when axis is not Servo On state, the error 295 occurs.

(f) Address of Positioning Module

In this example, Positioning Module installed at the slot no.3 of 0 bases.

(g) Axis of command execution

You can set an axis for Simultaneous Start. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Simultaneous Start, you can set a value for axis 1 through 8 axes.

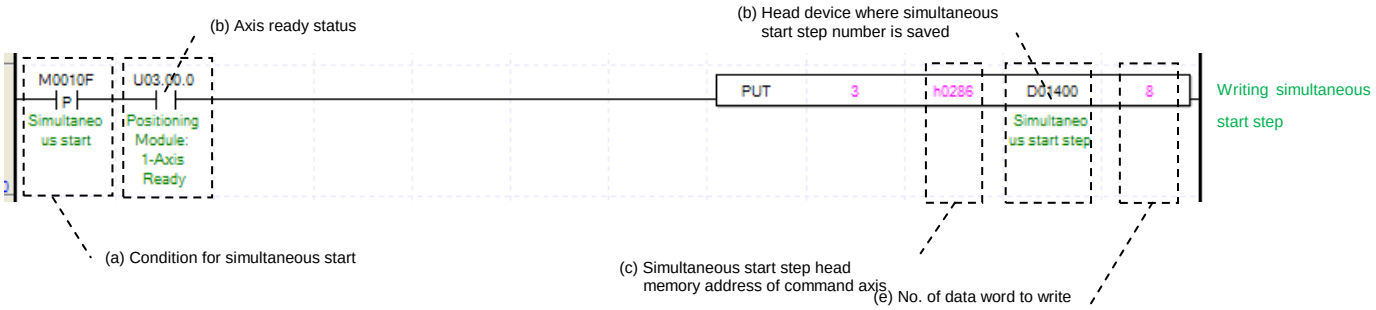
(h) Axis for Simultaneous Start

Set axis for Simultaneous Start. The axis for Simultaneous Start uses a “bit” from WORD Data setting as a “1” for each axis. Axis for each bits are as below.

15 ~ 8 Bit	7Bit	6Bit	5Bit	4Bit	3Bit	2Bit	1Bit	0Bit
Not use	Axis8	Axis7	Axis6	Axis5	Axis4	Axis3	Axis2	Axis1

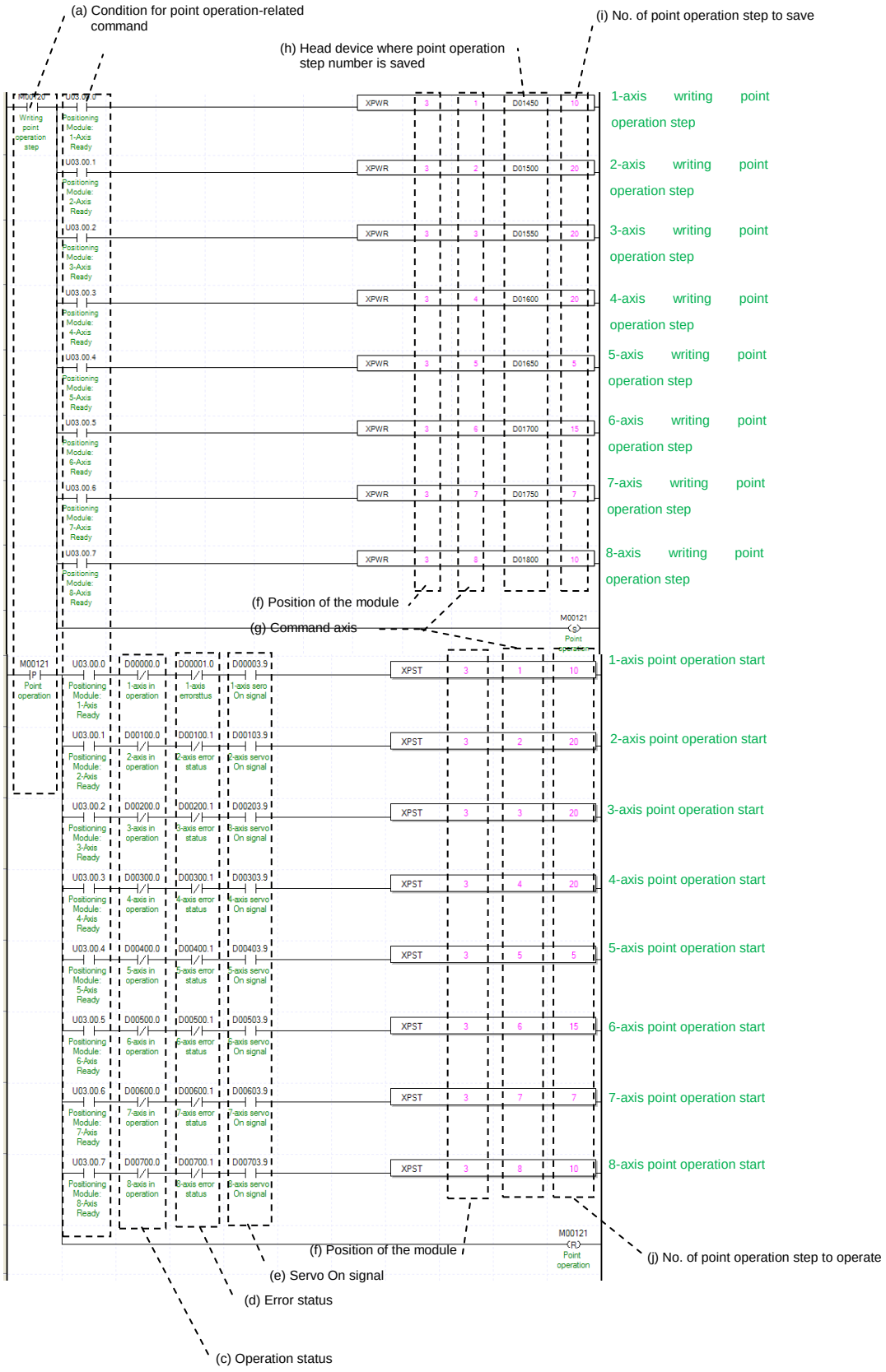
In the example program, since it is set as “hFF”, it operates axis1~axis8, all axes simultaneously.

(i) In this program above, you can use command “PUT” instead of XSWR.



(j) Setting a memory address for each axis of Simultaneous Start step number, look up reference for Simultaneous Start is in the “Chapter5.1.3.”

(6) Point Operation



(a) Condition of Point Operation
Condition of Point Operation Command (XPST) Point Operation Step Writing (XPWR)
XPWR has to be done before execute the Point Operation.

(b) Axis ready status
If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.

(c) Operating state by axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Point operation start command can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Point Operation while it is running, the “error 231” would be appeared.

(d) Error state for each axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo On signal
When applying the example program of “8.1.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since “Point operation start” command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state.

(f) Address of Positioning Module
In this example, Positioning Module installed at the slot no.3 of 0 bases.

(g) Axis of command execution
You can set an axis for Point Operation. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Point Operation, you can set a value for axis 1 through 8 axes.

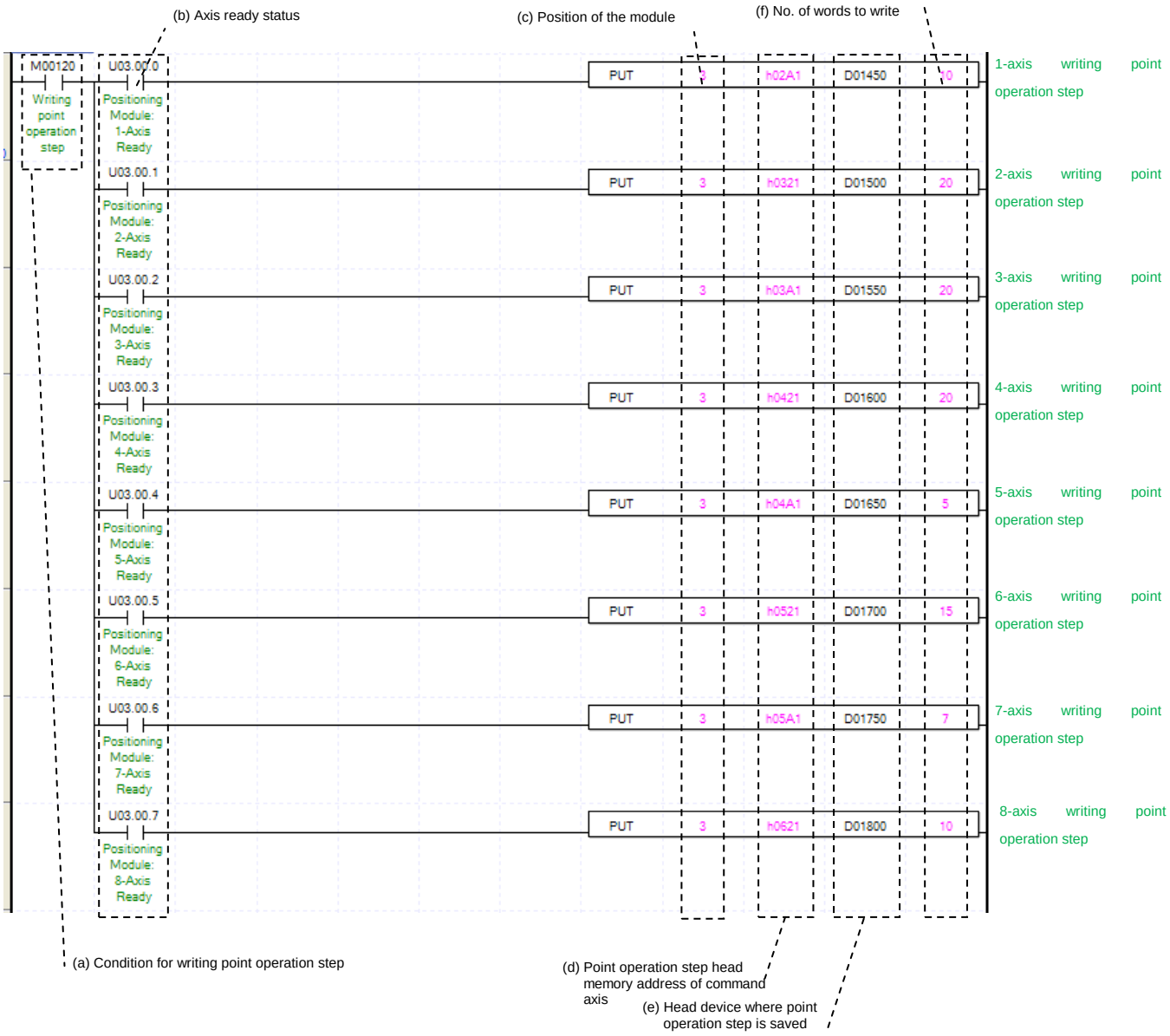
(h) Address of first device where those data for Step Numbers of Point Operation are saved
To execute a Point Operation, you need to set a specific value first. XPWR commands are using for set up those Point Operation steps. It has to be done before actual Point Operation. Point Operation Step Data will be set up depends on number of first device as below table.

Value	Device No.	Point start step data
1	Device + 0	Point start step data 1
2	Device + 1	Point start step data 2
3	Device + 2	Point start step data 3
4	Device + 3	Point start step data 4
5	Device + 4	Point start step data 5
6	Device + 5	Point start step data 6
7	Device + 6	Point start step data 7
8	Device + 7	Point start step data 8
9	Device + 8	Point start step data 9
10	Device + 9	Point start step data 10
11	Device + 10	Point start step data 11
12	Device + 11	Point start step data 12
13	Device + 12	Point start step data 13
14	Device + 13	Point start step data 14
15	Device + 14	Point start step data 15
16	Device + 15	Point start step data16
17	Device + 16	Point start step data17
18	Device + 17	Point start step data18
19	Device + 18	Point start step data19
20	Device + 19	Point start step data20

(i) Amount of Saving Point Operation Steps
Decide how many data will be saved by using XTWR command. In this example above, 10 Point Operation steps are saved in the axis 1. Therefore those Step data from D01450~D01459 are saved in the module.

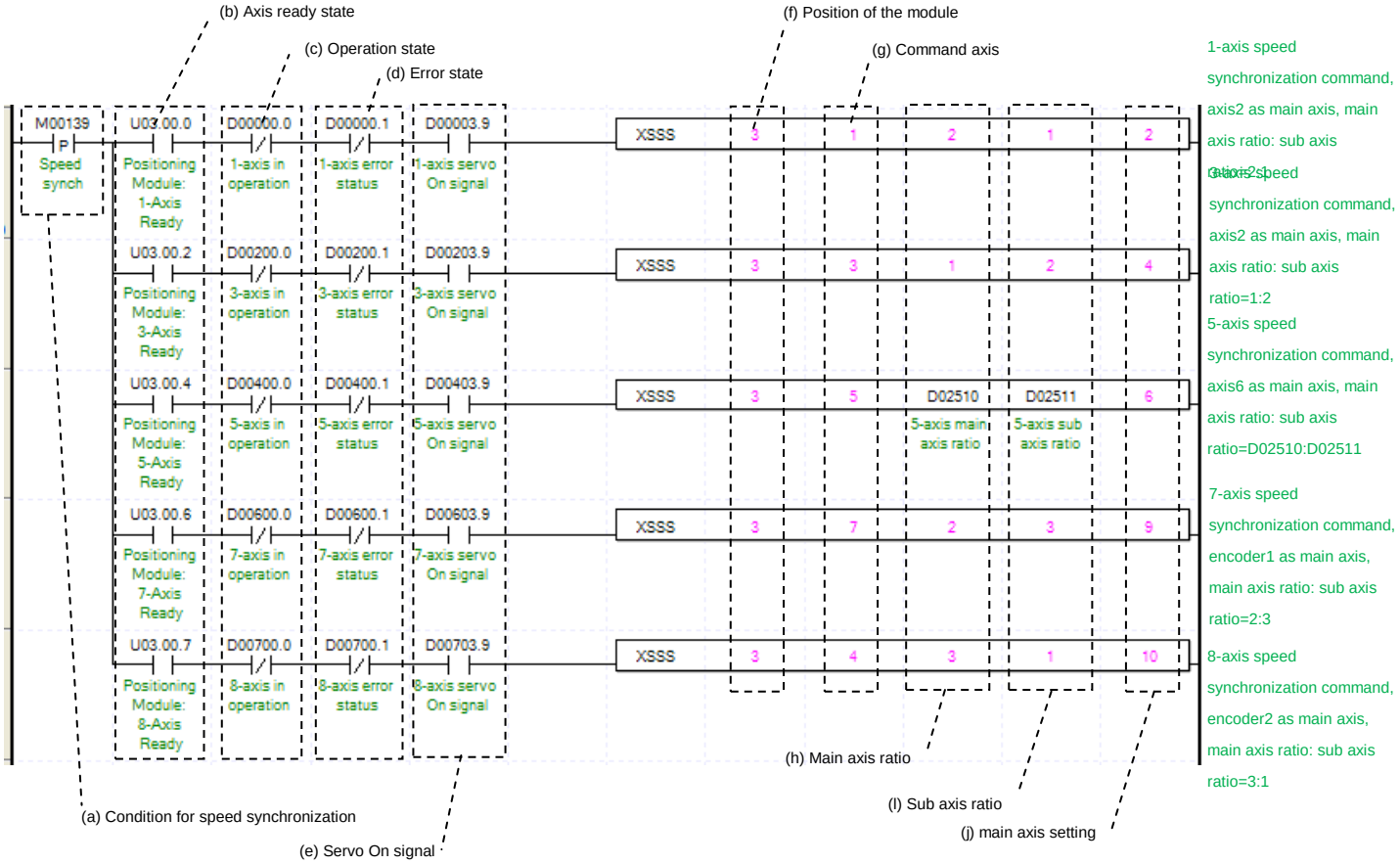
(j) Number of Operation amount by Point Operation
Set the number of saving Step numbers by Point Operating Writing command. For more information, reference for Setting of Point Operation is in the “Chapter 9.2.18.”

(k) In this program above, you can use command “PUT” instead of XPWR.



Setting a memory address for each axis of Point Operation step number, look up reference for Point Operation is in the “Chapter5.1.1.”

(7) Speed Synchronization



(a) Condition of Speed Synchronization

Condition of Speed Synchronization Command (XSSS)

(b) Axis ready status

If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.

(c) Operating state by axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Speed Synchronization while it is running, the “error 351” would be appeared.

(d) Error state for each axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo On signal

When applying the example program of “8.1.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since “Speed synchronization” command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state. If you execute this command when it is not “Servo On” state, number 354 error will appears

(f) Address of Positioning Module

In this example, Positioning Module installed at the slot no.3 of 0 bases.

(g) Axis of command execution

You can set an axis for Speed Synchronization. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Speed Synchronization, you can set a value for axis 1 through 8 axes.

(h) Ratio of Main Axis

Set value for Ratio of Main Axis to execute a Speed Synchronization.

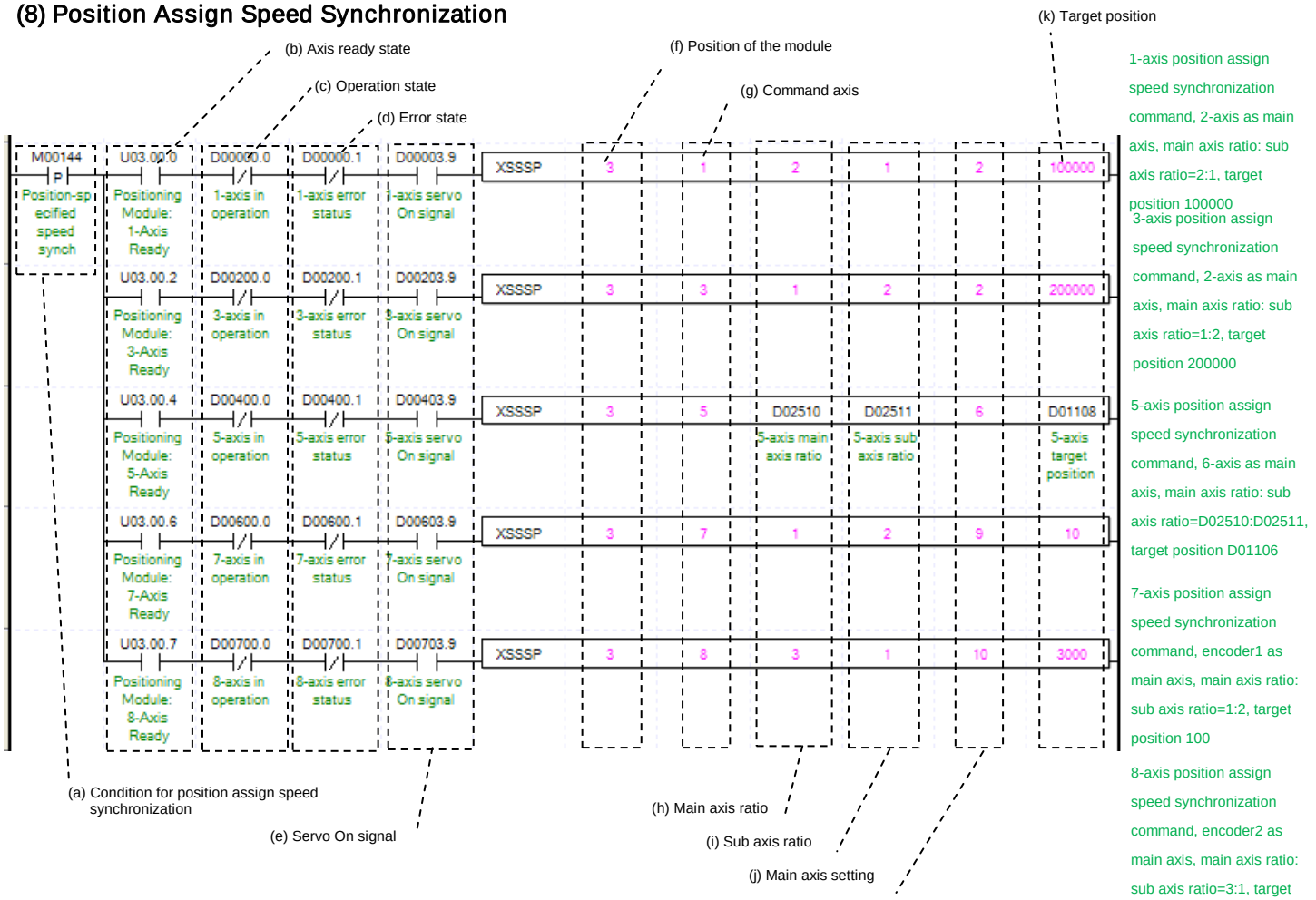
(i) Ratio of Subordinate Axis
Set value for Ratio of Subordinate Axis to execute a Speed Synchronization. In this example above, the ratio of main and subordinate axis is 2:1. Meaning that operational speed ratio of those axes is 2 to 1. So, if main axis is operating in speed of 10000, subordinate axis will be operating in speed of 5000.

(j) Main Axis Setting
Setting of main axis to operate Speed Synchronization. This setting is for main axis of Speed Synchronization. This setting cannot be set as same value as command axis, and possible setting values are as below.

Setting value	Main Axis
1	Axis1
2	Axis2
3	Axis3
4	Axis4
5	Axis5
6	Axis6
7	Axis7
8	Axis8
9	Encoder1
10	Encoder2

(k) For more information, reference for Speed Synchronization is in the “Chapter 9.4.1.”

(8) Position Assign Speed Synchronization



(a) Condition of Position Assign Speed Synchronization
Condition of Position Assign Speed Synchronization Command (XSSSP)

(b) Axis ready status

If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.

(c) Operating state by axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured if it is not running. If you execute Position Assign Speed Synchronization while it is running, the “error 351” would be appeared.

(d) Error state for each axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo On signal

When applying the example program of “8.1.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since “Speed synchronization” command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state. If you execute this command when it is not “Servo On” state, number 354 error will appears

(f) Address of Positioning Module

In this example, Positioning Module installed at the slot no.3 of 0 bases.

(g) Axis of command execution

You can set an axis for Position Assign Speed Synchronization. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Position Assign Speed Synchronization, you can set a value for axis 1 through 8 axes.

(h) Ratio of Main Axis

Set value for Ratio of Main Axis to execute a Speed Synchronization.

(i) Ratio of Subordinate Axis

Set value for Ratio of Subordinate Axis to execute a Speed Synchronization. In this example above, the ratio of main and subordinate axis is 2:1. Meaning that operational speed ratio of those axes is 2 to 1. So, if main axis is operating in speed of 10000, subordinate axis will be operating in speed of 5000.

(j) Main Axis Setting

Setting of main axis to operate Speed Synchronization. This setting is for main axis of Speed Synchronization. This setting cannot be set as same value as command axis, and possible setting values are as below.

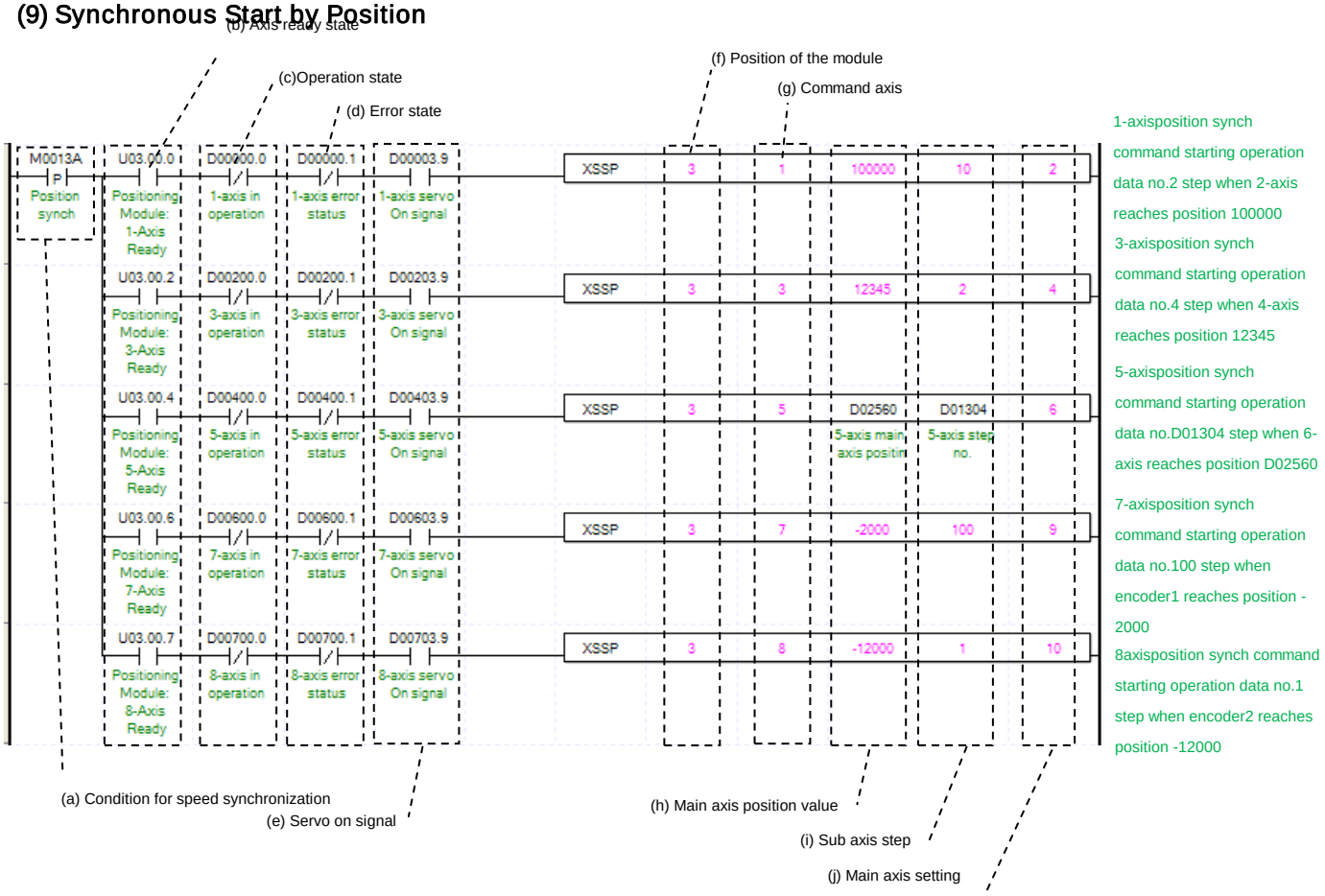
Setting value	Main Axis
1	Axis1
2	Axis2
3	Axis3
4	Axis4
5	Axis5
6	Axis6
7	Axis7
8	Axis8
9	Encoder1
10	Encoder2

(k) Goal Position

Set goal of Position Assign Speed Synchronization. Once command axis reaches the goal position, Speed Synchronization ends and operation will be stop immediately.

(l) For more information, reference for Position Assign Speed Synchronization is in the “Chapter 9.4.1.”

(9) Synchronous Start by Position



(a) Condition of Synchronous Start by Position

Condition of Synchronous Start by Position Command (XSSP)

(b) Axis ready status

If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.

(c) Operating state by axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Synchronous Start by Position while it is running, the “error 341” would be appeared.

(d) Error state for each axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo On signal

When applying the example program of “8.1.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since “Speed synchronization” command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state. If you execute this command when it is not “Servo On” state, number 354 error will appears

(f) Address of Positioning Module

In this example, Positioning Module installed at the slot no.3 of 0 bases.

(g) Axis of command execution

You can set an axis for Synchronous Start by Position. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Synchronous Start by Position, you can set a value for axis 1 through 8 axes.

(h) Value of Main Axis
Set value for Main Axis to execute Synchronous Start by Position. Therefore main axis will be executed the command when the subordinate axis reaches this set value.

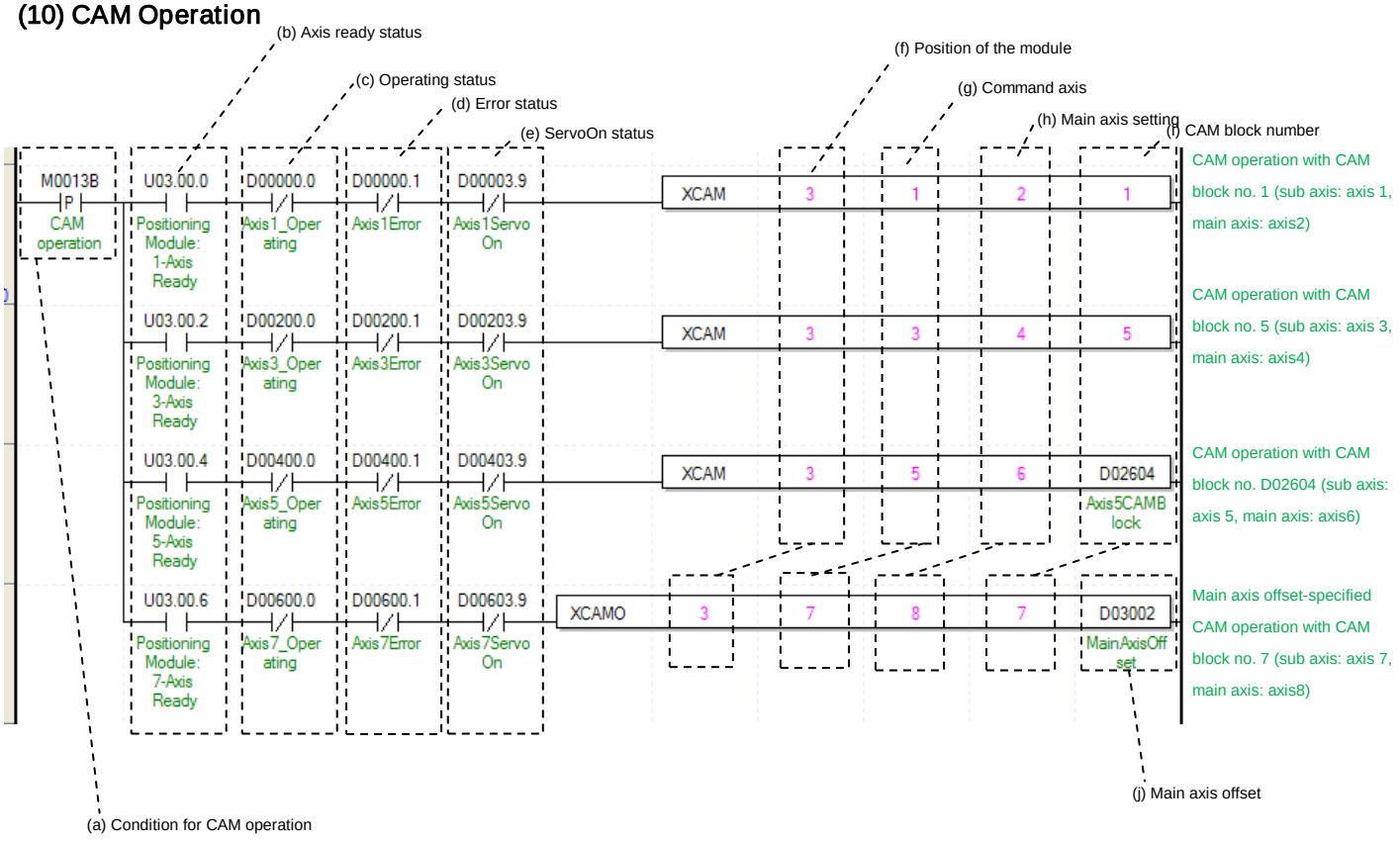
(i) Step of Subordinate Axis
Set step number for Subordinate Axis to execute a Speed Synchronization.

(j) Main Axis Setting
Setting of main axis to operate Speed Synchronization. This setting is for main axis of Speed Synchronization. This setting cannot be set as same value as command axis, and possible setting values are as below.

Setting value	Main Axis
1	Axis1
2	Axis2
3	Axis3
4	Axis4
5	Axis5
6	Axis6
7	Axis7
8	Axis8
9	Encoder1
10	Encoder2

(k) For more information, reference for Synchronous Start by Position is in the “Chapter 9.4.2.”

(10) CAM Operation



(a) Condition of CAM Operation
Condition of CAM Operation Command (XCAM)

(b) Axis ready status
If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.

(c) Operating state by axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute CAM Operation while it is running, the “error 701” would be appeared.

(d) Error state for each axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo On signal

When applying the example program of “8.1.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since “Speed synchronization” command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state. If you execute this command when it is not “Servo On” state, number 354 error will appears

(f) Address of Positioning Module

In this example, Positioning Module installed at the slot no.3 of 0 bases.

(g) Axis of command execution

You can set an axis for CAM Operation. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of CAM Operation, you can set a value for axis 1 through 8 axes.

(h) Main Axis Setting

Setting of main axis to operate .This setting is for main axis of CAM Operating. This setting cannot be set as same value as command axis. Can set a value 1~4, meaning from axis 1 to axis 4.

(i) CAM Block Numbers

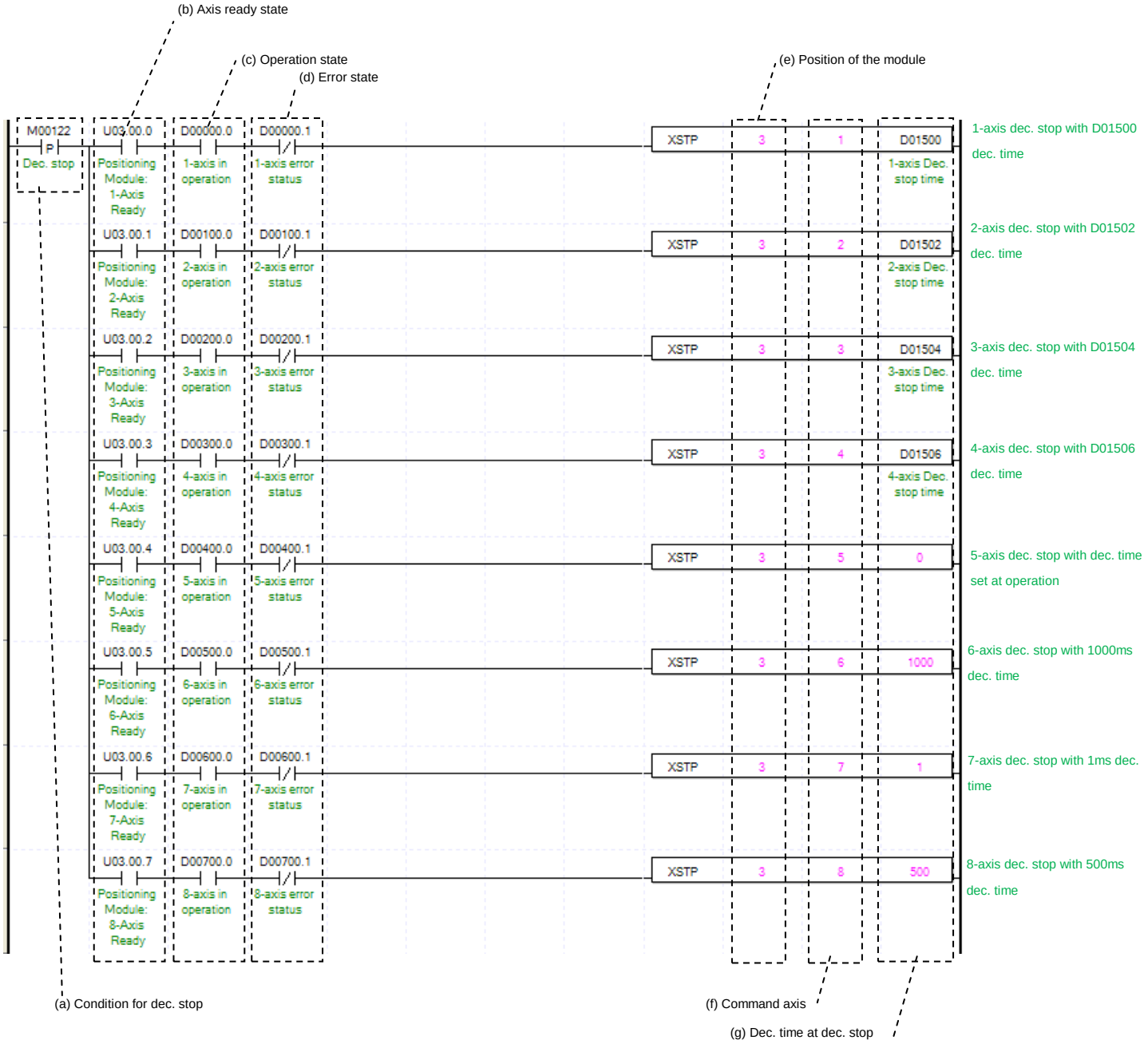
Setting for Block Numbers of CAM data to operate CAM operation. You can set up 9 CAM Blocks. The CAM Data for each Block would be downloaded to module written from Software Package.

(j) Main axis offset

In case of main axis offset specified CAM operation command, sets offset position of main axis for sub axis to start CAM operation. After operation, sub-axis starts CAM operation after main axis moves as much as position value set in main axis offset

(k) For more information, reference of CAM Operation is in the “Chapter 9.4.3.”

(11) Deceleration Stop



(a) Condition of Deceleration Stop
Condition of Deceleration Stop Command (XSTP)

(b) Axis ready status
If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.

(c) Operating state by axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running.

(d) Error state for each axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

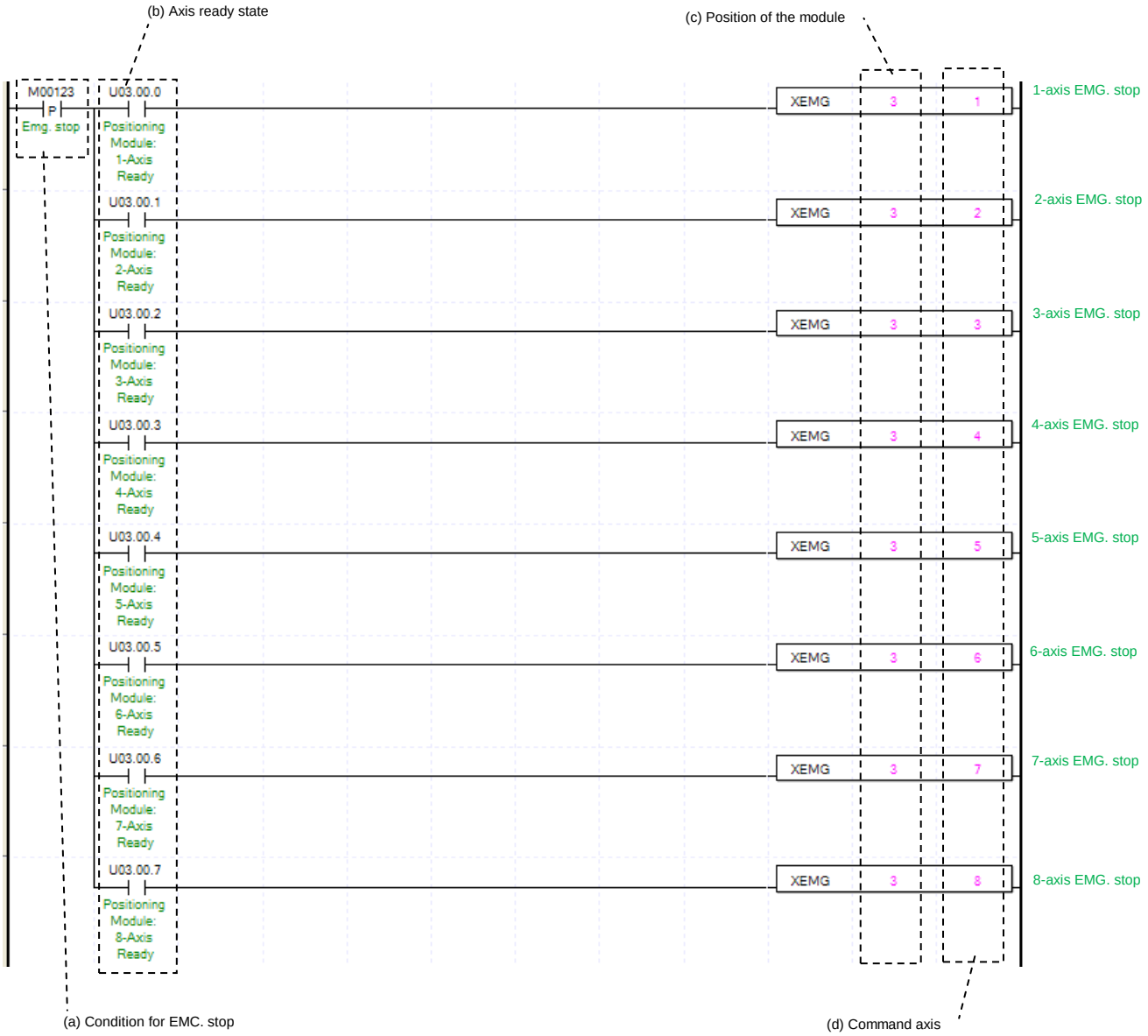
(e) Address of Positioning Module
In this example, Positioning Module installed at the slot no.3 of 0 bases.

(f) Axis of command execution
You can set an axis for Deceleration Stop. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Deceleration Stop, you can set a value for axis 1 through 8 axes.

(g) Deceleration time of Deceleration Stop
Setting a deceleration time of Deceleration Stop operation. Unit of Deceleration Stop is [ms]. Since this time refers deceleration time from the speed limit, there might be little difference between Deceleration Stop set time and actual stop time. The range of deceleration time is “0~2,147,483,674.” 1~2,147,483,674 means Deceleration Time set as 1ms ~ 2,147483674ms. If it set as “0,” it will be operated with set deceleration value. Also it use to stop Speed Synchronous Operation or CAM Operation while Speed and CAM Operation. During this time Deceleration Time is meaningless, CAM Operation Is just cancelled.

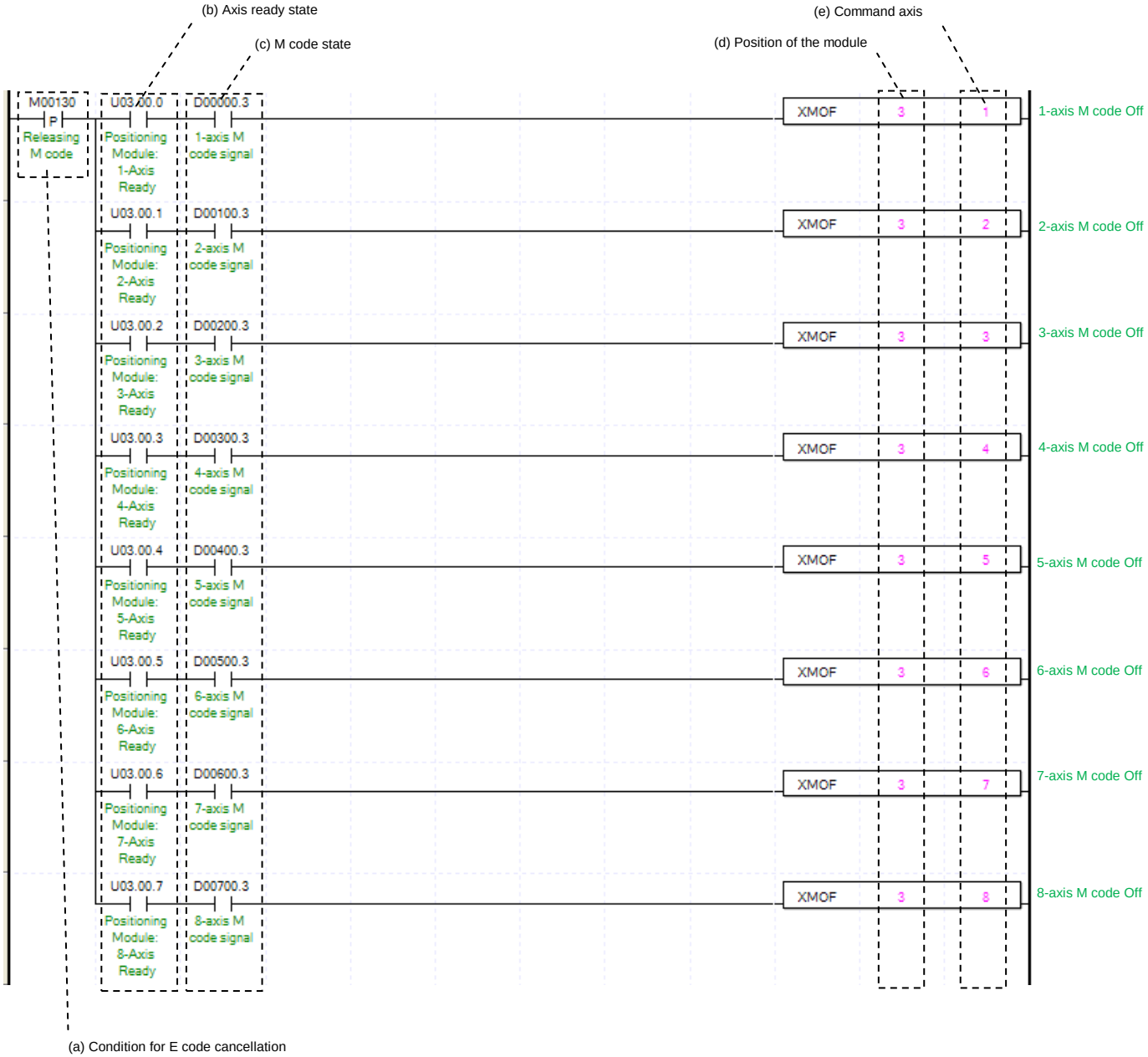
(i) For more information, reference of Deceleration Stop is in the “Chapter 9.2.18.”

(12) Emergency Stop



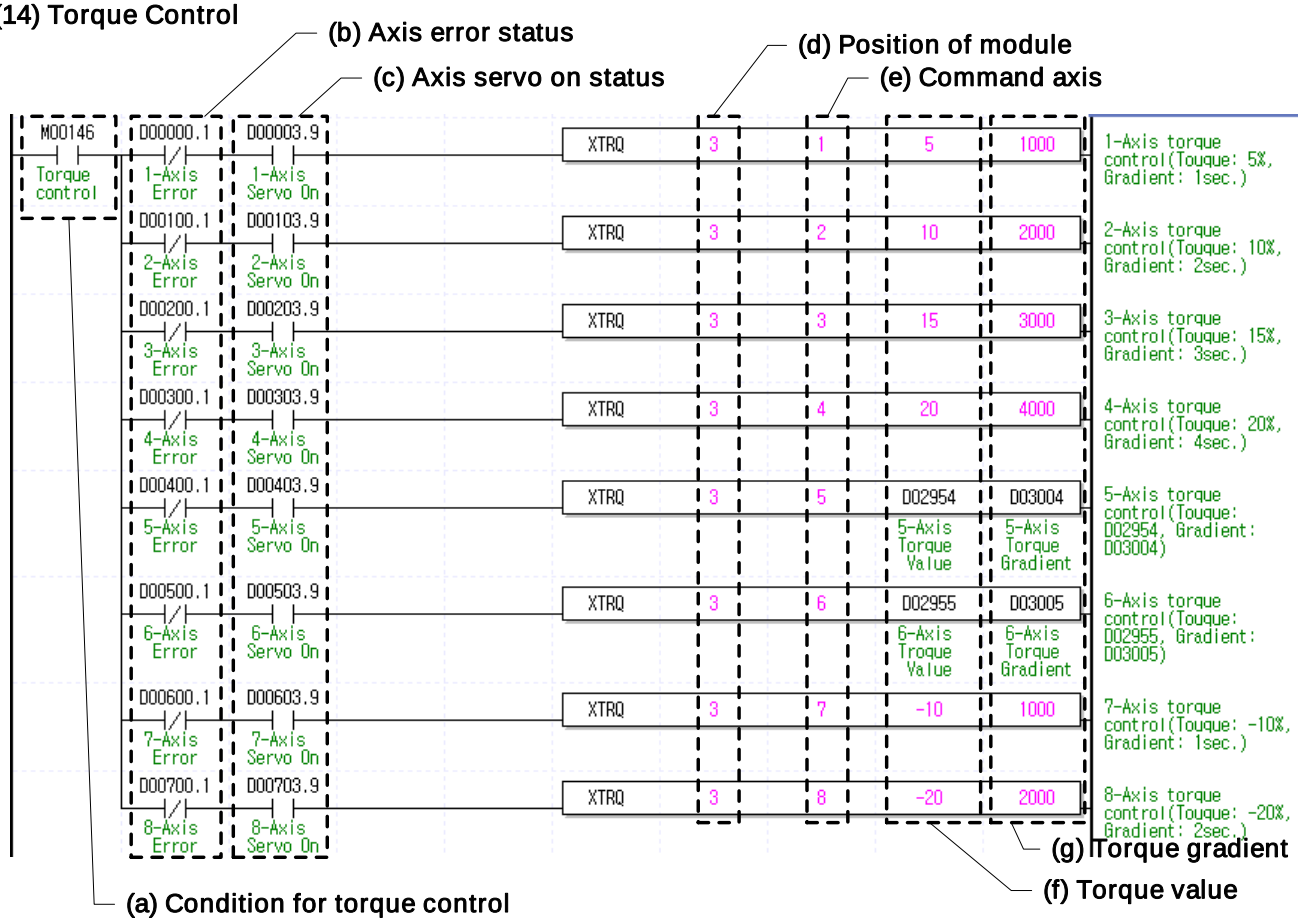
(a) Condition of Emergency Stop
Condition of Emergency Stop Command (XEMG)
(b) Axis ready status
If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.
(c) Address of Positioning Module
In this example, Positioning Module installed at the slot no.3 of 0 bases.
(d) Axis of command execution
You can set an axis for Emergency Stop. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Emergency Stop, you can set a value for axis 1 through 8 axes.
(e) Emergency Stop is operating by each axis.
Once Emergency Stop command executes the error “481” would be occurred. With the set value for deceleration time, it will be decelerated and stop the operation
(f) For more information, reference of Emergency Stop is in the “Chapter 9.2.18.”

(13) M code Off



(a) Condition of M code Off
Condition of M code Off(XMOF). Once M code Off command executed, number of M code would be change to "0," and signal of M code to "Off."
(b) Axis ready status
If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.
(c) M code state for each axis
According to exercise from "Chapter 8.1.2 Current State Reading," it is a signal of "M Code" for each axis. It turns on when it is operating. M code Off command can only be valid once M code are generated. The condition for execution is operation possible when it is "On."
(d) Address of Positioning Module
In this example, Positioning Module installed at the slot no.3 of 0 bases.
(e) Axis of command execution
You can set an axis for M code Off. XGF-PN8A/B supports for 8 axes. In the "execution of axis" from the configuration of M code Off, you can set a value for axis 1 through 8 axes.
(f) For more information, reference of M code Off is in the "Chapter 9.6.2."

(14) Torque Control



(a) Conditions to torque control
Conditions to implement the Torque Control command (XTRQ). If the command is implemented, the corresponding axis implements Torque Control with the set torque value and torque gradient.
(b) Error state of each axis
It is"Error State" signal of each axis when the example program of "8.1.2 Read the Current Sate"is applied. It shall be set to ensure any command is implement only when a relevant axis has no error. This condition may be removed if the user wants to implement a command regardless of occurrence of error.

(c) Servo On Signal of each axis
It is“Servo On” signal of each axis when the example program of “8.1.2 Read the Current Sate”is applied. It is On when a relevant axis is the state of “Servo On.” Since the Control Torque command cannot be implemented if the axis is not servo on, a condition to implement the command only in case of the state of servo on shall be set. If the Control Torque command is implemented when it is not the state of servo on, No. 743 error takes place.

(d) Address of Positioning Module
In this example, Positioning Module installed at the slot no.3 of 0 bases.

(e) Axis of command execution
It sets an axis that will implement the Control Torque command. Up to 8 axis can be connected and value 1 through 8, referring to Axis 1 through 8, can be set to “Axis to which Command is executed” item of the Torque Control command.

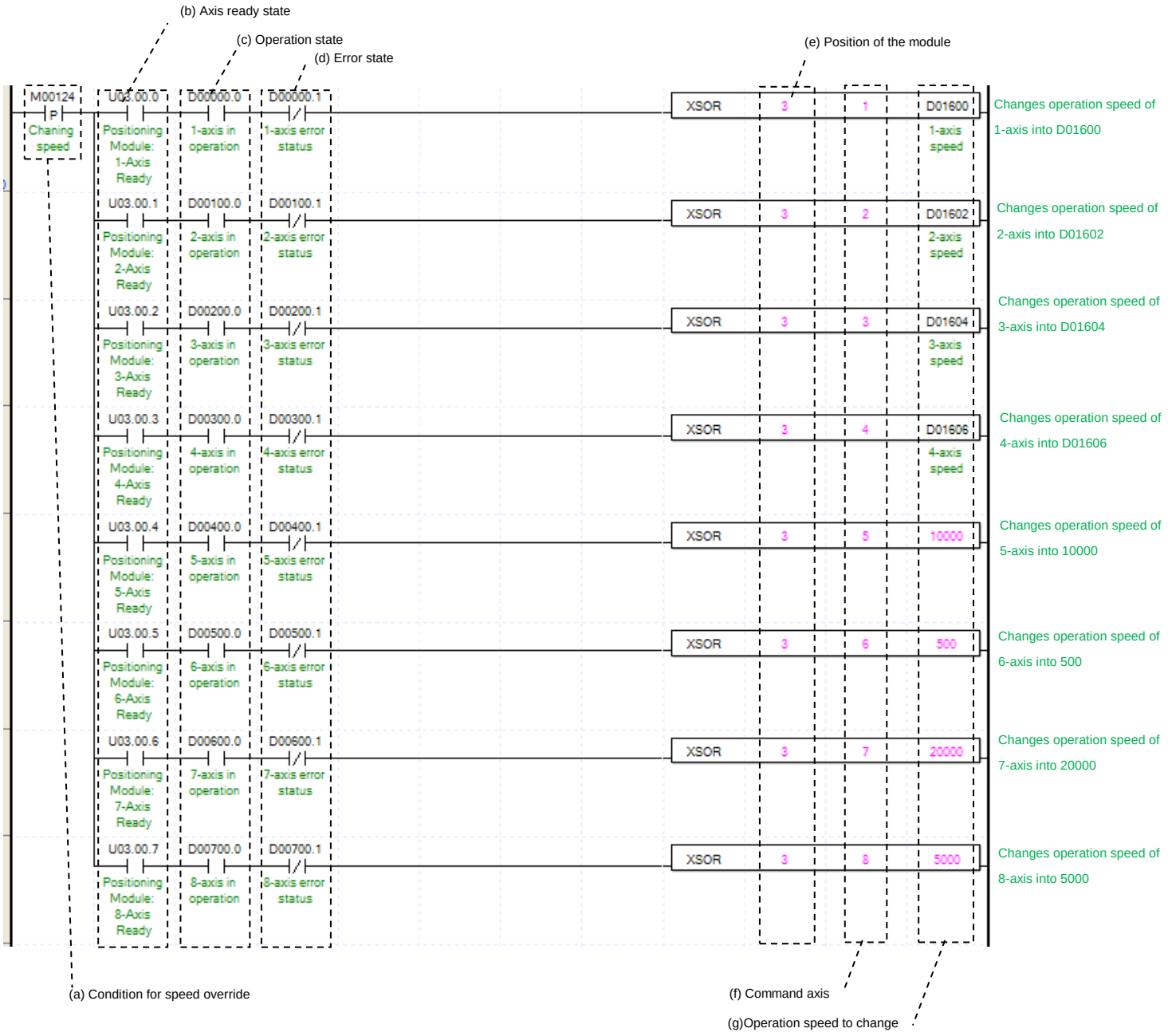
(f) After implementing the Torque Control command, set torque value to drive under the Torque Control command. The torque value range is -32768 through 32767%.

(g) Set gradient until reach the target torque in time. The gradient range is 0 through 65535ms.

(h) For further information on actions of the Torque Control command, refer to “9.2.21 Torque Control.

8.1.7 Operation Setting Change while Operating

(1) Speed Override



(a) Condition of Speed Override
Condition of Speed Override Command (XSOR)

(b) Axis ready status
If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.

(c) Operating state by axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Speed Override while it is running, the “error 371” would be appeared.

(d) Error state for each axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

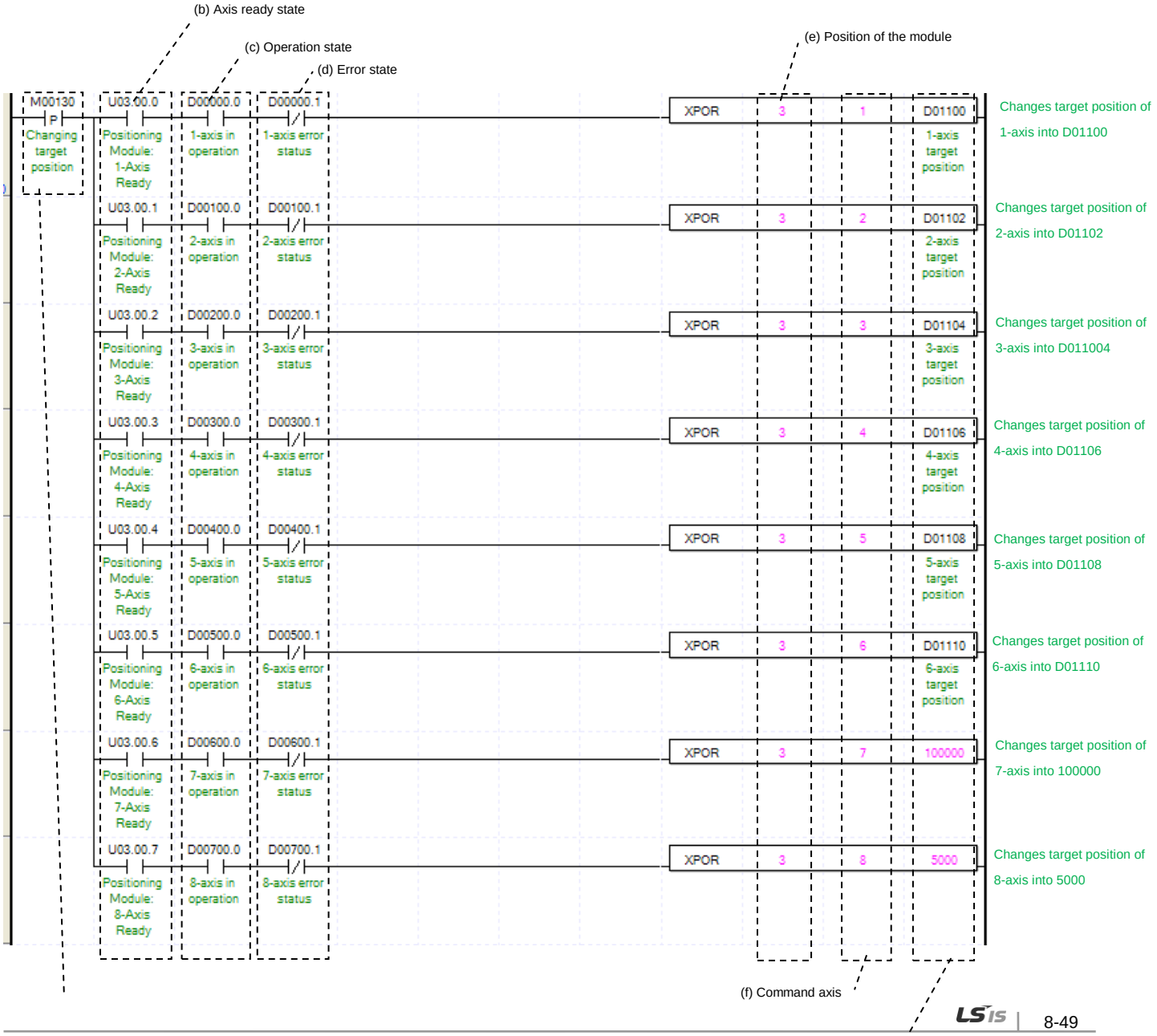
(e) Address of Positioning Module
In this example, Positioning Module installed at the slot no.3 of 0 bases.

(f) Axis of command execution
You can set an axis for Speed Override. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Speed Override, you can set a value for axis 1 through 8 axes.

(g) Value Change for Speed Operation
Setting Value Change for Speed Operation. According to Speed Override from common parameters, it is a signal of “%” or “Speed Value” depends on setting of category. Also, when Speed Override set as Speed Value, it means Unit/Time depends on Speed Command Unit from basic parameters, or it means “rpm.” If a changing Operation Speed Value is “%,” then the unit would be [$X10^{-2}$%]. If it is “rpm, “then the unit would be $X10^{-1}$rpm].

(h) For more information, reference of Speed Override is in the “Chapter 9.5.5.”

(2) Position Override



(a) Condition for position override

(g) Target position value to change

(a) Condition of Position Override
Condition of Position Override Command (XPOR)

(b) Axis ready status
If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.

(c) Operating state by axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Position Override while it is running, the “error 361” would be appeared.

(d) Error state for each axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

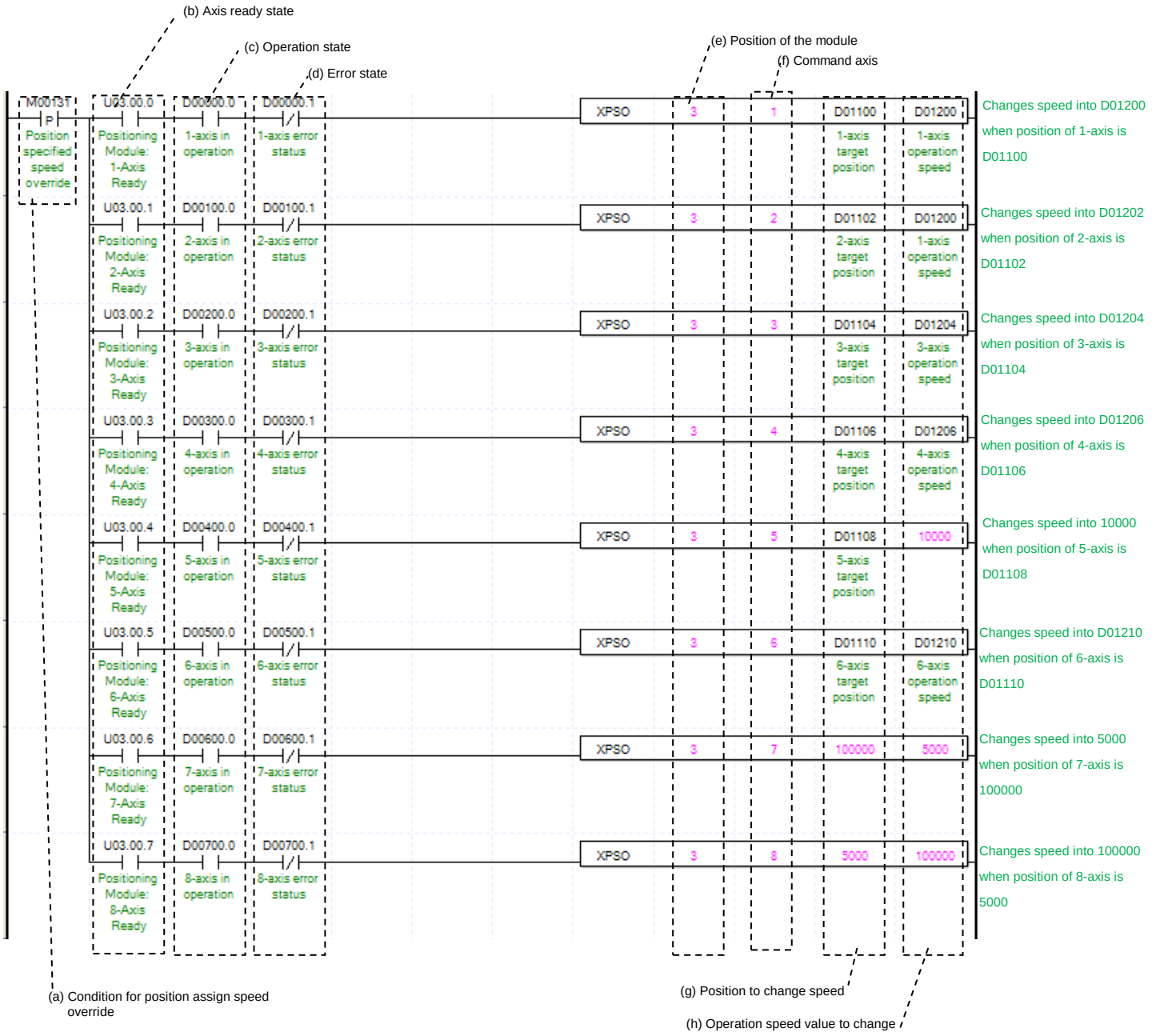
(e) Address of Positioning Module
In this example, Positioning Module installed at the slot no.3 of 0 bases.

(f) Axis of command execution
You can set an axis for Position Override. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Position Override, you can set a value for axis 1 through 8 axes.

(g) Change for Goal Position Value
Setting Value Change for Goal Position Value. The unit of this value depends on “Unit” category. Once Position Override commands are executed, the goal position of executed axis will be changed to set goal position.

(h) For more information, reference of Position Override is in the “Chapter 9.5.4.”

(3) Position Assign Speed Override



(a) Condition of Position Assign Speed Override
Condition of Position Assign Speed Override Command (XPSO)

(b) Axis ready status
If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.

(c) Operating state by axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Position Assign Speed Override while it is running, the “error 381” would be appeared.

(d) Error state for each axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Address of Positioning Module
In this example, Positioning Module installed at the slot no.3 of 0 bases.

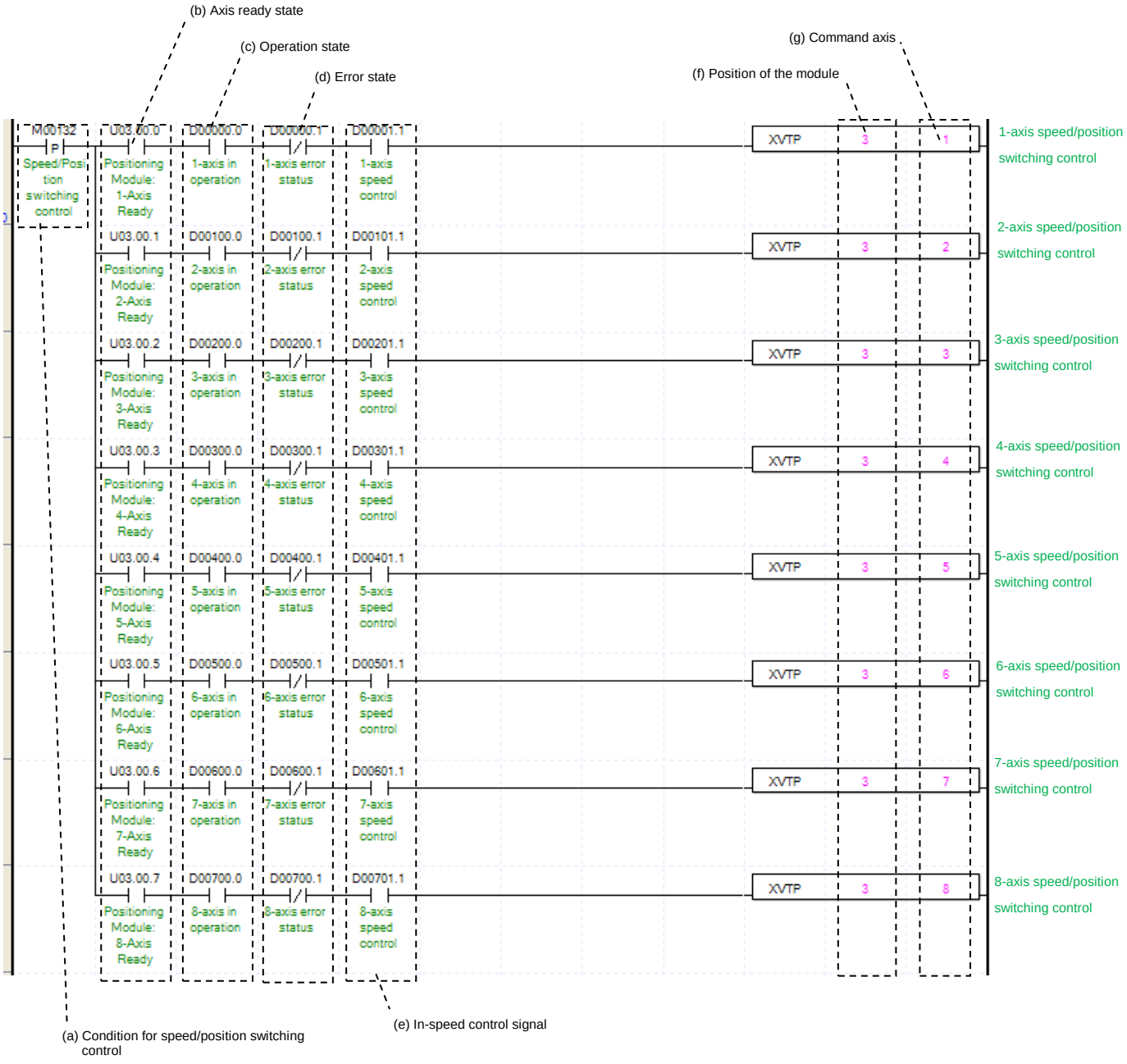
(f) Axis of command execution
You can set an axis for Position Assign Speed Override. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Position Assign Speed Override, you can set a value for axis 1 through 8 axes.

(g) Position of Speed Change Execution
Setting position of Speed Change. Once the actual position located at set position with speed override command running, the speed change commands are executed.

(h) Value Change for Operation speed
Setting Value Change for Operation speed. According to Speed Override from common parameters, it is a signal of “%” or “Speed Value” depends on setting of category. Also, when Speed Override set as Speed Value, it means Unit/Time depends on Speed Command Unit from basic parameters, or it means “rpm.” If a changing Operation Speed Value is “%,” then the unit would be [$X10^{-2}$%]. If it is “rpm, “then the unit would be $X10^{-1}$rpm].

(i) For more information, reference of Position Assign Speed Override is in the “Chapter 9.5.6.”

(4) Speed/Position Switching Control



(a) Condition of Speed/Position Switching Control
Condition of Speed/Position Switching Control Command (XVTP)

(b) Axis ready status
If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.

(c) Operating state by axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Speed/Position Switching Control while it is running, the “error 301” would be appeared.

(d) Error state for each axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Signal from Speed Control by each Axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Speed Control state” for each axis. It turns on when it is operating. Speed/Position Switching Control Setting can only be configured while it is running. If you execute Speed/Position Switching Control while it is not running, the “error 302” would be appeared.

(f) Address of Positioning Module

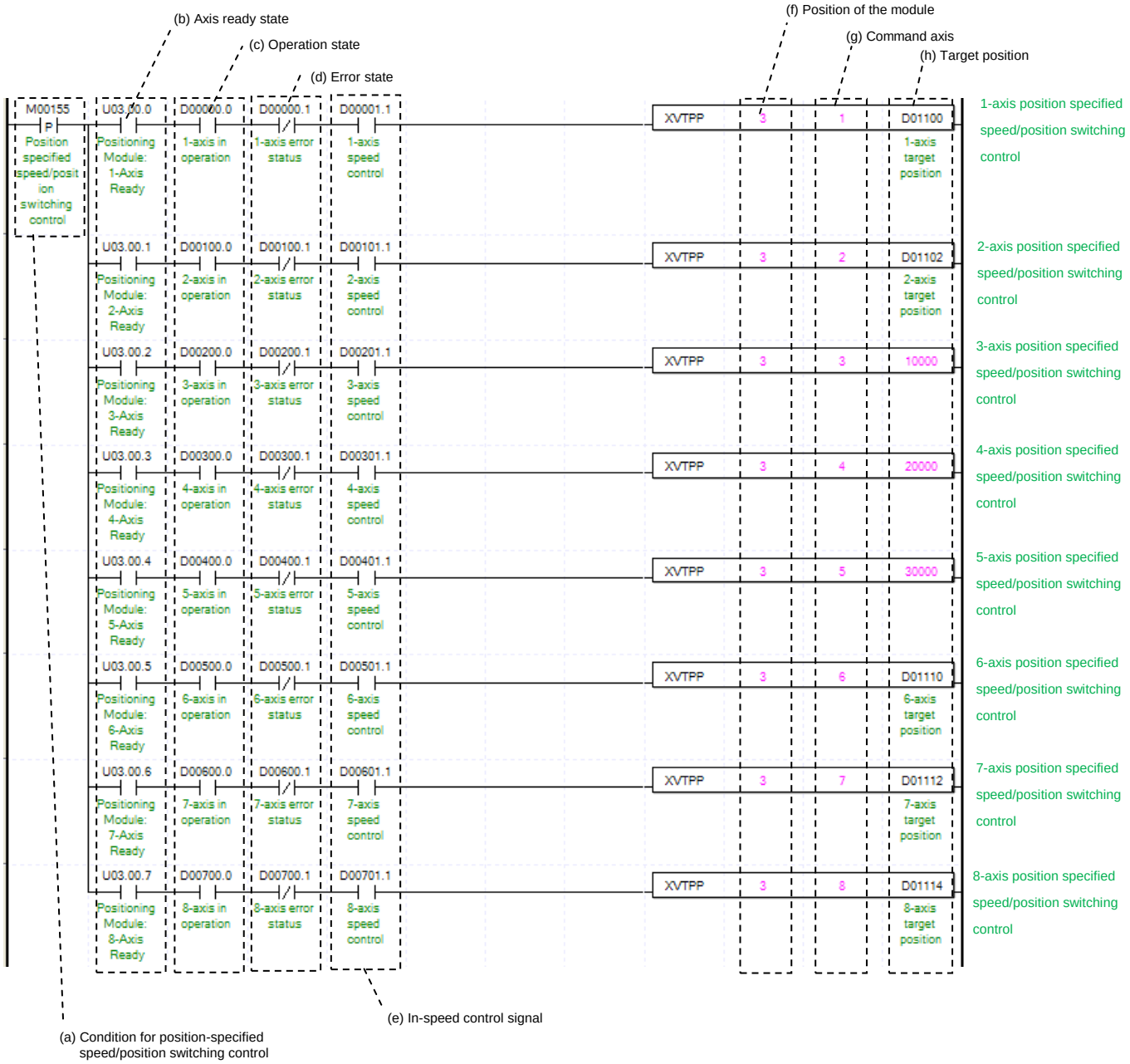
In this example, Positioning Module installed at the slot no.3 of 0 bases.

(g) Axis of command execution

You can set an axis for Speed/Position Switching Control. XGF-PN8A/B series supports for 8 axes. In the “execution of axis” from the configuration of Speed/Position Switching Control, you can set a value for axis 1 through 8 axes.

(h) For more information, reference of Speed/Position Switching Control is in the “Chapter 9.2.14.”

(5) Position-specified Speed/Position Control Switching



(a) Condition to perform “position-specified speed/position switching control”
Condition to perform control command (XVTPP) for position-specified speed/position switching

(b) Axis ready status
If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.

(c) Operation state for each axis
In case that an example program of“8.1.2 Read Current State” is applied, it is a signal showing that each axis is “operating.” If a relevant axis is running, it becomes ‘On’. A condition has been set to make the control command for position specified speed/position switching valid only when the relevant axis is running. If the control command for position specified switching is carried out when the relevant axis is not running, No.301 Error will take place.

(d) Error State for each axis

In case that an example program of"8.1.2 Read Current State" is applied, it is a signal showing "Error State" for each axis. If any error takes place, it becomes 'On'. A condition has been set to perform a control command only when there is no error with the relevant axis. If the user wants to execute a command regardless of the occurrence of errors, he/she may remove this condition.

(e) Speed Control Signal for each axis

In case that an example program of"8.1.2 Read Current State" is applied, it is a signal showing each axis is "controlling its speed." If the relevant axis is running under speed control, it becomes 'On.' A condition has been set to make the control command for position specified speed/position switching control valid only when the relevant axis is in a speed control status. If the control command is carried out when the relevant axis is not in a speed control status, No.302 Error will take place.

(f) Position of a module

For the example program above, it is assumed that positioning modules are installed on NO.0 Base and No. 3 Slot.

(g) Axis to make a command

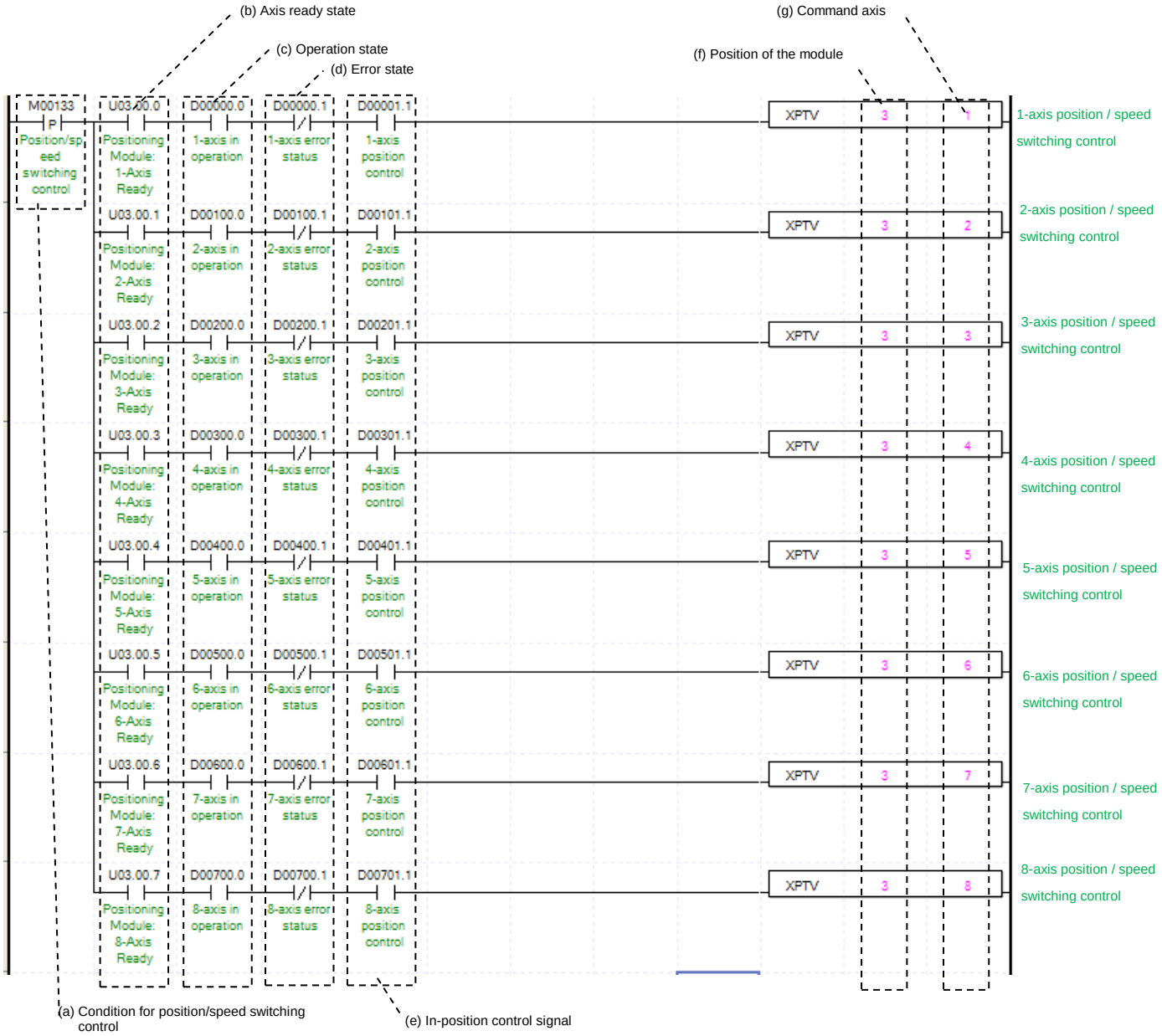
Decide an axis that will execute the control command. XGF-PA8A/B can control up to 8 axes and assign 1 through 8 referring to 1-axis through 8-axis for this item.

(h) Transfer amount

After the control command for position specified speed/position control switching is executed, convert from speed control to position control and moves by transfer amount.

(i) For details on the operation of position specified speed/position switching control, refer to "position specified speed/position switching control"

(6) Position/ Speed Switching Control



(a) Condition of Position/ Speed Switching Control

Condition of Position/ Speed Switching Control Command (XPTV)

(b) Axis ready status

If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.

(c) Operating state by axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Position/ Speed Switching Control while it is running, the “error 311” would be appeared.

(d) Error state for each axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Signal from Position Control by each Axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Position Control state” for each axis. It turns on when it is operating. Position/ Speed Switching Control Setting can only be configured while it is running. If you execute Position/Speed Switching Control while it is not running, the “error 317” would be appeared.

(f) Address of Positioning Module

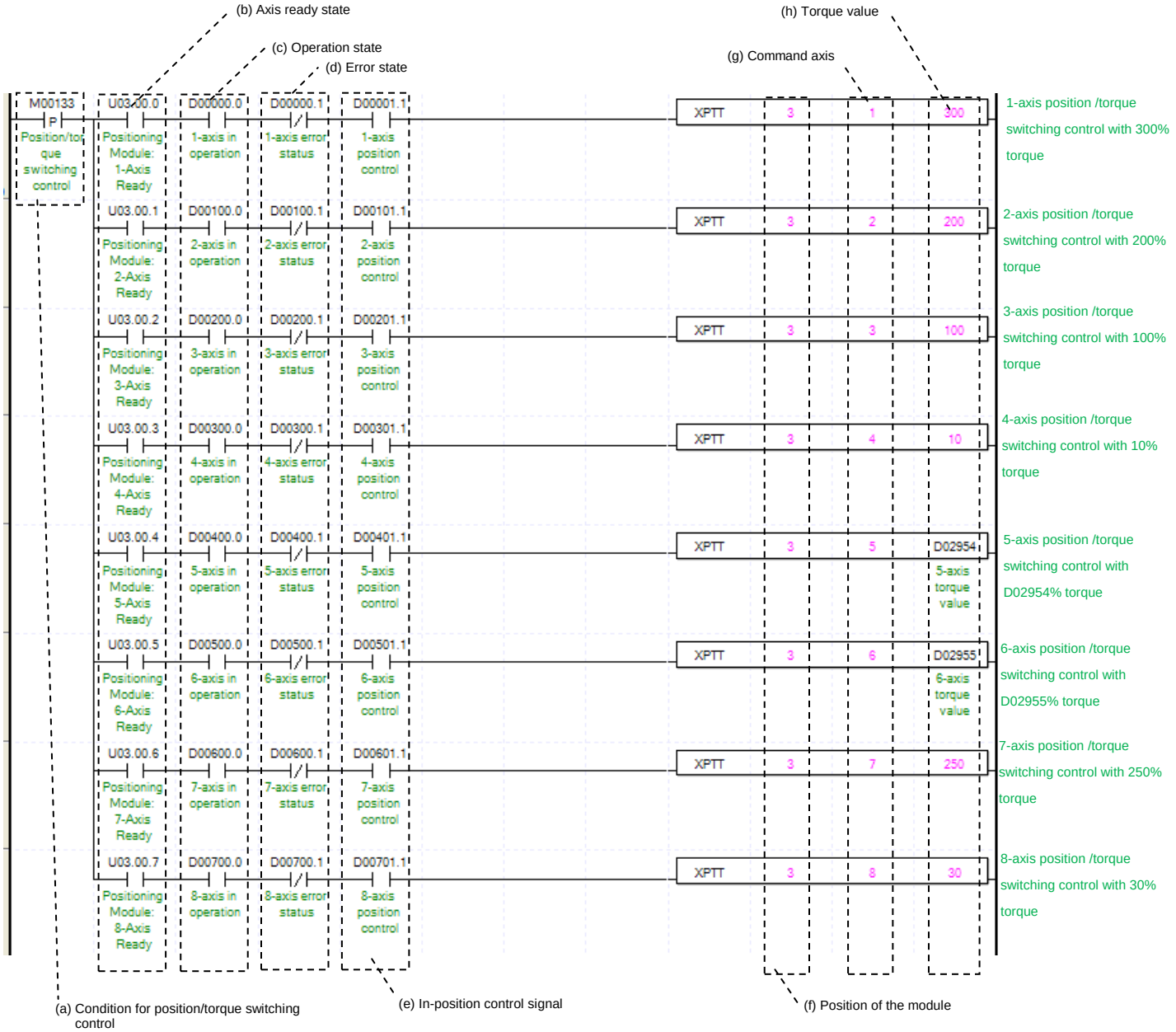
In this example, Positioning Module installed at the slot no.3 of 0 bases.

(g) Axis of command execution

You can set an axis for Position/ Speed Switching Control. XGF-PN8A series supports for 8 axes. In the “execution of axis” from the configuration of Position/ Speed Switching Control, you can set a value for axis 1 through 8 axes.

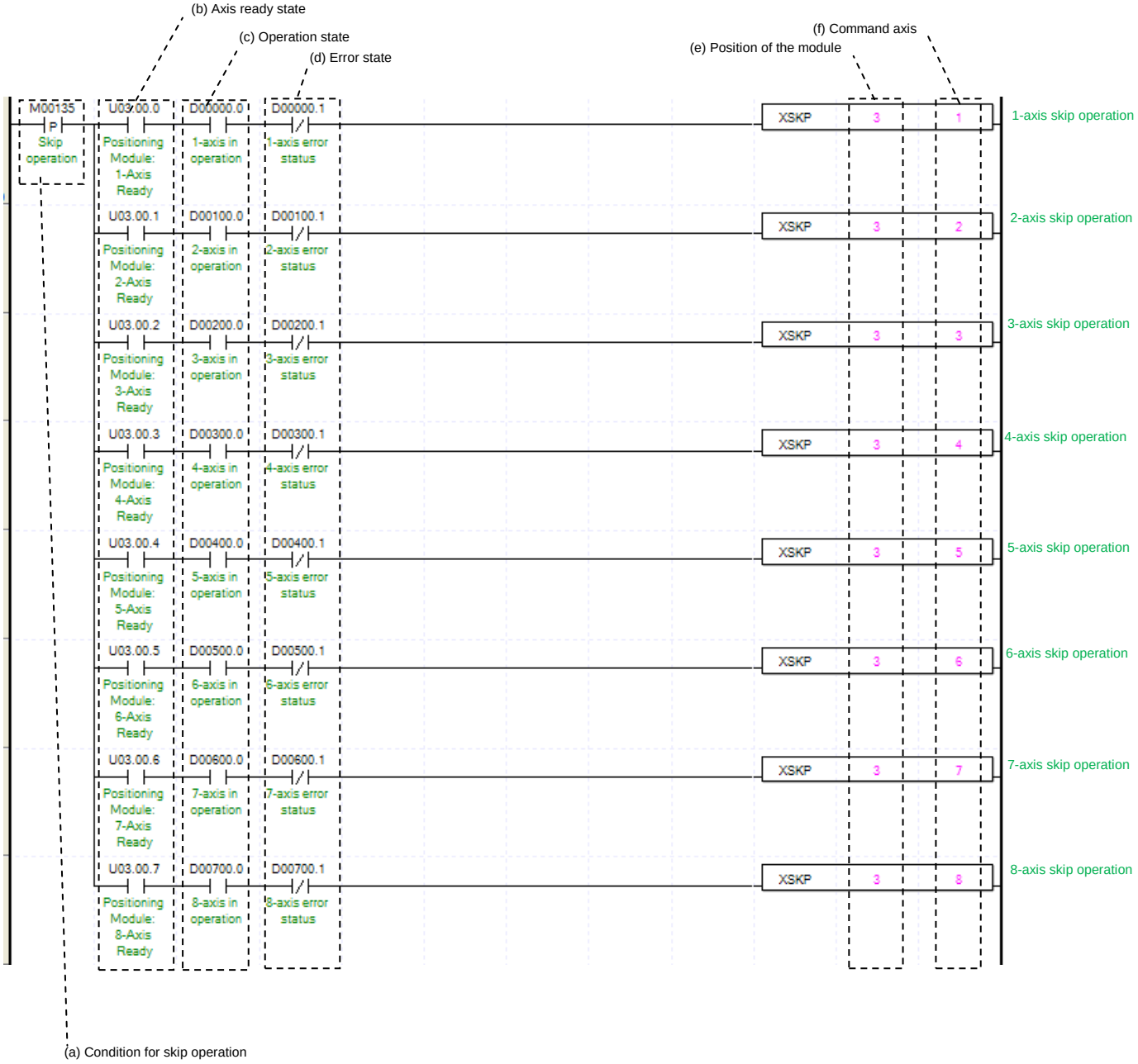
(h) For more information, reference of Position/ Speed Switching Control is in the “Chapter 9.2.15.”

(7) Position/Torque Switching Control



(a) Condition of Position/ Torque Switching Control
Condition of Position/ Torque Switching Control Command (XPTT)
(b) Axis ready status
If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.
(c) Operating state by axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Position/ Toque Switching Control while it is running, the “error 561” would be appeared.
(d) Error state for each axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.
(e) Signal from Position Control by each Axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Position Control state” for each axis. It turns on when it is operating. Position/ Torque Switching Control Setting can only be configured while it is running. If you execute Position/Torque Switching Control while it is not running, the “error 317” would be appeared.
(f) Address of Positioning Module
In this example, Positioning Module installed at the slot no.3 of 0 bases.
(g) Axis of command execution
You can set an axis for Position/ Torque Switching Control. XGF-PN8A/B series supports for 8 axes. In the “execution of axis” from the configuration of Position/ Torque Switching Control, you can set a value for axis 1 through 8 axes.
(h) It sets torque value. After position/torque switching command, it operates with that torque value. Range is -32768~32767%.
(i) For more information, reference of Position/ Torque Switching Control is in the “Chapter 9.2.15.”

(8) Skip Operation



(a) Condition of Skip Operation

Condition of Skip Operation Command (XSKP) Once Skip Operation is executed, current operation step is stop and will go to operate with next step.

(b) Axis ready status

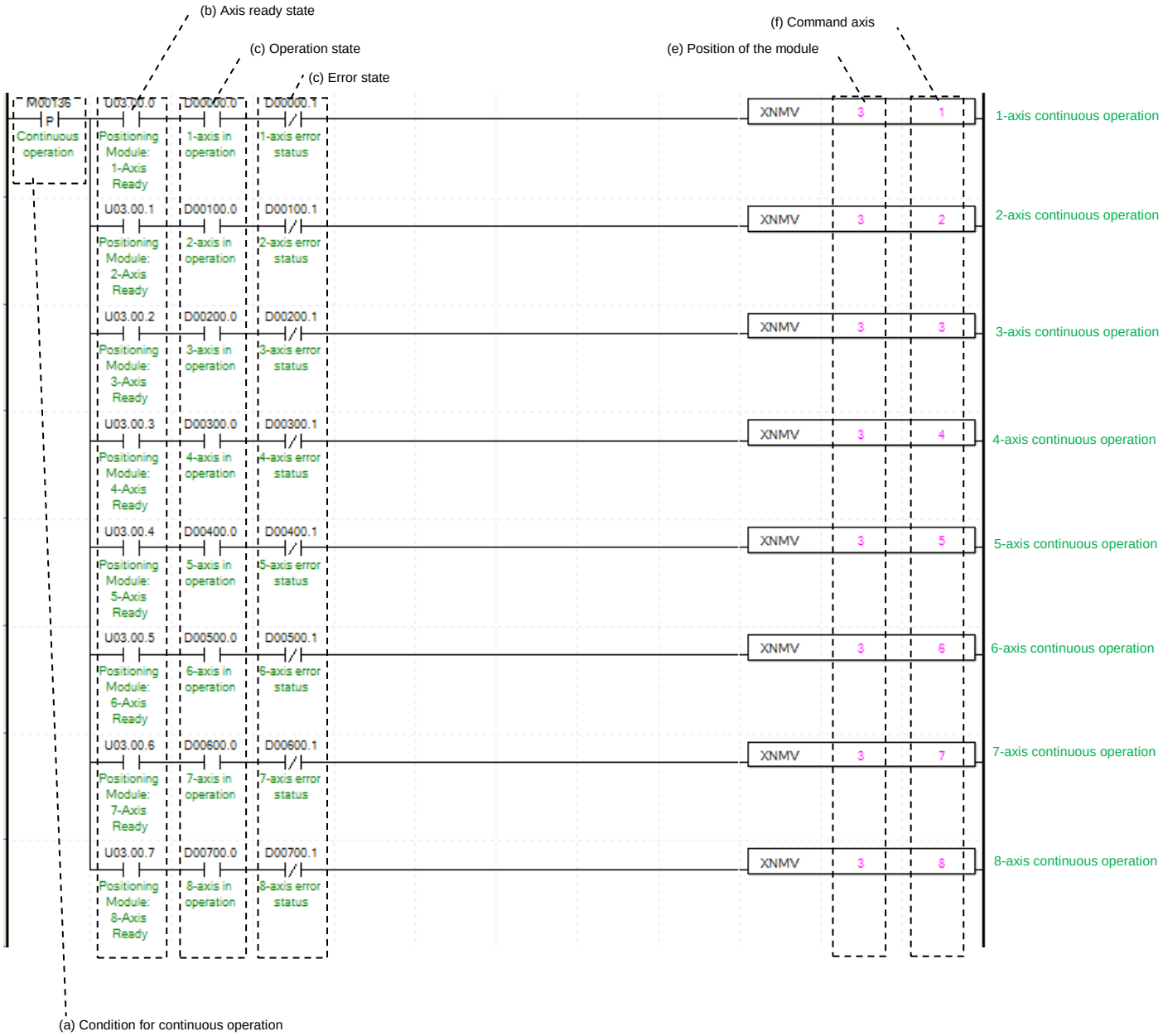
If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.

(c) Operating state by axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Skip Operation while it is running, the “error 331” would be appeared.

(d) Error state for each axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.
(e) Address of Positioning Module
In this example, Positioning Module installed at the slot no.3 of 0 bases.
(f) Axis of command execution
You can set an axis for Skip Operation. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Skip Operation, you can set a value for axis 1 through 8 axes.
(g) For more information, reference of Skip Operation is in the “Chapter 9.5.3”.

(9) Continuous Operation



(a) Condition of Continuous Operation
Condition of Continuous Operation Command (XNMV). Once Continuous Operation is executed, current operation step and next operation step would be operated continuously.

(b) Axis ready status

If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.

(c) Operating state by axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Continuous Operation while it is running, the “error 391” would be appeared.

(d) Error state for each axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Address of Positioning Module

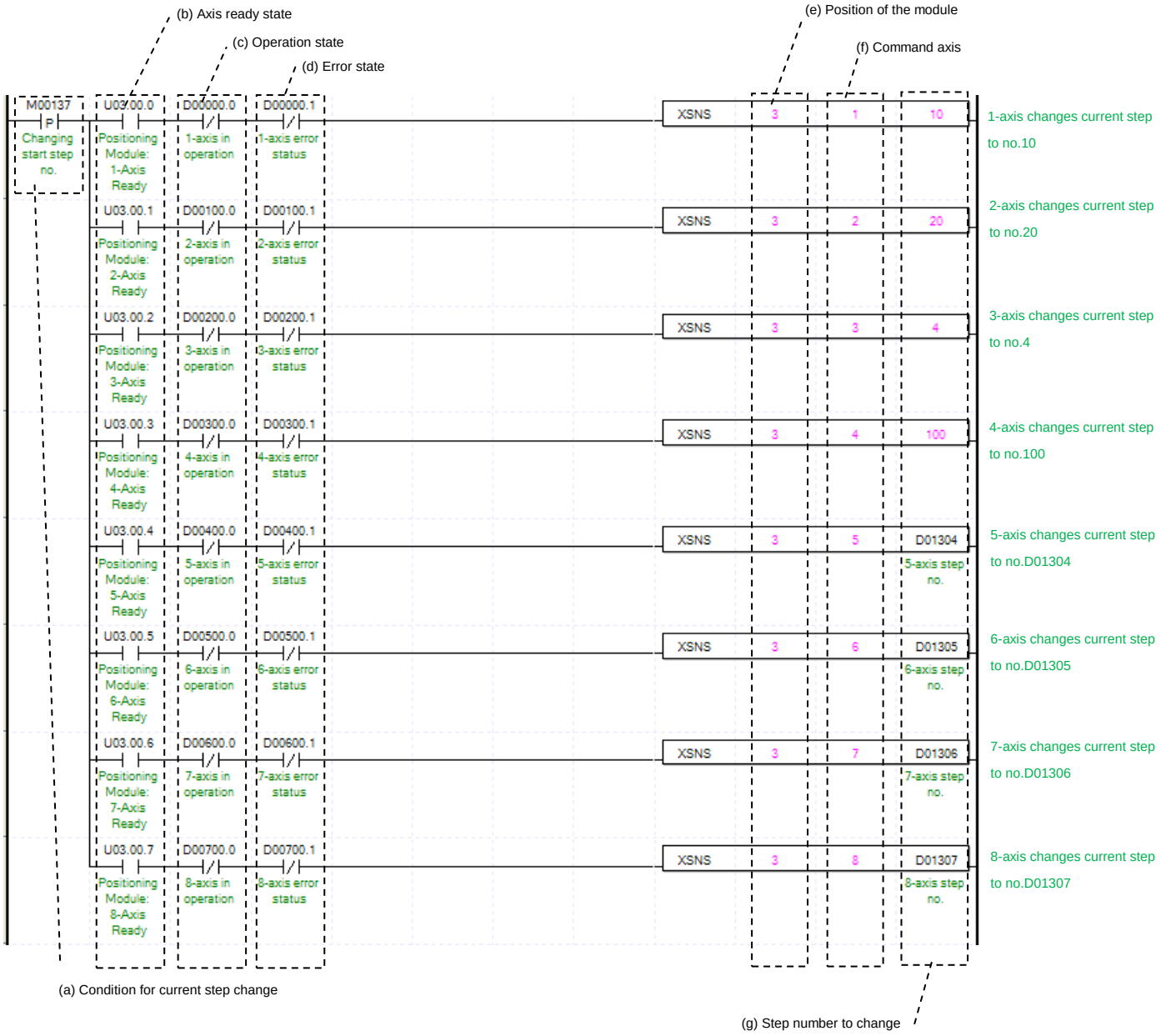
In this example, Positioning Module installed at the slot no.3 of 0 bases.

(f) Axis of command execution

You can set an axis for Continuous Operation. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Continuous Operation, you can set a value for axis 1 through 8 axes.

(g) For more information, reference of Continuous Operation is in the “Chapter 9.5.2”.

(10) Current Step Change (Start Step Number Change)



(a) Condition of Current Step Change

Condition of Current Step Change Command (XSNS). Once Current Step Change is executed, current operation step will move set step.

(b) Axis ready status

If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.

(c) Operating state by axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Current Step Change while it is running, the “error 441” would be appeared.

(d) Error state for each axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

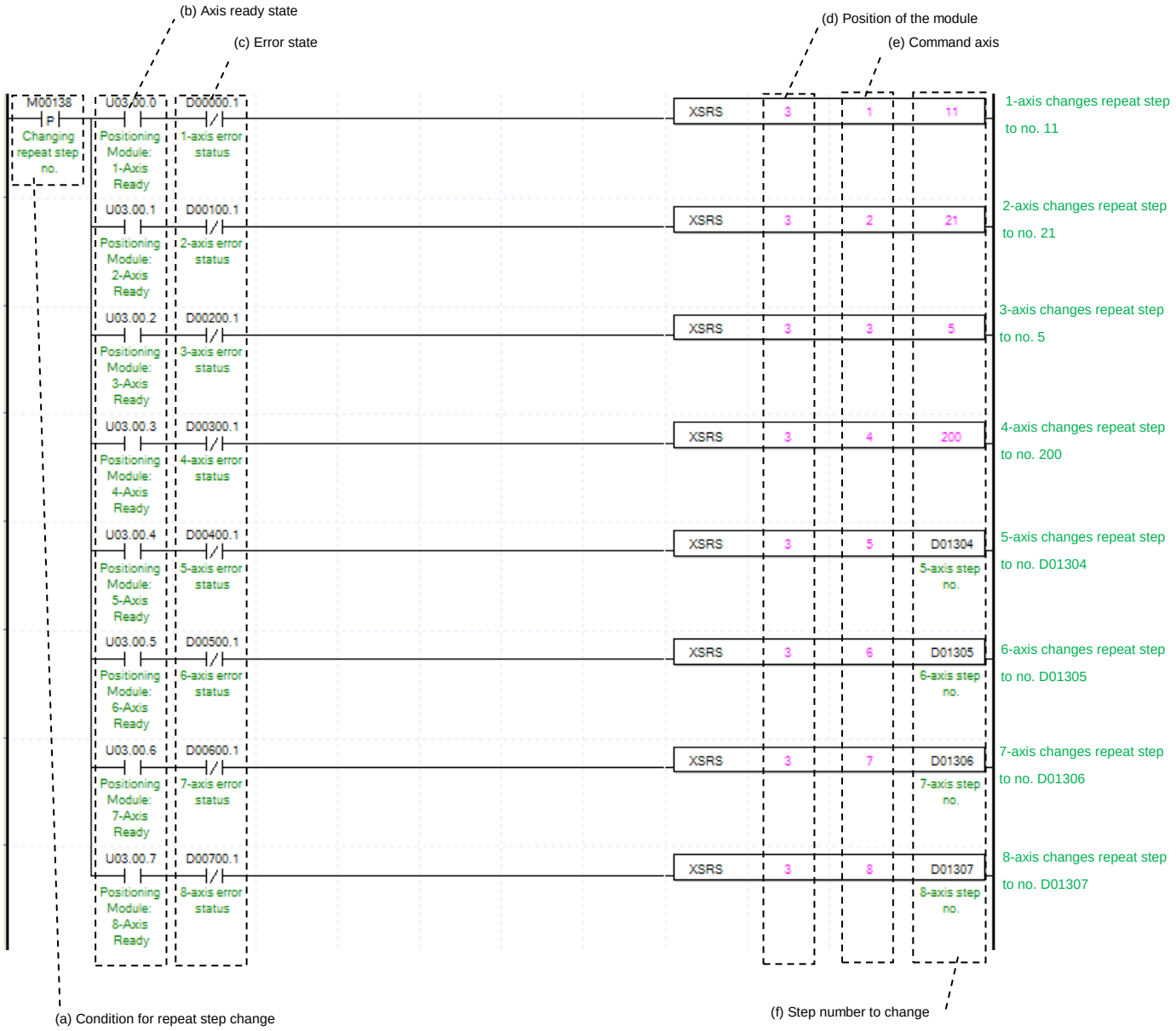
(e) Address of Positioning Module
In this example, Positioning Module installed at the slot no.3 of 0 bases.

(f) Axis of command execution
You can set an axis for Current Step Change. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Current Step Change, you can set a value for axis 1 through 8 axes.

(g) Change Step Number
Set change step number by Current Step Change. XGF series support 400 step operation data for each Axis. Therefore, the range of step number setting of Current Step Change is 1~400.

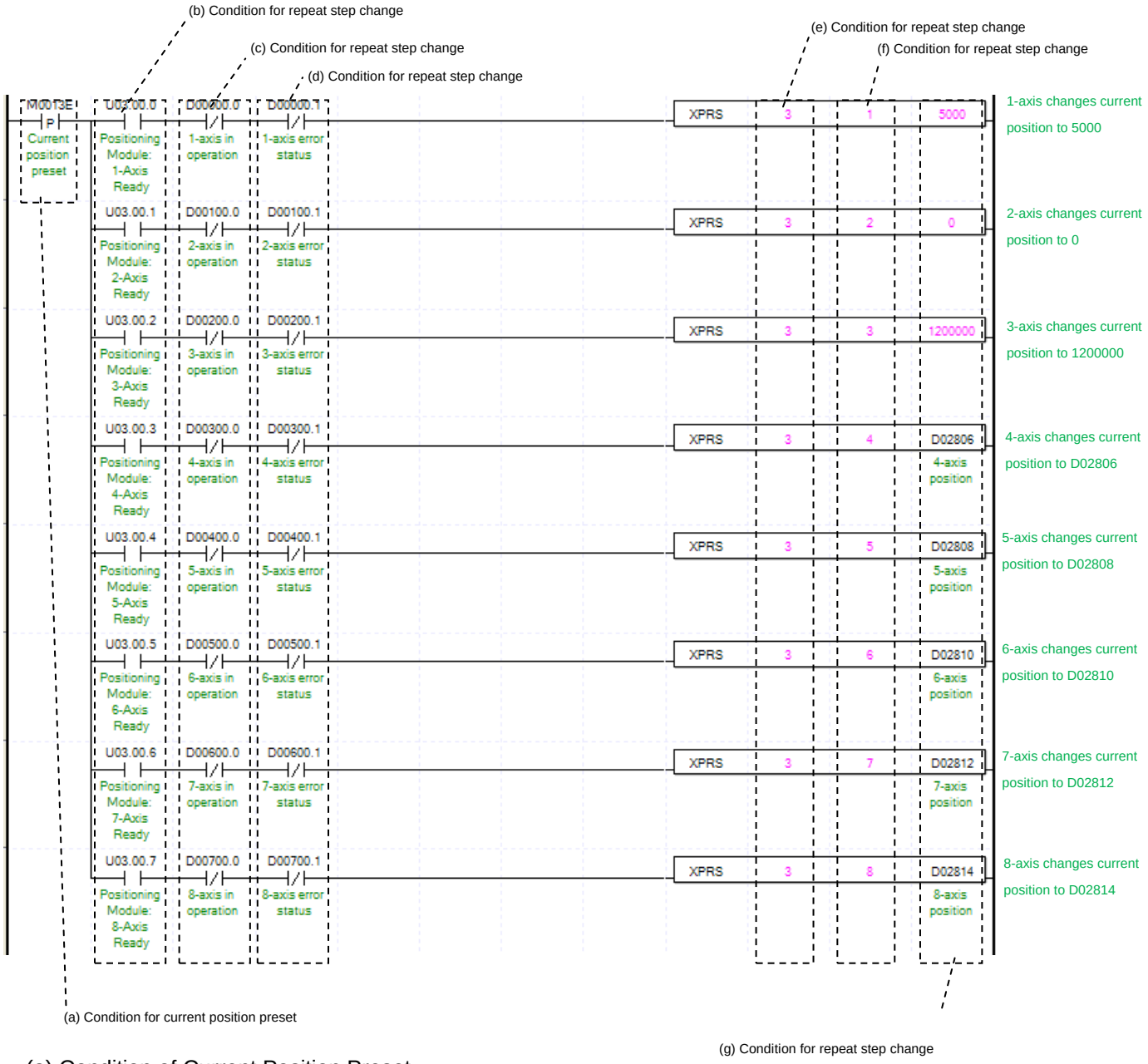
(h) For more information, reference of Current Step Change is in the “Chapter 9.5.9.”

(11) Repeat Step No. Change



(a) Condition of Repeat Step No. Change
Condition of Repeat Step No. Change Command (XSRS). Once Repeat Step No. Change is executed, current operation step will move set step. It will execute an operation when set of Operation Method is “Repeat.”
(b) Axis ready status
If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.
(c) Error state for each axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.
(d) Address of Positioning Module
In this example, Positioning Module installed at the slot no.3 of 0 bases.
(e) Axis of command execution
You can set an axis for Repeat Step No. Change. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Repeat Step No. Change, you can set a value for axis 1 through 8 axes.
(f) Change Step Number
Set change step number by Current Step Change. XGF-PN8A support 400 step operation data for each Axis. Therefore, the range of step number setting of Current Step Change is 1~400.
(g) For more information, reference of Repeat Step No. Change is in the “Chapter 9.5.10.”

(12) Current Position Preset



(a) Condition of Current Position Preset

Condition of Current Position Preset Command (XPRS). Once Current Position Preset is executed, current operation step will move to set step. If the origin has not set yet, the origin would be set to origin decided.

(b) Axis ready status

If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.

(c) Operating state by axis

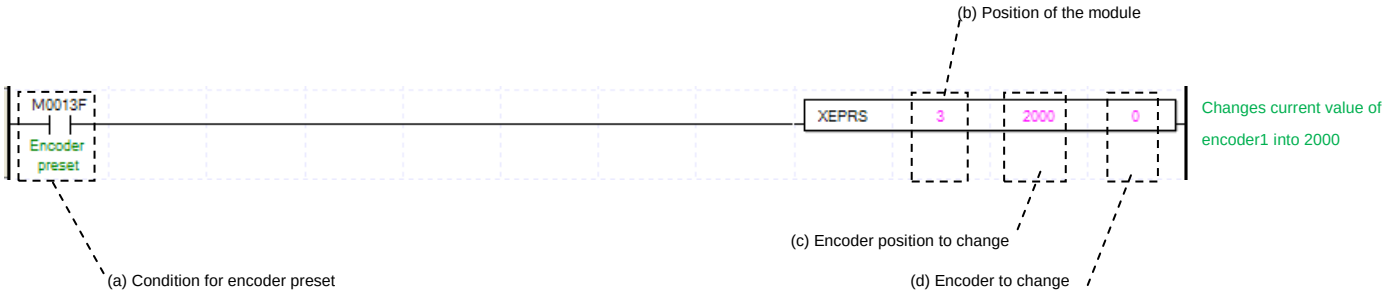
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Current Position Preset while it is running, the “error 451” would be appeared.

(d) Error state for each axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

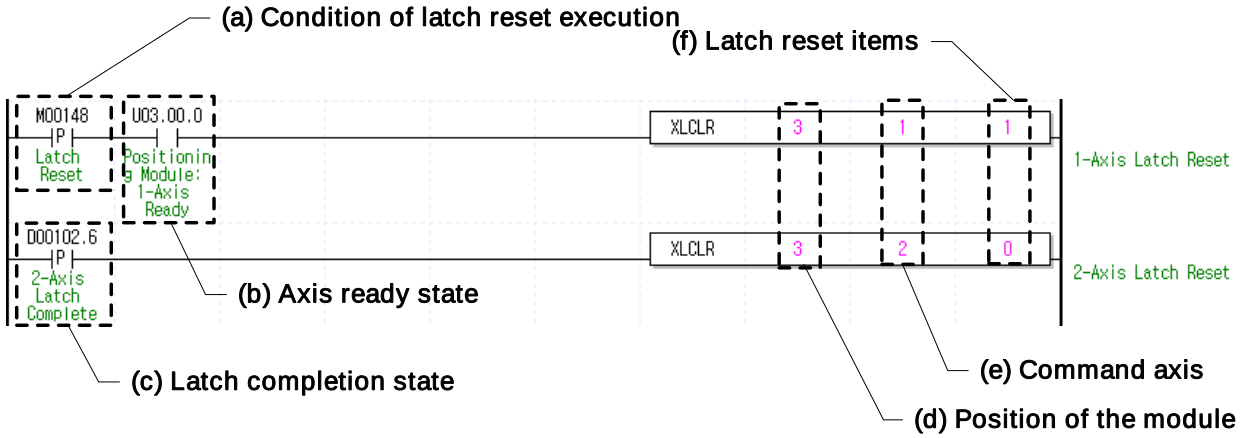
(e) Address of Positioning Module
In this example, Positioning Module installed at the slot no.3 of 0 bases.
(f) Axis of command execution
You can set an axis for Current Position Preset. XGF-PN8A/B series supports for 8 axes. In the “execution of axis” from the configuration of Current Position Preset, you can set a value for axis 1 through 8 axes.
(g) Change Current Position
Set change current position by Current Position Preset. Unit follows the value from “Unit” of basic parameter.
(h) For more information, reference of Current Position Preset is in the “Chapter 9.5.7.”

(13) Encoder Preset



(a) Condition of Encoder Preset
Condition of Encoder Preset Command (XEPRS). Once Encoder Preset is executed, current operation step will move to set step.
(b) Address of Positioning Module
In this example, Positioning Module installed at the slot no.3 of 0 bases.
(c) Changing Encoder Position
Set for Changing Encoder Position
(d) Changing Encoder
Set Changing Encoder to execute a preset. “0” means “Encoder1” and “1” means “Encoder2”
(e) For more information, reference of Encoder Preset is in the “Chapter 9.5.8.”

(14) Reset Latch



(a) Conditions to Reset Latch
Conditions to implement the Reset Latch command (XLCLR). In case of Axis 1, the Reset Latch command is implemented as soon as M00148 (Reset Latch) is On after the axis is connected to the network.
(b) Preparation for each axis
If communication with the servo drive connected to positioning module is normally conducted, the corresponding signal to the connected axis is On. In the example program, the Reset Latch command is implemented as soon as M00148(Reset Latch) is On after the axis connected with servo since Axis 1 preparation state (Uxx.00.0) is used.

(c) Latch Completion

It is the state of “Latch Completion” when an example program of“8.1.2 Read the Current Sate.”It is on when latch is completed once external latch command signal of the relevant axis is inputted. In case of Axis 2, the Reset Latch item is implemented as soon as D00102.6 (Latch Completion state) is On. To read latch data every time when latch is completed upon the input of the axis’s external latch command signal, program to set latch completion as a condition for the Reset Latch command after implementing the Latch Position Data Read command.

(d) Address of Positioning Module

In this example, Positioning Module installed at the slot no.3 of 0 bases.

(e) Axis of command execution

You can set an axis for Reset Latch. XGF-PN8A/B series supports for 8 axes. In the “execution of axis” from the configuration of Reset Latch, you can set a value for axis 1 through 8 axes.

(f) Latch Reset item

The following items are reset according to the Latch Reset item.

0: Reset the state when latch is completed

1: Latch position data Reset and the latch completion state Reset

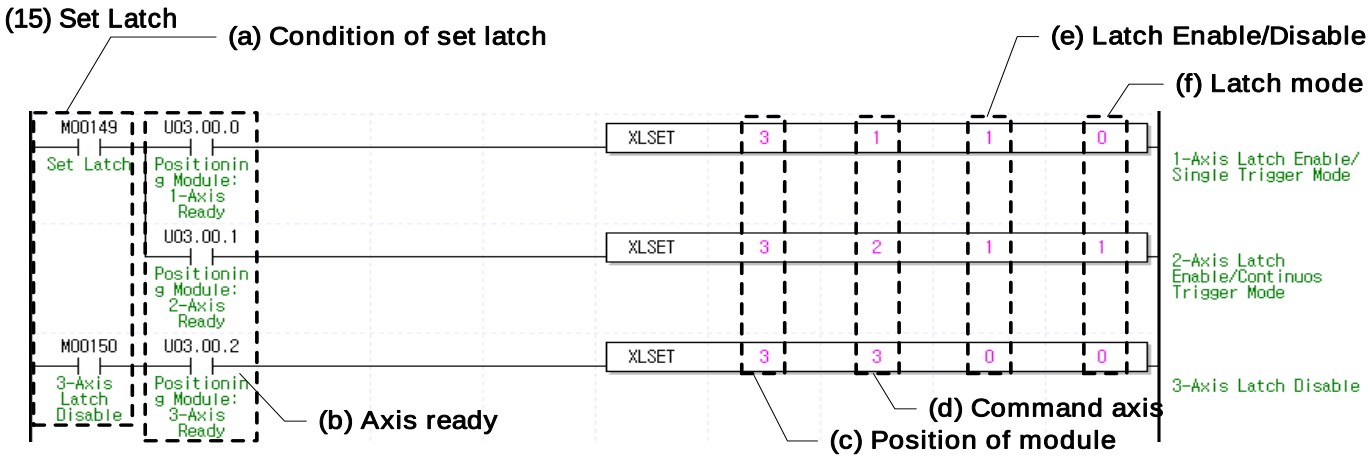
In the example program, latch position data and latch completion are reset for Axis 1 and only latch completion is reset for Axis 2 when implementing the Latch Reset command.

Note

Two latch modes are supported for XGF-PN8B module. In case that a single trigger from two latch modes is set, ensure latch function to perform through the second touch probe 1 signal after the first touch probe 1 signal is inputted and latched and latch reset command is completed.

That is, in XGF-PN8B module’s latch single trigger mode, the Reset Latch command will execute a function to activate the next latch trigger after the touch probe 1 signal is inputted and the latch location is saved.

(Even if the Set Latch command is re-executed after it is set as latch permission, it will work in the same way)



(a) Conditions to Set Latch

Conditions to implement the Latch Set command (XLSET). The Set Latch command is implemented on Axis 1 and 2 as soon as M00149(Set Latch) is On after the axis is connected to the network and it is implemented on Axis 3 as soon as M00150(3-Axis Latch Disable) is On.

(b) Preparation for each axis

If communication with the servo drive connected to the positioning module is normally conducted, the corresponding signal to the connected axis is On. In the example program, the Set Latch command is implemented as soon as the condition to Set Latch is On after the axis connected with servo since Axis 1 Ready (Uxx.00.0) is used.

(c) Address of Positioning Module

In this example, Positioning Module installed at the slot no.3 of 0 bases.

(d) Axis of command execution

You can set an axis for Set Latch. XGF-PN8B series supports for 8 axes. In the “execution of axis” from the configuration of Set Latch, you can set a value for axis 1 through 8 axes, can be set to “Axis to which Command is executed” item of the Latch Set command(XLSET).

(e) Latch Enable/Disable item

Actions according to the designated Latch Enable/Disable item are as following:

0: latch disable

1: latch enable

In the example program, latch is enabled for Axis 1 and 2 while it is disabled for Axis 3.

(f) Latch Mode Item

Actions according to the designated latch mode item are as following:

0: Single trigger (The current position latch is available only the touch probe 1 signal inputted at first after latch is permitted)

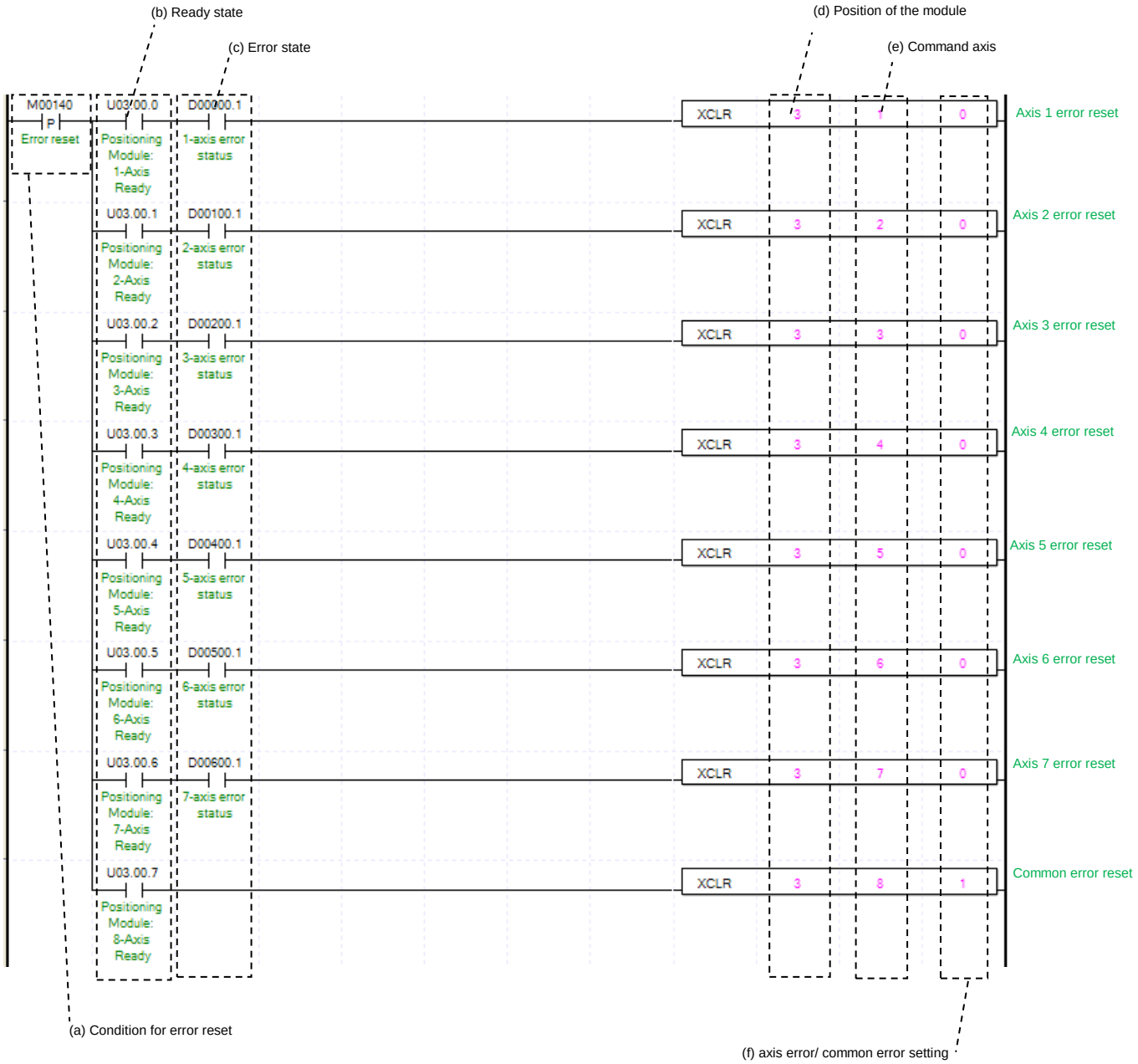
1: Continuous trigger (The current position latch is available at every touch probe 1 signal after latch is permitted)

In the example program, Axis 1 is set in the single trigger mode while Axis 2 is set in the continuous trigger mode when implementing the Set Latch command.

(g) The Set Latch command is only used for XGF-PN8B.

8.1.8 Error

(1) Error Reset



(a) Condition of Error Reset

Condition of Error Reset Command (XCLR). Once Error Reset is executed, it erases errors of module form each axis.

(b) Axis ready status

If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.

(c) Error state for each axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(d) Address of Positioning Module

In this example, Positioning Module installed at the slot no.3 of 0 bases.

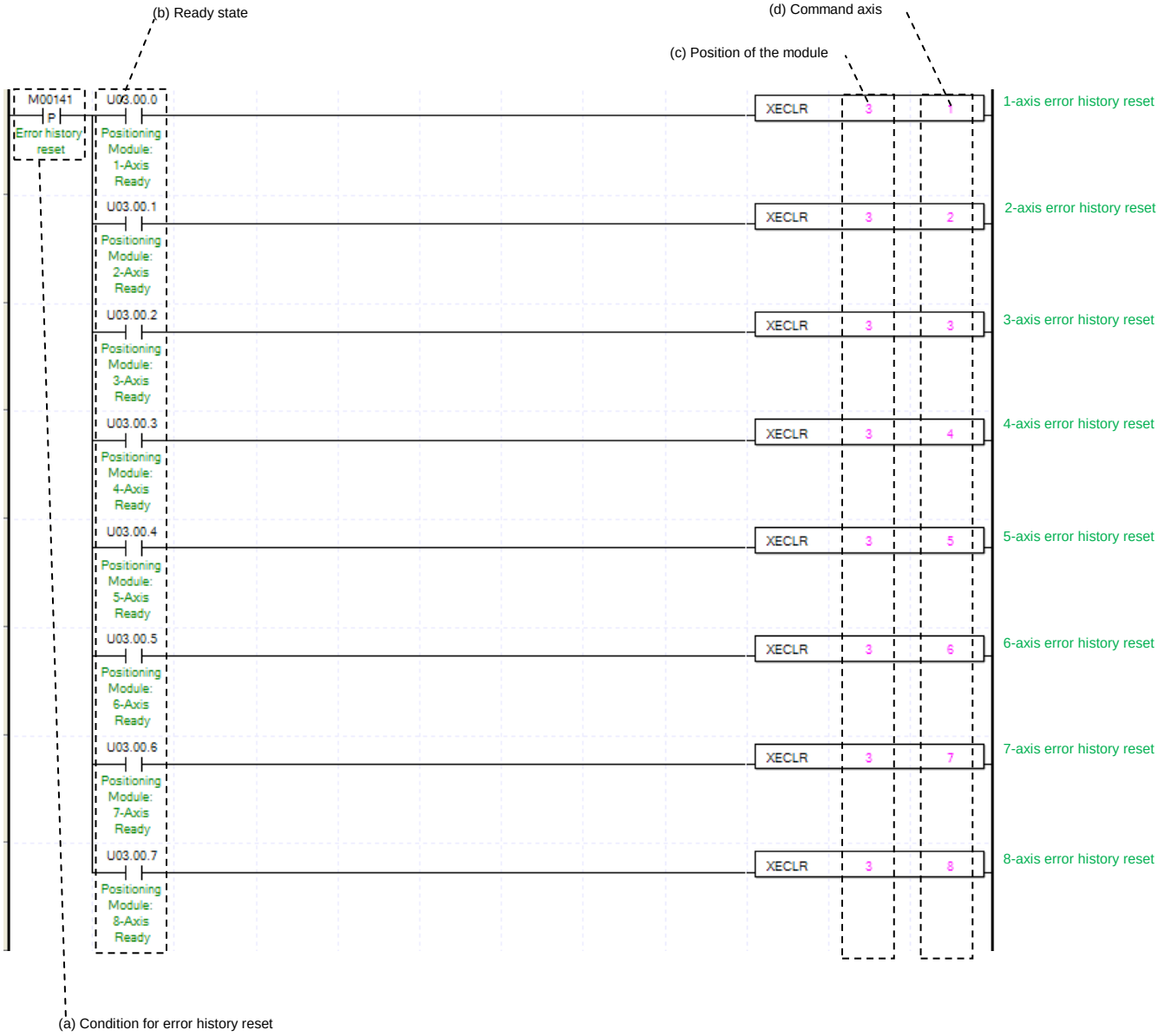
(e) Axis of command execution

You can set an axis for Error Reset. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Error Reset, you can set a value for axis 1 through 8 axes.

(f) Error setting of Error/Common by axis

If this is set as “0”, it will delete the axis error occurred during execution of command and if this is set as “1”, it will delete the error commonly occurred at common parameter or communication error.

(2) Error History Reset



(a) Condition of Error History Reset

Condition of Error History Reset Command (XECLR). Once Error Reset is executed, it erases history of generated errors of module. XGF series has ten error histories by each axis. It will be saved to FRAM, remain still even there is no power.

(b) Axis ready status

If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.

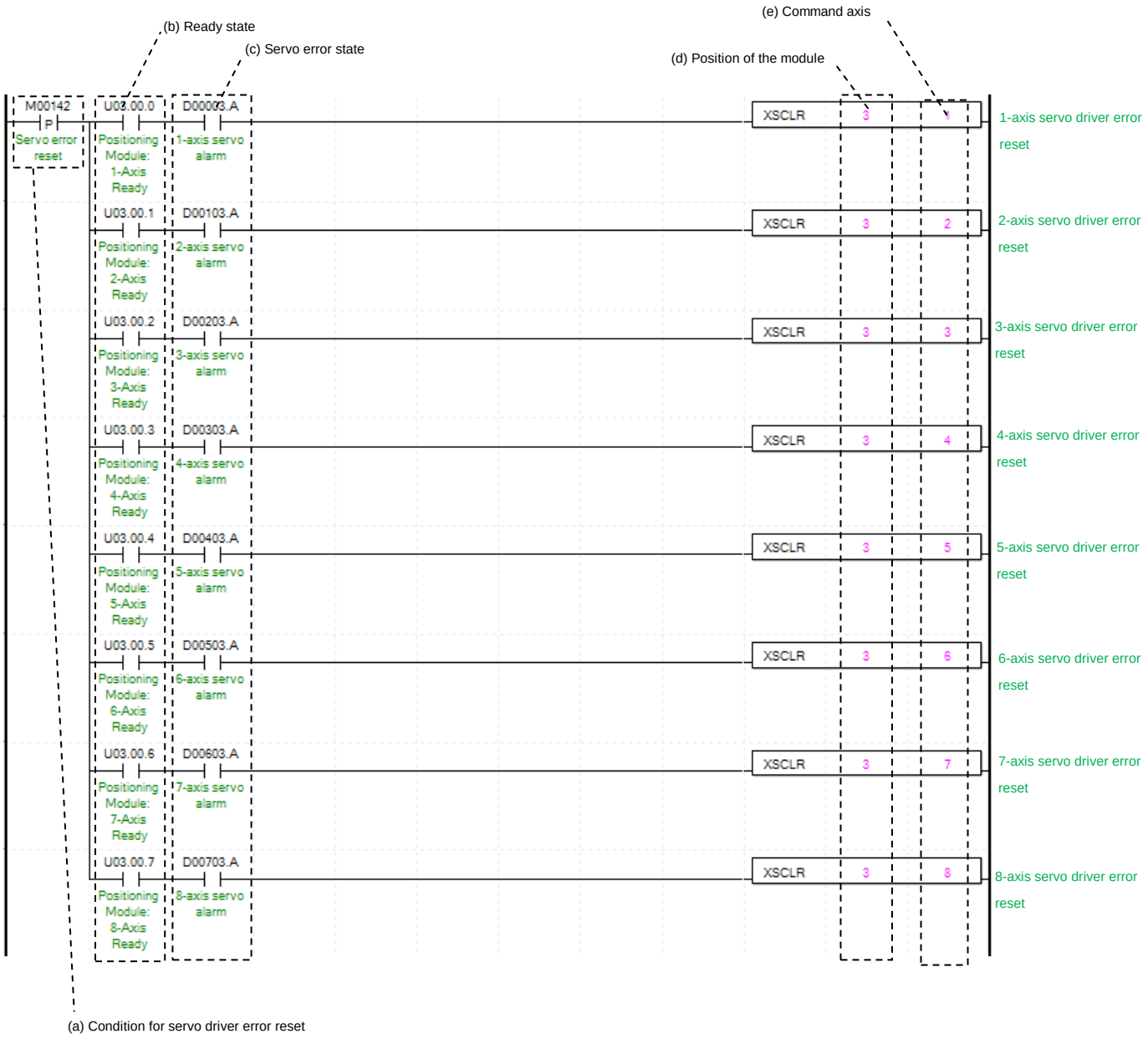
(c) Address of Positioning Module

In this example, Positioning Module installed at the slot no.3 of 0 bases.

(d) Axis of command execution

You can set an axis for Error History Reset. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Error History Reset, you can set a value for axis 1 through axis 8.

(3) Servo Driver Error Reset



(a) Condition of Servo Driver Error Reset

Condition of Servo Driver Error Reset Command (XSCLR). Once Error Reset is executed, it erases errors of the servo driver connected to corresponding axis. If you execute this command without removing the cause of error, error of the servo driver may remain.

(b) Axis ready status

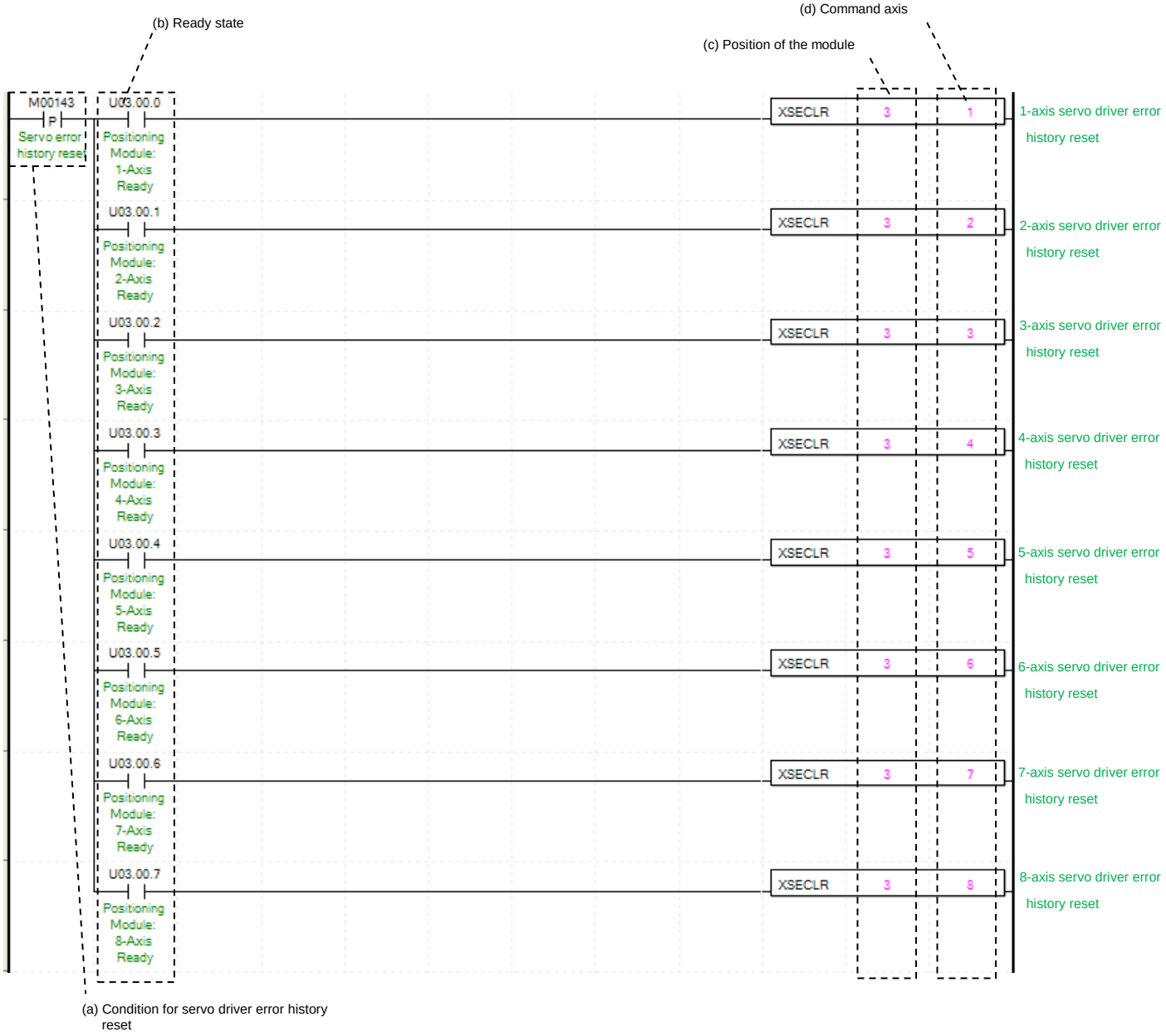
If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.

(c) Servo error state for each axis

According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Servo error state” for each axis. It turns on when an servo error occurred. Operation will only work when there is servo error. If you want to operate a system regardless of errors, you can just inactivate the function.

(d) Address of Positioning Module
In this example, Positioning Module installed at the slot no.3 of 0 bases.
(e) Axis of command execution
You can set an axis for Servo Driver Error Reset. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Servo Driver Error Reset, you can set a value for axis 1 through axis 8.

(4) Servo Driver Error History Reset



(a) Condition of Servo Error History Reset

Condition of Servo Error History Reset Command (XSECLR). Once Error Reset is executed, it erases history of generated errors of servo driver. Servo driver has ten error histories by each axis. .

(b) Axis ready status

If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.

(c) Address of Positioning Module

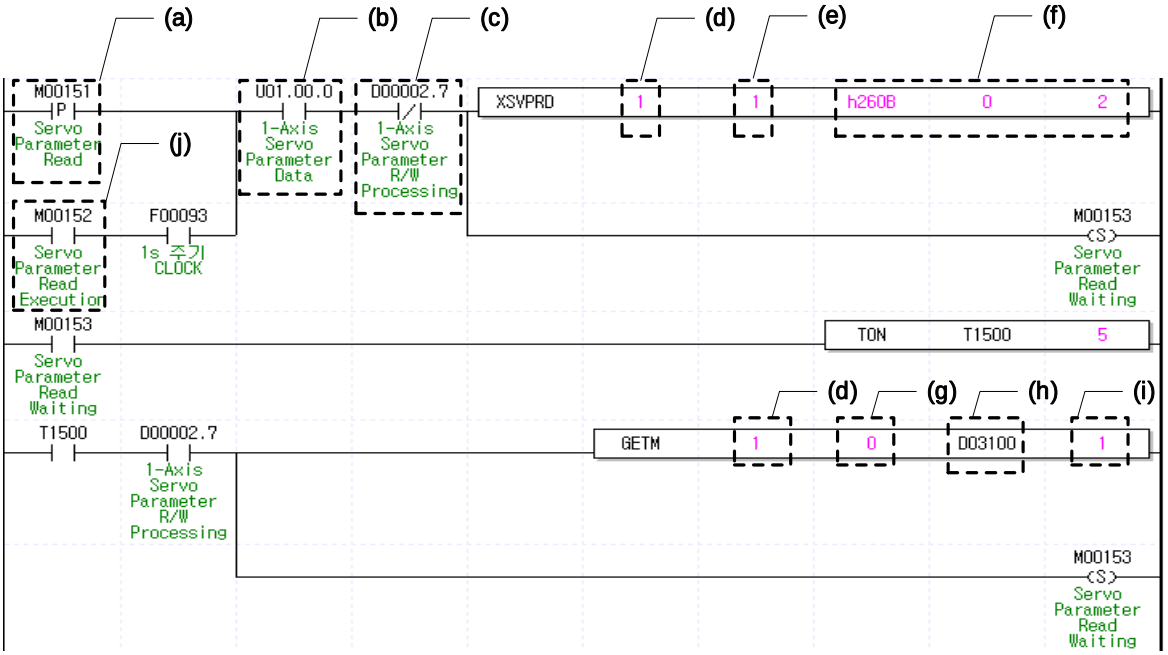
In this example, Positioning Module installed at the slot no.3 of 0 bases.

(d) Axis of command execution

You can set an axis for Servo Error History Reset. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Servo Error History Reset, you can set a value for axis 1 through axis 8.

8.1.9 Program related with the Servo Parameter (XGF-PN8B)

(1) Servo driver parameter read



(a) Condition of Servo Parameter Read
Condition of Servo Parameter Read Command (XSVPRD). Once “Servo Parameter Read” is executed, it saves to read parameter object value of the servo driver into addressed memory area.

(b) Axis ready status
If communication between positioning module and servo drive is done, the signal corresponding to each signal will be On.

(c) Axis servo parameter R/W processing status
Display execution status of Servo drive parameter read/write command or memory save command.
Set command executed during servo drive read/write do not executing.

(d) Position of the module
In this example, Positioning Module installed at the slot no.1 of 1 bases.

(e) Axis of command execution
You can set an axis for Parameter Read. XGF-PN8B supports for 8 axes. In the “execution of axis” from the configuration of Parameter Read, you can set a value for axis 1 through axis 8.

(f) Set servo driver parameter
Set index number, SubIndex number, Size of reading parameter object in servo drive parameters.
In this example, read servo drive internal temperature of specified by h2610:00 with 2 byte size.

(g) Address of common data area
If you execute “Servo parameter read”, the data read from positioning module will be saved in common area. In order to save in device for using in program, use GETM or GETMP command as program example after executing “Servo parameter read” command. common data common area address can be used to GETM or GETMP command as follows.

Address	Description
0	1axis servo parameter Index (high) / SubIndex (low)
1	1axis servo parameter data value
2	2axis servo parameter Index (high) / SubIndex (low)
3	2axis servo parameter data value
4	3axis servo parameter Index (high) / SubIndex (low)
5	3axis servo parameter data value
6	4axis servo parameter Index (high) / SubIndex (low)
7	4axis servo parameter data value
8	5axis servo parameter Index (high) / SubIndex (low)
9	5axis servo parameter data value
10	6axis servo parameter Index (high) / SubIndex (low)
11	6axis servo parameter data value
12	7axis servo parameter Index (high) / SubIndex (low)
13	7axis servo parameter data value
14	8axis servo parameter Index (high) / SubIndex (low)
15	8axis servo parameter data value

(h) Save device of common data

Set starting address of the device to be saved after read data. In the example, saves data into D03100.

(i) Data size

It set up size of data to read from common data area. In the example, reads 2 DWORD.

In the example, saves in D03100 device to read data of h2610 (Inner temperature of servo driver) parameter after executed the Servo driver parameter read command. It saves the Index/SubIndex and data value of servo parameter in d03100 and D03102 at after 5ms executing servo parameter read command when “1-Axis Servo Parameter R/W Processing” is off state.

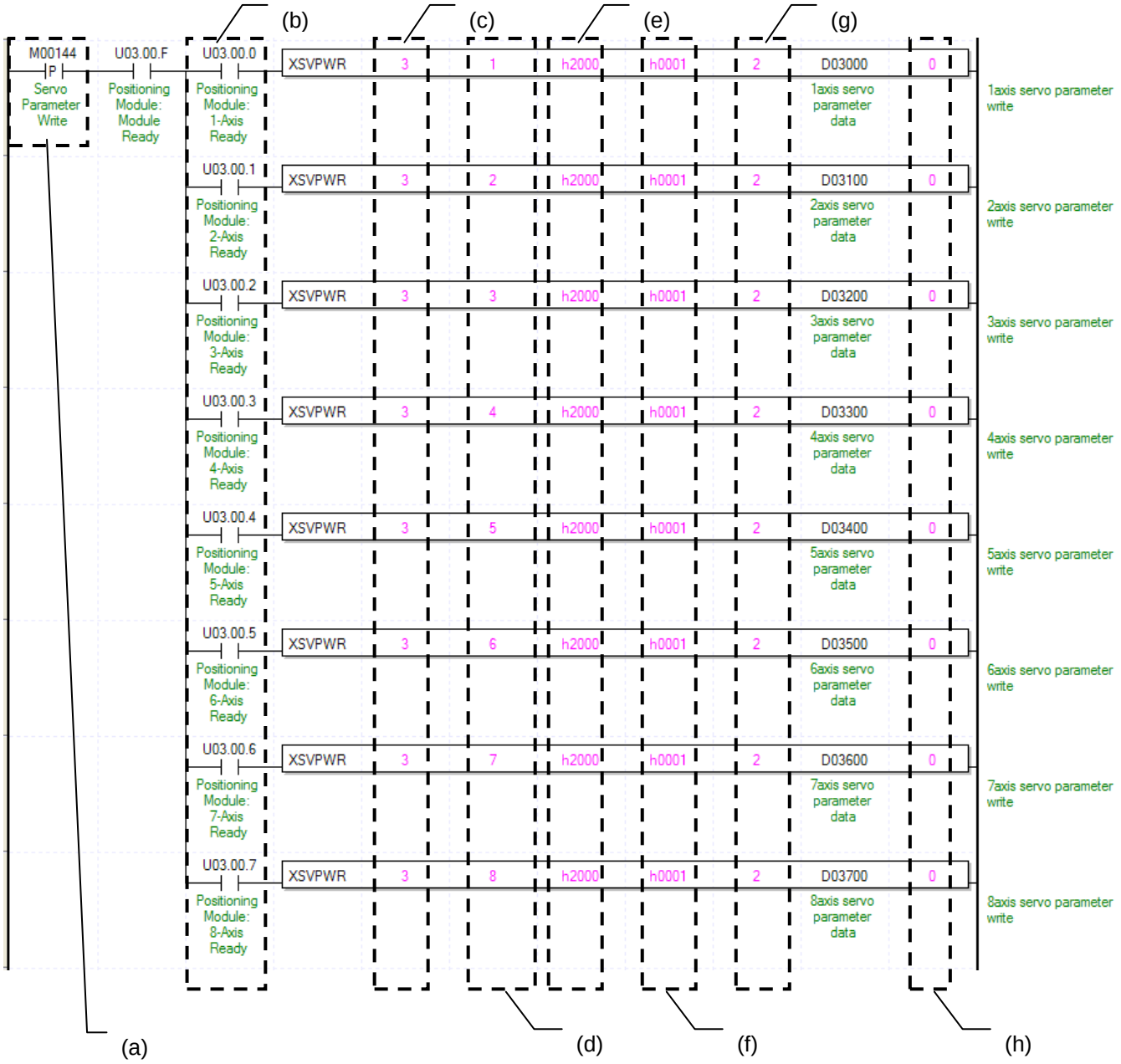
You can read the data of servo parameter as follows.

After executing “servo parameter read” command, you have to execute GETM command minimum 4ms to read updated data in common area.

(j) Cyclic read execution condition of servo parameter

When servo parameter cyclic read contact is ‘On’, ‘Servo driver parameter read’ command execute once per second. Periodically, you can monitor the servo driver parameters. If cycle is set too fast, 'Servo driver parameter read' command executed duplicate errors can occur.

(2) Servo driver parameter write



(a) Condition of Servo Parameter Write

Condition of Servo Parameter Write Command (XSPWR). Once “Servo Parameter Write” is executed, it changes parameter object value of the servo driver into setting value.

(b) Axis ready status

If communication between positioning module and servo drive is done, the signal corresponding to each signal will be on.

(c) Address of Positioning Module

In this example, Positioning Module installed at the slot no.3 of 0 bases.

(d) Axis of command execution

You can set an axis for Servo Parameter Write. XGF-PN8B supports for 8 axes. In the “execution of axis” from the configuration of Servo Parameter Write, you can set a value for axis 1 through axis 8.

(e) Servo driver parameter index

Index number of the parameter object among servo driver parameters. You can set up as follows.

Setting value	Description
0x2000 ~ 0x5FFF	Manufacturer Specific Profile Area
0x6000 ~ 0x9FFF	Standardized Device Profile Area

(f) Servo driver parameter sub-index

Index number of the parameter object among servo driver parameters. You can set up as follows.

Setting value	Description
0x0~0xFF	Servo parameter Object Subindex

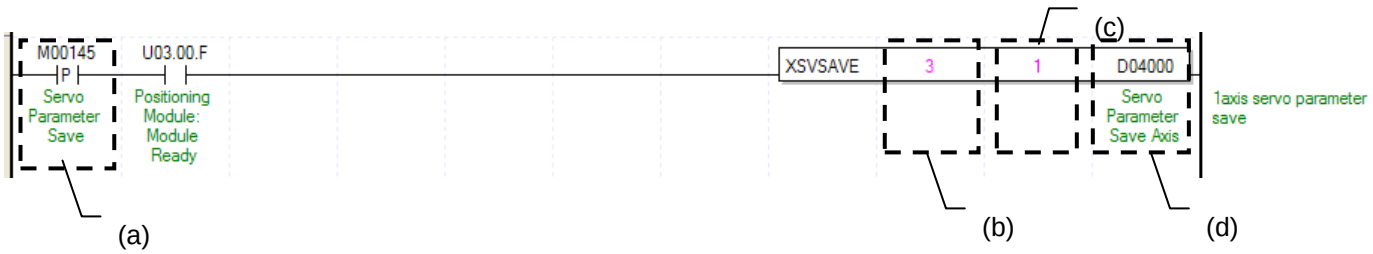
(g) Servo driver parameter size

It set up size of the servo driver parameter. You can set up 1~4byte with 1~4.

(h) How to write the servo driver parameter

It determines whether to save the servo driver parameter at the internal RAM of the servo driver or at the internal EEPROM. If it is set as 0, it saves at RAM and if it is set as 1, it saves at EEPROM. When saving at EEPROM, it may take several scans according to servo driver model. You can check whether writing is complete or not, by seeing bit 7 among module axis information (refer to manual 5.4.1 state information list)

(3) Servo Driver Parameter Save (XSVSAVE)



(a) Condition of Servo Parameter Save

Condition of Servo Parameter Save Command (XSVSAVE). Once “Servo Parameter Save” is executed, it saves parameter of the servo driver at the internal EEPROM.

(b) Address of Positioning Module

In this example, Positioning Module installed at the slot no.3 of 0 bases.

(c) Axis of command execution

You can set an axis for Servo Parameter Save. XGF-PN8B supports for 8 axes. In the “execution of axis” from the configuration of Servo Parameter Save, you can set a value for axis 1 through axis 8.

(d) Servo Driver Parameter Save Axis

It sets up the servo driver among servo drivers to save the parameter at the EEPROM. Select the servo driver by setting each bit as follows.

15 ~ 8 Bit	7Bit	6Bit	5Bit	4Bit	3Bit	2Bit	1Bit	0Bit
Not used	8axis	7axis	6axis	5axis	4axis	3axis	2axis	1axis

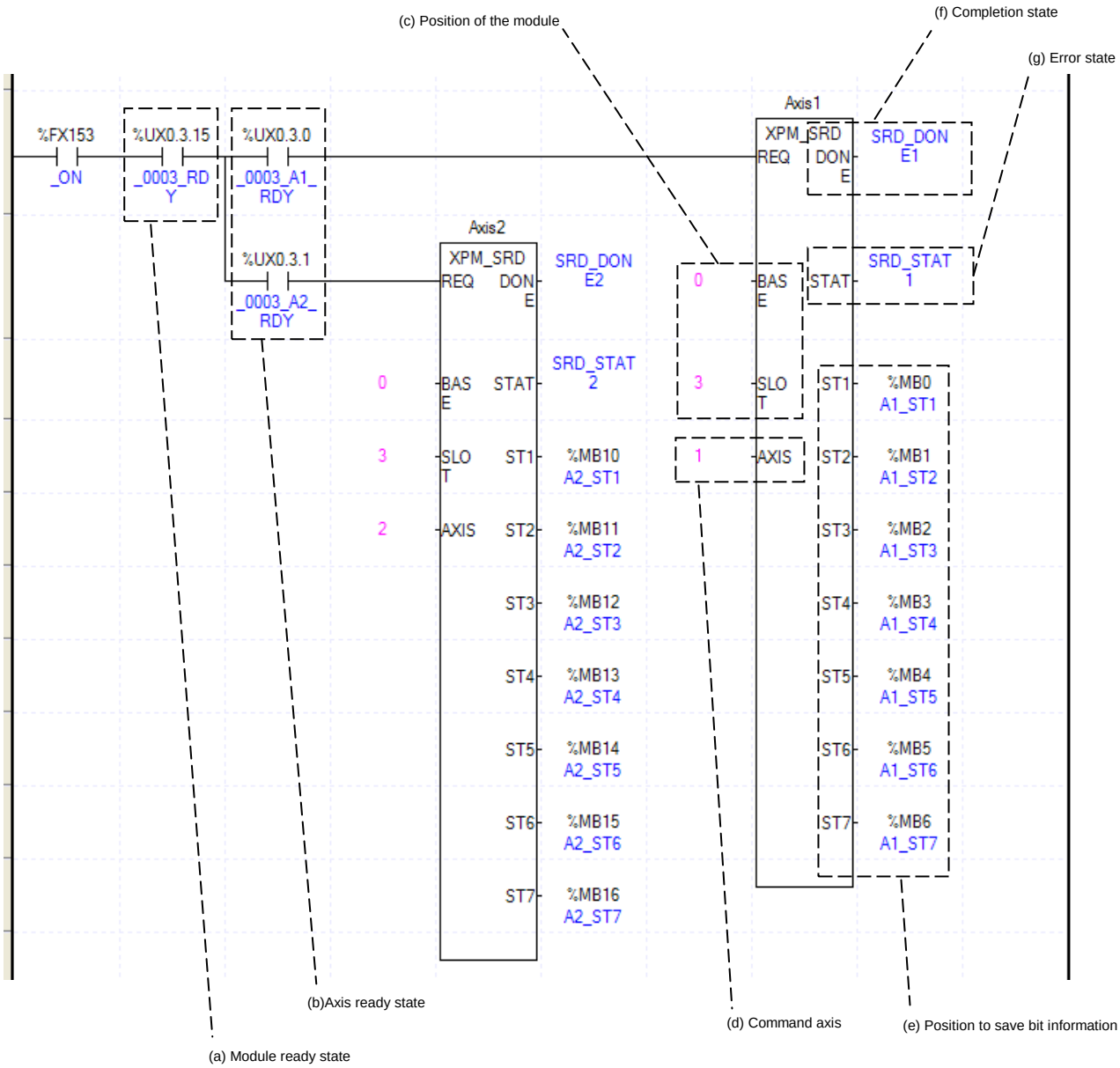
8.2 Example of XGI Programming

8.2.1 General description

Here we supposed the positioning Module is installed at the 3 slot of the 0 base and two servo drivers are installed at axis1 and axis2. In the real usage, you need to change its value according to your actual set up.

8.2.2 Current State Read

(1) Bit Information about Operation state Reading (XPM_SRD)



(a) Module's ready
After Turn On, if there is no error occurred in Positioning Module, it is "ON," meaning that modules are ready to operate.

(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on. In the example program, since _ON (Always ON), positioning module ready (UX0.3.15) and axis ready (UX0.3.0 ~ UX.3.1) are used, if there is no error in the module, it reads the current status every scan.

(c) Address of Positioning Module
Before operation, you need to configure its position by numbers. In this example, Positioning Module is installed at the 3 slot.

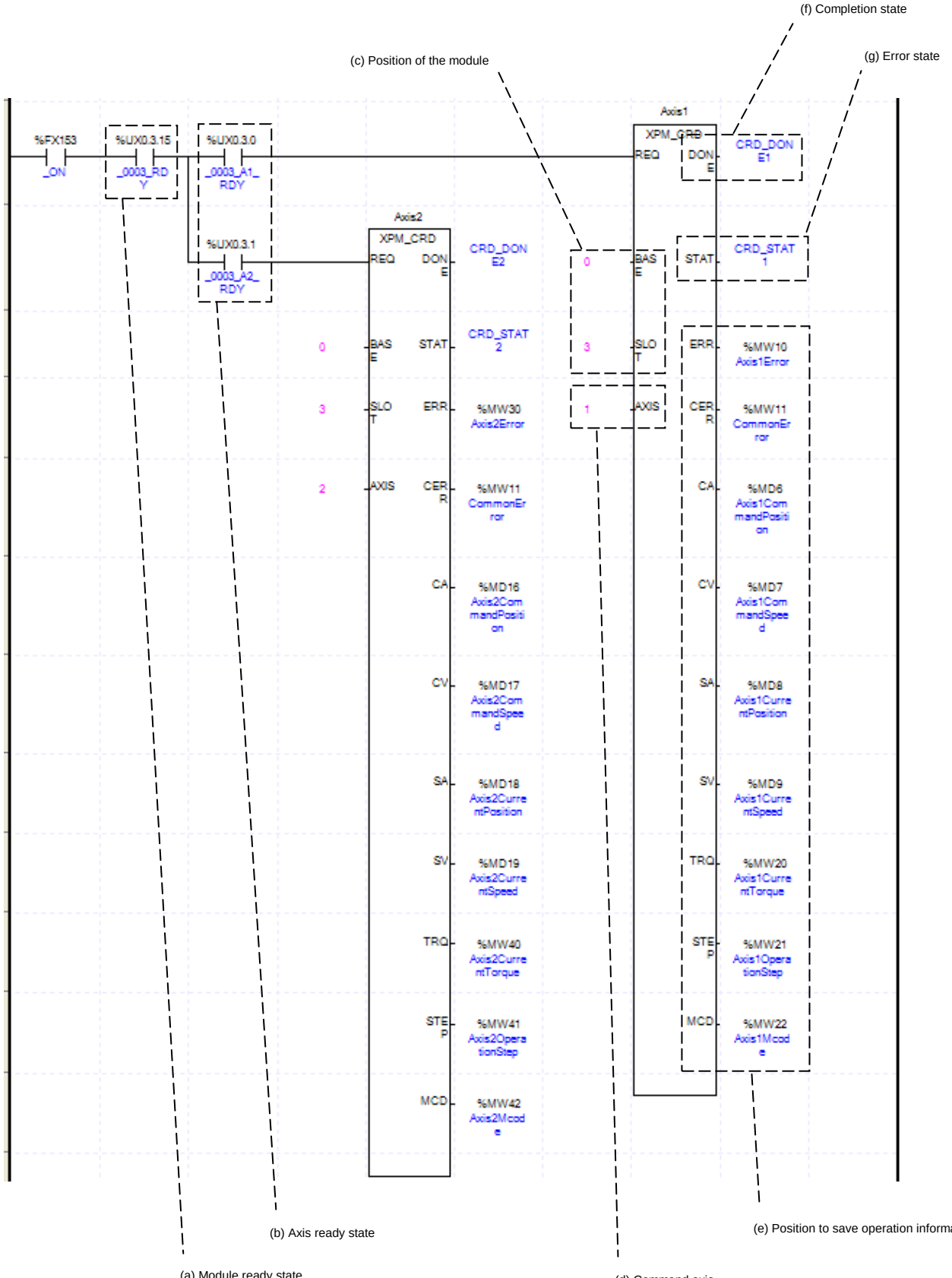
(d) Axis of operation
If you command each axis, need to set Axis of command execution. XGF-PN8A/B can control max. 8 axes and Axis of command execution 1~8 means axis1~axis8.

(e) The position for saving bit information
Set the device to save bit state value of axis from the module with XPM_SRD. This device is available to be used in sequence program as a condition. For example, the current bit state in the example program above is saved in %MB0 ~ % MB6. For the detail description about the device saved, refer to "7.3.2 Current Operation State Bit Information Reading". Bit information which saved in a device is available to be used to execute another command. For example, if you need to use In-operation-signal of axis1, just set as %MB0.0. If you need to use Error-state of axis2, just set %MB10.1.

(f) State of Operation complete
If function block is completed without error, "1" will be outputted and maintain "1" until the next operation. If error occurred, "0" will be outputted.

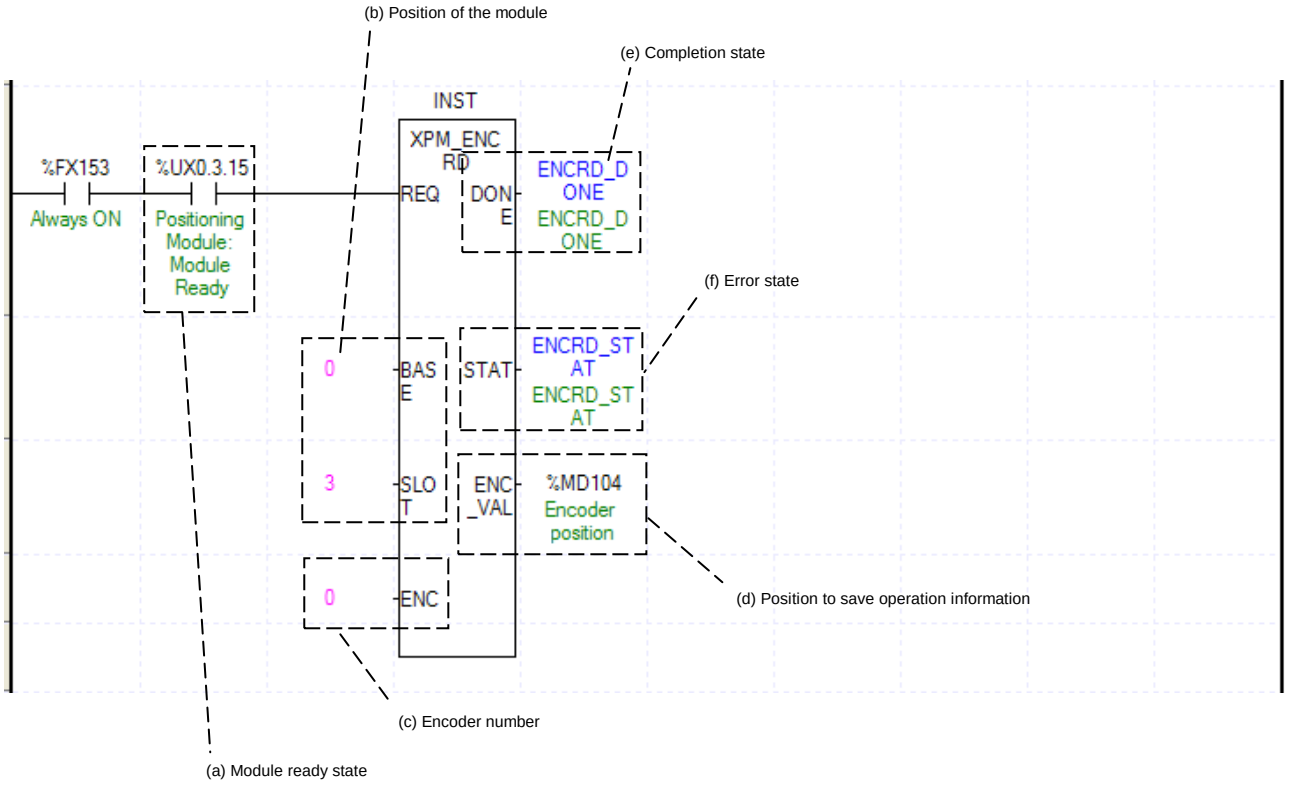
(g) Error State
This is the area that output error no. if there are errors in operation of function block.

(2) Current Operation Information Reading



(a) Module's ready
After Turn On, if there is no error occurred in Positioning Module, it is "ON," meaning that modules are ready to operate.
(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on. In the example program, since _ON (Always ON), positioning module ready (UX0.3.15) and axis ready (UX0.3.0 ~ UX.3.1) are used, if there is no error in the module, it reads the current status every scan.
(c) Address of Positioning Module
Before operation, you need to configure its position by numbers. In this example, Positioning Module is installed at the 3 slot.
(d) Axis of operation
If you command each axis, need to set Axis of command execution. XGF-PN8A/B can control max. 8 axes, Axis of command execution1~8 means axis1~axis8.
(e) The position for saving operation information
Set the device to save operation state value of axis from the module with XPM_CRD. This device is available to be used in sequence program as a monitoring value. For example, the current position value of axis1 in the example program above is saved in %MD8. For the detail description about the device saved, refer to "7.3.1 Operation Information Reading (XPM_CRD)".
(f) State of Operation complete
If function block is completed without error, "1" will be outputted and maintain "1" until the next operation. If error occurred, "0" will be outputted.
(g) Error State
This is the area that output error no. if there are errors in operation of function block.

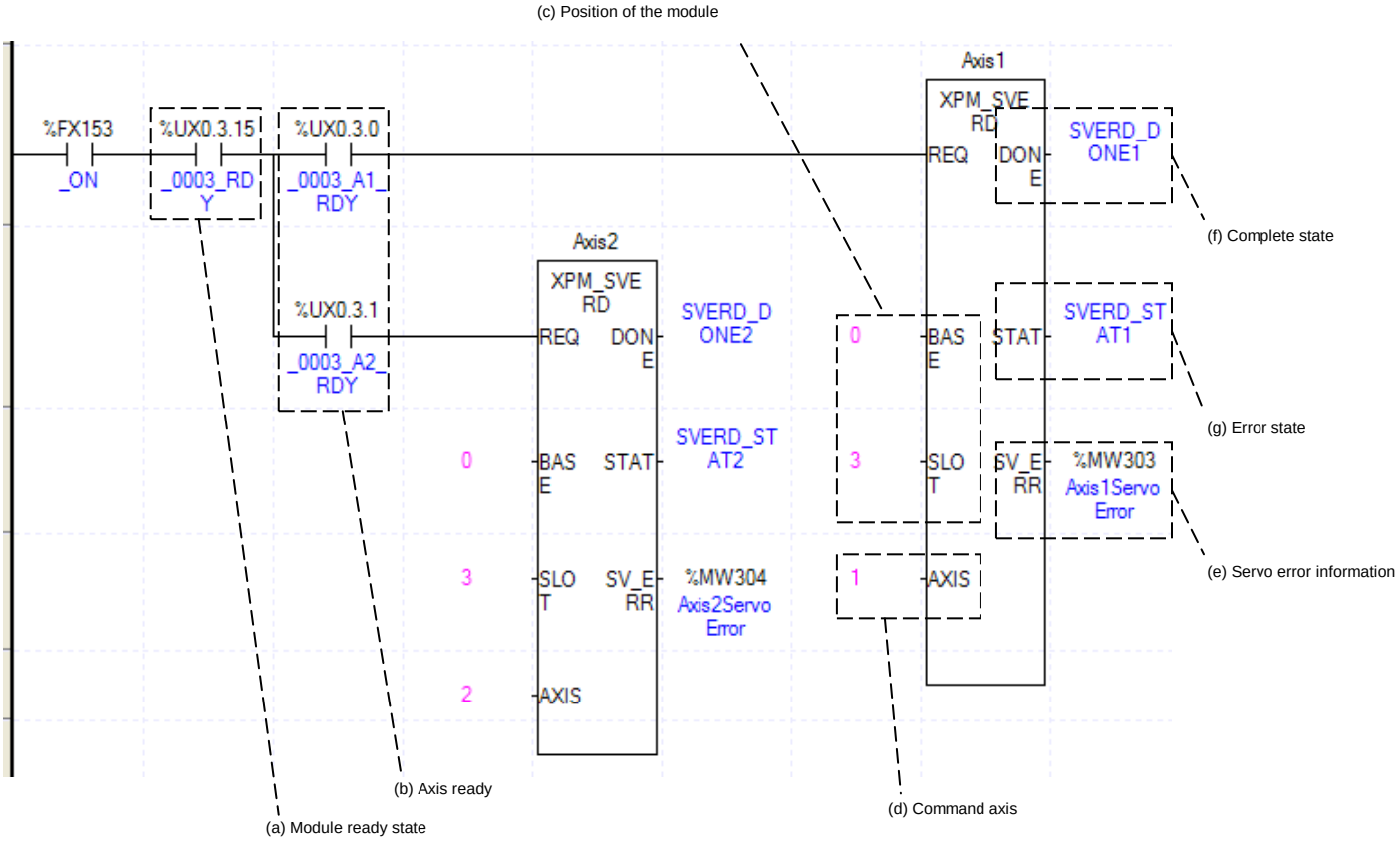
(3) Encoder value Reading



(a) Module's ready
After Turn On, if there is no error occurred in Positioning Module, it is "ON," meaning that modules are ready to operate.

(b) Address of Positioning Module
Before operation, you need to configure its position by numbers. In this example, Positioning Module is installed at the 3 slot.
(c) Encoder No.
Set the encoder no. to read encoder value.
0: encoder1, 1:encoder2
(d) Encoder value
The current value of encoder is displayed.
(e) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.
(f) Error State
This is the area that output error no. if there are errors in operation of function block.

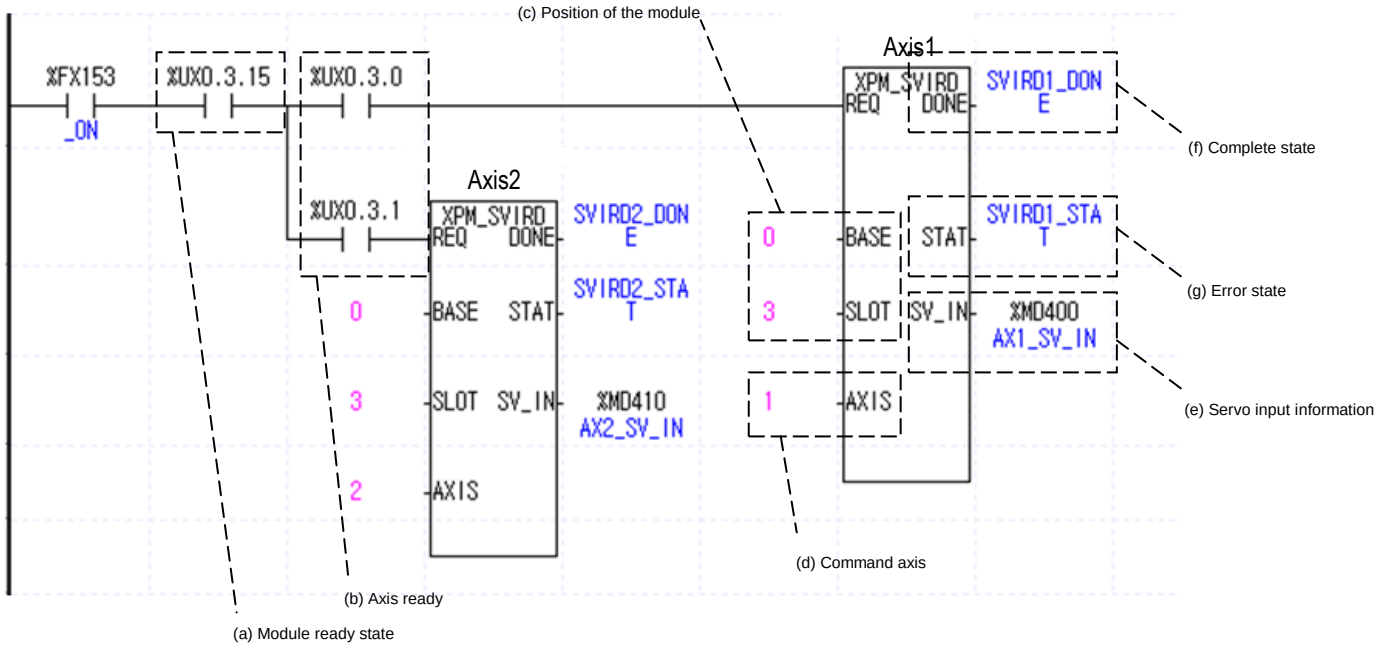
(4) Reading Servo Error Information (XPM_SVERD)



(a) Module’s ready
After Turn On, if there is no error occurred in Positioning Module, it is “ON,” meaning that modules are ready to operate.
(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on. In the example program, since _ON (Always ON), positioning module ready (UX0.3.15) and axis ready (UX0.3.0 ~ UX.3.1) are used, if there is no error in the module, it reads the current status every scan.
(c) Address of Positioning Module
Before operation, you need to configure its position by numbers. In this example, Positioning Module is installed at the 3 slot.
(d) Axis of operation
If you command each axis, need to set Axis of command execution. XGF-PN8A/B can control max. 8 axes and Axis of command execution 1~8 means axis1~axis8.

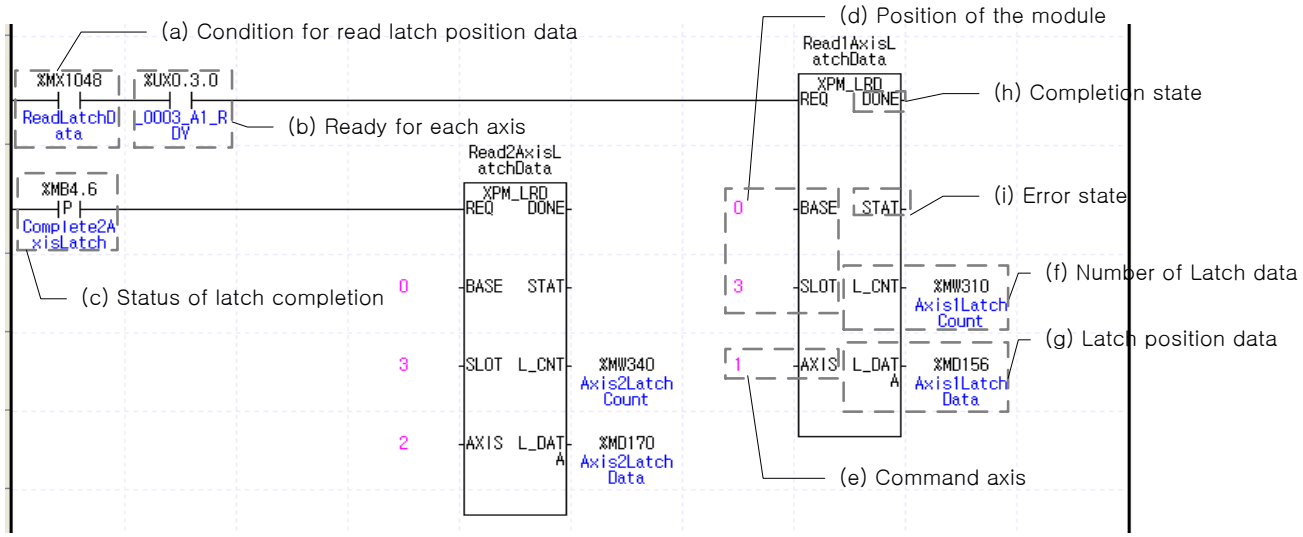
(e) Servo error information
It specifies the device to save “servo error information” read by “XPM_SVERD”. You can use this device as execution condition in the sequence program. In the above example, current servo error information of axis 1 is saved in the device “%MW303”.
(f) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.
(g) Error State
This is the area that output error no. if there are errors in operation of function block.

(5) Reading Servo Input Information (XPM_SVIRD)



(a) Module’s ready
After Turn On, if there is no error occurred in Positioning Module, it is “ON,” meaning that modules are ready to operate.
(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on. In the example program, since _ON (Always ON), positioning module ready (UX0.3.15) and axis ready (UX0.3.0 ~ UX.3.1) are used, if there is no error in the module, it reads the current status every scan.
(c) Address of Positioning Module
Before operation, you need to configure its position by numbers. In this example, Positioning Module is installed at the 3 slot.
(d) Axis of operation
If you command each axis, need to set Axis of command execution. XGF-PN8A/B can control max. 8 axes and Axis of command execution 1~8 means axis1~axis8.
(e) Servo input information
It sets the device to save input signal information of the each axis from positioning module by using XPM_SVIRD. This device can be used as a condition in sequence program. For example above, servo input signal information of 1-axis is saved at %MD400.
(f) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.
(g) Error State
This is the area that output error no. if there are errors in operation of function block.

(6) Read Latch Position Data (XPM_LRD)



(a) Conditions to Read Latch Position Data

Conditions to implement the Read Latch Position Data command (XPM_LRD). Fox Axis 1, the Read Latch Position Data command is always implement if %MX1048 is On after the axis is connected with the network.

(b) Axis ready state

If communication between the positioning module and the servo driver is normal, corresponding signal will be on. In the example program, latch position data are read if %MX1048 (Read latch position data) is On after the axis is connected with the module since Axis 1 preparation state (UX0.3.0) is used.

(c) Status of Latch Completion

It is the state of “Latch Completion” when an example program of “8.2.2 Read the Current Sate.” It is on when latch is completed once external latch command signal of the relevant axis is inputted. In case of Axis 2, the Read Latch Position Data command of Axis 2 is implemented as soon as %MB4.6 (Latch Completion state) is On.

(d) Address of Positioning Module

Before operation, you need to configure its position by numbers. In this example, Positioning Module is installed at the 3 slot..

(e) Axis of operation

If you command each axis, need to set Axis of command execution. XGF-PN8A/B can control maximum 8 axes. Axis of command execution1~8 means axis1~axis8.

(f) Number of latch position data

It is the device to save the axis’s number of latch data value read from the positioning module by using XPM_LRD. This device can be used on sequence programs. For example, Axis1’s data number of latch position is saved on %MW310.

(g) Latch position data

It is the device to save the axis’s latch data value read from the positioning module by using XPM_LRD. This device can be used on sequence programs. For example, Axis 1’s data of latch position is saved on %MD156 through %MD165.

(h) Status of Operation complete

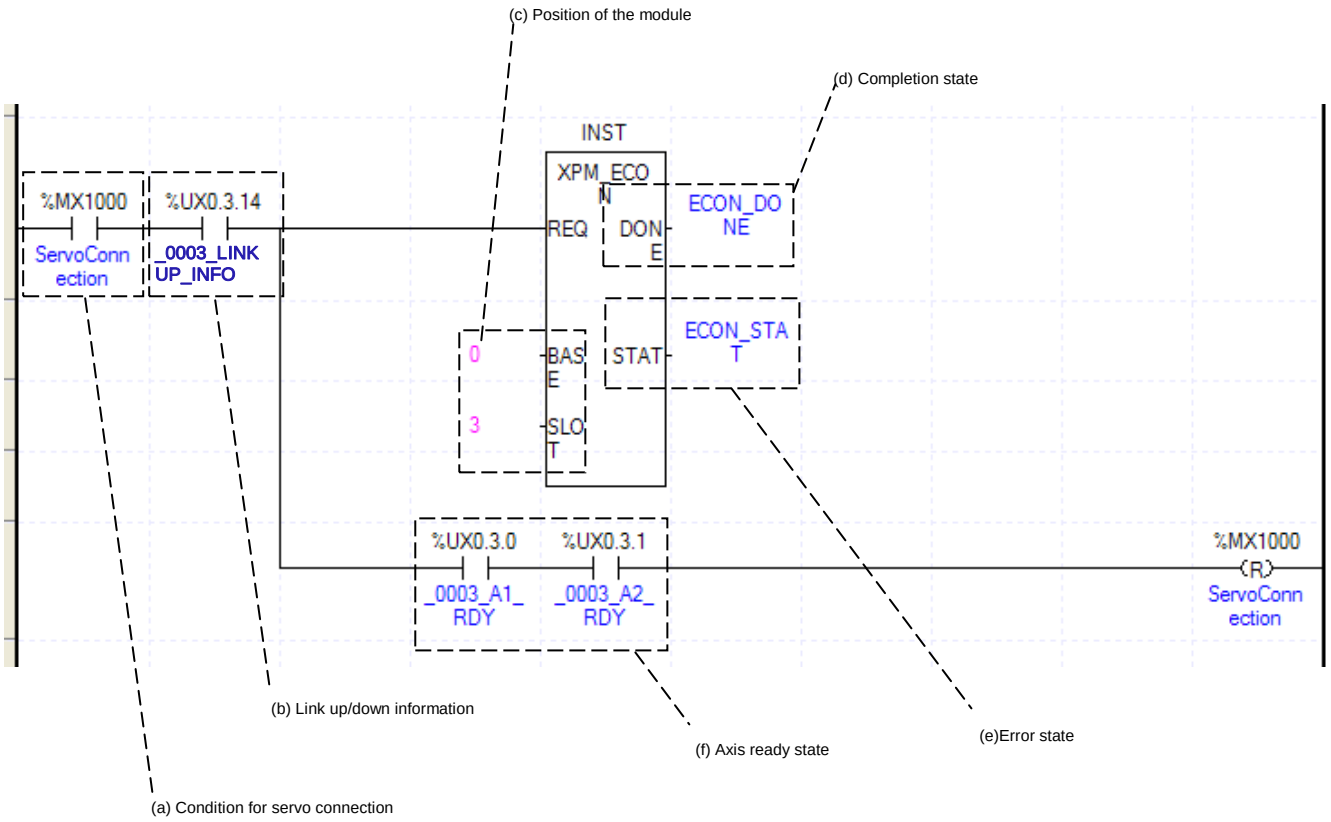
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(i) Error state

This is the area that output error no. if there are errors in operation of function block.

8.2.3 Operation Ready

(1) Connecting servo driver



(a) Condition for servo connection

Condition to execute Servo connection command (XPM_ECON)

(b) Link up/down information

If you use Link up down information as input condition point of servo connection command, you can execute the command only when network cable is actually connected.

(c) Address of Positioning Module

Before operation, you need to configure its position by numbers. In this example, Positioning Module is installed at the 3 slot.

(d) State of Operation complete

If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

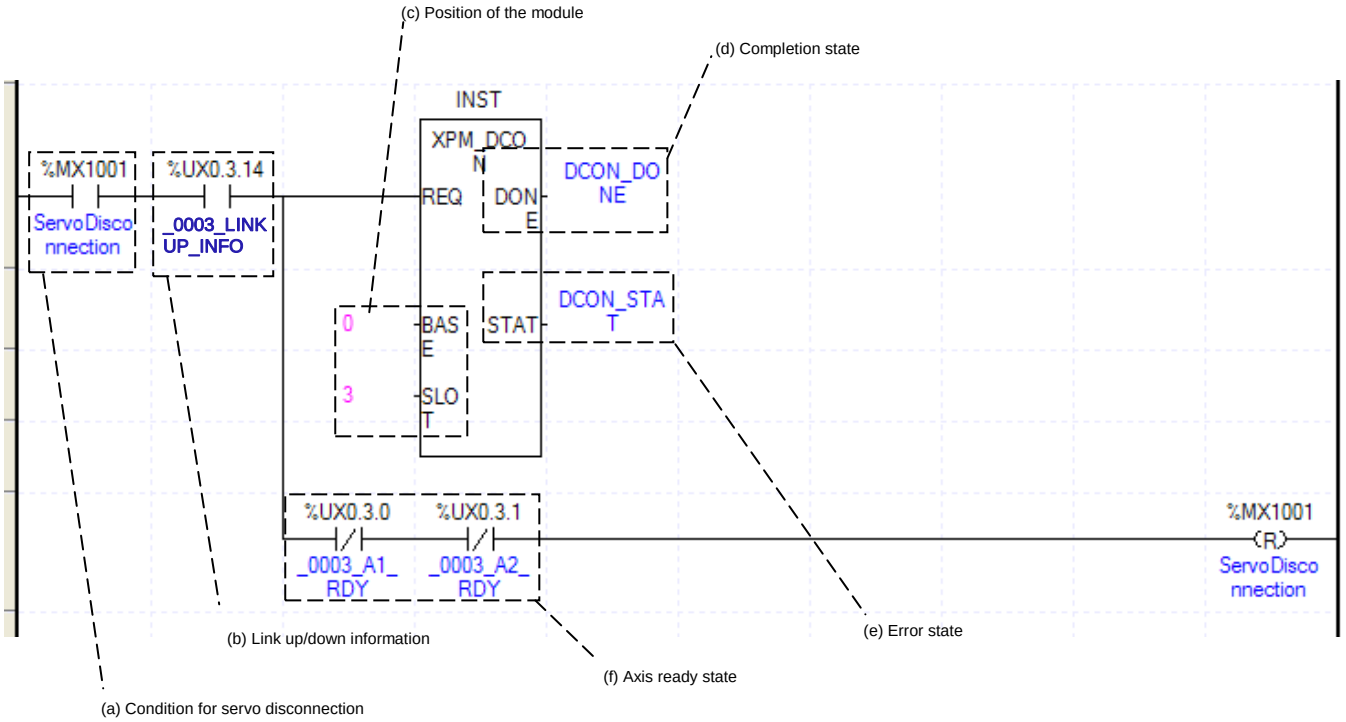
(e) Error State

This is the area that output error no. if there are errors in operation of function block.

(f) Axis ready state

If connection with servo driver is established, corresponding signal will be on. In the example, we assume that two axes are connected to the module. Set the only connected axis according to system. If connection is complete, corresponding signal will be on and reset the condition for servo connection.

(2) Disconnecting servo driver



(a) Condition for servo disconnection

Condition to execute Servo disconnection command (XPM_DCON)

(b) Link up/down information

If you use Link up down information as input condition point of servo connection command, you can execute the command only when network cable is actually connected.

(c) Address of Positioning Module

Before operation, you need to configure its position by numbers. In this example, Positioning Module is installed at the 3 slot.

(d) State of Operation complete

If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

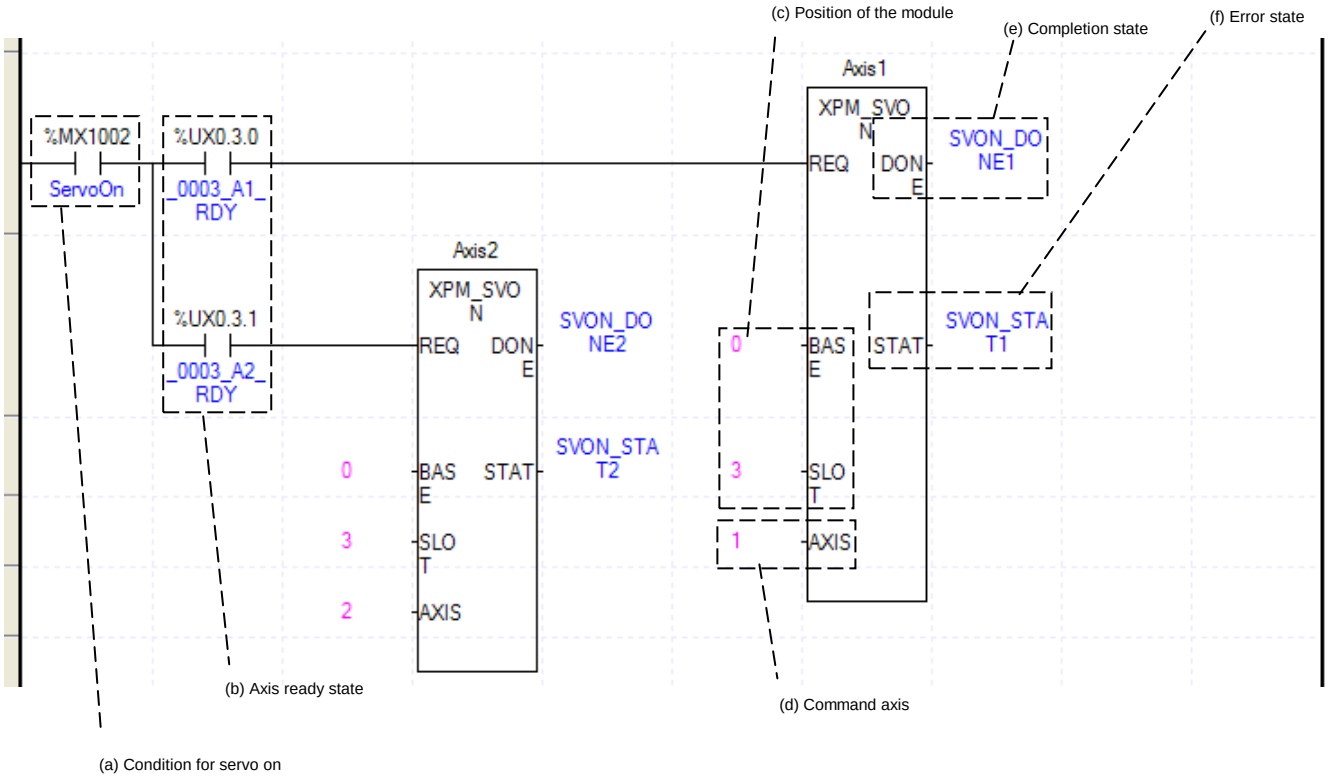
(e) Error State

This is the area that output error no. if there are errors in operation of function block.

(f) Axis ready state

If disconnection with servo driver is complete, corresponding signal will be off. In the example, we assume that two axes are connected to the module. Set the only connected axis according to system. If disconnection is complete, corresponding signal will be off and reset the condition for servo disconnection.

(3) Servo On



(a) Condition for servo on
Condition to execute Servo on command (XPM_SVON)

(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on. In the example program, if the condition for “Servo on” is on, it will gives “Servo on” command. You can remove the axis not connected.

(c) Address of Positioning Module
Before operation, you need to configure its position by numbers. In this example, Positioning Module is installed at the 3 slot.

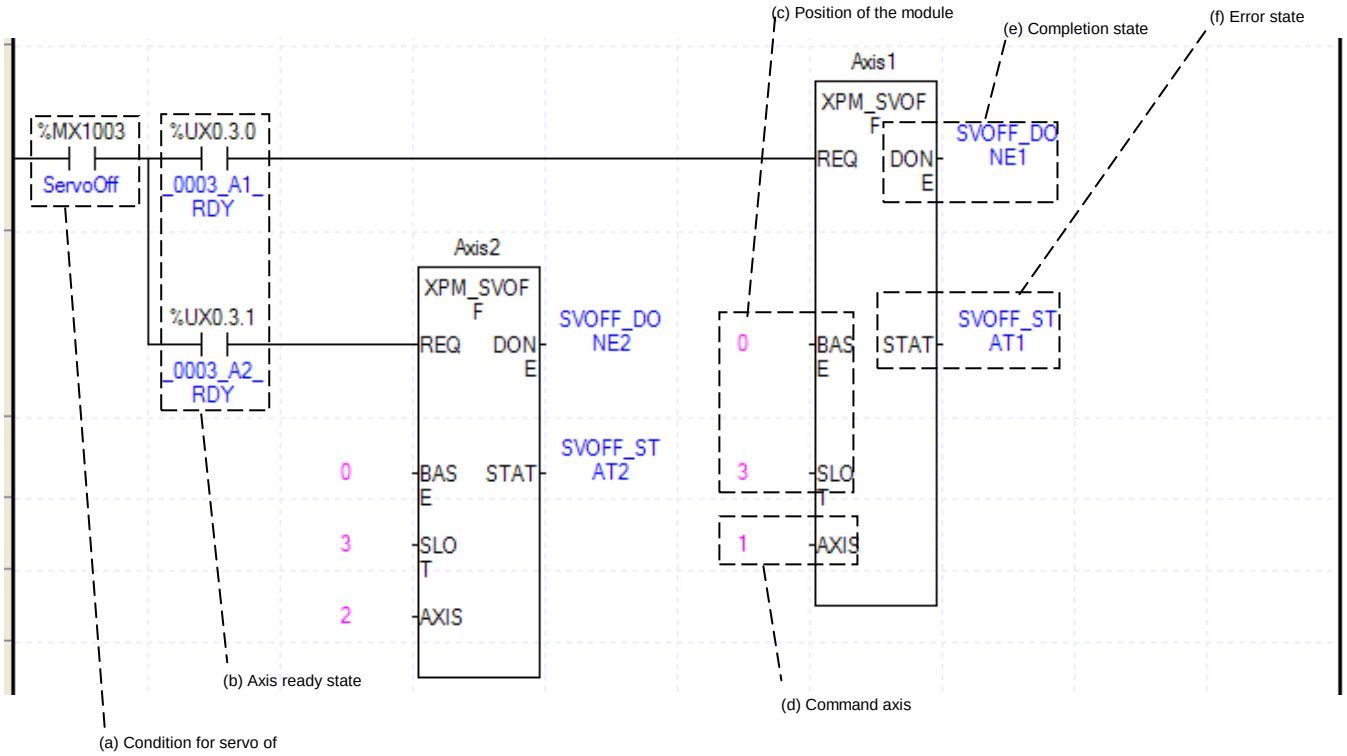
(d) Axis of operation
If you command each axis, need to set Axis of command execution. XGF-PN8A can control max. 8 axes. Axis of command execution1~8 means axis1~axis8.

(e) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(f) Error State
This is the area that output error no. if there are errors in operation of function block.

(g) If “Servo on” command is executed, corresponding servo driver will be “Servo on” state.

(4) Servo Off



(a) Condition for servo off
Condition to execute Servo off command (XPM_SVOFF)

(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on. In the example program, if the condition for “Servo off” is on, it will gives “Servo off” command. You can remove the axis not connected

(c) Address of Positioning Module
Before operation, you need to configure its position by numbers. In this example, Positioning Module is installed at the 3 slot.

(d) Axis of operation
If you command each axis, need to set Axis of command execution. XGF-PN8A can control max. 8 axes. Axis of command execution1~8 means axis1~axis8.

(e) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

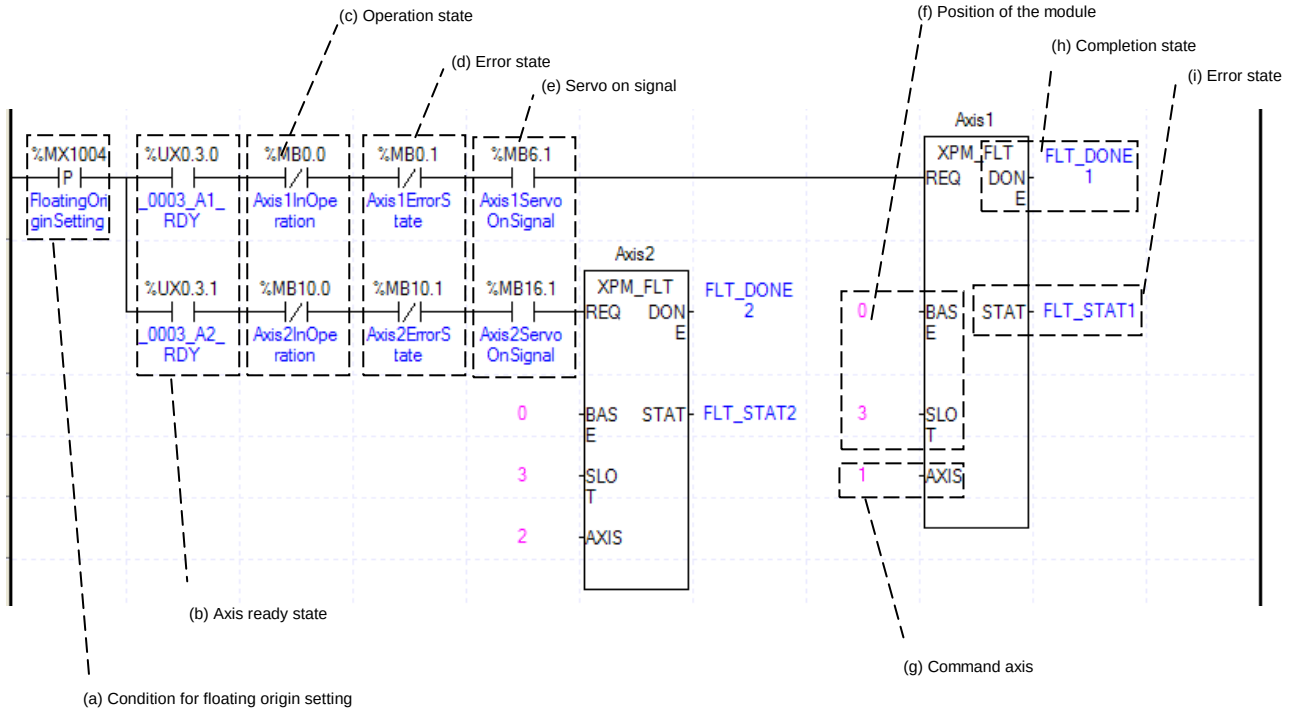
(f) Error State
This is the area that output error no. if there are errors in operation of function block.

(g) If “Servo off” command is executed, corresponding servo driver will be “Servo off” state.

8.2.4 Operation Test

(1) Floating Origin Setting

Decide origin of current motor's position without set a machinery origin.



(a) This is the condition for running a Floating Origin Setting
It only works with XPM_FLT command.

(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Operating state by axis
According to exercise from "Chapter 8.2.2 Current State Reading," it is a signal of "Operating" for each axis. When corresponding axis is not operating, it is on. Since "Floating origin setting" command can't be executed, the condition is set to execute when axis is not operating. If you execute "Floating origin setting" command while axis is operating, error 211 will appear.

(d) Error state for each axis
According to exercise from "Chapter 8.2.2 Current State Reading," it is a signal of "Error state" for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo On signal
When applying the example program of "8.2.2 Current State Read", this is "Servo On" signal for each axis. When each axis is Servo On state, it will be on. Since floating origin setting command can't be executed when the axis is not servo on, it makes command executed when servo driver is "Servo On" state. If you execute floating origin setting command when axis is not Servo On state, the error 212 occurs.

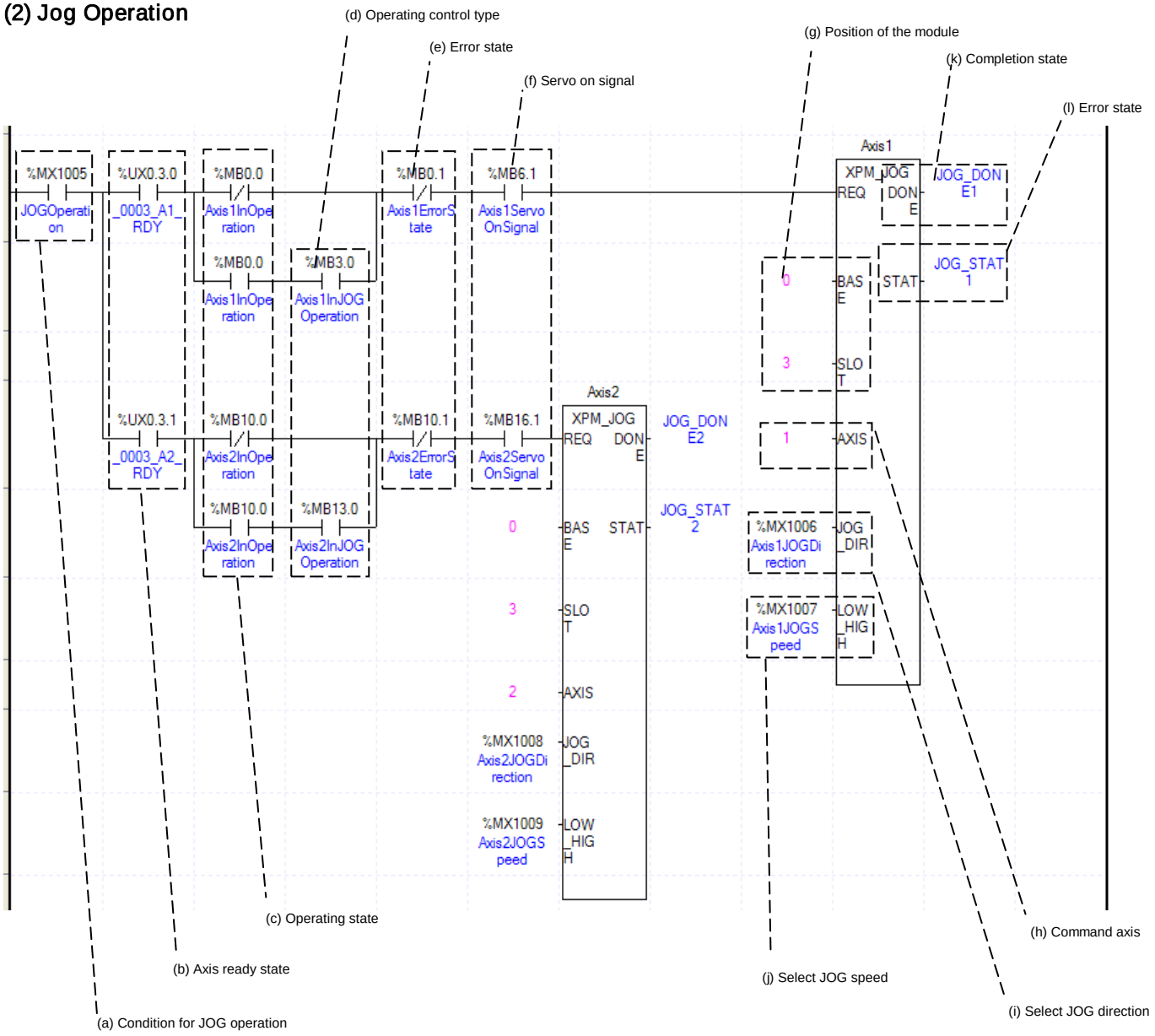
(f) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.

(g) Axis of command execution
You can set an axis for Floating Origin Setting. XGF-PN8A supports for 8 axes. In the "execution of axis" from the configuration of Floating Origin Setting, you can set a value for axis1 through axis 8

(h) State of Operation complete
If function block is completed without error, "1" will be outputted and maintain "1" until the next operation. If error occurred, "0" will be outputted.

(i) Error State
This is the area that output error no. if there are errors in operation of function block.

(2) Jog Operation



(a) This is the condition for Jog Operation
This is the condition for Jog Operation Command

(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Operating state by axis
Jog Operation can only be working when the state of axis set as Jog Operation. In this example above, specific axis set as Jog Operation otherwise it is not operating.

(d) State of driving control by axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Jog Operating” for each axis. It turns on when it is operating. Jog Operation configuration can be changed while it is operating.

(e) Error state for each axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(f) Servo On signal
When applying the example program of “8.2.2 Current State Read”, this is “Servo On” signal for each axis.

When each axis is Servo On state, it will be on. Since JOG operation can't be executed when the axis is not "servo on", it makes command executed when servo driver is "Servo On" state. If you execute JOG operation when axis is not Servo On state, the error 413 occurs.

(g) Address of Positioning Module

The module is attached to slot no.3 of no.0 base.

(h) Axis of command execution

Set an axis to execute Jog Operation. XGF-PN8A can control max. 8 axes. It is available to set 1 ~ 8(axis1~axis8) on "Axis of command execution" of Jog operation command.

(i) Selection for Jog Direction

Set the direction of Jog operation. If Input value is 0, it will execute Jog operation in forward direction. If Input value is 1, it will execute Jog operation in reverse direction. Direction is can be changed in operation.

(j) Selection for Jog Speed

Set the speed of Jog operation. If Input value is 0, it will execute low speed Jog operation. If Input value is 1, it will execute high speed Jog operation. Operating speed can be changed in operation.

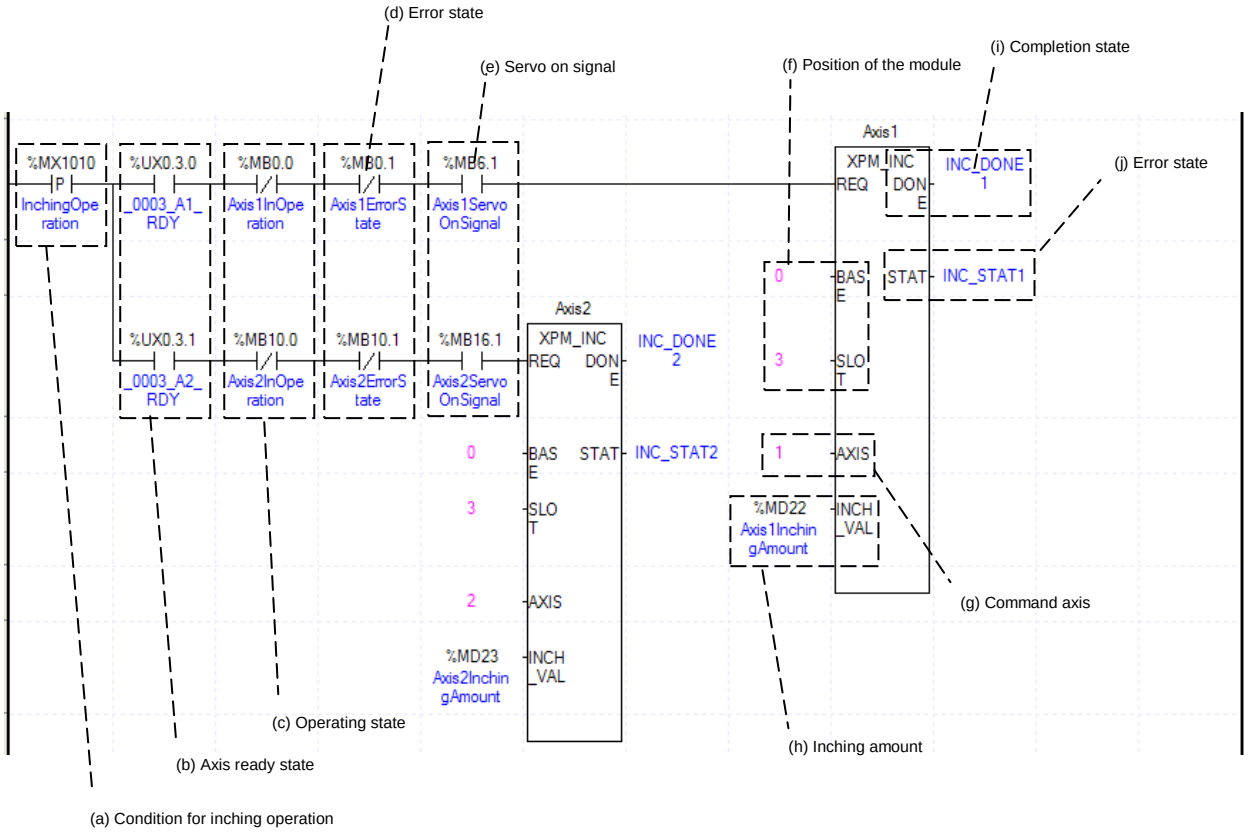
(k) State of Operation complete

If function block is completed without error, "1" will be outputted and maintain "1" until the next operation. If error occurred, "0" will be outputted.

(l) Error State

This is the area that output error no. if there are errors in operation of function block.

(3) Inching Operation



(a) This is the condition for Inching Operation

This is the condition for Inching Operation Command (XPM_INC)

(b) Axis ready

If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Operating state by axis

According to exercise from "Chapter 8.2.2 Current State Reading," it is a signal of "Operating" for each axis.

When corresponding axis is not operating, it is on. Since “Inching operation” command can’t be executed, the condition is set to execute when axis is not operating. If you execute “Inching operation” command while axis is operating, error 401 will appear.

(d) Error state for each axis

According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo On signal

When applying the example program of “8.2.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since “Inching operation” command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state. If you execute “Inching operation” command when axis is not Servo On state, the error 403 occurs.

(f) Address of Positioning Module

In this example, Positioning Module is installed at the 3 slot of 0 bases.

(g) Axis of command execution

You can set an axis for Inching Operation. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Inching Operation, you can set a value for axis1 through axis8.

(h) Amount of Inching Operation Movement

Measure the amount of moving range by Inching Operation.

(i) Complete Operating Status

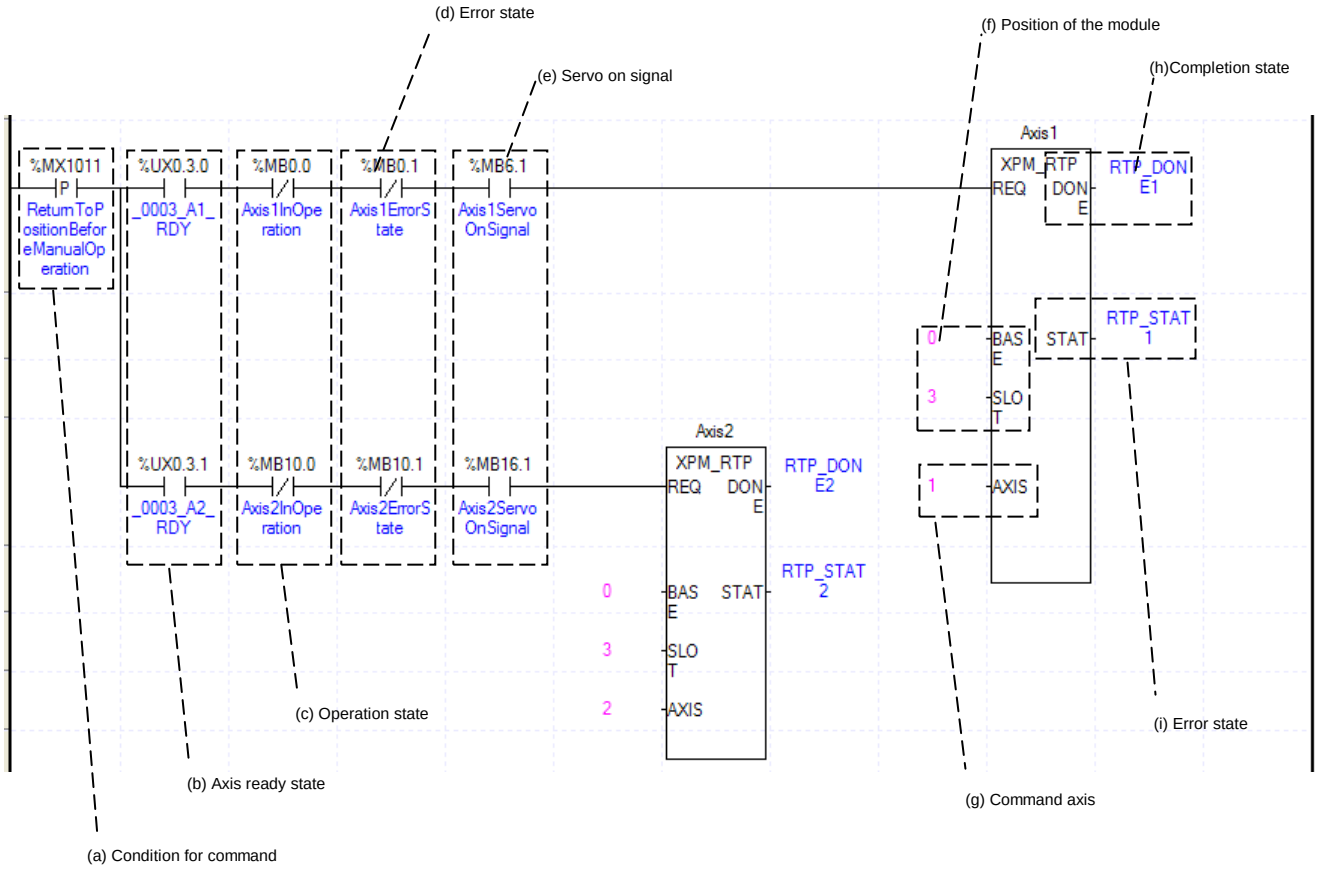
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(j) Error Status

This is the area that output error no. if there are errors in operation of function block.

(k) Reference for Inching Operation is from “Chapter 7.6.2.”

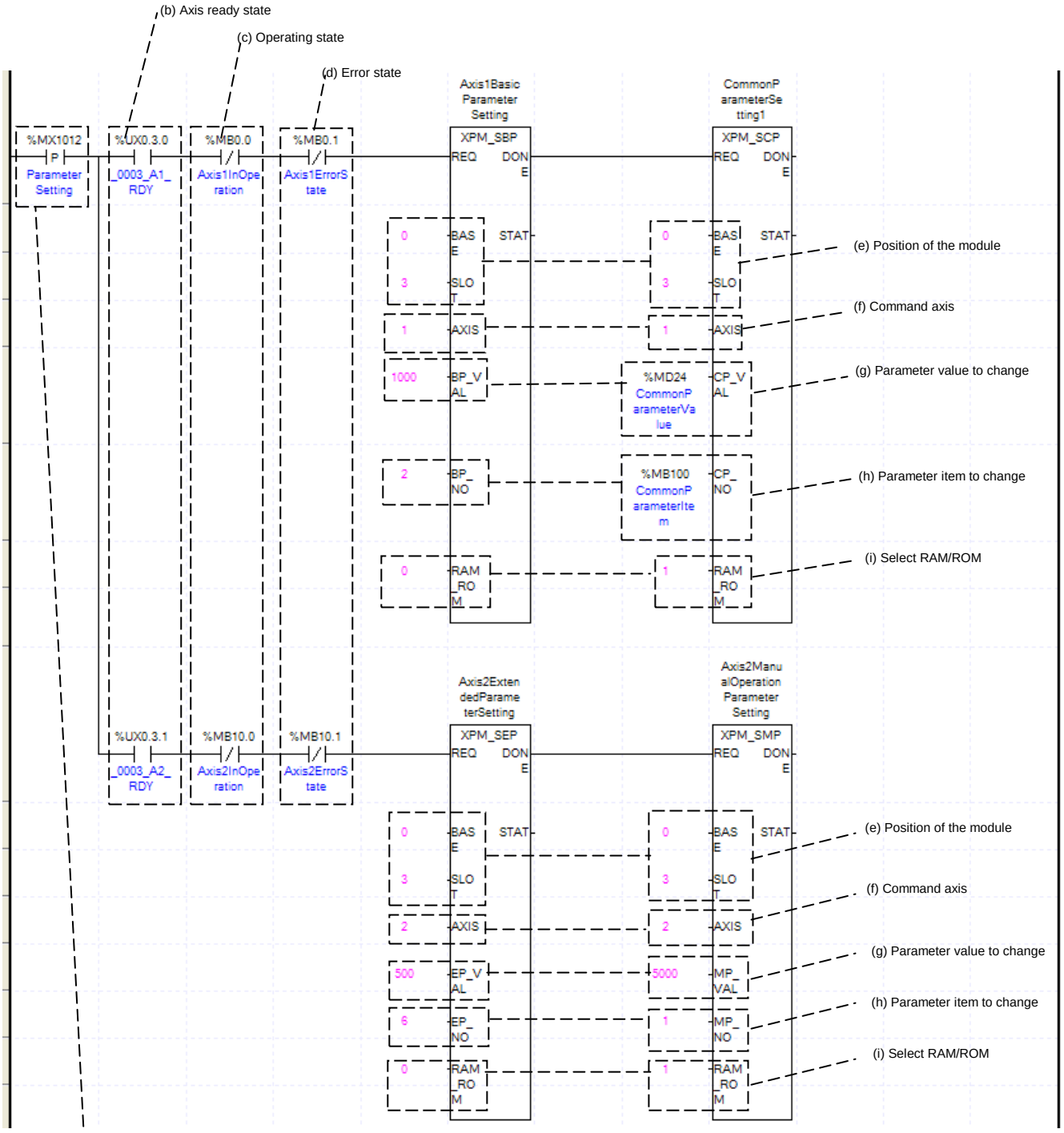
(4) Return to the position before Manual Operation



(a) This is the condition for Return to the position before Manual Operation
This is the condition for Return to the position before Manual Operation Command (XPM_RTP)
(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.
(c) Operating state by axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Manual Operating” for each axis. It turns on when it is operating. Inching Operation can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Manual Operation while it is running, the “error 431” would be appeared.
(d) Error state for each axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.
(e) Servo On signal
When applying the example program of “8.2.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since RTP command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state. If you execute RTP command when axis is not Servo On state, the error 434 occurs.
(f) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.
(g) Axis of command execution
You can set an axis for Inching Operation. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Manual Operation, you can set a value for axis1 through axis8.
(i) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.
(j) Error State
This is the area that output error no. if there are errors in operation of function block.
(h) When manual operation is running, the other operations are going back to its original position such as Jog Operation and Inching Operation. Reference for Manual Operation is from “Chapter 7.6.3 Return to the previous position of manual operation.”

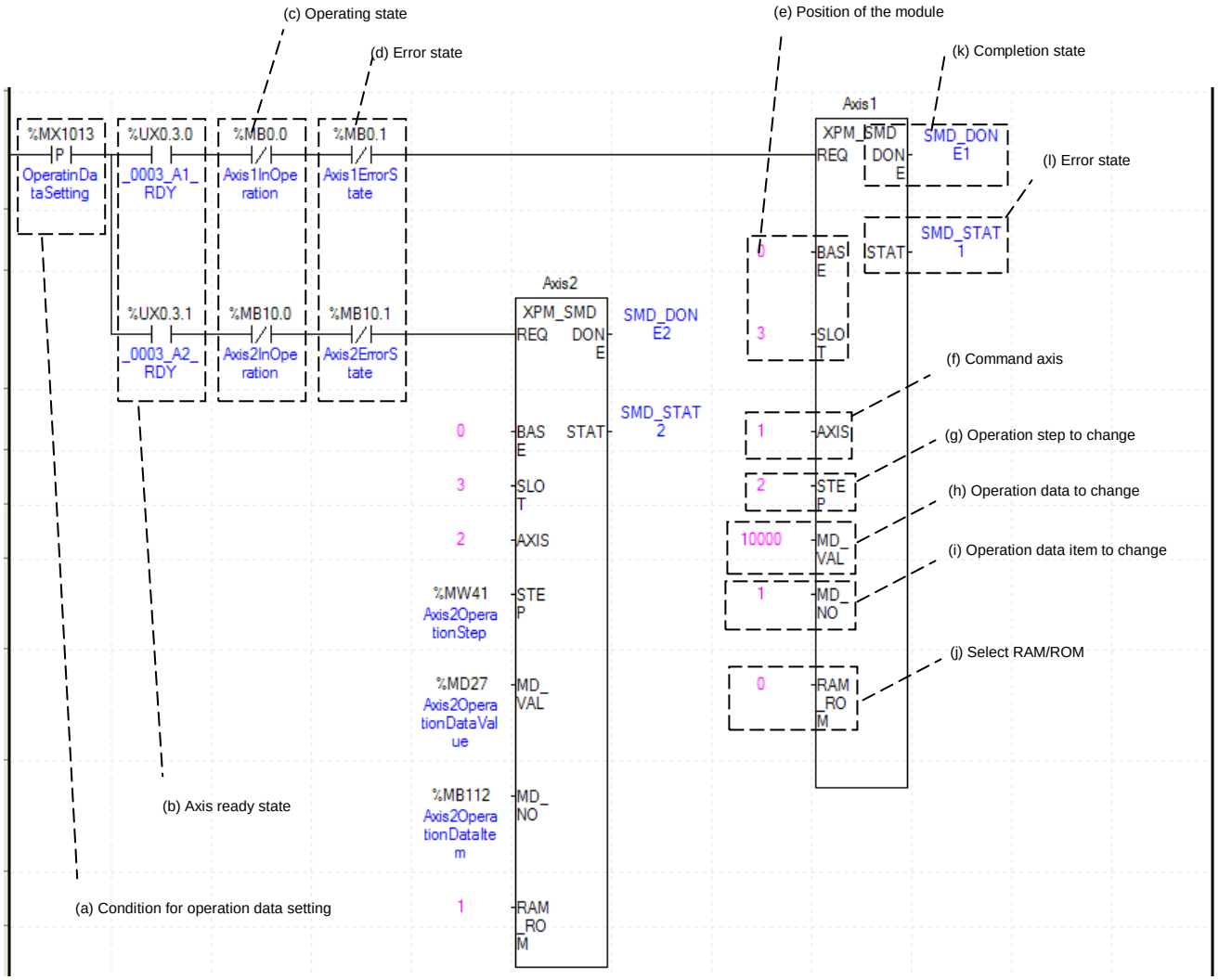
8.2.5 Parameter and Operation Data Setting

(1) Parameter Setting



(a) This is the condition for Parameter Setting Command
This is the condition for Parameter Setting Command (XPM_SBP, XPM_SEP, XPM_SMP, XPM_SCP)
(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.
(c) Operating state by axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Except common parameter setting, parameter setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Parameter Setting while it is running, the “error 471” would be appeared.
(d) Error state for each axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.
(e) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.
(f) Axis of command execution
You can set an axis for Parameter Setting. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.
(g) Value of Changing Parameter
You can set a value of changing parameter. For more information about Parameter Value Changing look for “Chapter 6. Command.” In case of setting I/O parameter, the value would be parameter value itself.
(h) List of Changing Parameter
You need to set a list for parameter (f) changing from set command. Once operating is working, this value will change to parameter (f). For more information of list of changing parameter look for “Chapter 6. Command.” In case of setting I/O parameter, the value would be parameter value itself. Therefore changing of list would not be necessary.
(i) ROM/RAM Setting
This function sets whether you save value of changing parameter to Rom or Ram. If you choose Rom the data will be saved regardless of power and if you save in the ram the data will be vanished when powers off. This parameter sets as 1 means Rom saved, and sets as 0 means Ram saved. There is no limitation of saving parameters in the Rom since parameter of Positioning Module saved in the FRAM.
(j) Execution content of each function block is as follows.
XPM_SBP : RAM Setting Acc. Time of basic parameter of axis1 as 1000ms
XPM_SEP : RAM Setting 2 axes linear interpolation continuous operation position that circular arc is added as 500
XPM_SMP : ROM Setting Jog speed of axis2 manual operation parameter as 5000.
XPM_SCP : ROM Setting %MB100 of common parameter as %MD24.

(2) Operating Data Setting



(a) This is the condition for Operating Data Command
This is the condition for Operating Data Command (XPM_SMD)

(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Operating state by axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. Operation data setting command is available to be executed when the axis is operating. However, if operation data of the step that is currently operated are changed, those changes are reflected after the current step is completed.

(d) Error state for each axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.

(f) Axis of command execution
You can set an axis for Parameter Setting. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.

(g) Operation data step to change

Set the operation data step no. to change with operation data setting command. XGF-PN8A can set 400 step operation data per each axis and the data would be 0 to 400. If the data is set as “0”, it means “Current step” of operation data of corresponding axis.

(h) Operation data value to change

Set the value of operation data to change.

(i) List of Changing Parameter

You need to set a list for parameter (h) changing from set command. Once operating is working, this value will change to parameter (h). Each value of Operating Data is listed below. For example if you put 1000 for value of Changing Operating Data and 4 for Operating data then the value of Dwell is going to be set as 1000ms.

Setting value	Operation Data
1	Goal position
2	Circle interpolation support position
3	Operation speed
4	Dwell time
5	M code No.
6	Second axis setting
7	Helical interpolation axis
8	Count for circle interpolation turn
9	Coordinate
10	Control method
11	Operation method
12	Operation pattern
13	Size of circle
14	Acceleration No.
15	Deceleration No.
16	Circle interpolation method
17	Circle interpolation direction

(j) ROM/RAM Setting

This function sets whether you save value of changing parameter to Rom or Ram. If you choose Rom the data will be saved regardless of power and if you save in the ram the data will be vanished when powers off. This parameter sets as 1 means Rom saved, and sets as 0 means Ram saved. There is no limitation of saving parameters in the Rom since parameter of Positioning Module saved in the FRAM.

(k) State of Operation complete

If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(l) Error State

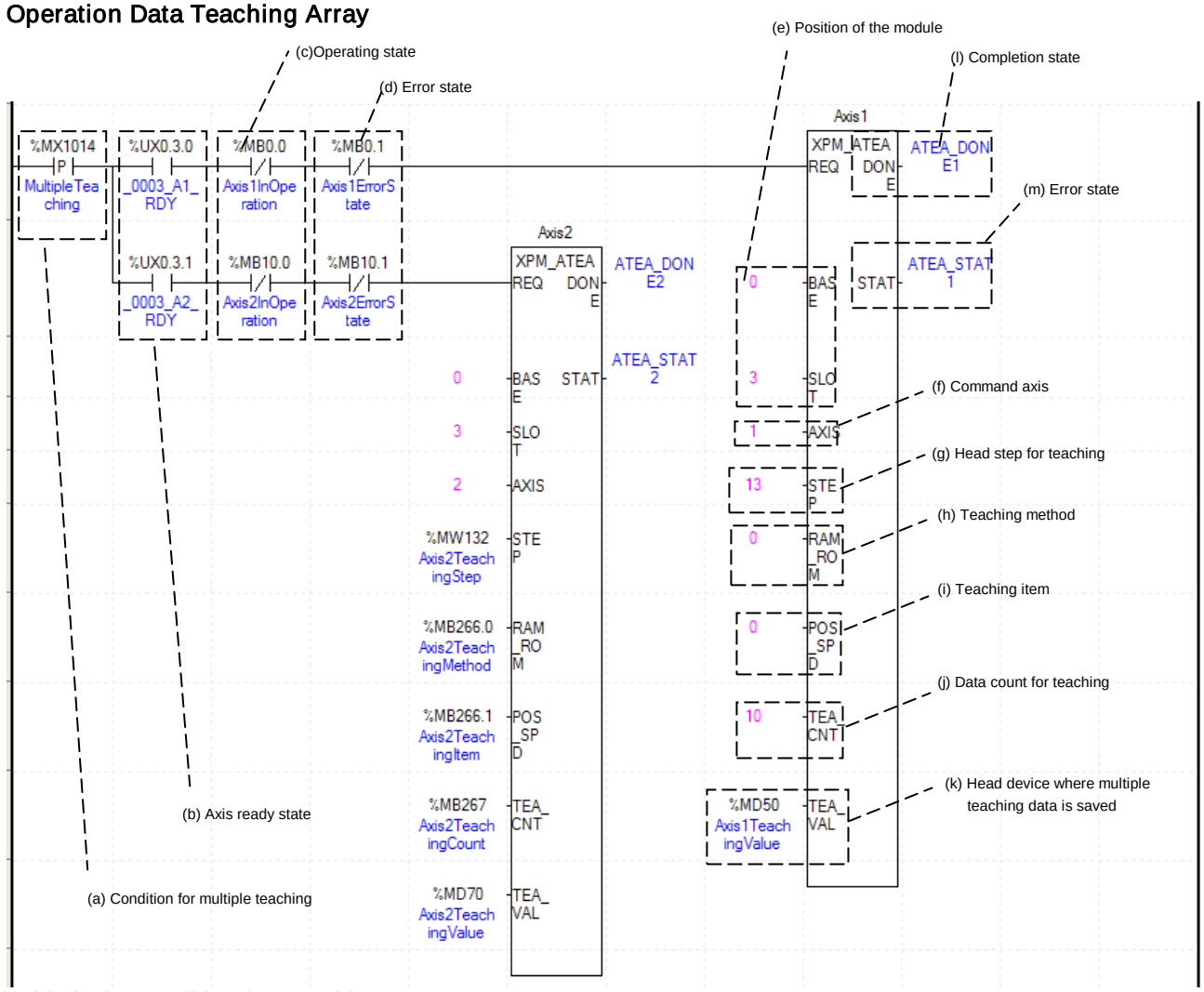
This is the area that output error no. if there are errors in operation of function block.

(m) Execution content of each function block is as follows.

Operation data setting for axis1 : RAM Setting the goal position on step no.2 of axis1 operation data as 10000.

Operation data setting for axis2 : ROM Setting %MB112(Operation data item of axis2) of axis2 operation data %MW41(Operation step of axis2) step as %MD27(Operation data value of axis2).

(3) Operation Data Teaching Array



(a) This is the condition for Teaching Array
Condition Teaching Array Command (XPM_ATEA)

(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Operating state by axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Teaching Array can not be configured while it is running hence configuration will only be configured when it is not running. Even though teaching can be performed even when the axis subject to teaching is being operated but, only the current step’s data is reflected after the current step operation is completed if the step that is currently running is within the step area while other steps’ data are immediately changed.

(d) Error state for each
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.

(f) Axis of command execution
You can set an axis for Parameter Setting. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.

(g) First number of Teaching Step

You can setup the first number of Teaching Step among the Operating Data step. In this example above, Teaching Array of axis1 will be operate from 22th step, which is 10th step away from 13th step, hence it will be operate between 13th step and 22th step.

(h) Teaching Method

This function sets whether you save value of changed Teaching data to Rom or Ram. If you choose Rom the data will be saved regardless of power and if you save in the ram the data will be vanished when powers off. This parameter sets as 1 means Rom saved, and sets as 0 means Ram saved. There is no limitation of saving parameters in the Rom since parameter of Positioning Module saved in the FRAM.

(i) List of Teaching

You can set a data with Teaching Method among the Operating Data. Both “Goal Position” and “Operating Speed” can be changed by Teaching Array. When its value set “0” means set a Goal Position and “1” means set an Operating Speed.

(j) Amount of Teaching

Decide how many steps will be operated using by Teaching Method. Maximum 16 Teaching Array data can be used. For more information about Teaching Array Operation, look for reference from “Chapter 7.4.8”

(k) Address of first device where those data for Teaching Array are saved

To execute a Teaching Array, you need to set a specific value first. TWR commands are using for set up those Teaching Array data. It has to be done before actual Teaching Array operation. Teaching Data will be set up depends on number of first device as below table.

Value	Device No.	Teaching Array Data
1	Device + 0	Teaching Array Data 1
2	Device + 1	Teaching Array Data 2
3	Device + 2	Teaching Array Data 3
4	Device + 3	Teaching Array Data 4
5	Device + 4	Teaching Array Data 5
6	Device + 5	Teaching Array Data 6
7	Device + 6	Teaching Array Data 7
8	Device + 7	Teaching Array Data 8
9	Device + 8	Teaching Array Data 9
10	Device + 9	Teaching Array Data 10
11	Device + 10	Teaching Array Data 11
12	Device + 11	Teaching Array Data 12
13	Device + 12	Teaching Array Data 13
14	Device + 13	Teaching Array Data 14
15	Device + 14	Teaching Array Data 15
16	Device + 15	Teaching Array Data 16

(l)State of Operation complete

If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(m) Error State

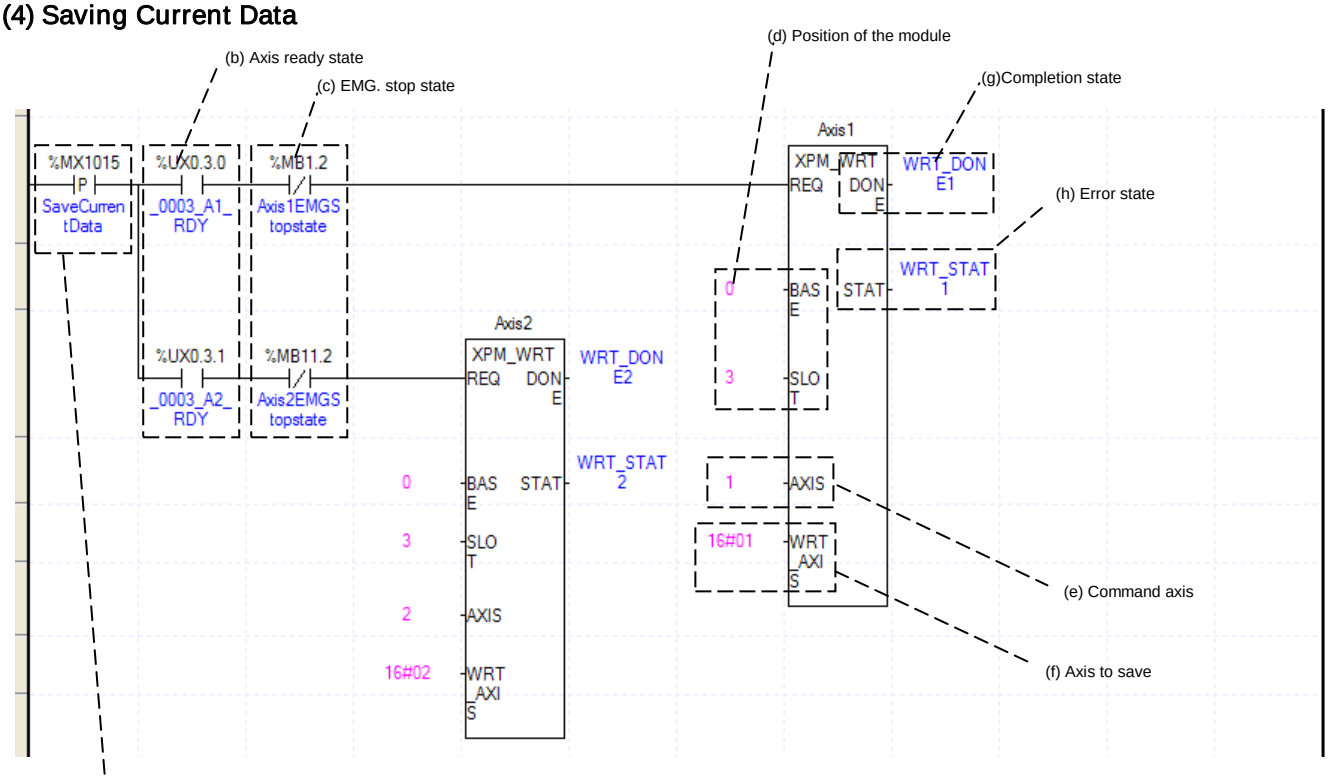
This is the area that output error no. if there are errors in operation of function block.

(n) Execution content of each function block is as follows.

Axis1 Teaching Array : Execute RAM Teaching the position value of 10 steps from no.13 to no.22 of axis1 as the value saved in %MD50 ~ %MD59.

Axis2 Teaching Array : Teaching the items of 2axis(from %MW132~%MB2666.1) as the value saved in that from %MD70 to MB267 by %MB266.0

(4) Saving Current Data



(a) This is the condition for Saving Current Data

This is the condition for Saving Current Data Command (XPM_WRT). When current saving data operated, those values of module parameter and operating data would be saved in FRAM. Therefore configuration of Ram or Ram Teaching would be constantly saved whether power is on or not.

(b) Axis ready

If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Emergency Stop by each axis

According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “State of Emergency Stop” for each axis. It turns on when it is Emergency Stop. Emergency Stop can not be configured while it is running hence configuration will only be configured when it is not running.

(d) Address of Positioning Module

In this example, Positioning Module is installed at the 3 slot of 0 bases.

(e) Axis of command execution

You can set an axis for Parameter Setting. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.

(f) Saving by axis

Configure current data operation setting. Choosing axis are configured follow by below table. Therefore even if those axis are not operated as it programmed, saving axis can be saved in Array. The data of operated axis saved in FRAM, which make constantly stable whether its power is on or not.

15 ~ 8 Bit	7Bit	6Bit	5Bit	4Bit	3Bit	2Bit	1Bit	0Bit
N/A	axis 8	axis 7	axis 6	axis 5	axis 4	axis 3	Axis 2	axis 1

(g) State of Operation complete

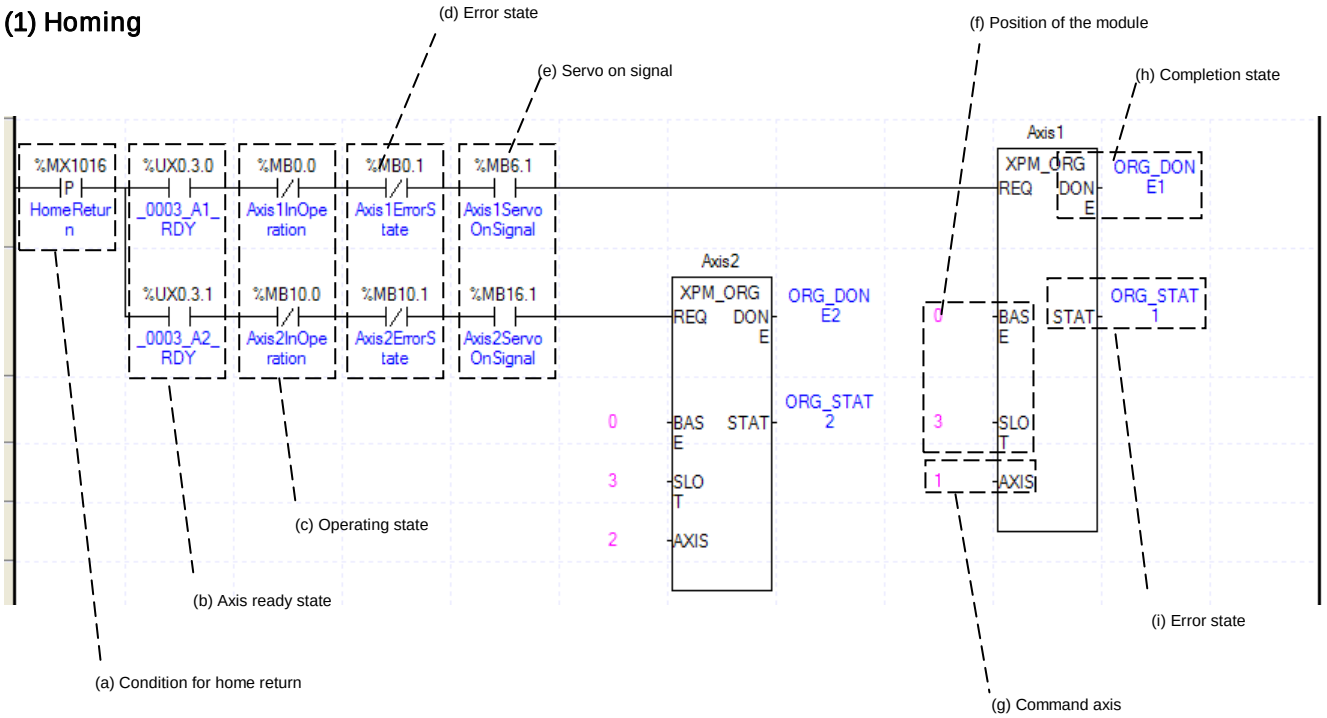
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(h) Error State

This is the area that output error no. if there are errors in operation of function block.

8.2.6 Positioning Operation

(1) Homing



(a) This is the condition for Homing
This is the condition for Homing Command (XPM_ORG)

(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Operating state by axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Homing command can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Homing while it is running, the “error 201” would be appeared.

(d) Error state for each axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo On signal
When applying the example program of “8.2.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since “Home return” command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state. If you execute “Home return” command when axis is not Servo On state, the error 203 occurs.

(f) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.

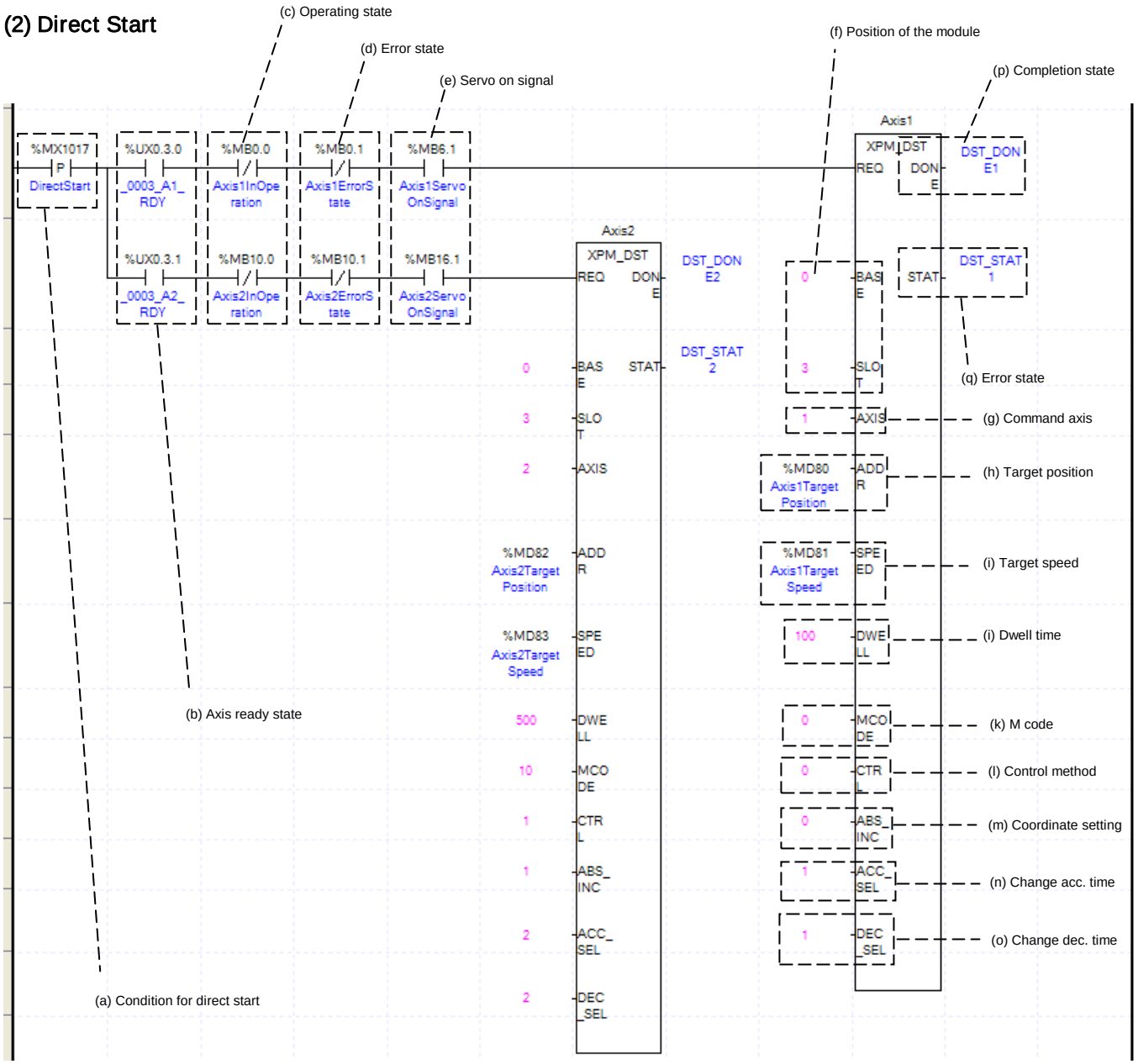
(g) Axis of command execution
You can set an axis for Inching Operation. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Manual Operation, you can set a value for axis1 through axis8.

(h) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(i) Error State
This is the area that output error no. if there are errors in operation of function block.

(j) For more information, reference for Homing is in the “Chapter 9.1.”

(2) Direct Start



(a) This is the condition for Direct Start
This is the condition for Direct Start Command (XPM_DST)

(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Operating state by axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Direct Start command can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Direct Start while it is running, the “error 221” would be appeared.

(d) Error state for each axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo On signal
When applying the example program of “8.2.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since “Direct start” command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state. If you execute “Direct start” command when axis is not Servo On state, the error 212 occurs.

(f) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.

(g) Axis of command execution
You can set an axis for Inching Operation. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Manual Operation, you can set a value for axis1 through axis8.

(h) Goal of Direct Start
Decide changing position of Direct Start command. In this example above, the initialized value is “device,” but you can also change it with “real numbers,” which data type is “DINT.”

(i) Speed of Direct Start
Decide goal speed of Direct Start. In this example above, the initialized value is “device,” but you can also change it with “real numbers,” which data type is “UDINT.”

(j) Dwell Time of Direct Start
Dwell Time consider as a total amount of time from beginning of Direct Start operation that reach to the goal position and make output of Positioning Done Signal. That means after done its operation, direct Start will make a Positioning done signal. Its unit is “ms,” and type is “UINT”

(k) Direct Start M code
You can set a value of M code which are displaying of Operating Parameter by Direct Start. The way of M code outputs are “Parameter Expansion, M code Mode,” within the “None, With, After.” It will make an M code besides you choose “None” for its parameter. For more information, reference for M code is in the “Chapter 4.2.2”

(l) Control method
Set direct start. Follows are executed depending on setting value.
0 : Position control
1 : Speed control
2 : Feed control
3: Shortest position control

(m) Coordinates setting
Set the operating coordinates of direct start. Followings are executed depending on setting value.
0 : Absolute coordinates
1 : Relative coordinates

(n) Acceleration No.
Set the acc. No. used in positioning control. It operates by corresponding acc. Time of basic parameter depending on setting value.
0 : Acc. Time 1
1 : Acc. Time 2
2 : Acc. Time 3
3 : Acc. Time 4

(o) Deceleration No.
Set the dec. No. used in positioning control. It operates by corresponding dec. Time of basic parameter depending on setting value.
0 : Dec. Time 1
1 : Dec. Time 2
2 : Dec. Time 3
3 : Dec. Time 4

(p) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

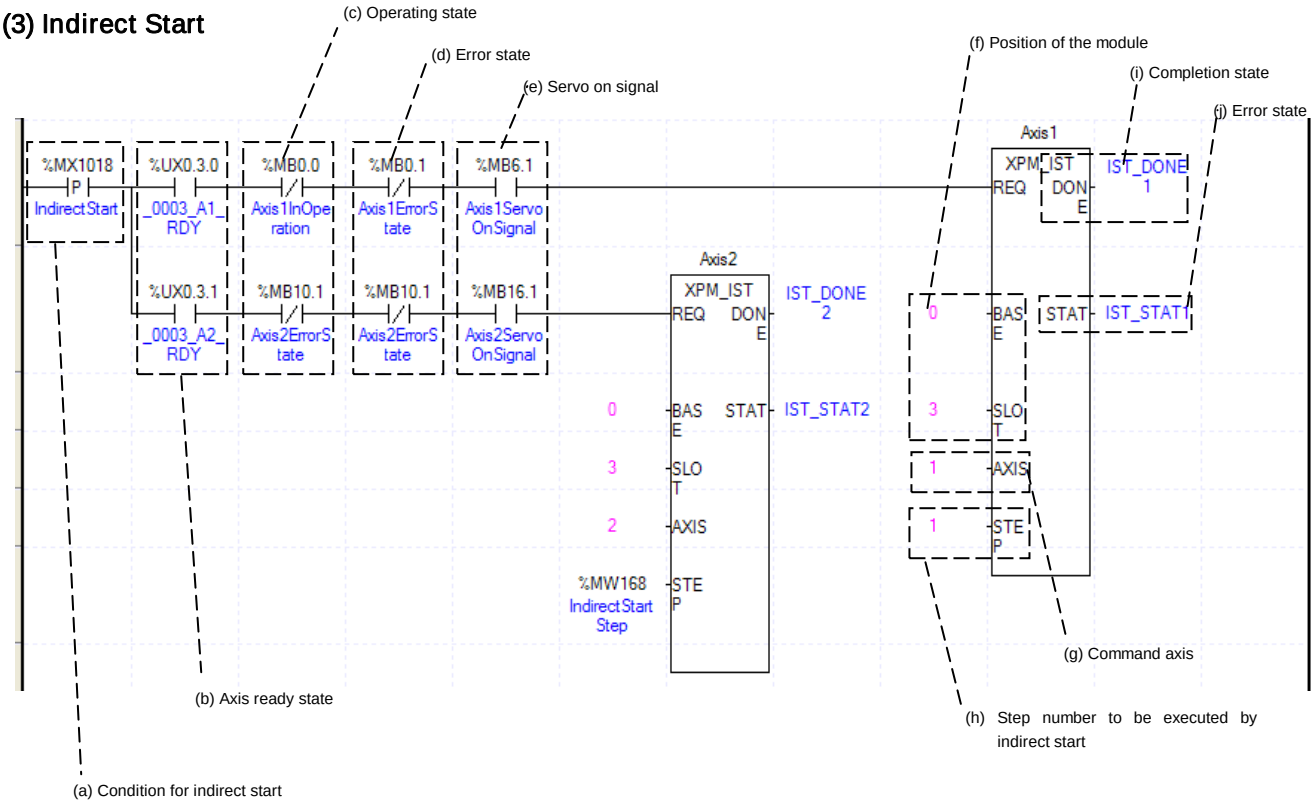
(q) Error State
This is the area that output error no. if there are errors in operation of function block.

(r) The function block used in the example is as follows.

Axis1 Direct Start : Execute position control with Axis1 Goal Position %MD80(axis1 Goal position), Goal Speed %MD81(axis Goal Speed), Dwell time 100ms, M code 0, Absolute coordinates, Acc. Time1, Dec Time 1

Axis2 Direct Start : Execute position control with Axis1 Goal Position %MD82(axis2 Goal position), Goal Speed %MD83(axis2 Goal Speed), Dwell time 500ms, M code 0, Absolute coordinates, Acc. Time 2, Dec Time 2

(3) Indirect Start



(a) This is the condition for Indirect Start

This is the condition for Indirect Start Command (XPM_IST)

(b) Axis ready

If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Operating state by axis

According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Indirect Start while it is running, the “error 231” would be appeared.

(d) Error state for each axis

According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo On signal

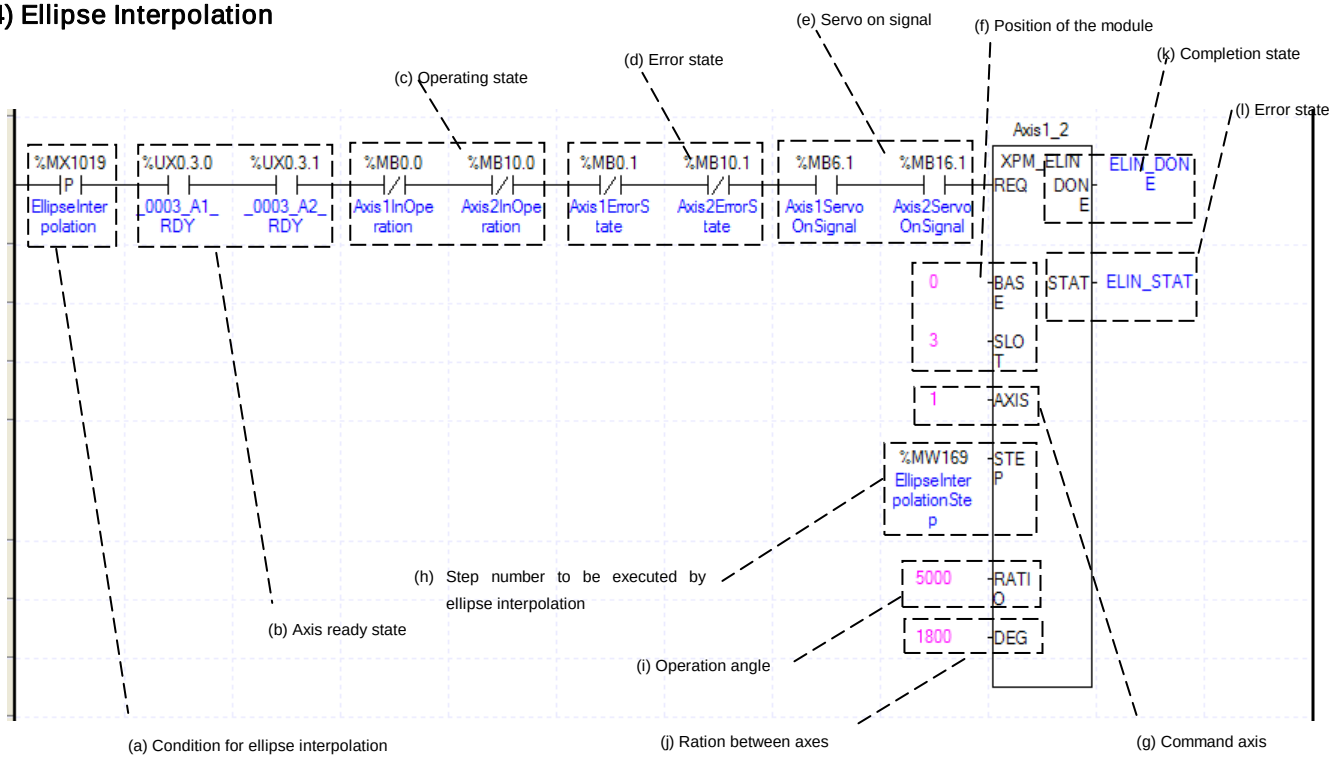
When applying the example program of “8.2.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since “Indirect start” command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state. If you execute “Indirect start” command when axis is not Servo On state, the error 212 occurs.

(f) Address of Positioning Module

In this example, Positioning Module is installed at the 3 slot of 0 bases.

(g) Axis of command execution
You can set an axis for Parameter Setting. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.
(h) Operating step number by Indirect Start
Set the operating step number by indirect start for main Axis of command execution.
(i) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.
(j) Error State
This is the area that output error no. if there are errors in operation of function block.
(k) Indirect start operates by appointing step of position data for each axis. Therefore it could run those commands of Positioning control, Speed control, Feed control, Linear circular interpolation depends on setting of positioning data. For more information, reference for Setting of Operating Data is in the “Chapter4.6.”
(l) The operation of function block is as follows.
Axis1 Indirect Start : Execute step no.1 of axis1 by indirect start
Axis2 Indirect Start : Execute %MW168(Indirect start step) of axis2 by indirect start

(4) Ellipse Interpolation



(a) This is the condition for Ellipse Interpolation
This is the condition for Ellipse Interpolation Command (XPM_ELIN)
(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.
(c) Operating state by axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Ellipse Interpolation while it is running, the “error 541” would be appeared.
(d) Error state for each axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo On signal
When applying the example program of “8.2.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since “Ellipse interpolation” command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state. If you execute “Ellipse interpolation” command when axis is not Servo On state, the error 549 occurs.

(f) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.

(g) Axis of command execution
You can set an axis for Parameter Setting. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.

(h) Operating step number by Ellipse Interpolation
Set the operating step number by Ellipse Interpolation. The setting of main operating step and subordinate step is the same.

(i) Ratio of Ellipse Interpolation Axis
Set both ratio values for main and subordinate axis of set operates data from circular interpolation locus. It is to change circular locus into ellipse locus by using ratio of main and subordinate axis.

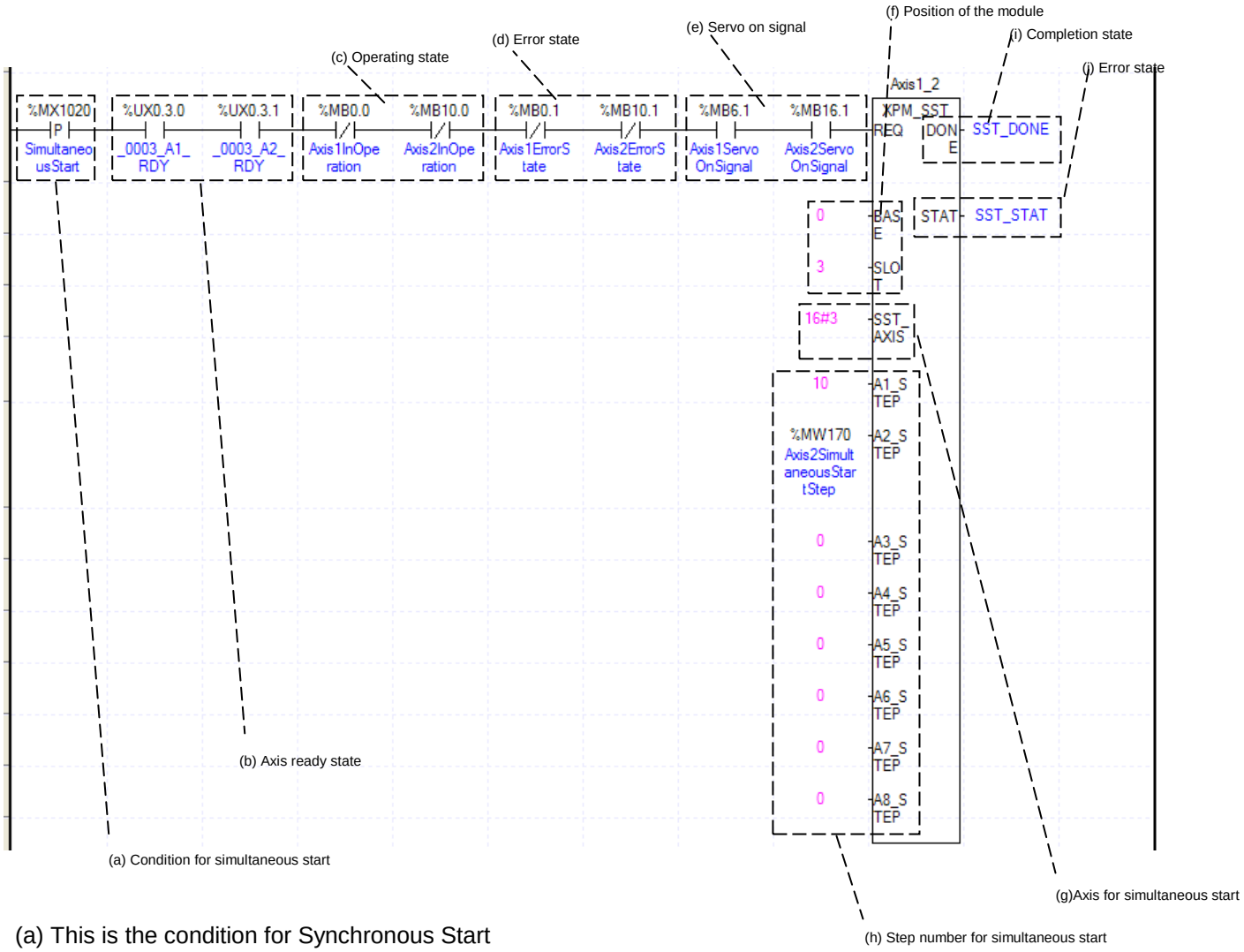
(j) Angle of Ellipse Interpolating Operation
Set the degree for Ellipse Interpolating Operation. Unit is [$X10^{-1}$ degree]. For more information, reference for Ellipse Interpolation is in the “Chapter9.213.”

(k) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(l) Error State
This is the area that output error no. if there are errors in operation of function block.

(m) The function block used in the example is as follows.
Axis1_2 Ellipse interpolation: Execute ellipse interpolation of 180°, ratio of between axis as 50% with operation data of %MW169(Ellipse interpolation step)step.

(5) Synchronous Start



(a) This is the condition for Synchronous Start
This is the condition for Synchronous Start Command

(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Operating state by axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Axis1 Synchronous Start while it is running, the “error 291” would be appeared.

(d) Error state by axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo On signal
When applying the example program of “8.2.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since “Simultaneous start” command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state. If you execute simultaneous start” command when axis is not Servo On state, the error 295 occurs.

(f) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.

(g) Axis for Synchronous Start
Set axis for Synchronous Start. The axis for Synchronous Start uses a “bit” from WORD Data setting as a “1” for each axis. Axis for each bits are as below.

15~8 Bit	7Bit	6Bit	5Bit	4Bit	3Bit	2Bit	1Bit	0Bit
N/A	Axis 8	Axis 7	Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1

(h) Synchronous start step no. per each axis
Set the step no. of each axis for synchronous start. XGF series can control 4 axes, it doesn’t use A4_STEP ~ A8_STEP input.

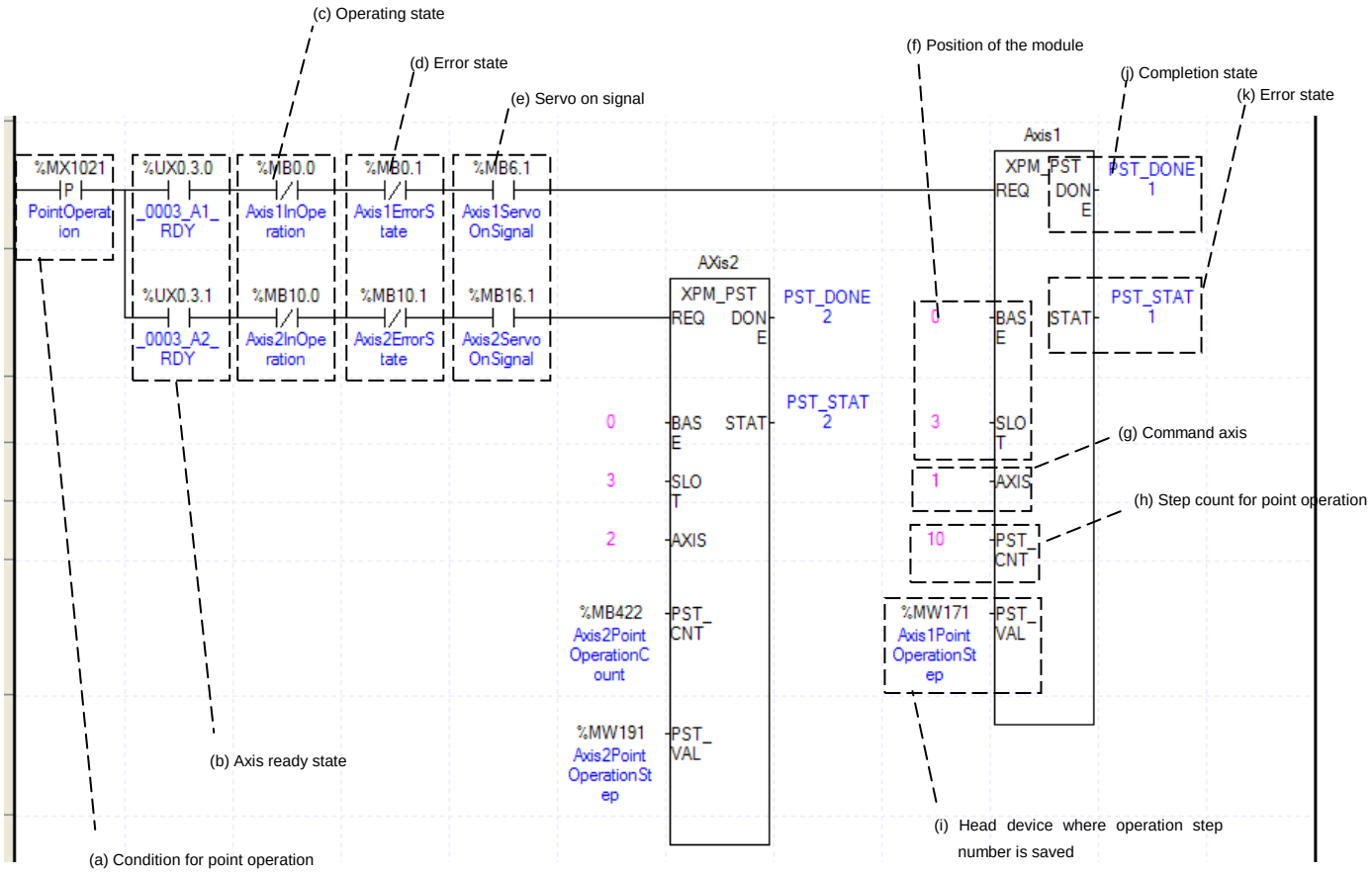
(i) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(j) Error State
This is the area that output error no. if there are errors in operation of function block.

(k) The function block used in the example is as follows.
Axis1_2 Synchronous start: Execute no.10 operation step of axis1 and step of %MW170(axis2 synchronous start step) synchronously.

.

(6) Point Operation



(a) This is the condition for Point Operation
This is the condition for Point Operation Command (XPM_PST).

(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Operating state by axis

According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Point Operation while it is running, the “error 231” would be appeared.

(d) Error state for each axis

According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo On signal

When applying the example program of “8.2.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since “Point operation” command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state. If you execute “Point operation” command when axis is not Servo On state, the error 212 occurs.

(f) Address of Positioning Module

In this example, Positioning Module is installed at the 3 slot of 0 bases.

(g) Axis of command execution

You can set an axis for Parameter Setting. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.

(h) Amount of Point Operation Steps

Decide how many steps will be operated. In this example above, 10 Point Operation steps are set in the axis1. Therefore, the step no. saved in %MW171 ~ %MW180 will be executed by point operation. For the details about point operation, refer to “(4) Point operation” of “9.2.17 Positioning start”.

(i) Address of first device where those data for Step Numbers of Point Operation are saved

To execute a Point Operation, you need to set a specific value first. Point Operation Step Data will be set up depends on number of first device as below table.

Value	Device No.	Point Operating Step Data
1	Device + 0	Point Operating Step Data 1
2	Device + 1	Point Operating Step Data 2
3	Device + 2	Point Operating Step Data 3
4	Device + 3	Point Operating Step Data 4
5	Device + 4	Point Operating Step Data 5
6	Device + 5	Point Operating Step Data 6
7	Device + 6	Point Operating Step Data 7
8	Device + 7	Point Operating Step Data 8
9	Device + 8	Point Operating Step Data 9
10	Device + 9	Point Operating Step Data 10
11	Device + 10	Point Operating Step Data 11
12	Device + 11	Point Operating Step Data 12
13	Device + 12	Point Operating Step Data 13
14	Device + 13	Point Operating Step Data 14
15	Device + 14	Point Operating Step Data 15
16	Device + 15	Point Operating Step Data 16
17	Device + 16	Point Operating Step Data 17
18	Device + 17	Point Operating Step Data 18
19	Device + 18	Point Operating Step Data 19
20	Device + 19	Point Operating Step Data 20

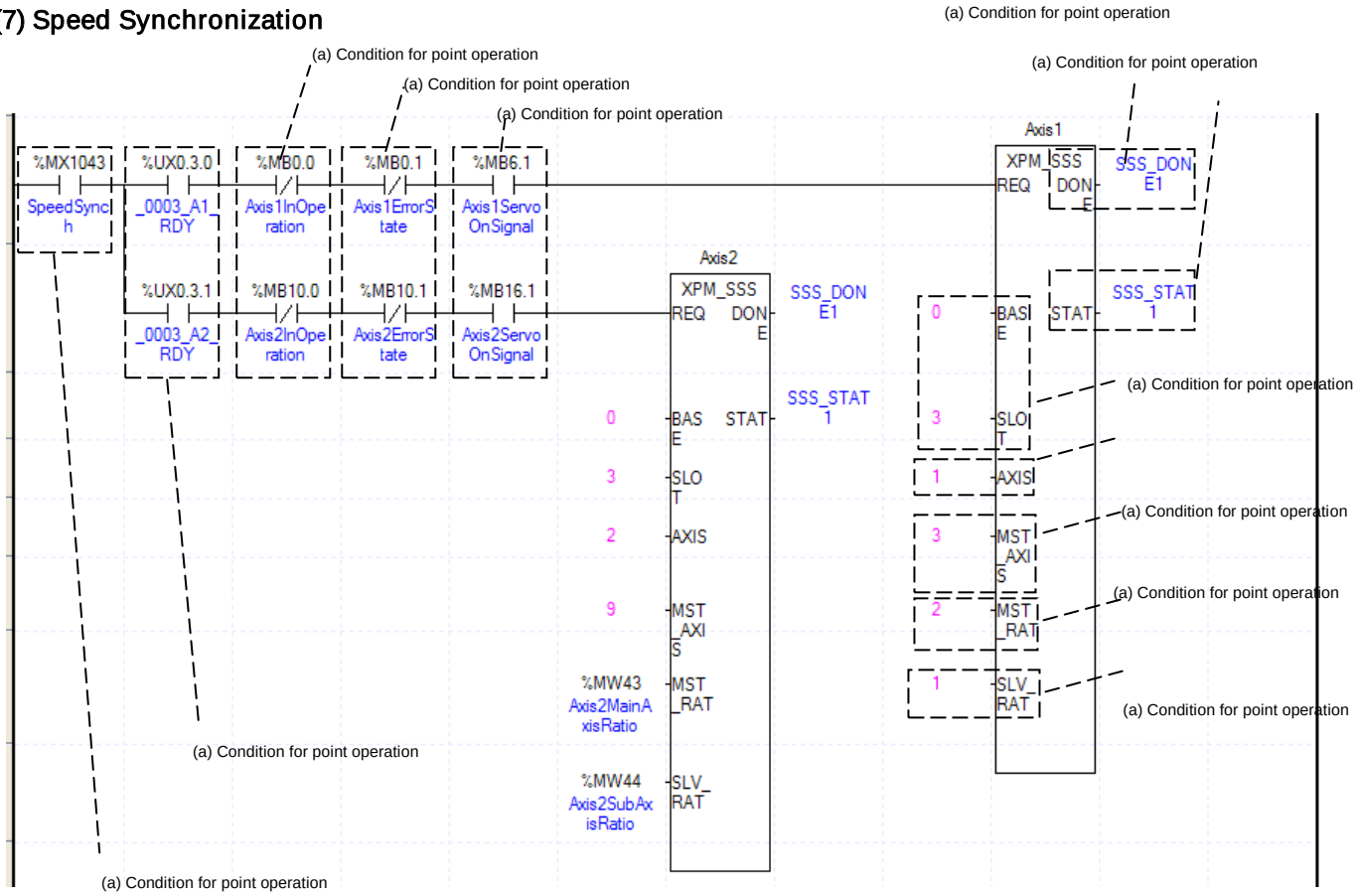
(j) State of Operation complete

If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(k) Error State

This is the area that output error no. if there are errors in operation of function block.

(7) Speed Synchronization



(a) This is the condition for Speed Synchronization
This is the condition for Speed Synchronization Command (XPM_SSS)

(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Operating state by axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Speed Synchronization while it is running, the “error 351” would be appeared.

(d) Error state for each axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo On signal
When applying the example program of “8.2.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since “Speed synchronization” command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state. If you execute “Speed synchronization” command when axis is not Servo On state, the error 354 occurs.

(f) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.

(g) Axis of command execution
You can set an axis for Parameter Setting. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.

(h) Main Axis Setting
Set a main axis to operate Speed Synchronization. This setting is for main axis of Speed Synchronization. This setting cannot be set as same value as Axis of command execution, and possible setting values are as below.

(i) Ratio of Main Axis
Set value for Ratio of Main Axis to execute a Speed Synchronization.

(j) Ratio of Subordinate Axis
Set value for Ratio of Subordinate Axis to execute a Speed Synchronization. In this example above, the ratio of main and subordinate axis is 2:1. Meaning that operational speed ratio of those axis is 2 to 1. So, if main axis is operating in speed of 10000, subordinate axis will be operating in speed of 5000.

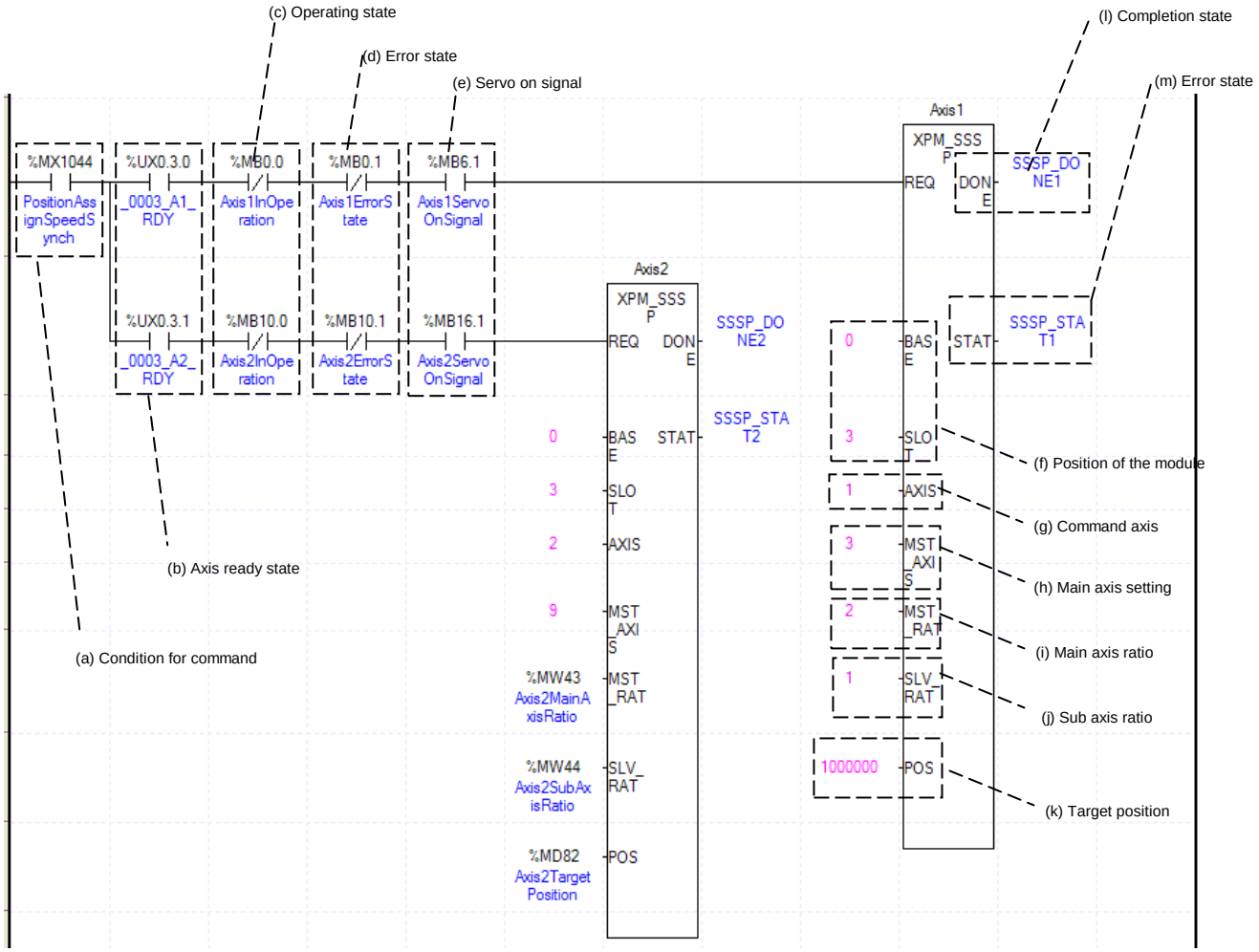
Set value	Main Axis
1	Axis1
2	Axis 2
3	Axis 3
4	Axis 4
5	Axis 5
6	Axis 6
7	Axis 7
8	Axis 8
9	Encoder1
10	Encoder2

(k) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(l) Error State
This is the area that output error no. if there are errors in operation of function block.

(m) For more information, reference for Speed Synchronization is in the “Chapter 9.4.1.”

(8) Position Assign Speed Synchronization



(a) This is the condition for Position Assign Speed Synchronization
This is the condition for Position Assign Speed Synchronization Command (XPM_SSSP)

(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Operating state by axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured if it is not running. If you execute Position Assign Speed Synchronization while it is running, the “error 351” would be appeared.

(d) Error state for each axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo On signal
When applying the example program of “8.2.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since “Position assign speed synchronization” command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state. If you execute “Position assign speed synchronization” command when axis is not Servo On state, the error 354 occurs.

(f) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.

(g) Axis of command execution
You can set an axis for Parameter Setting. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.

(h) Main Axis Setting
Set a main axis to operate Speed Synchronization. This setting is for main axis of Speed Synchronization. This setting cannot be set as same value as Axis of command execution, and possible setting values are as below.
‘

Set value	Main Axis
1	Axis1
2	Axis2
3	Axis3
4	Axis4
5	Axis5
6	Axis6
7	Axis7
8	Axis8
9	Encoder1
10	Encoder2

(i) Ratio of Main Axis
Set value for Ratio of Main Axis to execute a Speed Synchronization.

(j) Ratio of Subordinate Axis
Set value for Ratio of Subordinate Axis to execute a Speed Synchronization. In this example above, the ratio of main and subordinate axis is 2:1. Meaning that operational speed ratio of those axes are 2 to 1. So, if main axis is operating in speed of 10000, subordinate axis will be operating in speed of 5000.

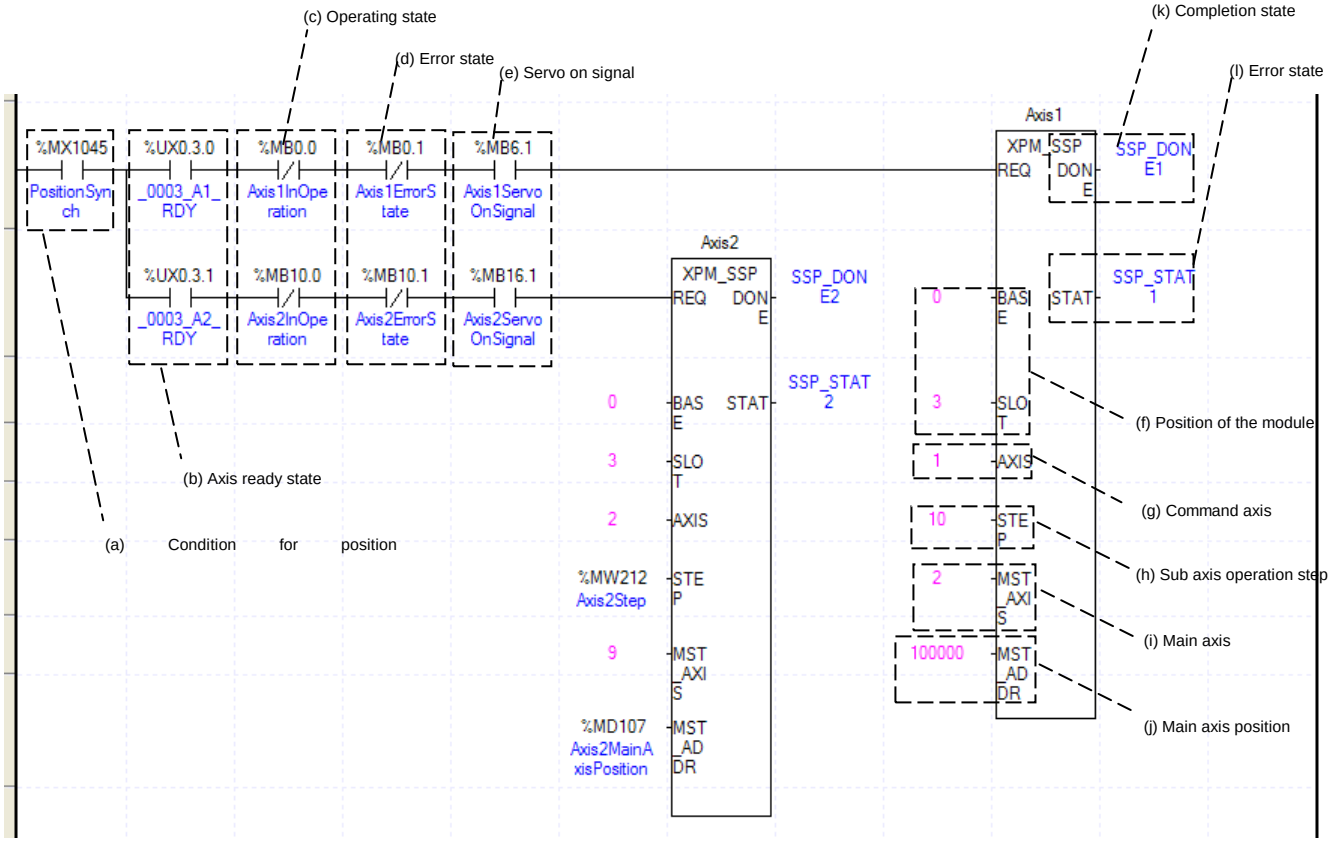
(k) Goal Position
Set goal of Position Assign Speed Synchronization. Once Axis of command execution reaches the goal position, Speed Synchronization ends and operation will be stop immediately.

(l) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(m) Error State
This is the area that output error no. if there are errors in operation of function block.

(n) For more information, reference for Position Assign Speed Synchronization is in the “Chapter 9.4.1.”

(9) Synchronous Start by Position



(a) This is the condition for Synchronous Start by Position
This is the condition for Synchronous Start by Position Command (XPM_SSP)

(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Operating state by axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Synchronous Start by Position while it is running, the “error 341” would be appeared.

(d) Error state for each axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo On signal
When applying the example program of “8.2.2 Current State Read”, this is “Servo On” signal for each axis. When each axis is Servo On state, it will be on. Since “Position synchronization” command can’t be executed when the axis is not servo on, it makes command executed when servo driver is “Servo On” state. If you execute “Position synchronization” command when axis is not Servo On state, the error 212 occurs.

(f) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.

(g) Axis of command execution
You can set an axis for Parameter Setting. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis4.

(h) Step of Subordinate Axis
Set step number for Subordinate Axis to execute a Speed Synchronization.

(i) Main Axis Setting

Set a main axis to operate Speed Synchronization. This setting is for main axis of Speed Synchronization. This setting cannot be set as same value as Axis of command execution, and possible setting values are as below.

(j) Value of Main Axis

Set value for Main Axis to execute Synchronous Start by Position. Therefore main axis will be executed the command when the subordinate axis reaches this set value.

Set value	Main Axis
1	Axis1
2	Axis2
3	Axis3
4	Axis4
5	Axis5
6	Axis6
7	Axis7
8	Axis8
9	Encoder1
10	Encoder2

(k) State of Operation complete

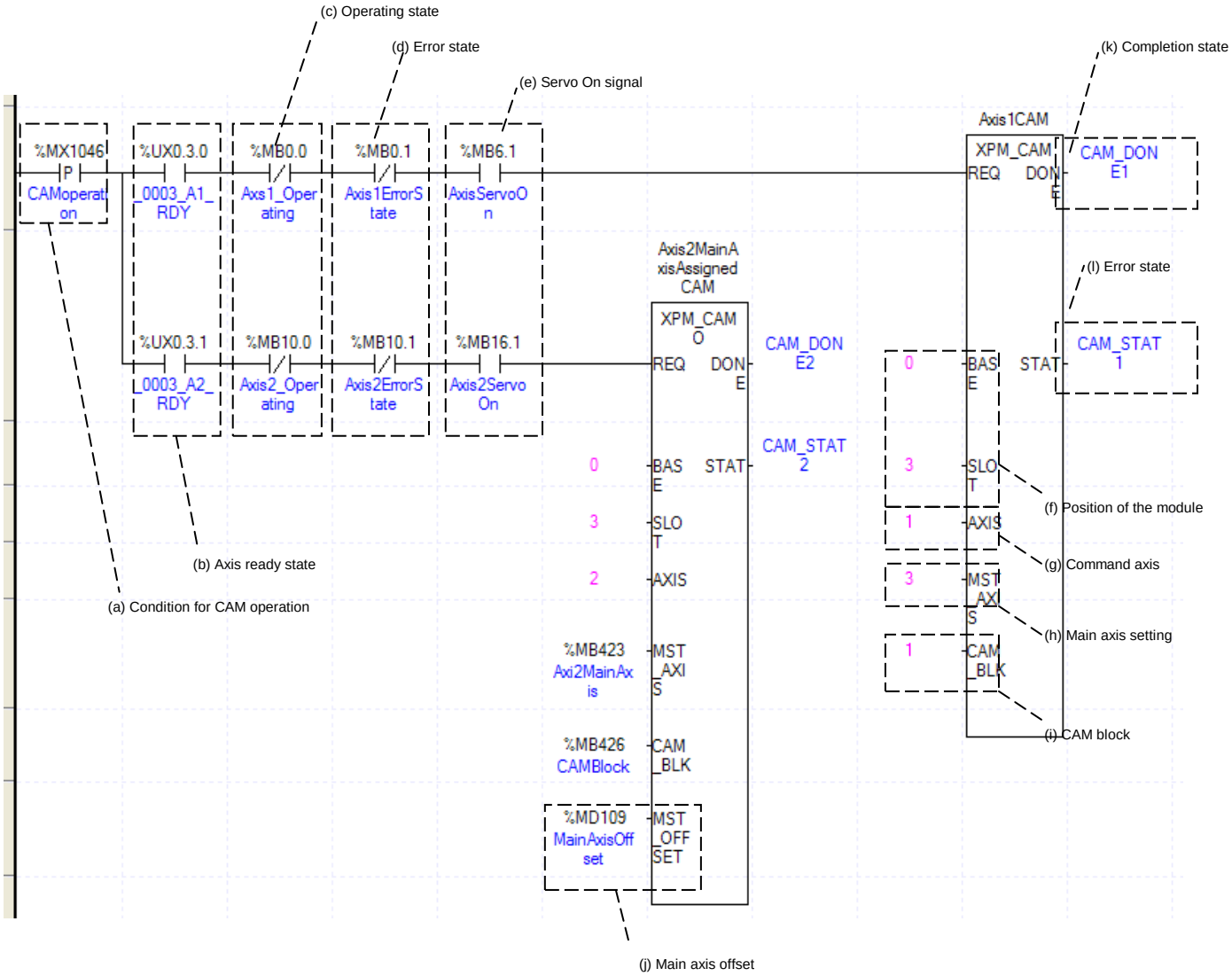
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(l) Error State

This is the area that output error no. if there are errors in operation of function block.

(m) For more information, reference for Synchronous Start by Position is in the “Chapter 9.4.2.”

(10) CAM Operation



(a) This is the condition for CAM Operation
This is the condition for CAM Operation Command (XPM_CAM)

(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

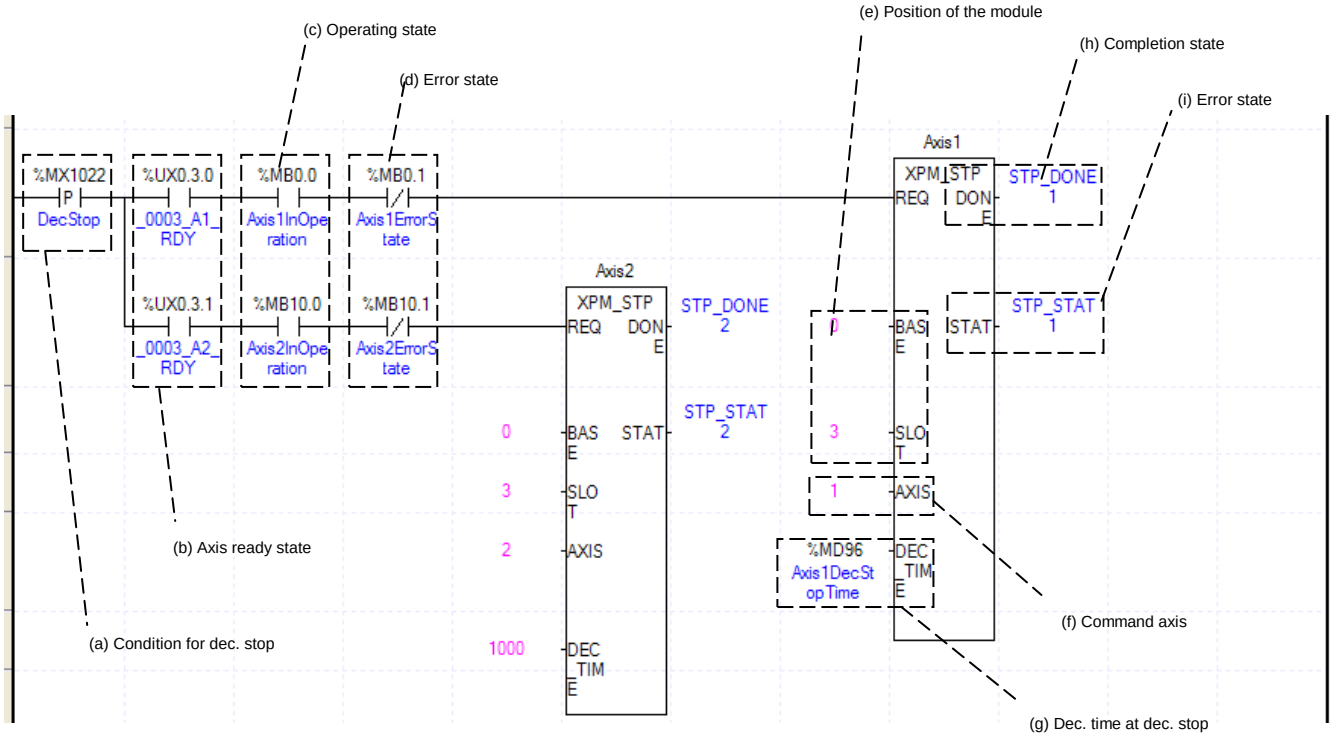
(c) Operating state by axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute CAM Operation while it is running, the “error 701” would be appeared.

(d) Error state for each axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Ready signal for each axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Drive Ready” for each axis. This command only works when this is the condition for Drive Ready is on. If a Drive Ready of main axis is not set as “ON,” the “error 703” would be appeared.

(f) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.
(g) Axis of command execution
You can set an axis for Parameter Setting. XGF series supports for 4 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis4.
(h) Main Axis Setting
Setting of main axis to operate .This setting is for main axis of CAM Operating. This setting cannot be set as same value as Axis of command execution. Can set a value 1~4, meaning from axis1 to axis 4.
(i) CAM Block Numbers
Setting for Block Numbers of CAM data to operate CAM operation. XGF series support 8 CAM Blocks. The CAM Data for each Block would be downloaded to module written from Software Package.
(j) Main axis offset
In case of “XPM_CAMO”, you have to set the main axis offset position where sub axis starts CAM operation. After execution of instruction, sub axis starts CAM operation after main axis moves as far as the moving amount set at the main axis offset.
(k) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.
(l) Error State
This is the area that output error no. if there are errors in operation of function block.
(m) For more information, reference of CAM Operation is in the “Chapter 9.4.3.”

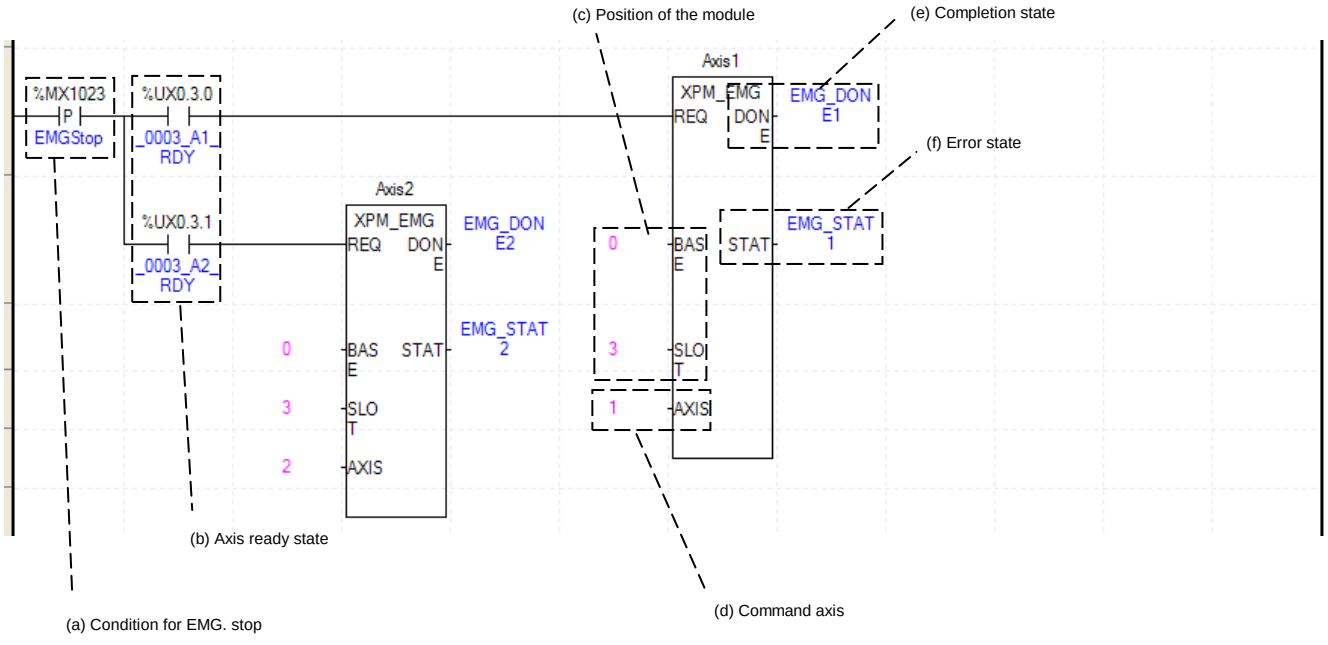
(11) Deceleration Stop



(a) This is the condition for Deceleration Stop
This is the condition for Deceleration Stop Command (XPM_STP)
(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.
(c) Operating state by axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running.

(d) Error state for each axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.
(e) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.
(f) Axis of command execution
You can set an axis for Parameter Setting. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.
(g) Deceleration time of Deceleration Stop
Set a deceleration time of Deceleration Stop operation. Unit of Deceleration Stop is [ms]. Since this time refers deceleration time from the speed limit, there might be little difference between Deceleration Stop set time and actual stop time. The range of deceleration time is “0~2,147,483,674.” 1~2,147,483,674 means Deceleration Time set as 1ms ~ 2,147483674ms. If it set as “0,” it will be operated with set deceleration value. Also it use to stop Speed Synchronous Operation or CAM Operation while Speed and CAM Operation. If Dec. stop command is executed at this time, Speed synchronization or CAM Operation is cancelled, it stops with Dec. time
(h) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.
(i) Error State
This is the area that output error no. if there are errors in operation of function block.
(j) For more information, reference of Deceleration Stop is in the “Chapter 9.2.18.”
(k) Operation of each function block is as follows.
Axis1 Dec. Time : When axis1 is in operation, decelerate to %MD96(axis1 Dec. stop Time), then stop.
Axis2 Dec. Time : When axis 2 is in operation, decelerate to 1000ms, then stop.

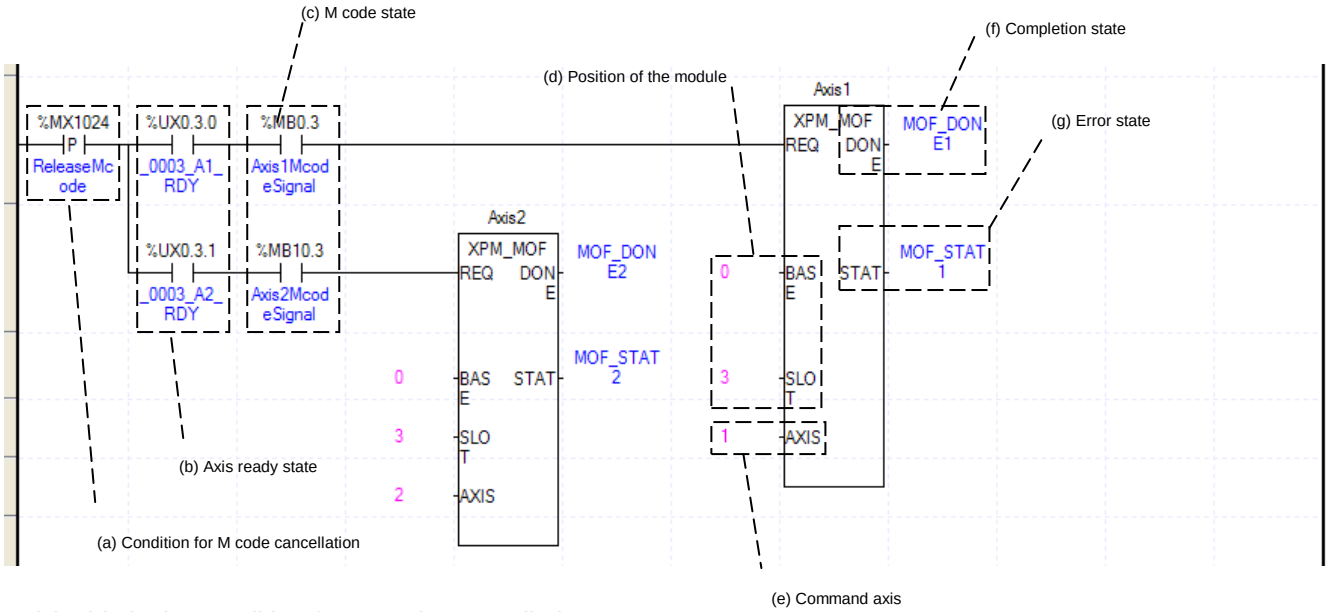
(12) Emergency Stop



(a) This is the condition for Emergency Stop
This is the condition for Emergency Stop Command (XPM_EMG)
(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

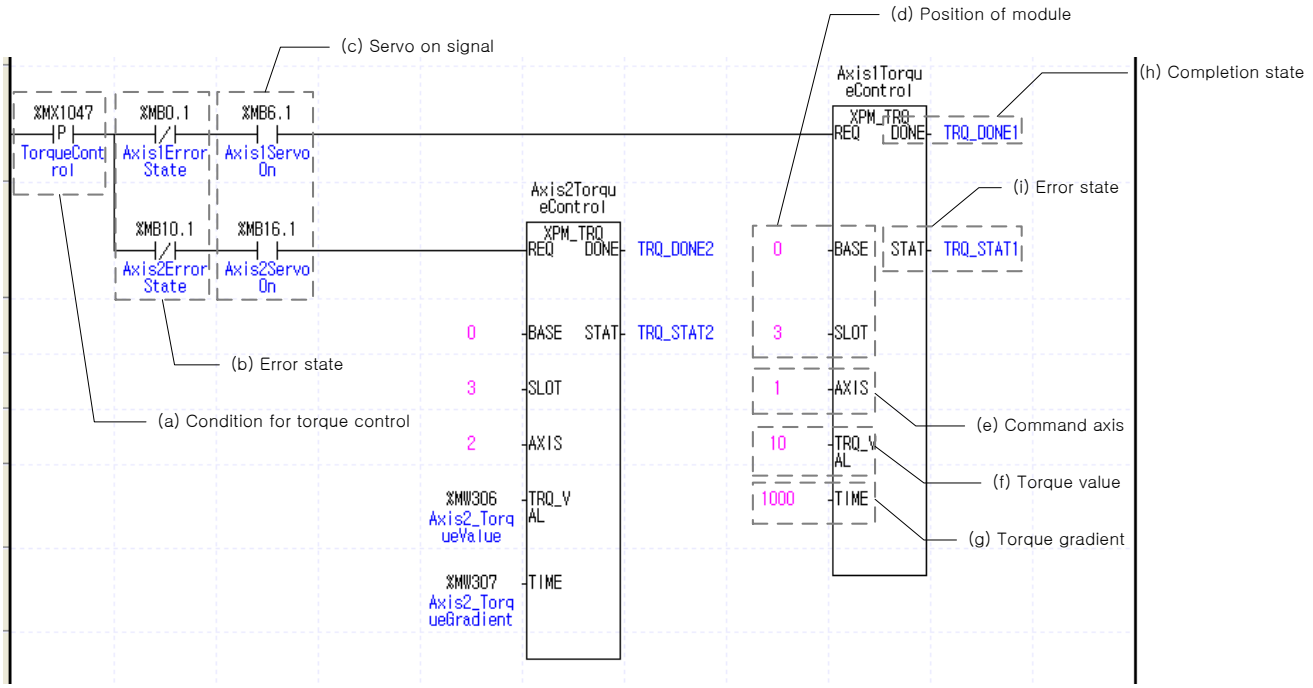
(c) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.
(d) Axis of command execution
You can set an axis for Emg. stop. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.
(e) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.
(f) Error State
This is the area that output error no. if there are errors in operation of function block.
(g) Emergency Stop is operating by each axis.
Once Emergency Stop command executes the error “481” would be occurred. With the set value for deceleration time, it will be decelerated and stop the operation
(h) For more information, reference of Emergency Stop is in the “Chapter 9.2.18.”

(13) M code Cancellation



(a) This is the condition for M code Cancellation
This is the condition for M code Cancellation (XPM_MOF). Once M code Cancellation command executed, number of M code would be change to “0,” and signal of M code to “Off.”
(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.
(c) M code state for each axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “M Code” for each axis. It turns on when it is operating. M code Cancellation command can only be valid once M code are generated. The condition for execution is operation possible when it is “On.”
(d) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.
(e) Axis of command execution
You can set an axis for M code cancellation. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.
(f) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.
(g) Error State
This is the area that output error no. if there are errors in operation of function block.
(h) For more information, reference of M code Cancellation is in the “Chapter 9.6.2.”

(14) Torque Control



(a) This is the condition for Torque Control
Conditions to execution the Control Torque command (XPM_TRQ). Once Torque Control command executed, the corresponding axis executions Control Torque with the set torque value and torque gradient.

(b) Error state for each axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(c) Servo on signal for each axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Servo On” for each axis. This command only works when this is the condition for Servo is on. If the Control Torque command is executed when it is not the state of servo on, No. 743 error takes place.

(d) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.

(e) Axis of command execution
You can set an axis for M code cancellation. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.

(f) After executing the Control Torque command, set torque value to drive under the Torque Control command. The torque value range is -32768 through 32767%.

(g) Set gradient until the target torque in time. The gradient range is 0 through 65535ms.

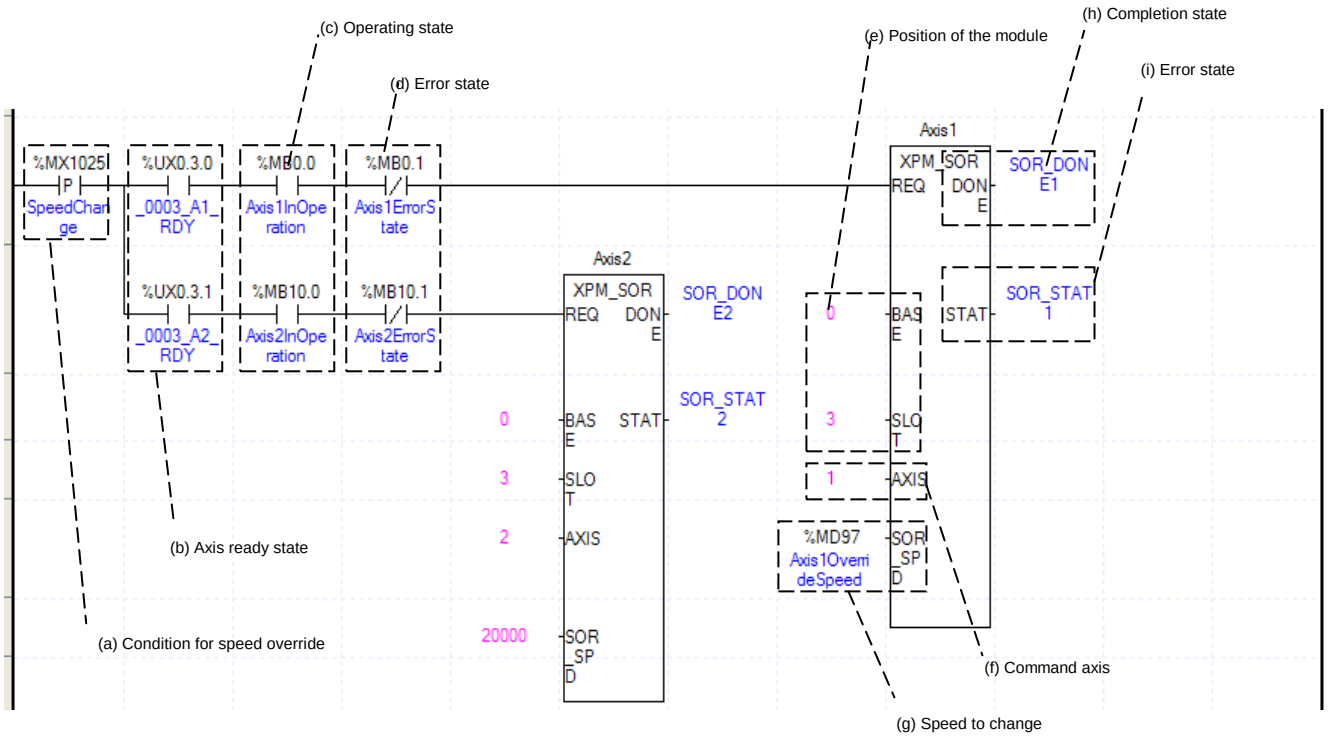
(h) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(i) Error State
This is the area that output error no. if there are errors in operation of function block.

(j) For more information, reference of Torque Control is in the “Chapter 9.2.21 Torque Control.”

8.2.7 Operation Setting Change while Operating

(1) Speed Override



(a) This is the condition for Speed Override
This is the condition for Speed Override Command (XPM_SOR)

(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Operating state by axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Speed Override while it is running, the “error 371” would be appeared.

(d) Error state for each axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.

(f) Axis of command execution
You can set an axis for Speed override. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis 8.

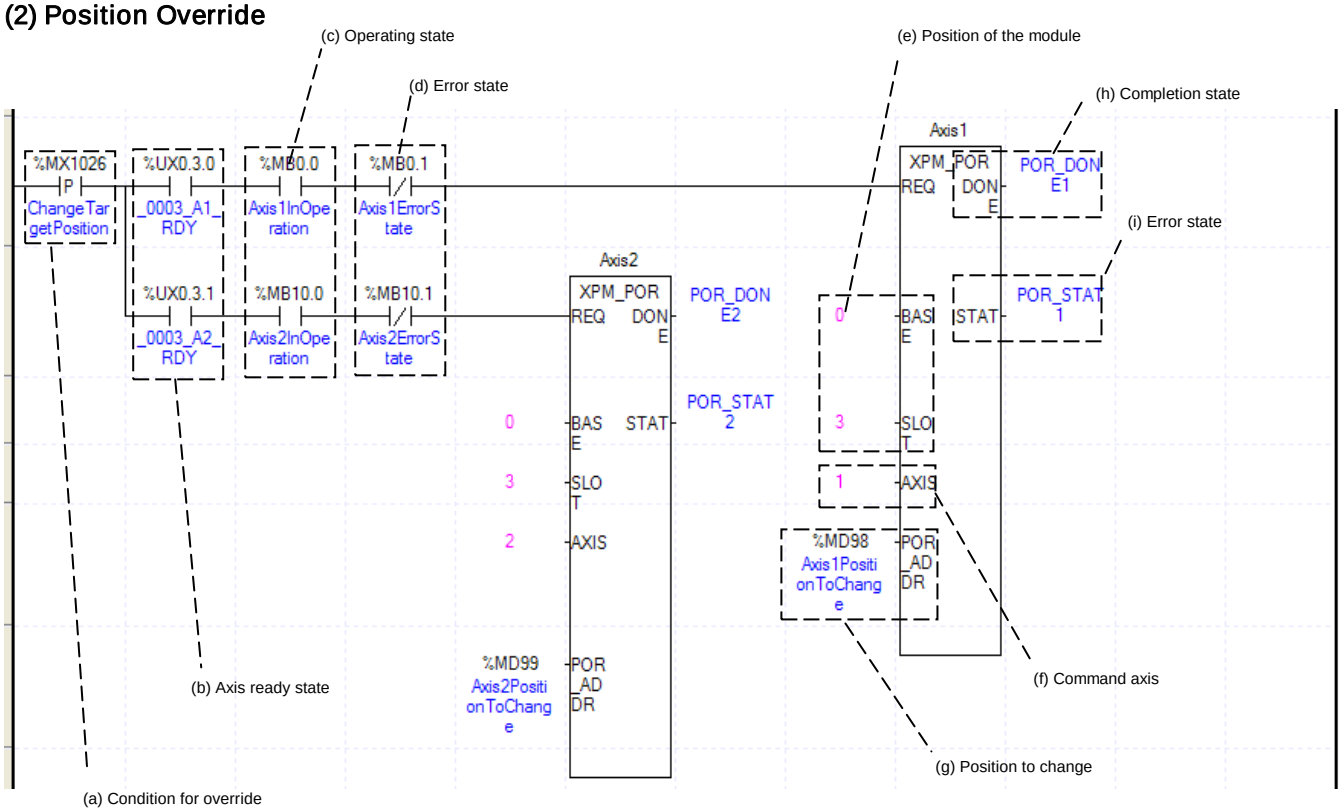
(g) Value Change for Speed Operation
Set speed value. According to Speed Override from common parameters, it is a signal of “%” or “Speed Value” depends on setting of category. Also, when Speed Override set as Speed Value, it means Unit/Time depends on Speed Command Unit from basic parameters, or it means “rpm.” If a changing Operation Speed Value is “%,” then the unit would be [$X10^{-2}$%]. If it is “rpm, “then the unit would be $X10^{-1}$rpm].

(h) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(i) Error State
This is the area that output error no. if there are errors in operation of function block.

(j) The function block in the example above is as follows.
Axis1 Speed Override : The operating speed of axis1 will be changed to speed value saved in %MD97 and then continue to operate.
Axis2 Speed Override : The operating speed of axis2 will be changed to 20000 and then continue to operate.
(k) For more information, reference of Speed Override is in the “Chapter 9.5.5.”

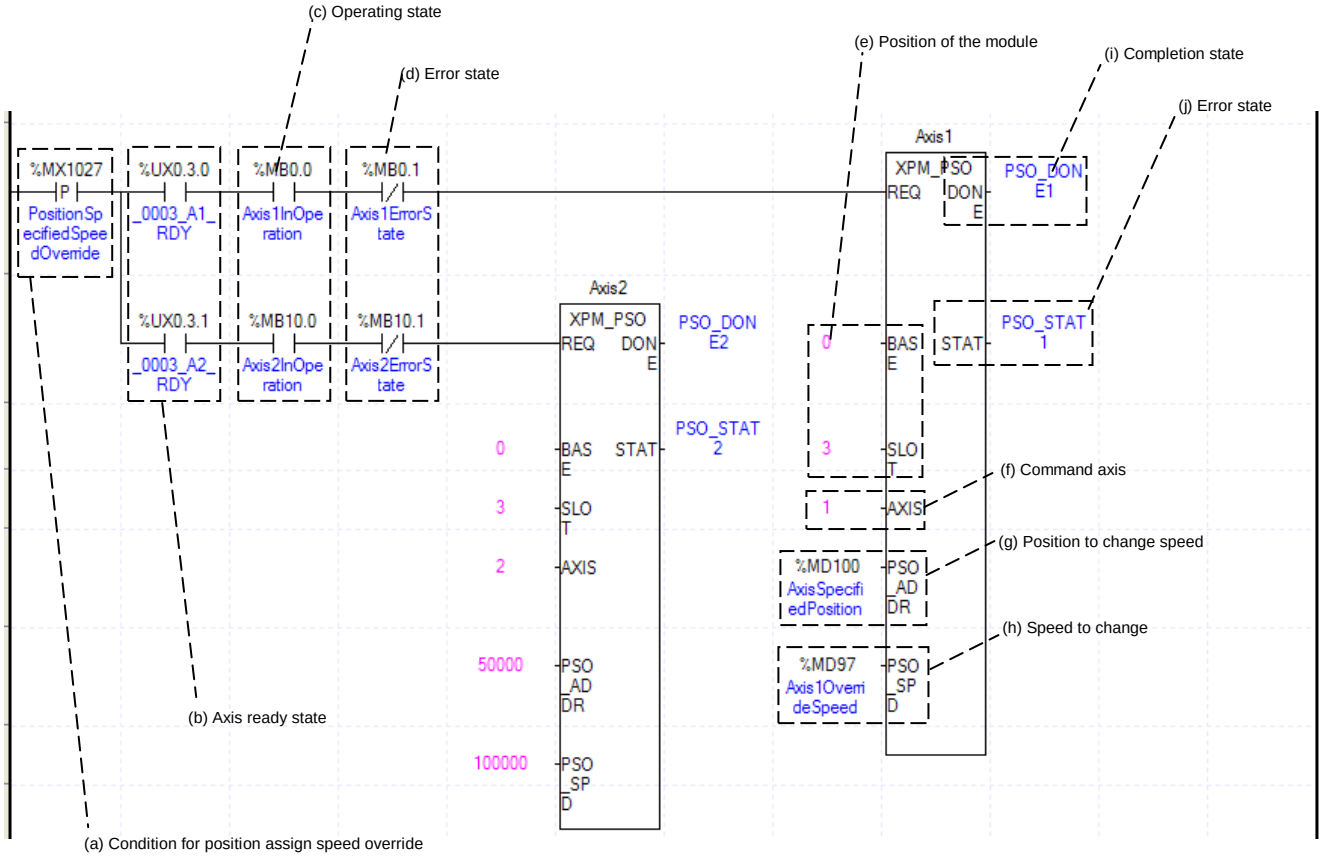
(2) Position Override



(a) This is the condition for Position Override
This is the condition for Position Override Command (XPM_POR)
(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.
(c) Operating state by axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Position Override while it is running, the “error 361” would be appeared.
(d) Error state for each axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.
(e) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.
(f) Axis of command execution
You can set an axis for Position override. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.
(g) Change for Goal Position Value
Setting Value Change for Goal Position Value. The unit of this value depends on “Unit” category. Once Position Override commands are executed, the goal position of executed axis will be changed to set goal position.

(h) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.
(i) Error State
This is the area that output error no. if there are errors in operation of function block.
(j) The function block in the example above is as follows.
Axis1 Position Override: Goal position of axis1 is changed to the value saved in %MD98.
Axis2 Position Override: Goal position of axsi2 is changed to the value saved in %MD99.
(k) For more information, reference of Position Override is in the “Chapter 9.5.4.”

(3) Position Assign Speed Override



(a) This is the condition for Position Assign Speed Override
This is the condition for Position Assign Speed Override Command (XPM_PSO)
(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.
(c) Operating state by axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Position Assign Speed Override while it is running, the “error 381” would be appeared.
(d) Error state for each axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.
(e) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.
(f) Axis of command execution
You can set an axis for Position assign speed override. XGF-PN8A supports for 8 axes. In the

"execution of axis" from the configuration of Parameter Setting, you can set a value for axis1 through axis8.

(g) Position of Speed Change Execution

Set the position of Speed Change. Once the actual position located at set position with speed override command running, the speed change commands are executed.

(h) Value Change for Operation speed

Set the Value Change for Operation speed. According to Speed Override from common parameters, it is a signal of "%" or "Speed Value" depends on setting of category. Also, when Speed Override set as Speed Value, it means Unit/Time depends on Speed Command Unit from basic parameters, or it means "rpm." If a changing Operation Speed Value is "%," then the unit would be [$X10^{-2}$%]. If it is "rpm, "then the unit would be $X10^{-1}$rpm].

(i) State of Operation complete

If function block is completed without error, "1" will be outputted and maintain "1" until the next operation. If error occurred, "0" will be outputted.

(j) Error State

This is the area that output error no. if there are errors in operation of function block.

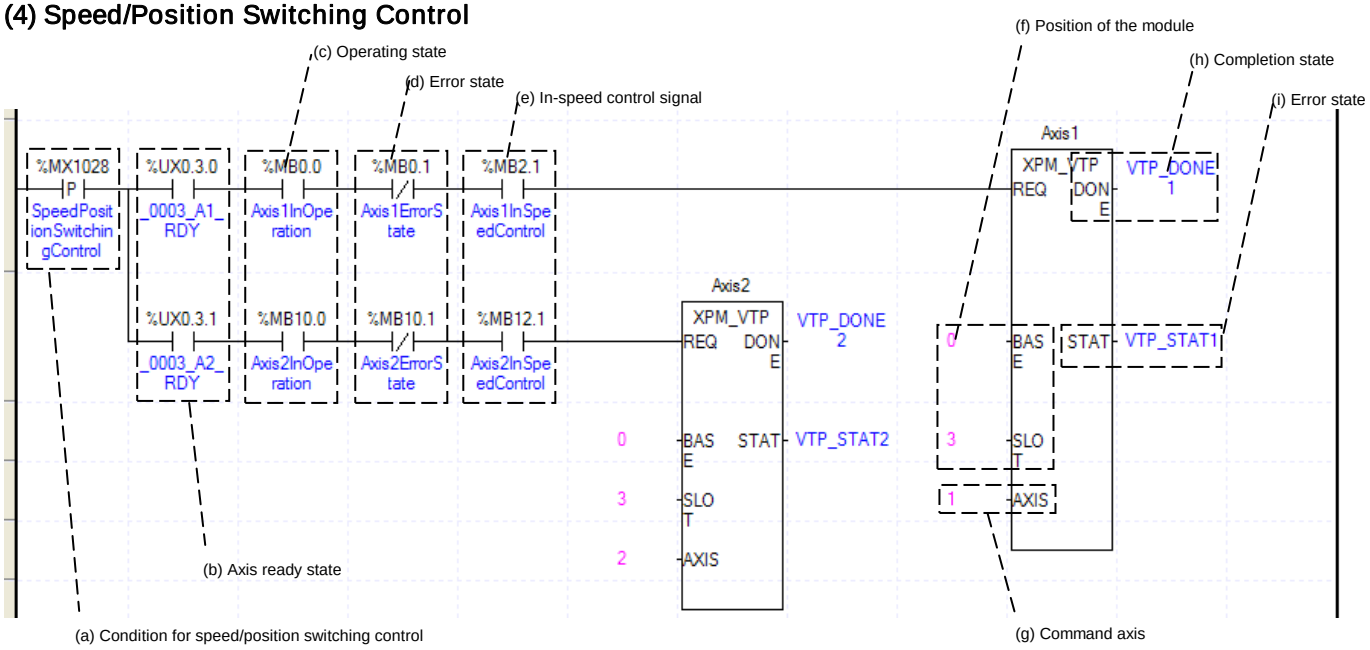
(k) The function block in the example above is as follows.

Axis1 Positioning Speed Override : When the current position of axis1 become the same position as the position saved in %MD100, the speed value will be changed to the speed saved in %MD92.

Axis2 Positioning Speed Override : When the current position of axis1 become 50000, the speed will be changed to 100000.

(l) For more information, reference of Position Assign Speed Override is in the "Chapter 9.5.6."

(4) Speed/Position Switching Control



(a) This is the condition for Speed/Position Switching Control

This is the condition for Speed/Position Switching Control Command (XPM_VTP)

(b) Axis ready

If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Operating state by axis

According to exercise from "Chapter 8.2.2 Current State Reading," it is a signal of "Operating" for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Speed/Position Switching Control while it is running, the "error 301" would be appeared.

(d) Error state for each axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Signal from Speed Control by each Axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Speed Control state” for each axis. It turns on when it is operating. Speed/Position Switching Control Setting can only be configured while it is running. If you execute Speed/Position Switching Control while it is not running, the “error 302” would be appeared.

(f) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.

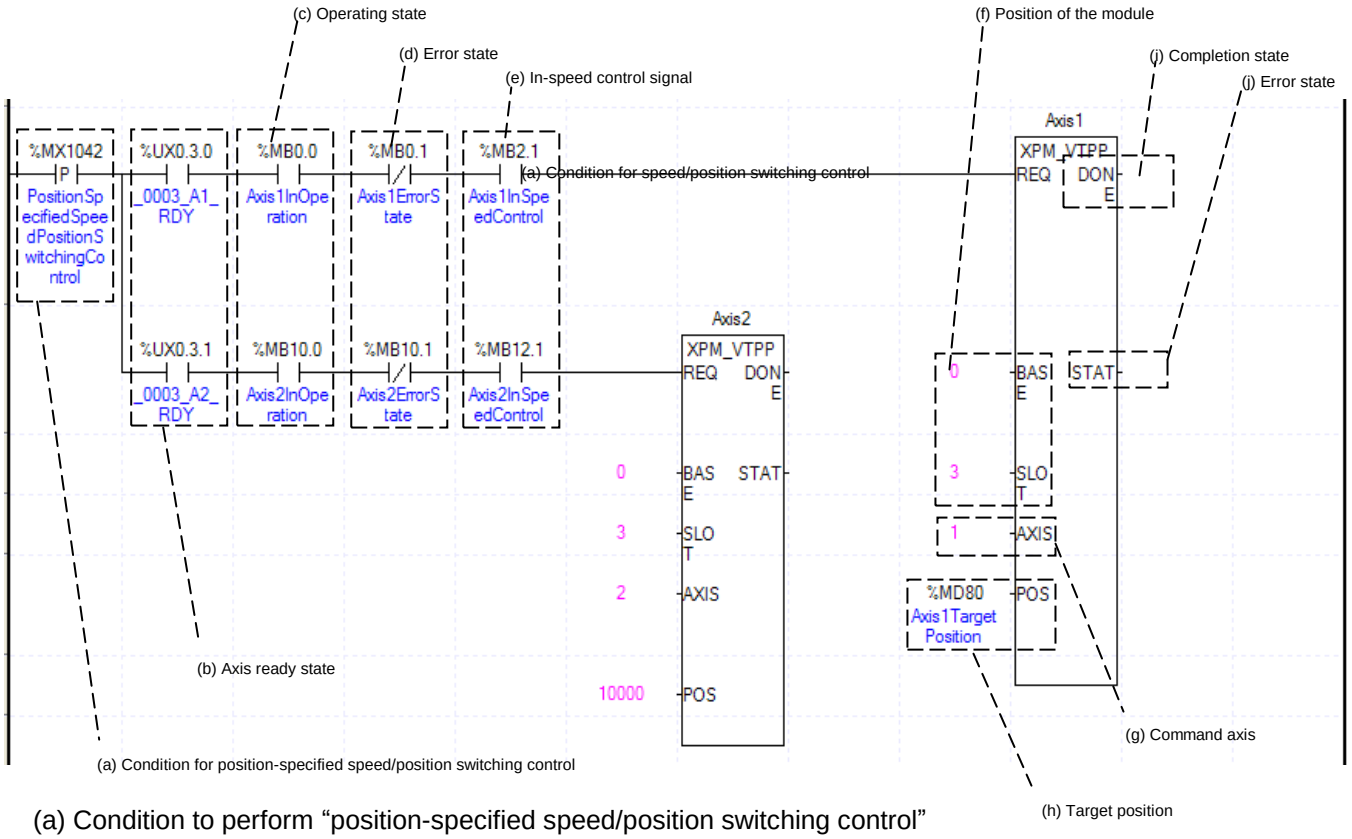
(g) Axis of command execution
You can set an axis for Parameter Setting. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.

(h) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(i) Error State
This is the area that output error no. if there are errors in operation of function block.

(j) For more information, reference of Speed/Position Switching Control is in the “Chapter 9.2.14.”

(5) Position Specified Speed/Position Switching Control



(a) Condition to perform “position-specified speed/position switching control”
Condition to perform control command (XPM_VTPP) for position-specified speed/position switching

(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Operation state for each axis

In case that an example program of"8.1.2 Read Current State" is applied, it is a signal showing that each axis is "operating." If a relevant axis is running, it becomes 'On'. A condition has been set to make the control command for position specified speed/position switching valid only when the relevant axis is running. If the control command for position specified switching is carried out when the relevant axis is not running, No.301 Error will take place.

(d) Error State for each axis

In case that an example program of"8.1.2 Read Current State" is applied, it is a signal showing "Error State" for each axis. If any error takes place, it becomes 'On'. A condition has been set to perform a control command only when there is no error with the relevant axis. If the user wants to execute a command regardless of the occurrence of errors, he/she may remove this condition.

(e) Speed Control Signal for each axis

In case that an example program of"8.1.2 Read Current State" is applied, it is a signal showing each axis is "controlling its speed." If the relevant axis is running under speed control, it becomes 'On.' A condition has been set to make the control command for position specified speed/position switching control valid only when the relevant axis is in a speed control status. If the control command is carried out when the relevant axis is not in a speed control status, No.302 Error will take place.

(f) Position of a module

For the example program above, it is assumed that positioning modules are installed on NO.0 Base and No. 3 Slot.

(g) Axis to make a command

Decide an axis that will execute the control command. XGF-PN8A can control up to four axes and assign 1 through 8 referring to 1-axis through 8-axis for this item.

(h) Transfer amount

After the control command for position specified speed/position control switching is executed, convert from speed control to position control and moves by transfer amount.

(i) Completion state

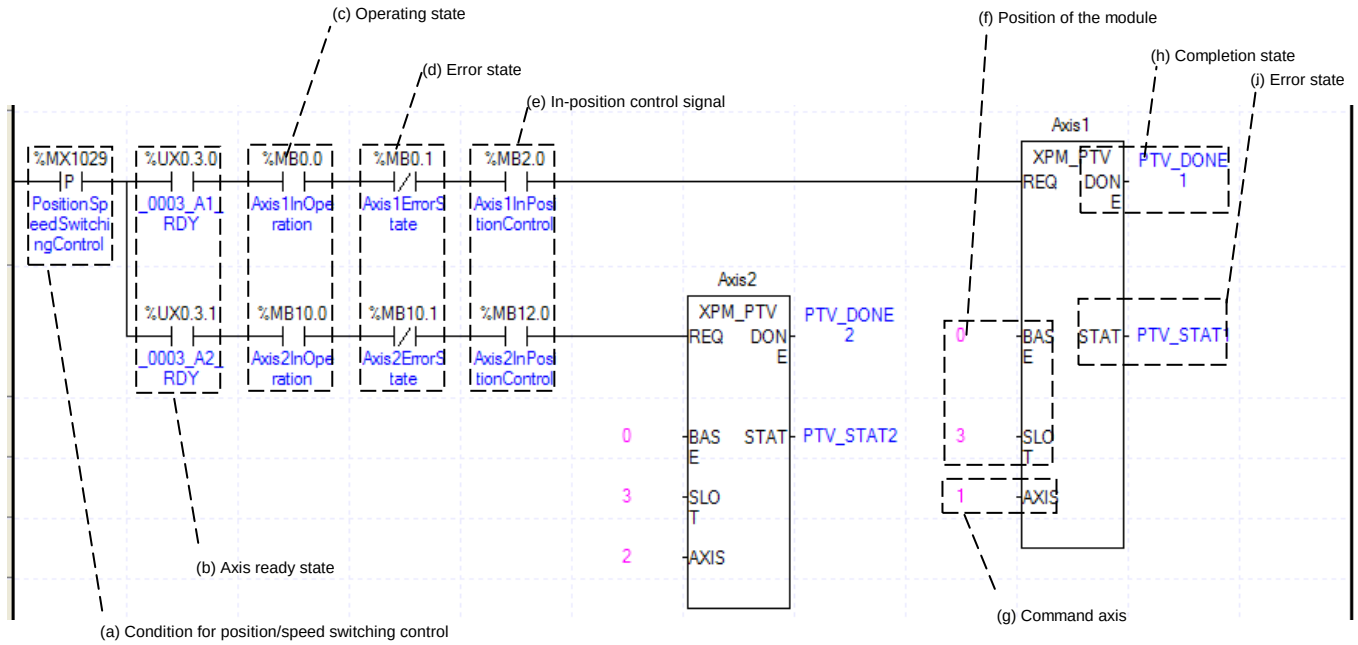
If any function block is completely executed without any error, it displays and maintains "1" until the next execution while it displays"0" if any error takes place.

(j) Error state

If any error takes place when any function block is executed, this area generates its error number.

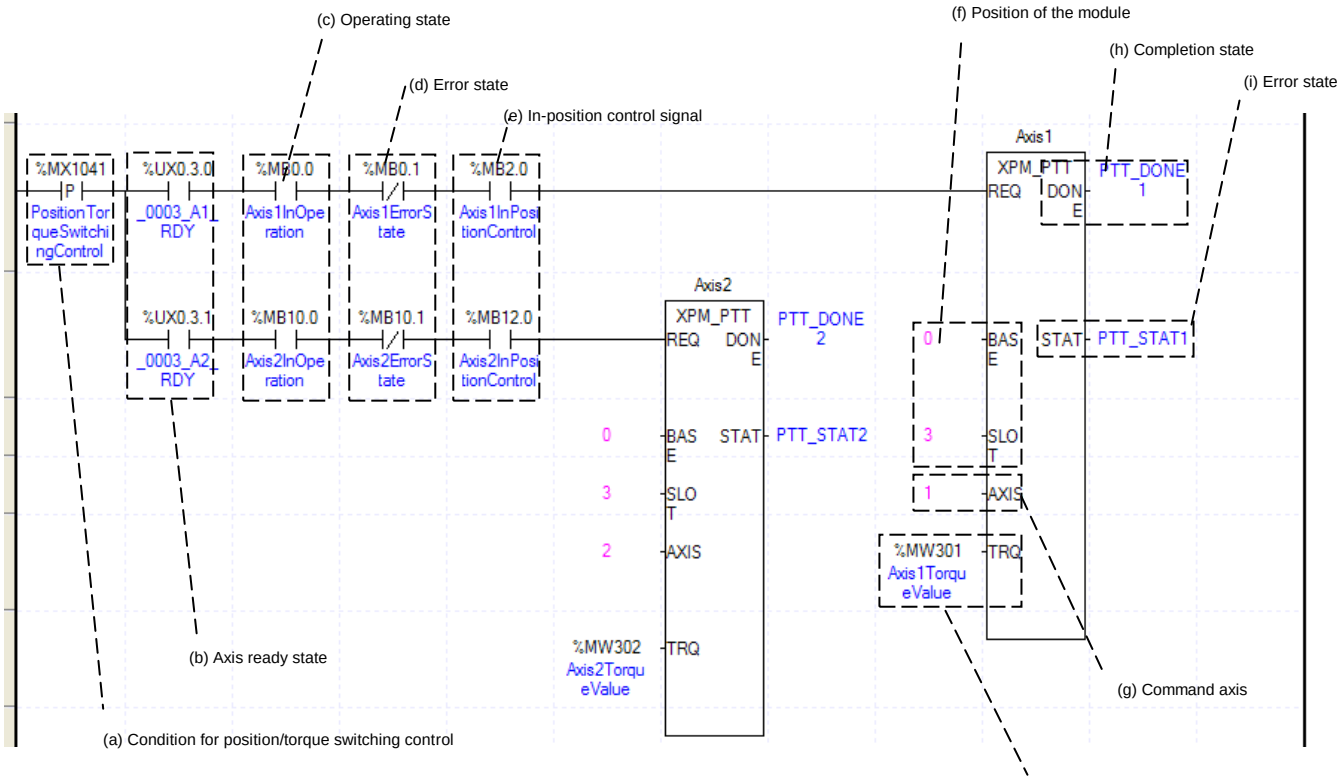
(k) For details on the operation of position specified speed/position switching control, refer to "position specified speed/position switching control"

(6) Position/ Speed Switching Control



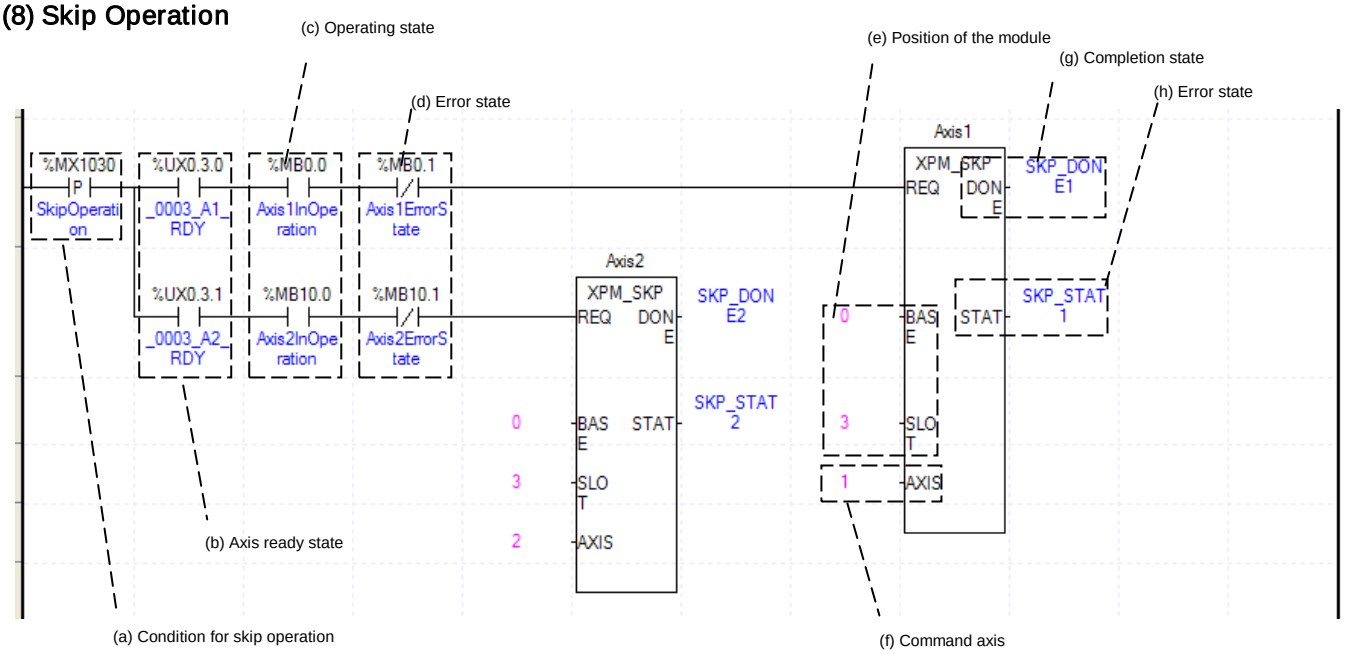
(a) This is the condition for Position/ Speed Switching Control
This is the condition for Position/ Speed Switching Control Command (XPM_PTV)
(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.
(c) Operating state by axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Position/ Speed Switching Control while it is running, the “error 311” would be appeared.
(d) Error state for each axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.
(e) Signal from Position Control by each Axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Position Control state” for each axis. It turns on when it is operating. Position/ Speed Switching Control Setting can only be configured while it is running. If you execute Position/Speed Switching Control while it is not running, the “error 317” would be appeared.
(f) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.
(g) Axis of command execution
You can set an axis for Parameter Setting. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.
(h) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.
(i) Error State
This is the area that output error no. if there are errors in operation of function block.
(j) For more information, reference of Position/ Speed Switching Control is in the “Chapter 9.2.15.”

(7) Position/ Torque Switching Control



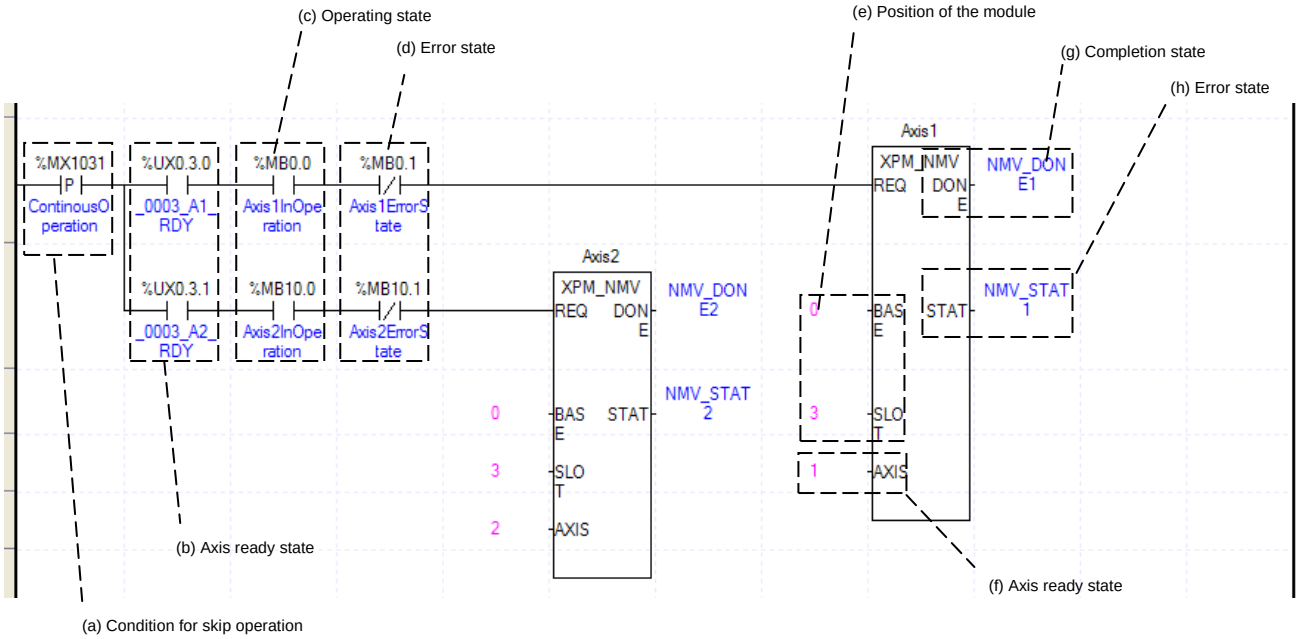
(a) This is the condition for Position/ Torque Switching Control
This is the condition for Position/ Torque Switching Control Command (XPM_PTT) (j) Torque value to operate
(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.
(c) Operating state by axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Position/ Torque Switching Control while it is running, the “error 561” would be appeared.
(d) Error state for each axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.
(e) Signal from Position Control by each Axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Position Control state” for each axis. It turns on when it is operating. Position/ Torque Switching Control Setting can only be configured while it is running. If you execute Position/Torque Switching Control while it is not running, the error would be appeared according to control type
(f) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.
(g) Axis of command execution
You can set an axis for Parameter Setting. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.
(h) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.
(i) Error State
This is the area that output error no. if there are errors in operation of function block.
(j) Torque value to operate
This is the area that sets torque value to be used after switching
(k) For more information, reference of Position/ Speed Switching Control is in the “Chapter 9.2.17.”

(8) Skip Operation



(a) This is the condition for Skip Operation
This is the condition for Skip Operation Command (XPM_SKP) Once Skip Operation is executed, current operation step is stop and will go to operate with next step.
(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.
(c) Operating state by axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Skip Operation while it is running, the “error 331” would be appeared.
(d) Error state for each axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.
(e) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.
(f) Axis of command execution
You can set an axis for Parameter Setting. XGF-PN8A series supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.
(g) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.
(h) Error State
This is the area that output error no. if there are errors in operation of function block.
(i) For more information, reference of Skip Operation is in the “Chapter 9.5.3.”

(9) Continuous Operation



(a) This is the condition for Continuous Operation
This is the condition for Continuous Operation Command (XPM_NMV). Once Continuous Operation is executed, current operation step and next operation step would be operated continuously.
(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Operating state by axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Continuous Operation while it is running, the “error 391” would be appeared.

(d) Error state for each axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.

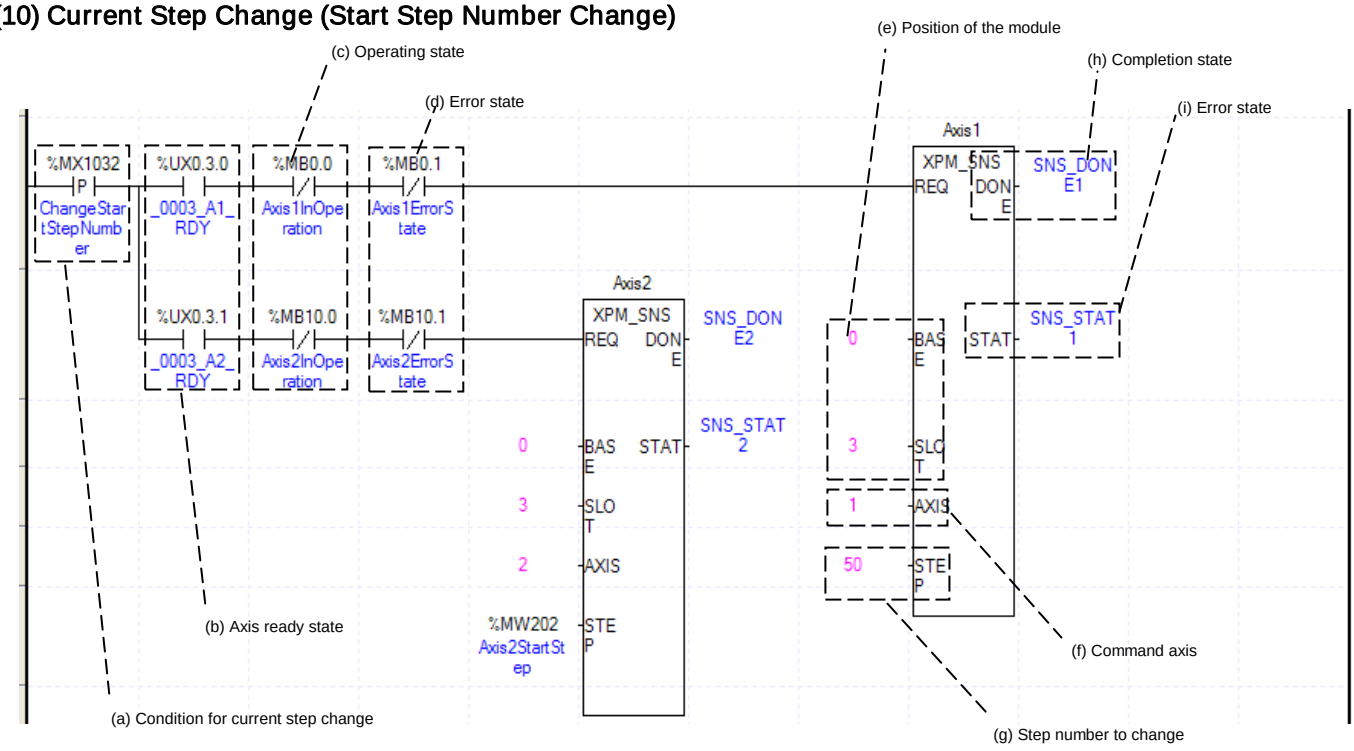
(f) Axis of command execution
You can set an axis for Parameter Setting. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.

(g) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(h) Error State
This is the area that output error no. if there are errors in operation of function block.

(i) For more information, reference of Continuous Operation is in the “Chapter 9.5.2.”

(10) Current Step Change (Start Step Number Change)



(a) This is the condition for Current Step Change
This is the condition for Current Step Change Command (XPM_SNS). Once Current Step Change is executed, current operation step will move set step.

(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Operating state by axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Current Step Change while it is

running, the “error 441” would be appeared.

(d) Error state for each axis

According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Address of Positioning Module

In this example, Positioning Module is installed at the 3 slot of 0 bases.

(f) Axis of command execution

You can set an axis for Parameter Setting. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.

(g) Change Step Number

Set change step number by Current Step Change. XGF-PN8A support 400 step operation data for each Axis. Therefore, the range of step number setting of Current Step Change is 1~400.

(h) State of Operation complete

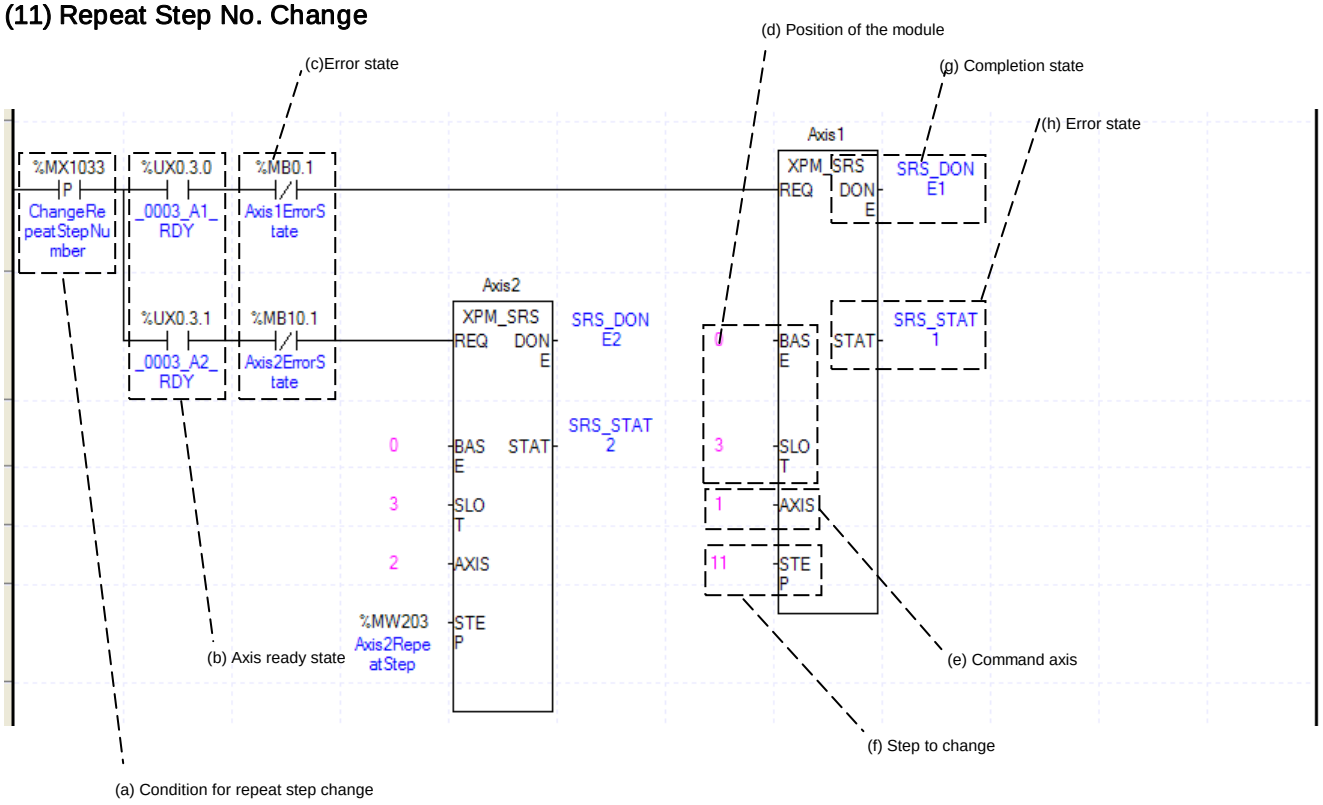
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(i) Error State

This is the area that output error no. if there are errors in operation of function block.

(j) For more information, reference of Current Step Change is in the “Chapter 9.5.9.”

(11) Repeat Step No. Change



(a) This is the condition for Repeat Step No. Change

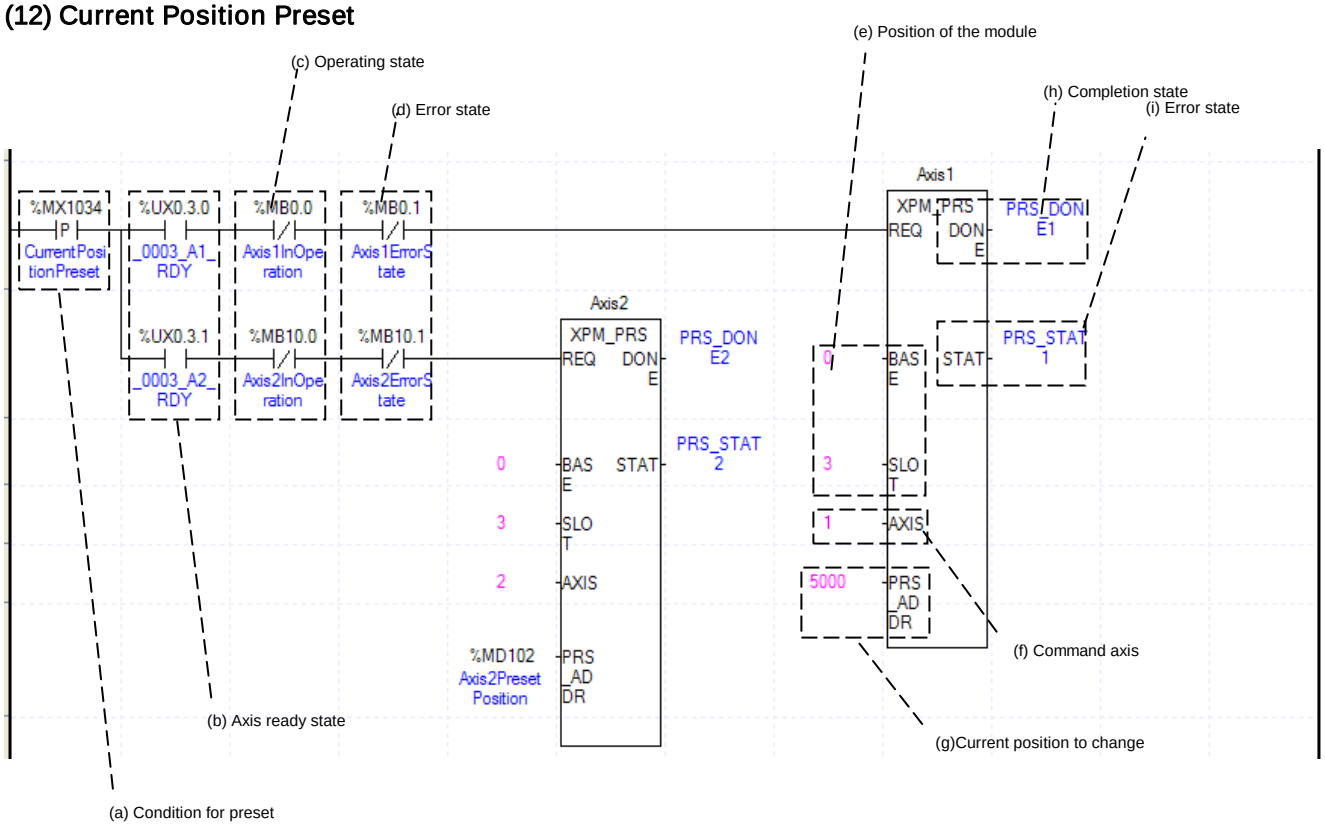
This is the condition for Repeat Step No. Change Command (XSRS). Once Repeat Step No. Change is executed, current operation step will move set step. It will execute a operation when set of Operation Method is “Repeat.”

(b) Axis ready

If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Error state for each axis
According to exercise from “Chapter 8.1.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.
(d) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.
(e) Axis of command execution
You can set an axis for Parameter Setting. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.
(f) Change Step Number
Set change step number by Current Step Change. XGF series support 400 step operation data for each Axis. Therefore, the range of step number setting of Current Step Change is 1~400. In the example, Axis1 and axis2 are changed to step no.11 and step no. saved in %MW203.
(g) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.
(h) Error State
This is the area that output error no. if there are errors in operation of function block.
(i) For more information, reference of Repeat Step No. Change is in the “Chapter 9.5.10.”

(12) Current Position Preset



(a) This is the condition for Current Position Preset
This is the condition for Current Position Preset Command (XPM_PRS). Once Current Position Preset is executed, current operation step will move to set step. If the origin has not set yet, the origin would be set to origin decided.
(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Operating state by axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Operating” for each axis. It turns on when it is operating. Operating Data Setting can not be configured while it is running hence configuration will only be configured when it is not running. If you execute Current Position Preset while it is running, the “error 451” would be appeared.

(d) Error state for each axis
According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.

(f) Axis of command execution
You can set an axis for Parameter Setting. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.

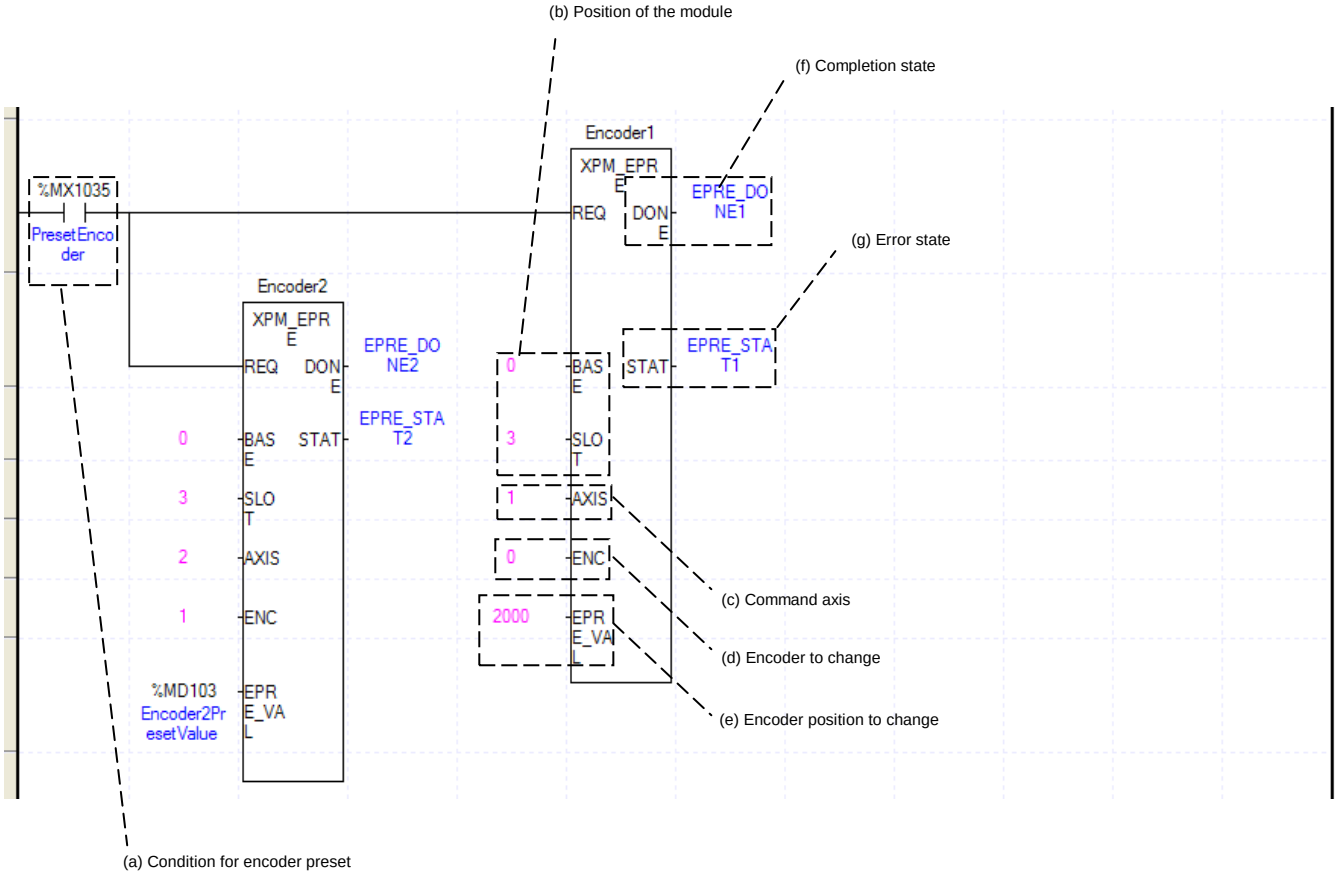
(g) Change Current Position
Set change current position by Current Position Preset. Unit follows the value from “Unit” of basic parameter. In the example, Axis1 and axis2 are changed to 5000 and the position saved in %MD102.

(h) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(i) Error State
This is the area that output error no. if there are errors in operation of function block.

(j) For more information, reference of Current Position Preset is in the “Chapter 9.5.7.”

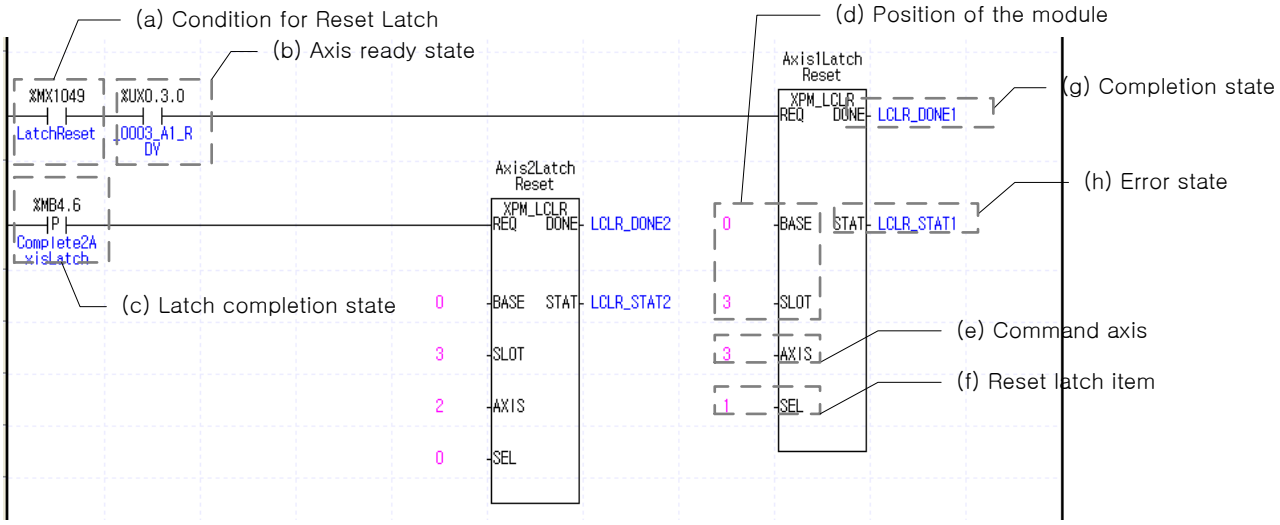
(13) Encoder Preset



(a) This is the condition for Encoder Preset
This is the condition for Encoder Preset Command (XPM_EPRS). Once Encoder Preset is executed, current operation step will move to set step.

(b) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.
(c) Axis of command execution
You can set an axis for Parameter Setting. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.
(d) Changing Encoder
Set Changing Encoder to execute a preset. 0 means “Encoder1” and 1 means “Encoder2”
(e) Changing Encoder Position
Set for Changing Encoder Position. In the example, the encoder1 position is changed to 2000 and the encoder2 position is changed to the value in %MD103(encoder2 preset value
(f) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.
(g) Error State
This is the area that output error no. if there are errors in operation of function block.
(h) For more information, reference of Encoder Preset is in the “Chapter 9.5.8.”

(14) Reset Latch



(a) This is the condition for Reset Latch
This is the condition for Reset Latch Command (XPM_LCLR). Once Reset Latch is executed, it reset state of latch completion or latch data by set the reset latch item.
(b) Axis ready
If communication between the positioning module and the servo driver is normal, corresponding signal will be on.
(c) Latch completion state
It is the state of “Latch Completion” when an example program of“8.2.2 Read the Current Sate.” It is on when latch is completed once external latch command signal of the relevant axis is inputted. In case of Axis 2, the Reset latch item is executed as soon as %MB4.6 (Latch Completion state) is On. To read latch data every time when latch is completed upon the input of the axis’s external latch command signal, program to set latch completion as a condition for the Reset Latch command after executing the Read Latch Location Data command.
(d) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.
(e) Axis of command execution
You can set an axis for Reset Latch. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Reset Latch, you can set a value for axis1 through axis8.

(f) Reset latch item

The following items are reset according to the Reset latch item.

0: Reset the state when latch is completed

1: Reset latch location data and the state when latch is completed

In the example program, latch location data and latch completion are reset for Axis 1 and only latch completion is reset for Axis 2 when executing the Reset Latch command.

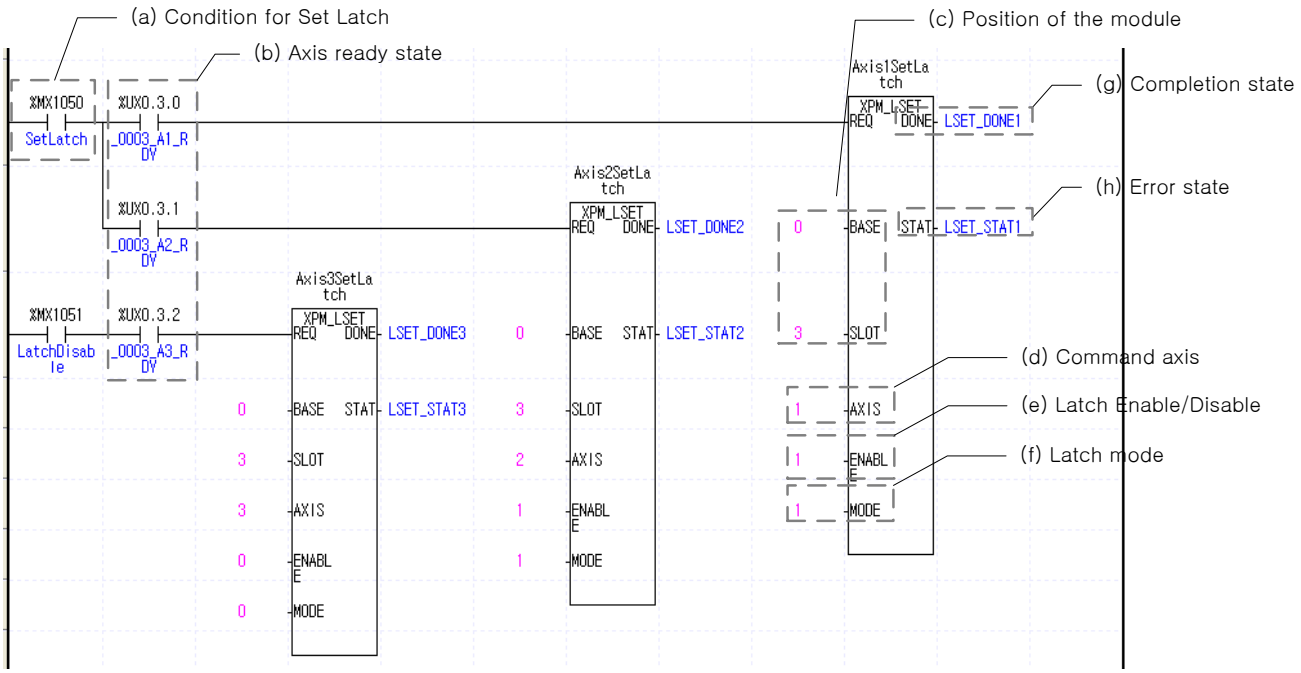
(g) State of Operation complete

If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(h) Error State

This is the area that output error no. if there are errors in operation of function block.

(15) Set Latch



(a) This is the condition for Reset Latch

This is the condition for Set Latch Command (XPM_LSET). The Set Latch command is executed on Axis 1 and 2 as soon as %MX1050(Set Latch) is On after the axis is connected to the network and it is executed on Axis 3 as soon as %MX1051(3-Axis Latch Disable) is On.

(b) Axis ready

If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Address of Positioning Module

In this example, Positioning Module is installed at the 3 slot of 0 bases.

(d) Axis of command execution

You can set an axis for Set Latch. XGF-PN8A/B supports for 8 axes. In the “execution of axis” from the configuration of Set Latch, you can set a value for axis1 through axis8.

(e) Latch enable/disable

Actions according to the designated Enable/Disable Latch item are as following:

0: latch disable

1: latch enable

In the example program, latch is enabled for Axis 1 and 2 while it is disabled for Axis 3.

(f) Latch mode item

Actions according to the designated latch mode item are as following:

0: Single trigger (The current position latch is available only the touch probe 1 signal inputted at first after latch is permitted)

1: Continuous trigger (The current position latch is available at every touch probe 1 signal after latch is permitted)

In the example program, Axis 1 is set in the single trigger mode while Axis 2 is set in the continuous trigger mode when implementing the Set Latch command.

(g) State of Operation complete

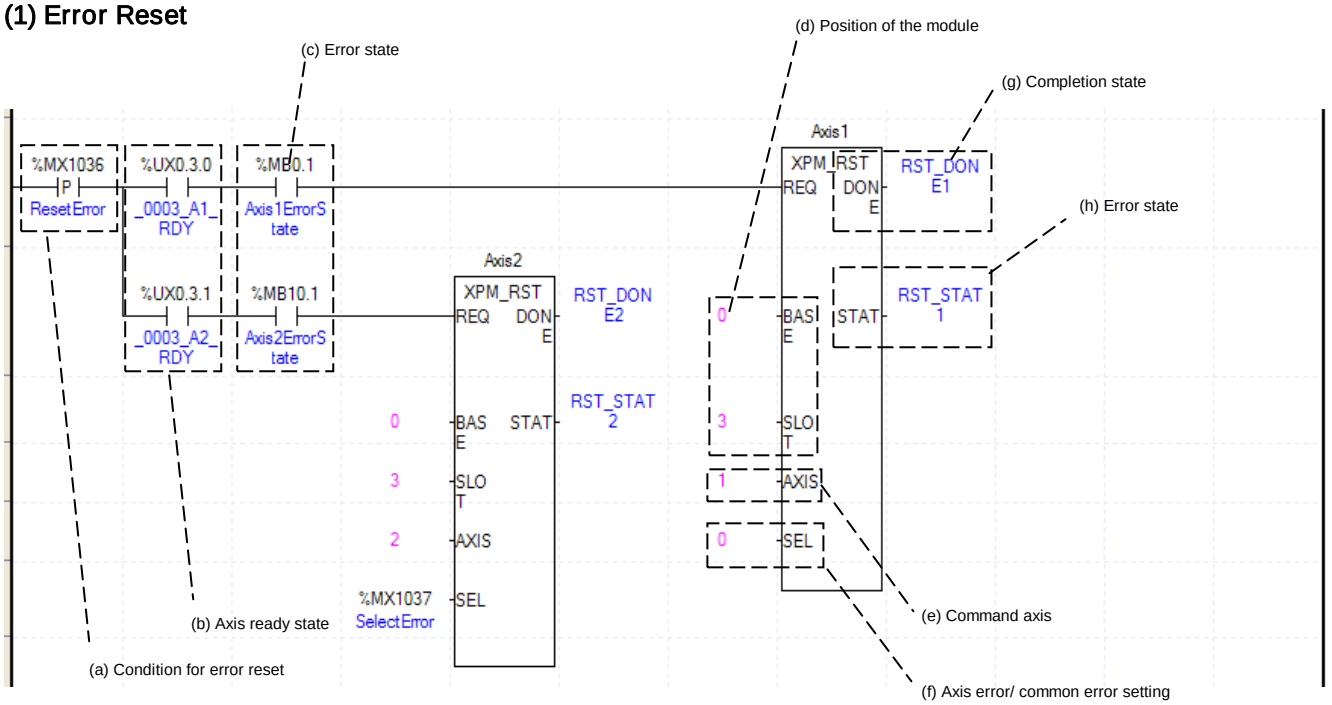
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(h) Error State

This is the area that output error no. if there are errors in operation of function block.

8.2.8 Error

(1) Error Reset



(a) This is the condition for Error Reset

This is the condition for Error Reset Command (XPM_RST). Once Error Reset is executed, it erases errors of module form each axis.

(b) Axis ready

If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Error state for each axis

According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(d) Address of Positioning Module

In this example, Positioning Module is installed at the 3 slot of 0 bases.

(e) Axis of command execution

You can set an axis for Parameter Setting. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.

(f) Error setting of Error/Common by axis

Depending on the errors, if it is set by “0”, erase the errors in operation of each axis, if it is set by “1”, erase the common errors of each modules.

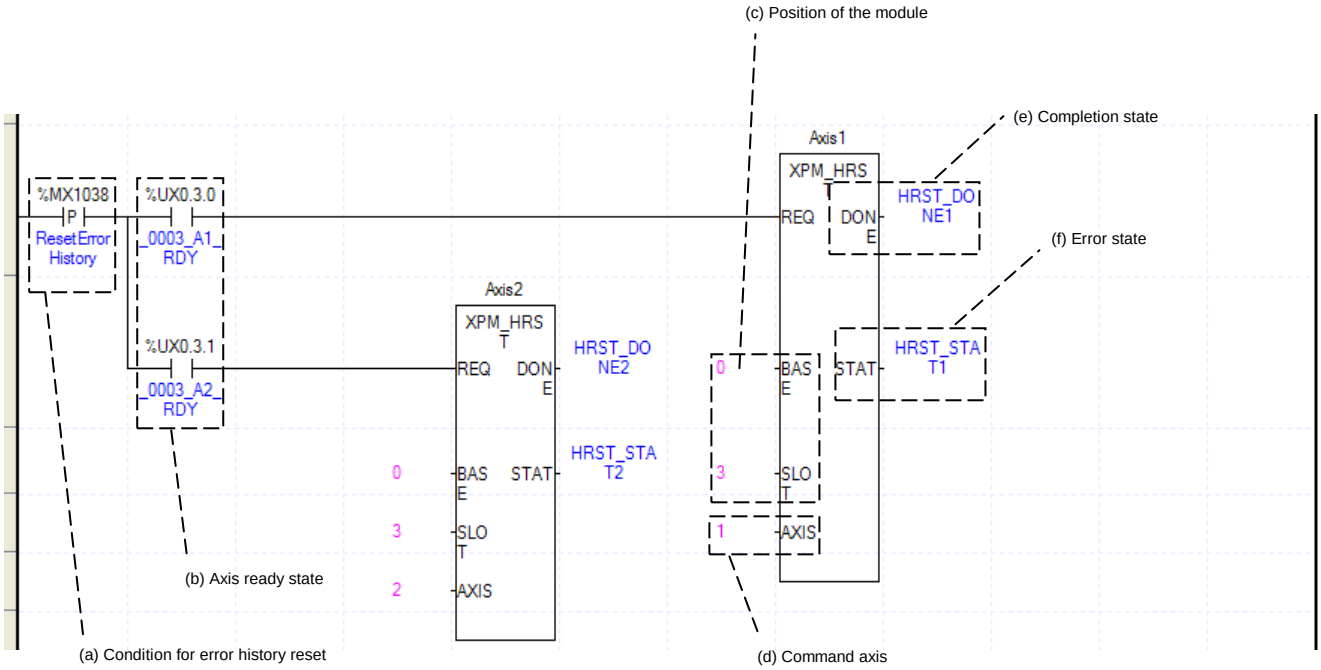
(g) State of Operation complete

If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(h) Error State

This is the area that output error no. if there are errors in operation of function block.

(2) Error History Reset



(a) This is the condition for Error History Reset

This is the condition for Error History Reset Command (XPM_HRST). Once Error Reset is executed, it erases history of generated errors of module. XGF series has ten error histories by each axis. It will be saved to FRAM, remain still even there is no power.

(b) Axis ready

If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Address of Positioning Module

In this example, Positioning Module is installed at the 3 slot of 0 bases.

(d) Axis of command execution

You can set an axis for Parameter Setting. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis 8.

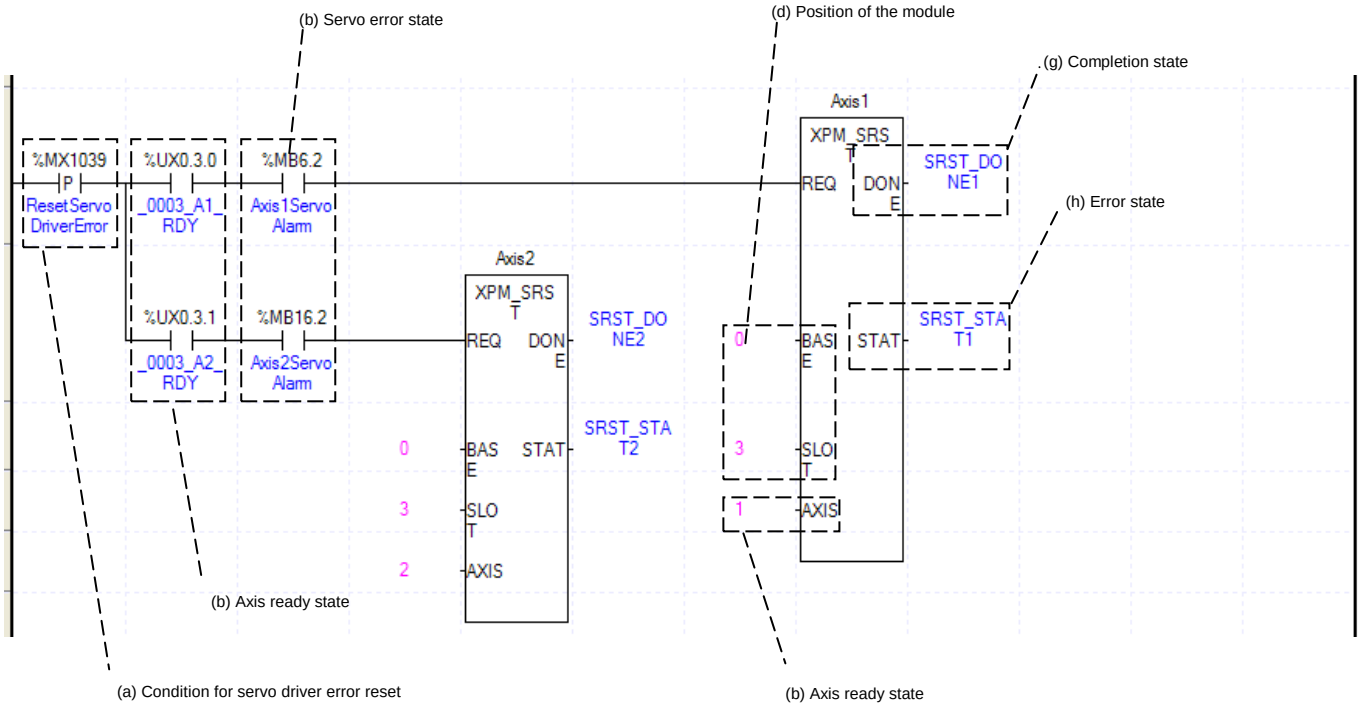
(e) State of Operation complete

If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(f) Error State

This is the area that output error no. if there are errors in operation of function block.

(3) Servo Driver Error Reset



(a) This is the condition for Servo Driver Error Reset

This is the condition for Servo Driver Error Reset Command (XPM_SRST). Once Servo Driver Error Reset is executed, it erases errors of module form each axis. At this time, if you execute this command without removing causes of error, error may ramin.

(b) Axis ready

If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Error state for each axis

According to exercise from “Chapter 8.2.2 Current State Reading,” it is a signal of “Error state” for each axis. It turns on when an error occurred. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(d) Address of Positioning Module

In this example, Positioning Module is installed at the 3 slot of 0 bases.

(e) Axis of command execution

You can set an axis for Parameter Setting. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis8.

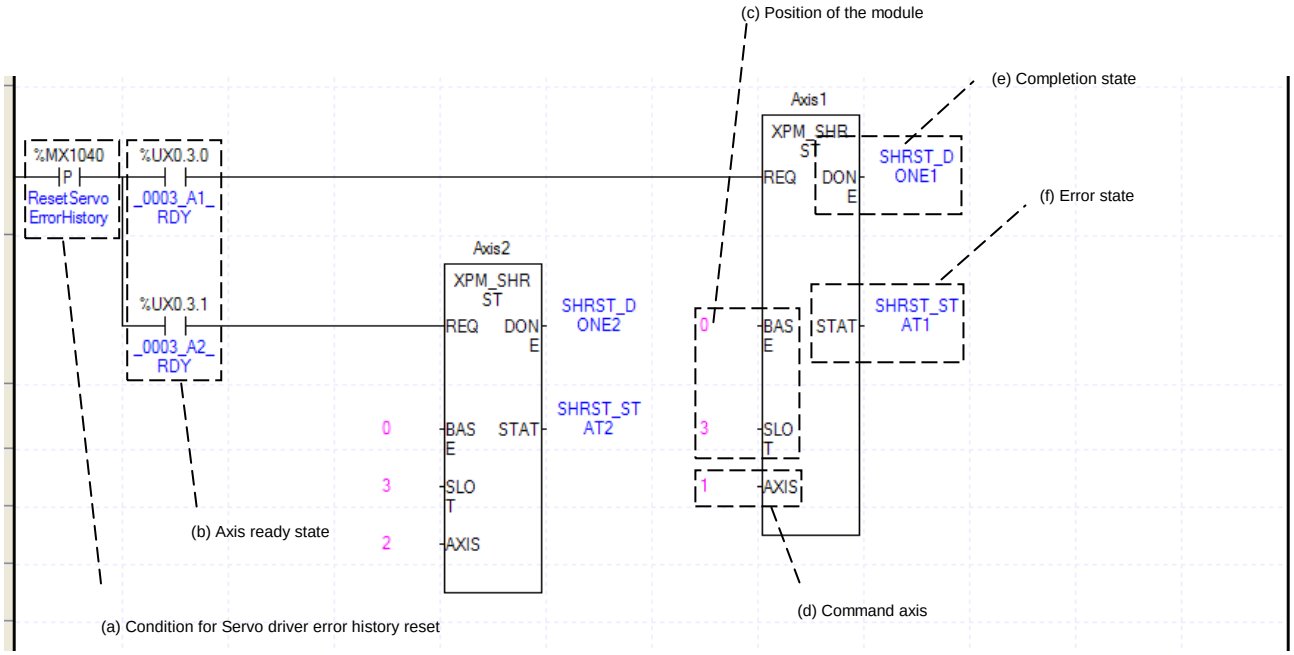
(f) State of Operation complete

If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(g) Error State

This is the area that output error no. if there are errors in operation of function block.

(4) Servo Driver Error History Reset



(a) This is the condition for Servo Driver Error History Reset

This is the condition for Servo Driver Error History Reset Command (XPM_SHRST). Once Servo Driver Error Reset is executed, it erases history of generated errors of servo driver. Servo driver can have ten error histories by each axis.

(b) Axis ready

If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Address of Positioning Module

In this example, Positioning Module is installed at the 3 slot of 0 bases.

(d) Axis of command execution

You can set an axis for Parameter Setting. XGF-PN8A supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis 8.

(e) State of Operation complete

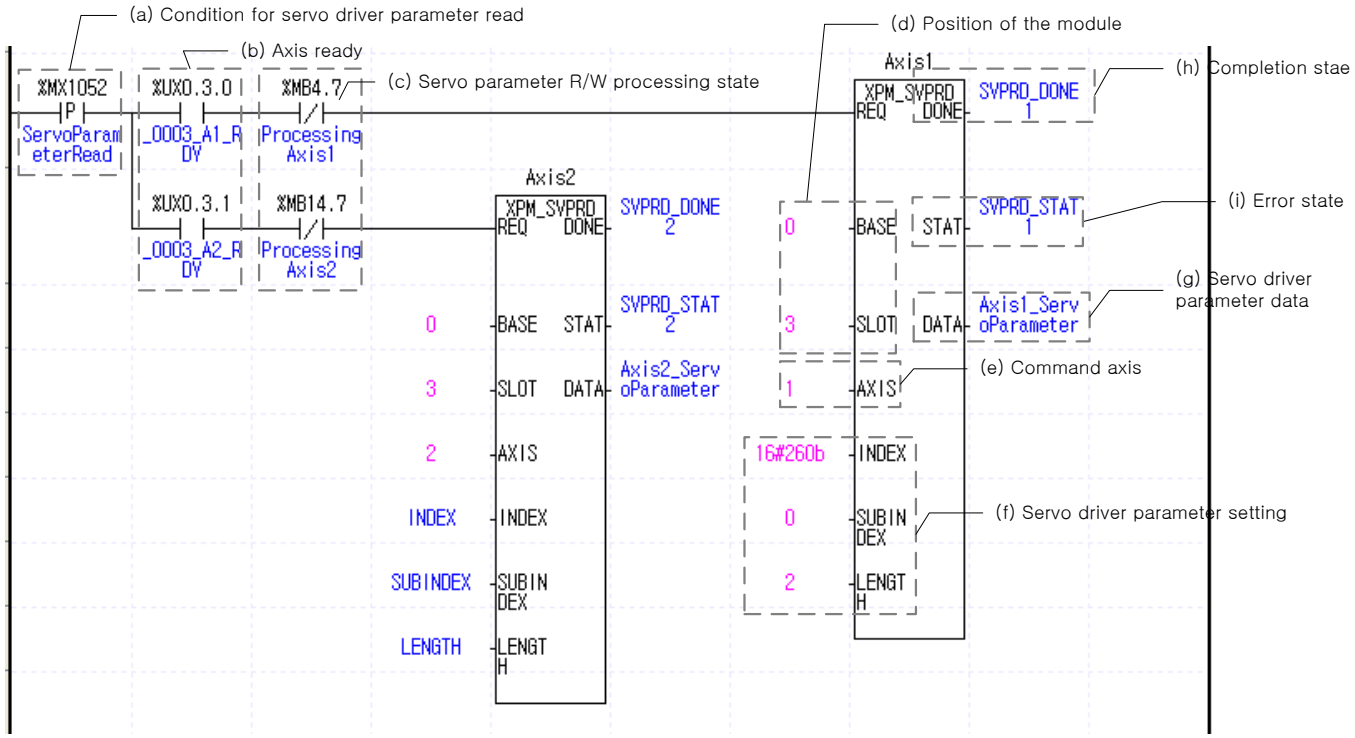
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(f) Error State

This is the area that output error no. if there are errors in operation of function block.

8.2.9 Program related with Servo Parameter (XGF-PN8B)

(1) Servo Driver Parameter Read



(a) This is the condition for Servo Drive Parameter Read

This is the condition for Servo Driver Parameter Read Command (XPM_SVPRD). Once “Servo Driver Parameter Read” command is executed, it saves to read parameter object value of the servo driver.

(b) Axis ready

If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Servo parameter R/W processing state

It indicates the executing state of “Servo Driver Parameter Read/Write” or “EEPROM Save” command. In the example, “Servo Driver Parameter Read” command executes when servo parameter R/W processing is off.

(d) Address of Positioning Module

In this example, Positioning Module is installed at the 3 slot of 0 bases.

(e) Axis of command execution

You can set an axis for Servo Driver Parameter Read. XGF-PN8B supports for 8 axes. In the “execution of axis” from the configuration of Servo Driver Parameter Read, you can set a value for axis1 through axis 8.

(f) Set servo driver parameter

Set index number, SubIndex number, Size of reading parameter object in servo drive parameters. In this example, save to “Axis1_ServoPameter” to read axis1 servo DCLink voltage of specified by h260b:00 with 2byte size. Save to “Axis2_ServoParameter” to read axis2 servo parameter of specified by INDEX, SUBINDEX with LENGTH size.

(g) Servo Parameter Data

It sets up data to read to the servo driver parameter.

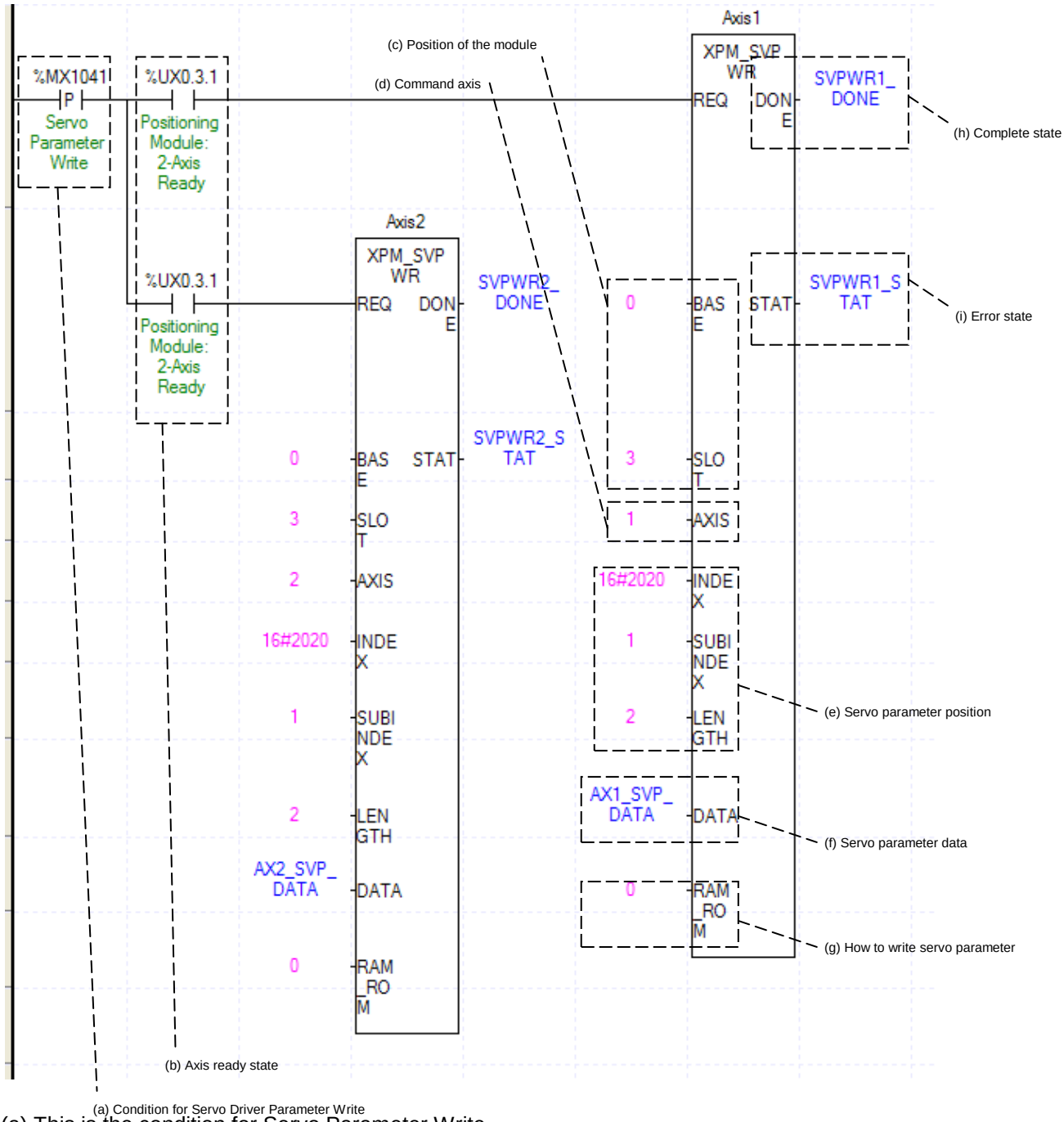
(h) State of Operation complete

If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.

(i) Error State

This is the area that output error no. if there are errors in operation of function block.

(2) Servo Driver Parameter Write



(a) This is the condition for Servo Parameter Write

This is the condition for Servo Parameter Write Command (XPM_SVPWR). Once “Servo Parameter Write” command is executed, it changes parameter value of the servo driver into setting value

(b) Axis ready

If communication between the positioning module and the servo driver is normal, corresponding signal will be on.

(c) Address of Positioning Module

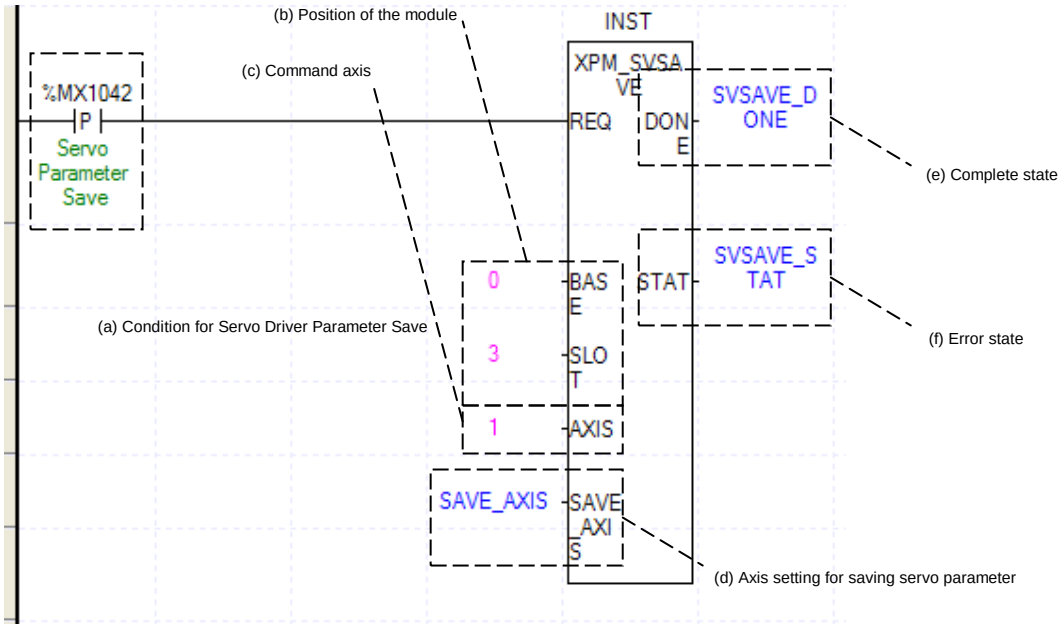
In this example, Positioning Module is installed at the 3 slot of 0 bases.

(d) Axis of command execution

You can set an axis for Parameter Setting. XGF-PN8B supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis 8.

(e) Servo Parameter Position
It sets position of the servo parameter to write. In INDEX, set up Index number of the servo parameter object , and in SUBINDEX, set up sub-index number of the servo parameter object, and in LENGTH, set up length of the servo parameter by byte unit.
(f) Servo Parameter Data
It sets up data to write to the servo parameter.
(g) How to write the servo parameter
It sets how to write the servo parameter. If it is set as 0, servo parameter will be written at RAM. And if it is set as 1, servo parameter will be written at EEPROM.
(h) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.
(i) Error State
This is the area that output error no. if there are errors in operation of function block.

(2) Servo Driver Parameter Save

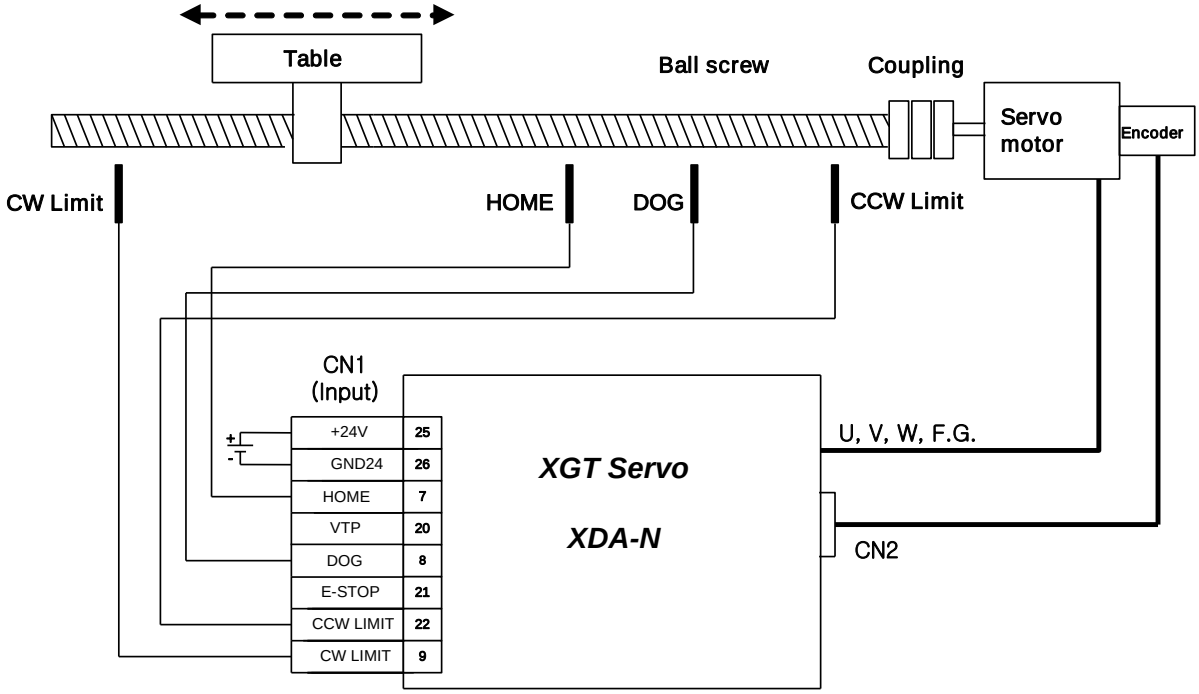


(a) This is the condition for Servo Parameter Save
This is the condition for Servo Parameter Save Command (XPM_SVSAVE). Once “Servo Parameter Save” command is executed, it saves all parameter values of the servo driver at the internal EEPROM.
(b) Address of Positioning Module
In this example, Positioning Module is installed at the 3 slot of 0 bases.
(c) Axis of command execution
You can set an axis for Parameter Setting. XGF-PN8B supports for 8 axes. In the “execution of axis” from the configuration of Parameter Setting, you can set a value for axis1 through axis 8.
(d) Axis setting for saving servo parameter
It sets the axis of the servo driver to save. Each axis of 1-axis ~ 8-axis is assigned with 0~7 bit. Set the corresponding bit to select the axis.
(e) State of Operation complete
If function block is completed without error, “1” will be outputted and maintain “1” until the next operation. If error occurred, “0” will be outputted.
(f) Error State
This is the area that output error no. if there are errors in operation of function block.

Chapter 9 Functions

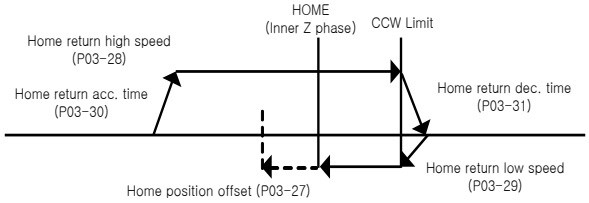
9.1 Home Return

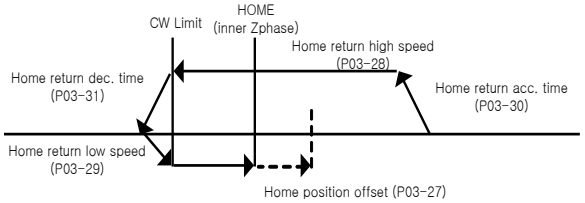
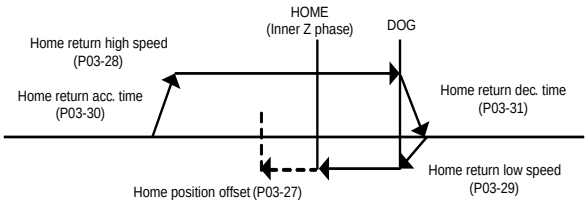
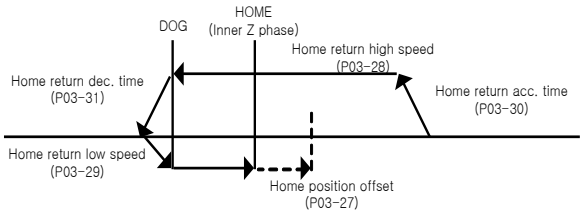
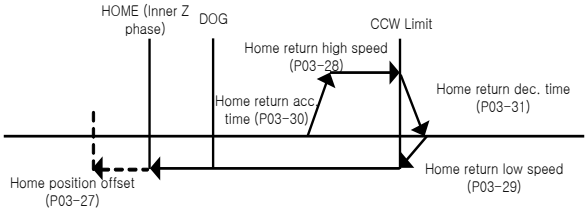
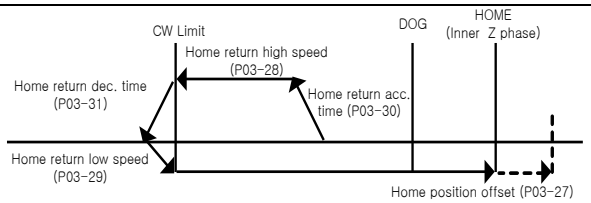
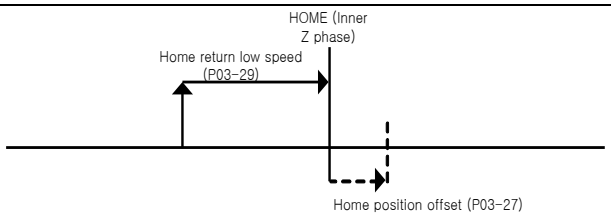
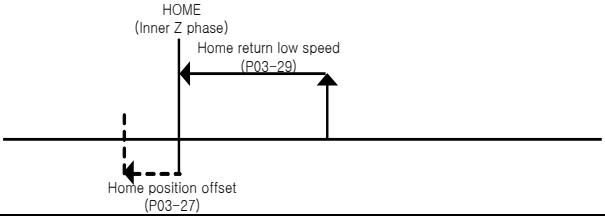
Home Return is carried out to confirm the origin of the machine when applying the power. In case of homing, it is required to set the parameters related with homing among servo parameters per axis. If the origin position is determined by homing, the origin detection signal is not recognized during positioning operation. In case of homing, the needed contact point is inputted through a CN1 connector of a servo driver (XDA-N series, XGF-PN8B: EtherCAT CoE-supported servo driver). Representative wiring is as follows.

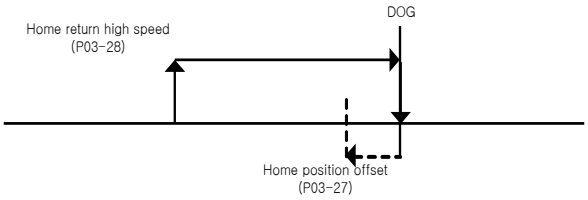
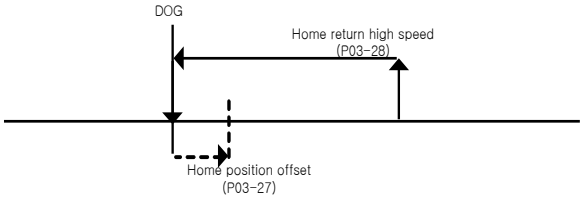


For home return, select “Home return method” (XDA-N: P03-25, EtherCAT CoE-supported driver: refer to manual) according to user system.

P3-25 *	Home return method	Unit	Setting range	Default	Position control
		-	0 ~ 10	0	

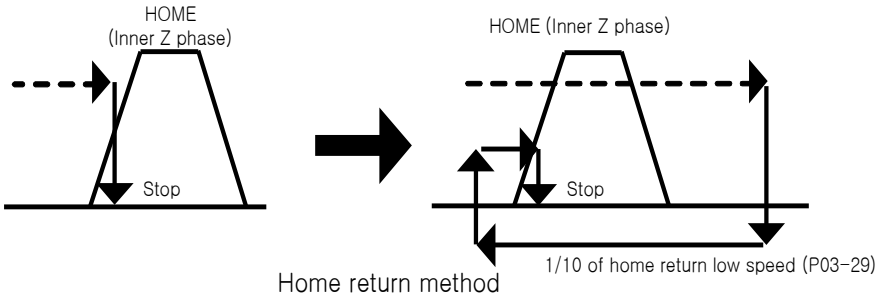
Home return method (P3-25)	Home return operation	
0 : No operation	Home return is not executed.	-
1 : upper limit + Z phase(CW)		Go CCW ⇒ CCW limit ⇒ Change to CW ⇒ HOME ⇒ Home return complete

Home return method (P3-25)	Home return operation	
2 : lower limit + Z phase (CCW)		Go CW ⇒ CW Limit ⇒ Change to CCW ⇒ HOME ⇒ Home return complete
3 : DOG + Z phase (CW)		Go CCW ⇒ DOG ⇒ Change to CW ⇒ HOME ⇒ Home return complete
4 : DOG + Z phase (CCW)		Go CW ⇒ DOG ⇒ Change to CCW ⇒ HOME ⇒ Home return complete
5 : Upper limit + DOG + Z Phase (CW)		Go CCW ⇒ CCW limit ⇒ Change to CW ⇒ DOG ⇒ HOME ⇒ Home return complete
6 : Upper limit + DOG + Z phase (CCW)		Go CW ⇒ CW limit ⇒ Change to CCW ⇒ DOG ⇒ HOME ⇒ Home return complete
7 : Z phase (CW)		Go CCW ⇒ HOME ⇒ Home return complete
8 : Z Phase (CCW)		Go CW ⇒ HOME ⇒ Home return complete

Home return method (P3-25)	Home return operation	
9 : DOG (CW)		Go CCW ⇒ DOG ⇒ Home return complete
10 : DOG (CCW)		Go CW ⇒ DOG ⇒ Home return complete

Note

1. Precaution in homing
   1) Input signal has the highest priority among all operations. If input signal is inputted before acc./dec. time, it will operate based on the input signal.
   2) If moving object meets CCW Limit (upper limit) and CW Limit (lower limit) during homing, it will change its direction to reduce the damage of the objects caused by the user mistake.
   3) If home offset (P3-27) is same as moving direction, it will (+) and otherwise (-).
   4) CCW Limit (upper limit) and CW Limit (lower limit) are switched in reverse direction as if direction of home return method (P3-25) gets reversed. (For example, if P3-25 = 1 and P2-27 = OFF, it is same as P3-25=2 and P2-27=ON) But, since the encoder value is different according to user system, select the mode you want.
   5) In case of home return complete, the algorithm compensating the slip always operates. During compensation algorithm operation, it operates with speed of one tenth of Home return low speed (P3-29).



Home return method

9.2 Positioning Control

Positioning control executes using data which is set on the 「Operation Data」. Positioning control includes Single-axis Position control, Single-axis Speed Control, Single-axis Feed Control, Interpolation control, Speed/Position Switching control, Position/Speed Switching control and Position/Torque Switching control.

Positioning Control		Control Method	Operation
Positioning Control	Single-axis Position Control	Absolute, Single-axis Position Control Incremental, Single-axis Position Control	Specified axis executes positioning control from the beginning (current stop position) to the goal position.
	Single-axis Feed Control	Absolute, Single-axis Feed Control Incremental, Single-axis Feed Control	The starting position (the current stop position) changes to 0 and executes positioning control as far as specified moving amount.
	Linear Interpolation	Absolute, Linear Interpolation Incremental, Linear Interpolation	Executes linear interpolation control by using specified axes from the start position (current stop position) to the target position.
	Circular Interpolation	Absolute, Circular Interpolation Incremental, Circular Interpolation	Executes positioning control by using 2 axes, controlling sub-axis in accordance with the data of command axis (main axis), to target position with the trajectory of arc
	Helical Interpolation		Executes positioning control by using 3 axes, controlling sub-axis in accordance with the data of command axis (main axis), to target position with the trajectory of arc. The axis set as helical interpolation axis executes linear interpolation until target position
	Ellipse Interpolation		Executes positioning control by using 2 axes, controlling sub-axis in accordance with the data of command axis (main axis), to target position with the trajectory of ellipse having specified angle.
Speed Control		Absolute, Single-axis Speed Control Incremental, Single-axis Speed Control	Execute Speed control with specified speed until deceleration stop command is entered.
Speed/Position Switching Control		Absolute, Single-axis Speed Control Incremental, Single-axis Speed Control	If speed / position switching command or speed / position control switching input signal is entered during speed control operation, speed control switches to position control and it executes positioning control as far as target position (moving amount).
Position/Speed Switching Control		Absolute, Single-axis Position Control Incremental, single-axis Position Control	If position/speed switching command is executed during position control operation, position control switches to speed control and it executes speed control with specified speed until deceleration stop command is entered.
Position/Torque Switching Control		Absolute, Single-axis Position Control Incremental, single-axis Position Control	If position/torque switching command is executed during position control operation, position control switches to torque control and it executes torque control with specified torque until deceleration stop command is entered.

9.2.1 Operation Data for Positioning Control

Describe the Operation data and Setting to execute positioning control.

Operation Data	Setting
Control Method	Sets the Type of control and standard coordinate of Positioning control.
Operation Method	Sets the control method of continuous operation.
Target Position	Sets the absolute target position or moving amount in case of position control.
Operation Speed	Sets the operation speed.
Acceleration No.	Sets the number to be used as acceleration time. Acceleration No. is selected among Acceleration No. 1, 2, 3, and 4 of basic parameters
Deceleration No.	Sets the number to be used as deceleration time. Deceleration No. is selected among Deceleration No. 1, 2, 3, and 4 of basic parameters
M Code	Sets the M Code when using the code number for auxiliary operation of positioning control.
Dwell Time	Sets the time needed for servo driver to complete the positioning after positioning the object
Sub Axis Setting	Sets the sub axis for interpolation control.
Circular Interpolation	Sets the auxiliary data (middle point, center point and radius) for circular interpolation.
Circular Interpolation Mode	Sets how to generate the arc (middle point, center point and radius) for circular interpolation.
Circular Interpolation Turn Number	Sets the number of arcs to draw for circular interpolation.
Helical Interpolation	Sets the axis to execute linear operation during helical interpolation.

Note

For operation data, It is available to set 1~400 steps per each 1~8axis.

9.2.2 Operation mode of Positioning Control

Operation mode of positioning control determines whether to execute the next operation data after executing current operation and how to handle the operation speed.

Operation mode types are as follows.

Control Method	Operation Method	Operation Pattern		Operation
Single-axis Positioning Control	Single	End	○	Ends after the completion of the current step
		Keep	○	Keeps operating the next step after the completion of the current step
		Continuous	○	Operates the current step and the next step with a continuous speed
	Repeat	End	○	Ends after the completion of the current step and changes the Current step number into Repeat Step
		Keep	○	Keeps operating the Repeat Step after the completion of the current step
		Continuous	○	Operates the current step and the Repeat Step with a continuous speed
Single-axis Speed Control	Single	End	○	Speed control operation with operation data of the current step
		Keep	○	Speed control operation with operation data of the current step In case of VTP command, after completing the positioning, keeps operating the next step.
		Continuous	X	Errors
	Repeat	End	○	Speed control operation with operation data of the current step
		Keep	○	Speed control operation with operation data of the current step In case of VTP command, after completing the positioning, keeps operating the step specified by Repeat Step.
		Continuous	X	Errors
Single-axis FEED Control	Single	End	○	Ends after the completion of the current step-Feed control
		Keep	○	Keeps operating the next step after the completion of the current step-Feed control
		Continuous	X	Errors
	Repeat	End	○	Ends after the completion of the current step-Feed control and changes the Current step number into Repeat Step
		Keep	○	Keeps operating the Repeat Step after the completion of the current step-Feed control
		Continuous	X	Errors
Linear Interpolation	Single	End	○	Ends after the completion of the current step Linear interpolation
		Keep	○	Keeps operating the next step after the completion of the current step
		Continuous	○	Operates the current step and the next step with a continuous speed
	Repeat	End	○	Ends after the completion of the current step and changes the Current step number into Repeat Step
		Keep	○	Keeps operating the Repeat Step after the completion of the current step
		Continuous	○	Operates the current step and the Repeat Step with a continuous speed
Circular Interpolation	Single	End	○	Ends after the completion of the current step Circular Interpolation
		Keep	○	Keeps operating the next step after the completion of the current step
		Continuous	○	Operates the current step and the next step with a continuous speed
	Single	End	○	Ends after the completion of the current step and changes the Current step number into Repeat Step
		Keep	○	Keeps operating the Repeat Step after the completion of the current step
		Continuous	○	The current step and the next step in a continuous arc interpolation drive speed

Note

1, Operation mode shall be set from PLC Program or Operation data of XG-PM.
2. Operation data can be set up to 400 ranging from operation step no. 1 ~ 400 per each axis.
3. With one start command, whether to operate one operation step or several operation steps is determined by operation mode set by the user.

(1) End Operation (Single)

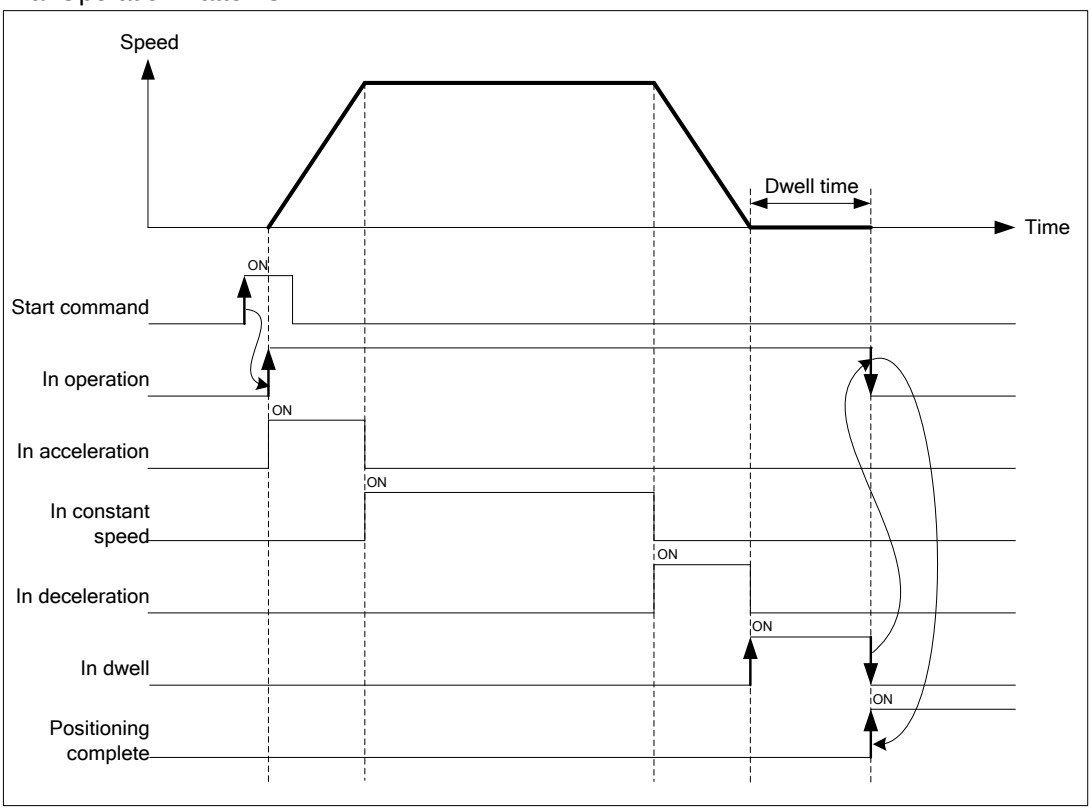
(a) With one time start command, positioning to the target position is executed and the positioning is completed after the dwell time.

(b) This is used as last operation data of Keep operation mode, Continuous operation mode. (After executing the operation data set as END, it stops)

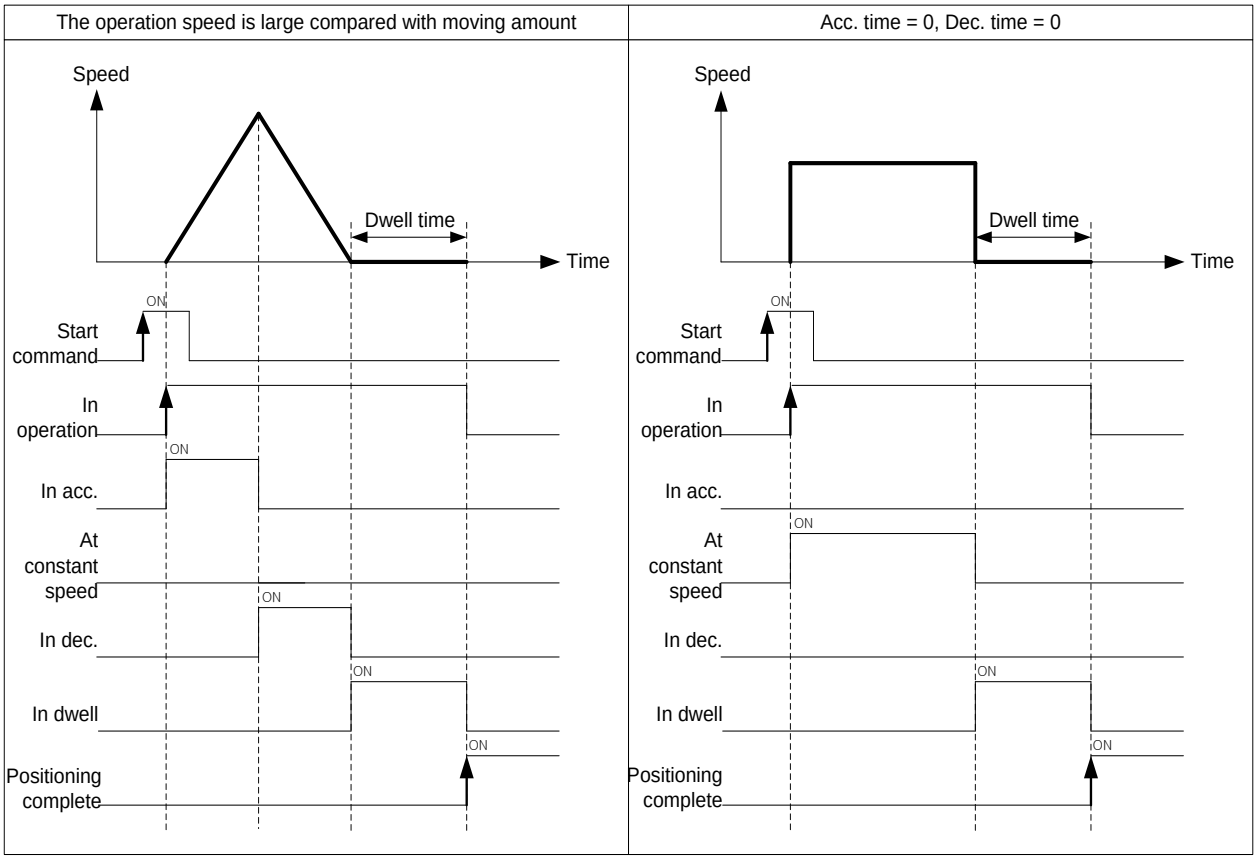
(c) Operation direction is determined by target position.

(d) Generally, operation action is trapezoid type operation that has acceleration, constant, deceleration section according to the operation speed and target position but according to the setting value, the operation pattern can be as follows.

1) Normal Operation Patterns



2) Abnormal Operation Patterns

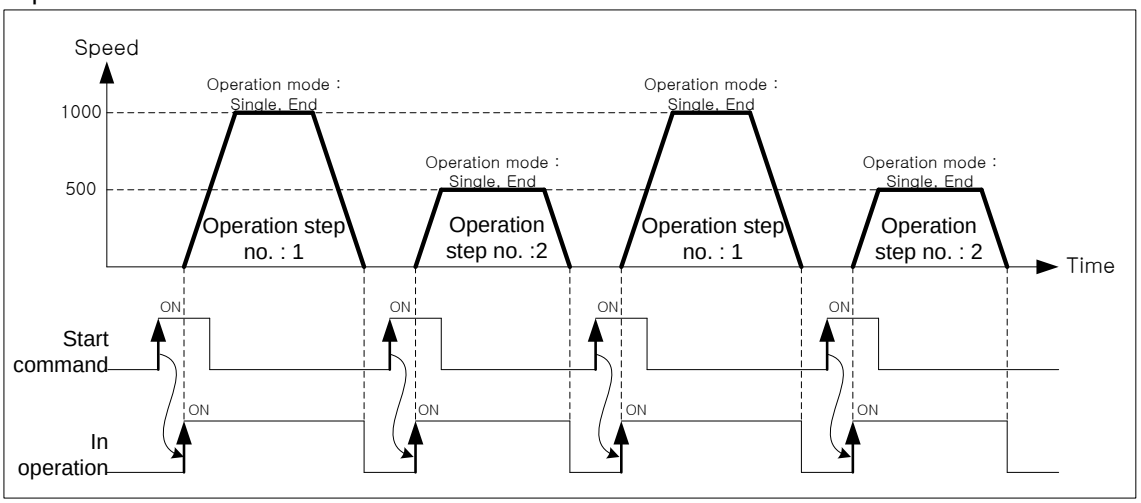


[Example] - Executes Start command after setting the step no. of “Indirect Start” as “0”
- Execute Start command total four times.

■ Setting of XG-PM

Step NO.	Control type	Operation type	Target Position [pls]	Operation Speed [pls/s]	Accel NO.	Decel NO.	M Code	Dwell Time
1	Absolute Single-axis Position Control	Single, End	10000	1000	1	1	0	0
2	Absolute Single-axis Position Control	Single, End	15000	500	1	1	0	0
3	Absolute Single-axis Position Control	Single, End	25000	1000	1	1	0	0
4	Absolute Single-axis Position Control	Single, End	30000	500	1	1	0	0

■ Operation Pattern



Operation step execution order according to start command will be [1] → [2] → [3] → [4].

(2) End Operation (Repeat)

(a) With one time start command, positioning to the target position is executed and the positioning is complete after the dwell time.

(b) The operation type of Repeat operation mode is same as that of Single operation but the different thing is that after completion of positioning, next operation is determined by operation step no. specified by Repeat Step No. Change command.

(c) Therefore, if Repeat step no. change command was not executed, the step no.“1” will be assigned after positioning completion of Repeat operation mode and operated at next Start command. Thus, this operation can be used for the structure that several operation steps are repeated.

(d) In case that operation step is set as the value except “0” (1~400) for Indirect Start, the positioning operation will be done with the set step no. regardless of the current operation step no. But, if the step no. is set as “0”, the positioning operation will be done with the operation step no. changed by Repeat operation mode.

(e) Operation direction will be determined by position value.

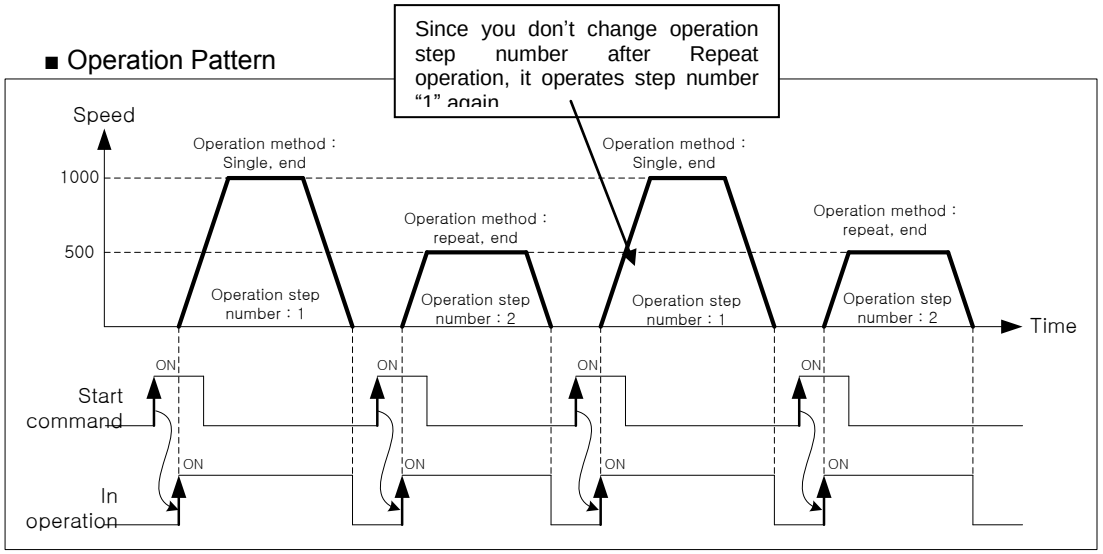
(f) Repeat operation step no. change command is available to execute during operation.

[Example 1] - Executes Start command after setting the step no. of “Indirect Start” as “0”
- Execute Start command total four times.

■ Setting of XG-PM

Step NO.	Control Method	Operation Method	Target Position [pls]	Operation Speed [pls/s]	Accel NO.	Decel NO.	M Code	Dwell Time
1	Absolute Single-axis Position Control	Single, End	10000	1000	1	1	0	0
2	Absolute Single-axis Position Control	Repeat, End	15000	500	1	1	0	0
3	Absolute Single-axis Position Control	Single, End	25000	1000	1	1	0	0
4	Absolute Single-axis Position Control	Repeat, End	30000	500	1	1	0	0

■ Operation Pattern



Operation step execution order according to start command will be [1] → [2] → [1] → [2].
Operation step 3, 4 will not be executed.

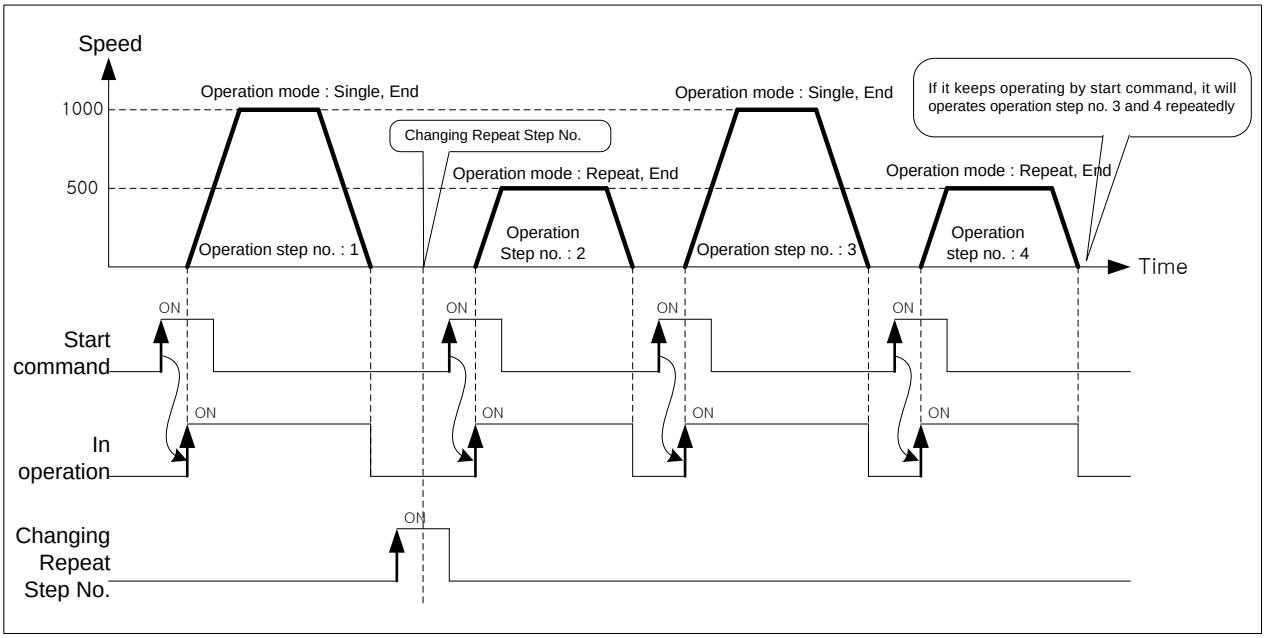
[Example 2] When operating by Start command and Repeat operation step no. assignment

- Setting the step no. of indirect start as “0”
- After the first Start command, change repeat operation step number as “3” by 「Change repeat step number」 command.
- Executes Start command 3 times more.

■ Setting of XG-PM

Step NO.	Control Method	Operation Method	Goal Position [pls]	Operation Speed [pls/s]	Accel NO.	Decel NO.	M Code	Dwell Time
1	Absolute Single-axis Position Control	Single, End	10000	1000	1	1	0	0
2	Absolute Single-axis Position Control	Repeat, End	15000	500	1	1	0	0
3	Absolute Single-axis Position Control	Single, End	25000	1000	1	1	0	0
4	Absolute Single-axis Position Control	Repeat, End	30000	500	1	1	0	0

■ Operation Pattern



Operation step execution order according to start command will be [1] → [2] → [3] → [4].

(3) Keep Operation

(a) With one time Start command, positioning to the target position of operation step is executed and the positioning will be completed after dwell time and without additional start command, the positioning of operation step for (current operation step no. +1) will be done.

(b) Keep operation mode is available to execute several operation steps in order.

(c) When using Keep operation pattern, set the operation pattern of last step as 'End'.

(d) When operation pattern is Keep (or continuous), operation doesn't end until it executes the step whose operation pattern is 'End'. Therefore, if there is no step whose operation pattern is "End", it will keep operating until the operation step No. 400. When operation pattern of the operation step No. 400 is not the "End", error occurs and operation will be stop. When operation pattern of the operation step No. 400 is 'Keep' and 'Repeat', it will execute the operation step specified by Repeat Step No.

(e) Operation direction will be determined by target position.

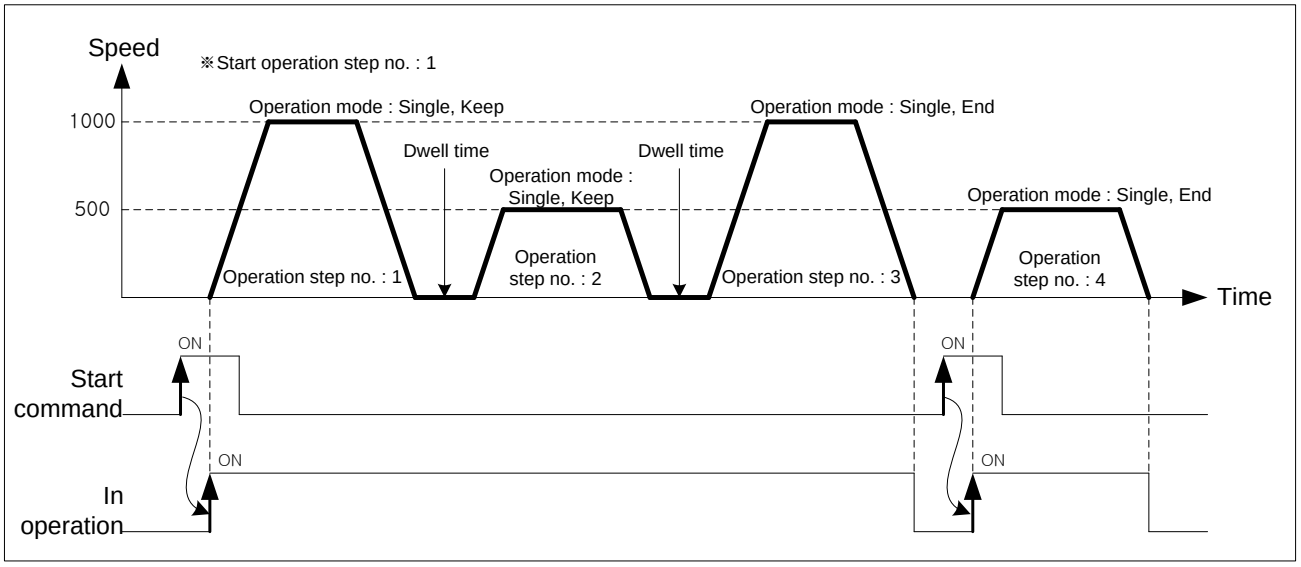
[Example] - Executes start command (Indirect Start command) after setting the step no. of "Indirect Start" as "0".

- Execute start command total four times.

■ Setting of XG-PM

Step NO.	Control Method	Operation Method	Target Position [pls]	Operation Speed [pls/s]	Accel NO.	Decel NO.	M Code	Dwell Time
1	Absolute Single-axis Position Control	Single Keep	10000	1000	1	1	0	0
2	Absolute Single-axis Position Control	Single Keep	15000	500	1	1	0	0
3	Absolute Single-axis Position Control	Single Keep	25000	1000	1	1	0	0
4	Absolute Single-axis Position Control	Single Keep	30000	500	1	1	0	0

■ Operation Pattern



Operation step execution order according to start command will be [1] → [2] → [3] → [4].

(4) Continuous Operation

(a) Continuous Operation Overview

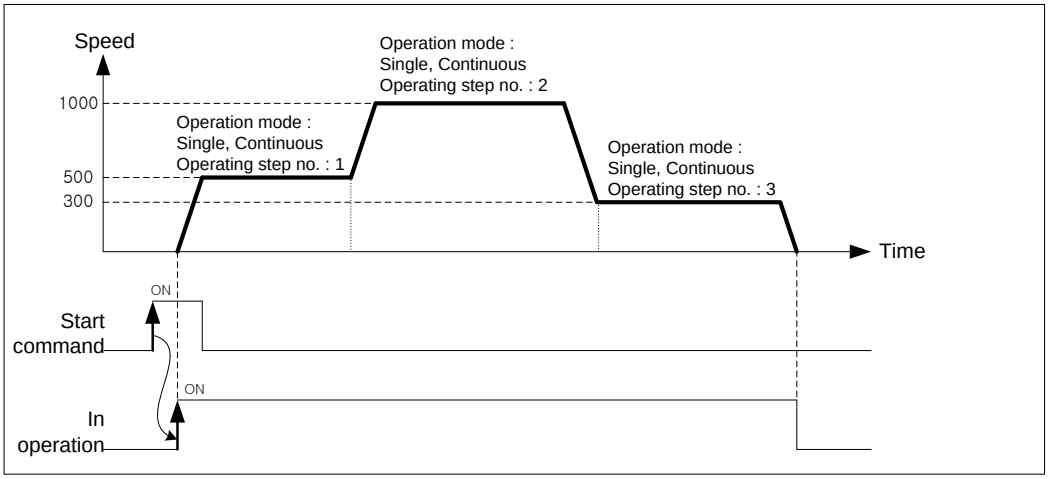
1) With one time Start command, the operation steps set as “Continuous” operation mode are executed until the target position without Dec. stop and the positioning will be completed after dwell time.
2) During “Continuous” operation, if the moving amount of next operation step is smaller than the distance needed to decelerate the current operation speed, “Look Ahead” control is used to avoid to stop immediately while operation speed ≠ 0
3) Dwell time of the operation step set as 'Continuous' operation mode is ignored, dwell time of the operation step set as 'End' operation pattern is valid.
4) When you execute 'Continuous' operation mode, always set the last operation step as 'End'.
5) When operation pattern is Continuous (or Keep), operation doesn’t end until it executes the step whose operation pattern is 'End'. Therefore, if there is no step whose operation pattern is “End”, it will keep operating until the operation step No. 400. When operation pattern of the operation step No. 400 is not the “End”, error occurs and operation will be stop. When operation pattern of the operation step No. 400 is 'Continuous' and 'Repeat', it will execute the operation step specified by Repeat Step No.
6) Operation direction will be determined by target position.
7) If you want to operate the next step before the operation step that is active currently reaches the target position, it is available with「Next Move continuous operation」(XNMV) command.
8) You can execute「Next Move continuous operation」(XNMV) command, when the operation is in the acceleration, constant speed, deceleration section.

[Example] - Executes start command after setting the step no. of “Indirect Start” as “0”
- Executes Start command once.

■ Setting of XG-PM

Step NO.	Control Method	Operation Method	Target Position [pls]	Operation Speed [pls/s]	Accel NO.	Decel NO.	M Code	Dwell Time
1	Absolute Single-axis Position Control	Single Continuous	10000	500	1	1	0	0
2	Absolute Single-axis Position Control	Single Continuous	30000	1000	1	1	0	0
3	Absolute Single-axis Position Control	Single End	40000	300	1	1	0	0

■ Operation Pattern



Operation step execution order according to start command will be [1] → [2] → [3].

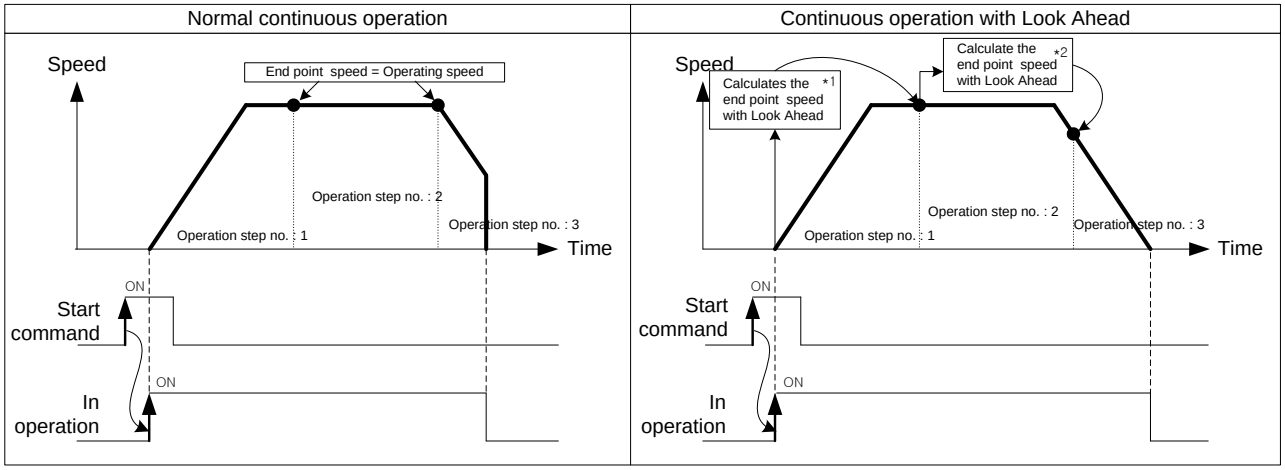
Note

1. When operation method is continuous, before reaching the amount of movement set by target position, sometimes its speed changes to next operation step speed.
   That is operating the remaining amount of movement less than operation speed at the next step to control the operation speed continuously
   (The remaining distance less than operation speed is less than distance the object can move within one control cycle (0.8 (less than 2 axes)~2.4ms (8 axes) with the speed of the object before reaching the target.
2. If control method is linear or circular interpolation and operation method is continuous, positioning speed control will be different according to “Interpolation continuous operation type” of the extended parameter. For more information, refer to “Interpolation control continuous operation”.

(b) Look Ahead

1) During “Continuous” operation, if the moving amount of next operation step is smaller than the distance needed to decelerate the current operation speed, “Look Ahead” control is used to avoid to stop immediately while operation speed ≠ 0
2) Look Ahead means is control that it calculates the permissible entry speed available for the next step by using current operation step data and target position of the next step previously and uses that as the speed of the end point of the current step. When target position (moving amount) of the next operation step is small, it makes the step speed as 0 by reducing the permissible entry speed available for the next step.
3) XGF-PN8A/XGF-PN8B positioning module calculate the speed of the end point using total 3 steps including current step for Look Ahead.

Next figure will explain the difference between general continuous operation using Look Ahead and not using Look Ahead.



*1 : Moving amount of step 2 and step 3 is more than the distance needed to decelerate step 1 operation speed. So, endpoint speed = operation speed.

*2 : Since moving amount of step 3 is less than distance needed to decelerate step 2 operation speed, it calculates the speed that makes the stop speed of step 3 as 0 and uses that as the end point speed of step 2.

(c) Continuous operation of interpolation control

When control method is linear or circular interpolation and operation method is Continuous, positioning control is different according to “Interpolation continuous operation type” of extended parameter. There are 「Pass Target Position」 in which the object goes through the specified target position and 「Pass Near Position」 in which the object goes to the target position of the next step at the near position not exceeding the specified target position.

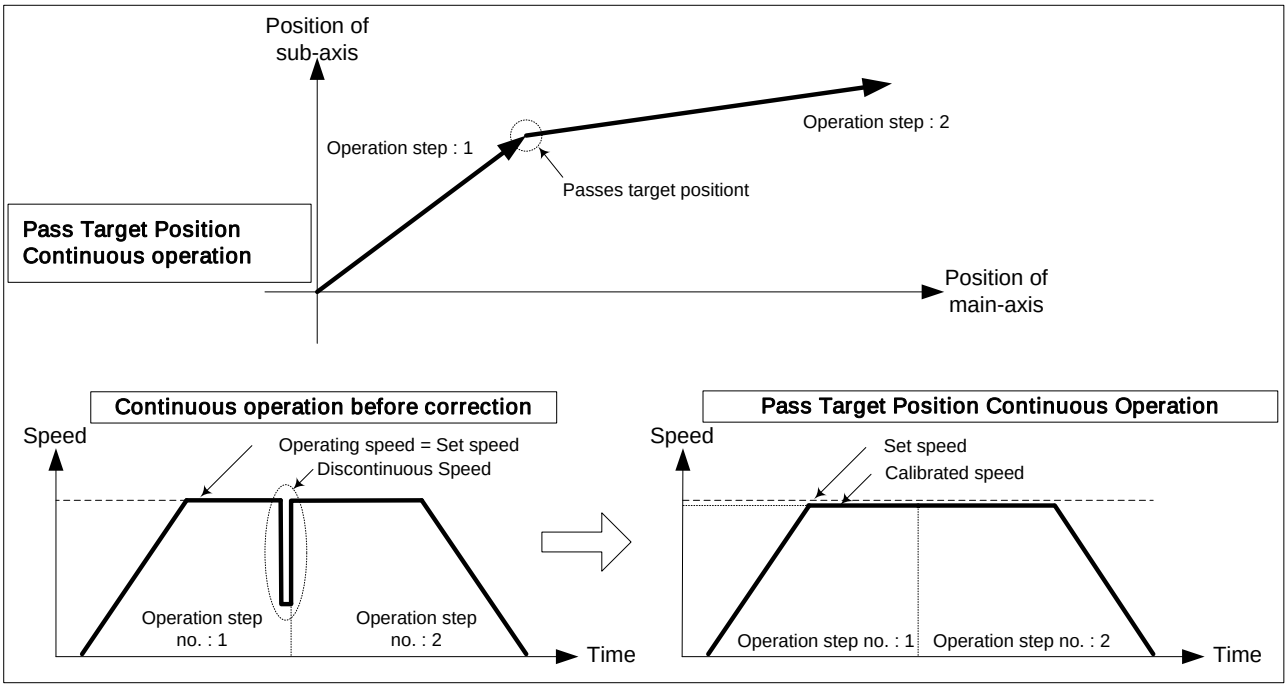
The next describes 「Interpolation continuous operation type」 setting of extended parameter.

Item	Setting Value	Contents
Interpolation continuous operation type	0 : Pass Target Position	In case of Continuous operation from current step to next step, the object passes the target position set on the operation data.
	1 : Pass Near Position	In case of Continuous operation from current step to next step, the object goes to the target position of next step at the near position not exceeding the target position set on the operation data.

1) Continuous Operation Passing Target Position

「Pass Target Position」 Continuous Operation means that in case of Continuous operation from current step to next step, the object passes the target position set on the operation data.

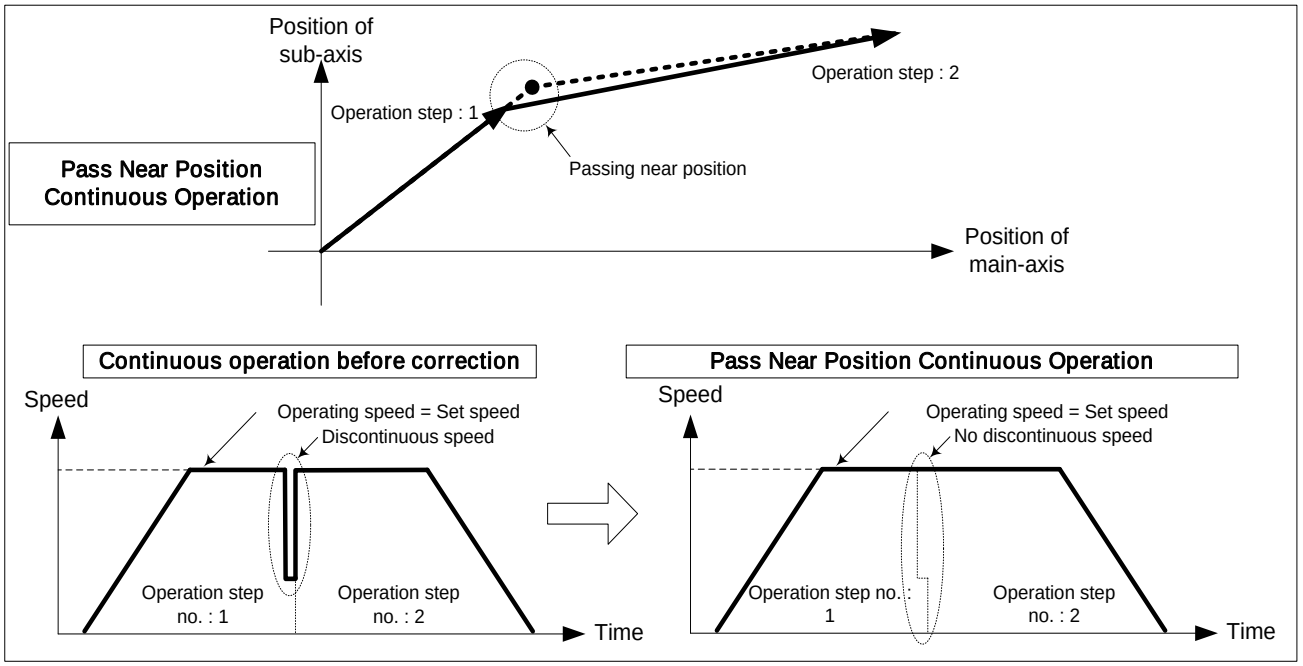
In general, when executing interpolation control passing the target position, there can be mechanical vibration because of discontinuous operating speed caused by remaining moving amount at the last section where operation data changes from current step to next step. XGF-PN8A/XGF-PN8B positioning module use the speed correction to solve mechanical vibration problem and execute Continuous operation precisely at the target position set by the user



In “Pass Target Position” Continuous Operation, in order to position the object at the target position of each operation data being executed continuously, it corrects the position at the acceleration speed, constant speed section by reducing the operation speed as much as the remaining of the moving amount occurring at the last section of the current step. When operating the next step, it uses the speed corrected at the previous step as current speed. So the continuous operation is available without discontinuous operation.

2) Pass Near Position Continuous Operation

In case of continuous operation form the current step to the next step, it executes continuous operation for the target position of the next step at the near position not exceeding the target position of the current operation step. This is method to remove the discontinuity caused by remaining moving amount at the last section where operation data changes from current step to next step. The following is principal of the Pass Near Position Continuous Operation.



In the picture above, during general Continuous Operation, speed discontinuity occurs because of the remaining of moving amount at the last of the operation step NO.1. Since「Pass Near Position」Continuous Operation make it move as much as the remaining of moving amount at the next step, continuous operation without discontinuity is available.

Note

「Pass Near Position」continuous operation may operate with operation speed of the next step before reaching the target position according to the remaining of the moving amount based on the operation speed in order to remove the speed discontinuity. In case of single-axis position control continuous operation, if it doesn’t change the direction, it always passes the target position, but in case of interpolation control continuous operation, it may operate with the operation speed of the next step before reaching the target position, then trajectory of actual movement may be different with that of operation data. The following is the Max. position gap per each axis.

Max. position gap per each axis < (operation speed of the each axis (pls/s) x control cycle (s))

(d) Deceleration Stop of Continuous Operation

Continuous operation control decelerates and stops at the 'End' step. And then positioning is complete. However, in the following case, it keeps the next operation step after Dec. stop

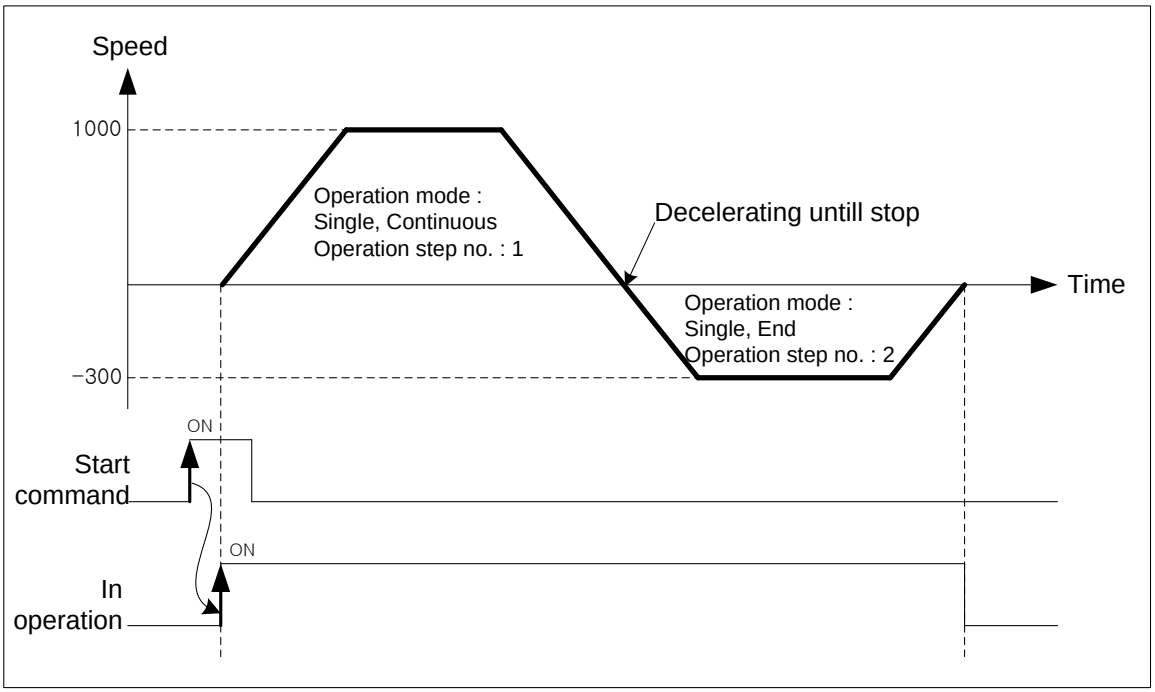
.

1) When the moving direction of current operation step and the moving direction of next step are different (only in case of the single-axis position control)

■ Setting of XG-PM

Step NO.	Control Method	Operation Method	Target Position [pls]	Operation Speed [pls/s]	Accel NO.	Decel NO.	M Code	Dwell Time
1	Absolute Single-axis Position Control	Single Continuous	10000	1000	1	1	0	0
2	Absolute Single-axis Position Control	Single End	3000	700	1	1	0	0

■ Operation Pattern



Step 1 operates by the start command and then changes moving direction because the target position of the next step goes 10000 → 3000. It decelerates and stops, and then operates Step 2 in a opposite direction.

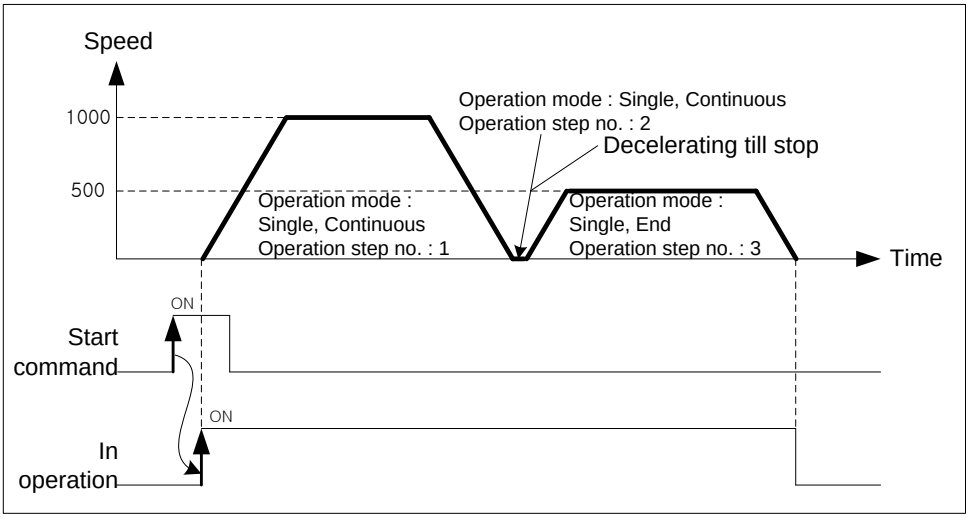
2) When the moving amount of next step is 0

When the moving amount of next step is 0, operation speed is 0 during one cycle.

■ Setting of XG-PM

Step NO.	Control Method	Operation Method	Target Position [pls]	Operation Speed [pls/s]	Accel NO.	Decel NO.	M Code	Dwell Time
1	Absolute Single-axis Position Control	Single Continuous	10000	1000	1	1	0	0
2	Absolute Single-axis Position Control	Single Continuous	10000	700	1	1	0	0
3	Absolute Single-axis Position Control	Single End	15000	500	1	1	0	0

■ Operation Pattern



Step 1 operates by the start command, and then because target position of next step is same as that of current step, moving amount becomes 0. It decelerates and stops. And then it operates step 3.

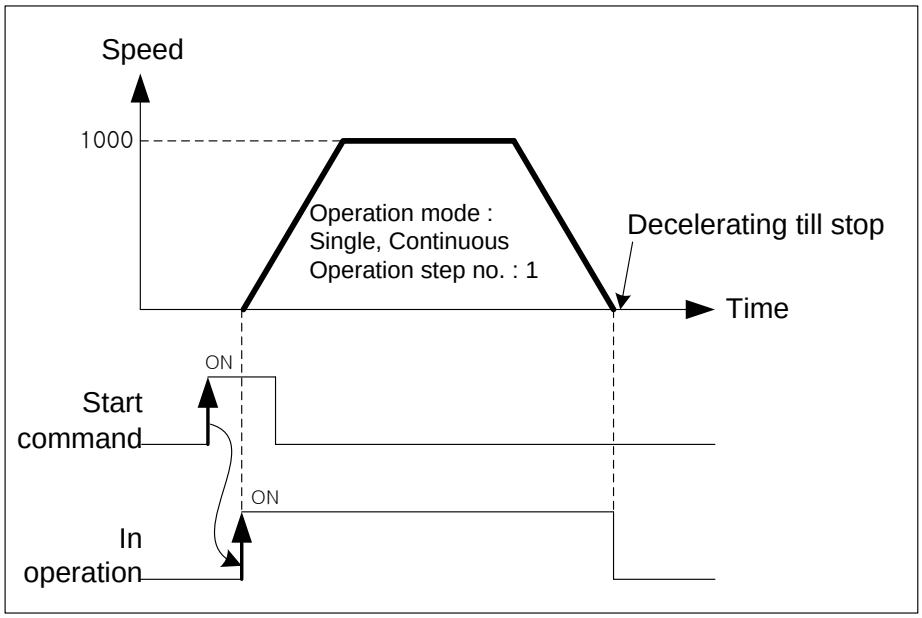
3) When error is on the operation data of the next step

When next step of operation speed is 0, or operation method of current step is 「Single-axis Positioning Control」 and operation method of next step is 「Single-axis FEED Control」, it can not execute next operation data. In this case, it decelerates and stops at the current step. And then positioning is complete

■ Setting of XG-PM

Step NO.	Control Method	Operation Method	Target Position [pls]	Operation Speed [pls/s]	Accel NO.	Decel NO.	M Code	Dwell Time
1	Absolute Single-axis Position Control	Single Continuous	10000	1000	1	1	0	0
2	Absolute Single-axis Feed Control	Single Continuous	20000	1000	1	1	0	0
3	Absolute Single-axis Position Control	Single End	30000	1000	1	1	0	0

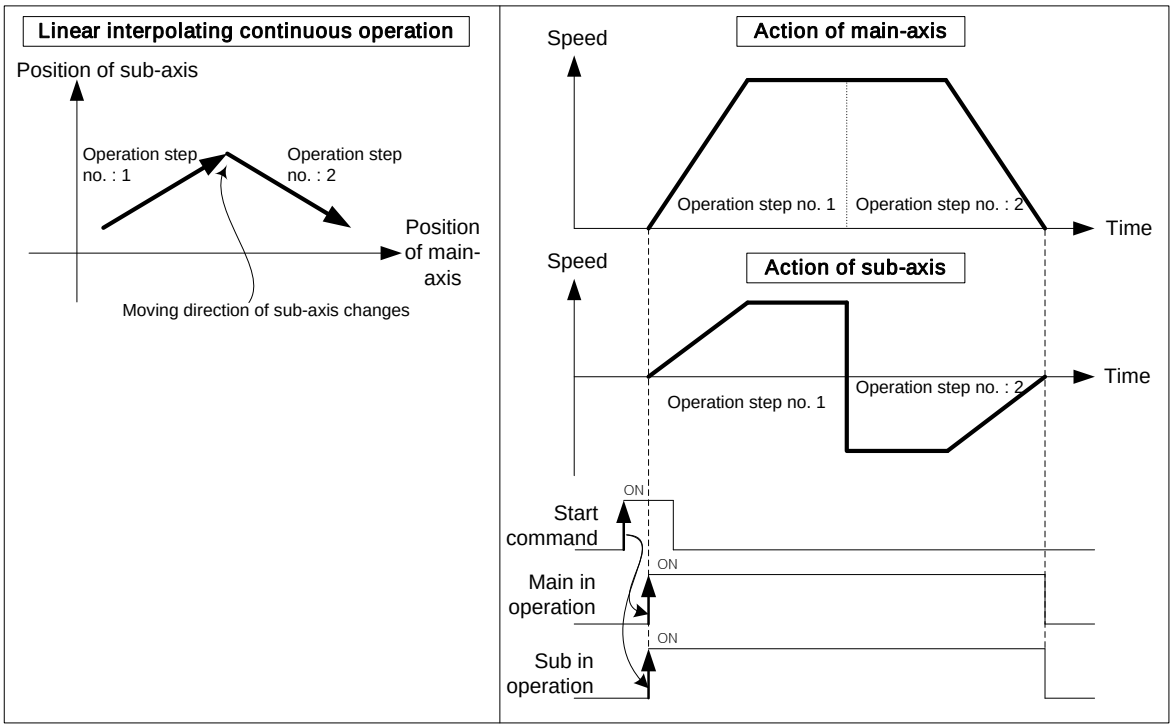
■ Operation Pattern



Note

During Continuous Operation of Linear interpolation or circular interpolation, it does not check the direction of movement. So even if moving direction changes, there is no Dec. stop. Therefore, if operation data is set to change the direction, because the direction of movement changes dramatically, it may damage the machine.

In this case, use the operation method of 「Keep 」and do not use「Continuous」, not to give the impact to the machine.



9.2.3 Single-axis Position Control

After executed by the start command (「Direct start」, 「Indirect start」, 「Simultaneous start」), it executes positioning control from start position (the current stop position) to target position (the position to move) on the specified axis.

(1) Control by Absolute method (Absolute coordinate) (「Absolute, Single-axis Position Control」)

(a) Position control from start position to target position (assigned by positioning data). Positioning control is carried out based on the position assigned by homing (origin position).

(b) Moving direction is determined by start position and target position.

▶Start position < target position: forward direction positioning

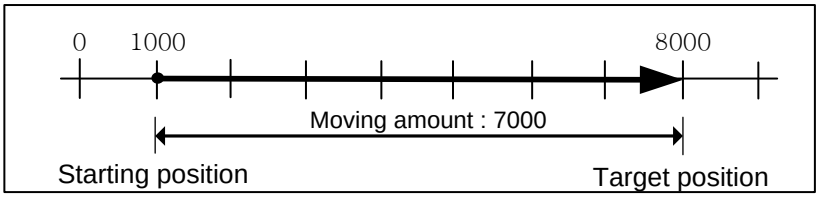
▶Start position > target position: reverse direction positioning

[Example] Executes Absolute coordinate, single-axis position control with the following setting

▷Start position: 1000,

▷Target position: 8000

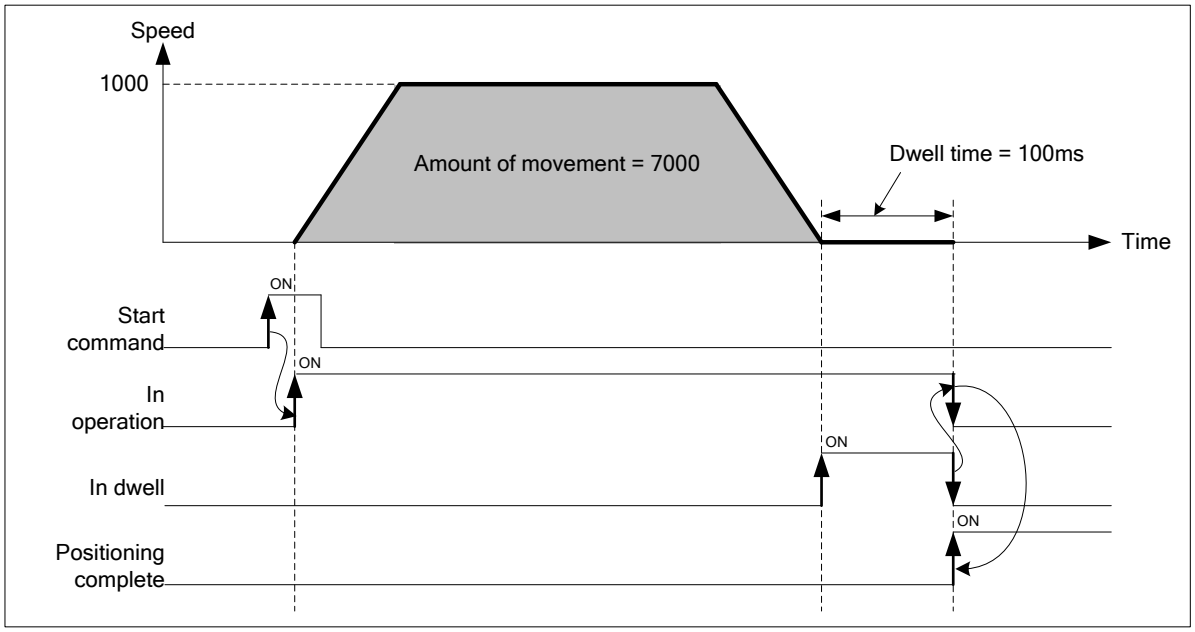
The moving amount to forward direction is 7000 (7000=8000-1000).



■ Setting of XG-PM

Step NO.	Control Method	Operation Method	Target Position [pls]	Operation Speed [pls/s]	Accel NO.	Decel NO.	M Code	Dwell Time
1	Absolute Single-axis Position Control	Single End	8000	1000	1	1	0	100

■ Operation Pattern



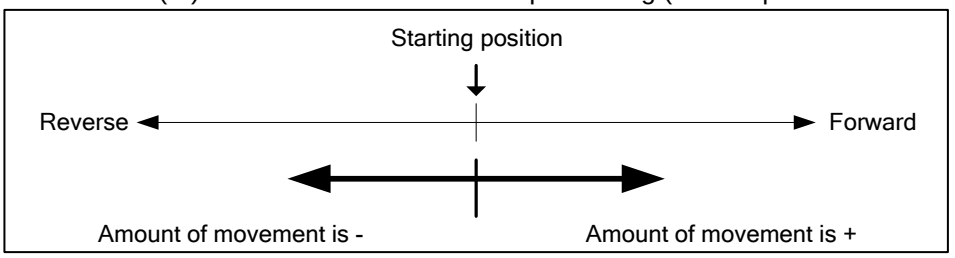
(2) Control by Incremental method (「Incremental, Single-axis Position Control」)

(a) It moves the object as much as the target moving amount from start position. Unlike the target position of the absolute coordinate, the value specified on target position is not position value. That is a transfer amount from the current position.

(b) Transfer direction is determined by the sign of moving amount.

▷ Transfer direction (+) or no sign: forward direction positioning (current position increases)

▷ Transfer direction (-) : reverse direction positioning (current position decreases)

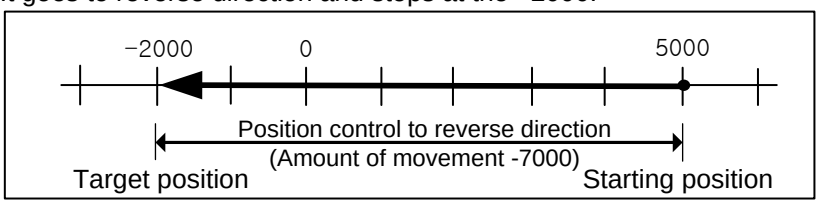


[Example] Executes Absolute coordinate, single-axis position control with the following setting

▷ Start position: 5000,

▷ Target position: -7000

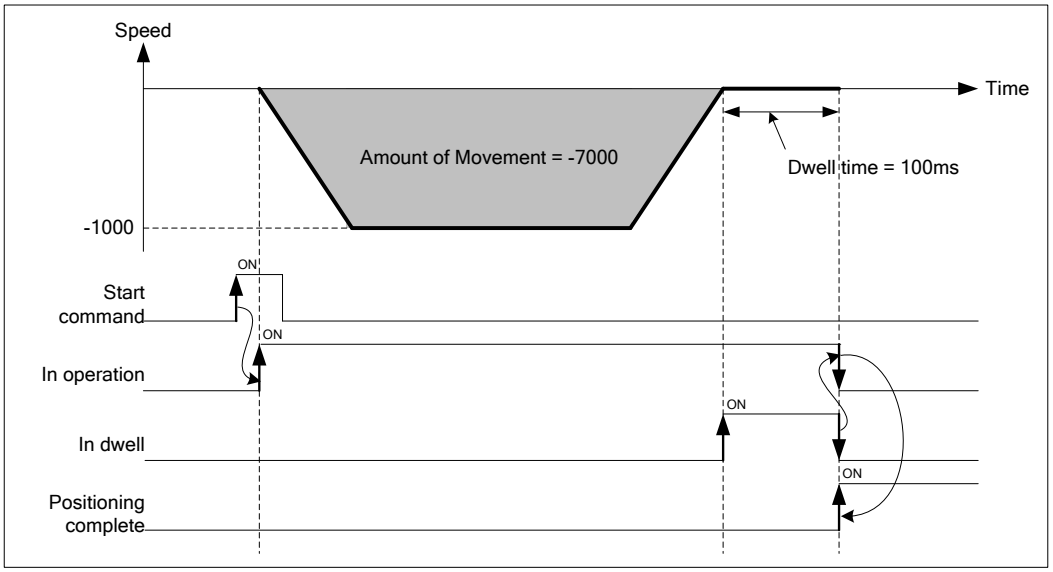
It goes to reverse direction and stops at the –2000.



■ Setting of XG-PM

Step NO.	Control Method	Operation Method	Target Position [pls]	Operation Speed [pls/s]	Accel NO.	Decel NO.	M Code	Dwell Time
1	Absolute Single-axis Position Control	Single End	-7000	1000	1	1	0	100

■ Operation Patten



9.2.4 Single-axis Speed Control

After executed by the start command (「Direct start」, 「Indirect start」, 「Simultaneous start」), it keeps moving with the specified speed until deceleration stop command is entered.

(1) Features of Control

(a) Speed control contains 2 types of start: Forward direction start and Reverse direction start.

▷Forward direction: when position value is positive number (+) (“0” included)

▷Reverse direction: when position value is negative number (-)

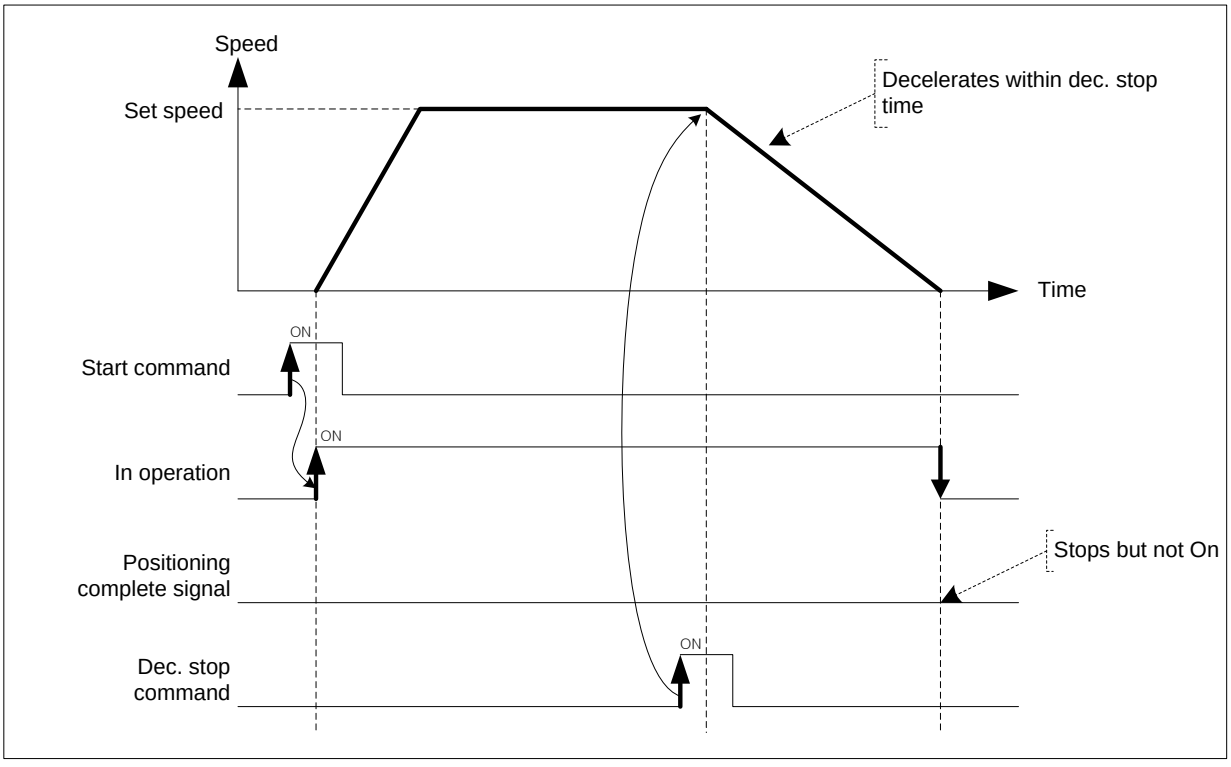
(b) In case of using speed control, the following items of operation data do not affect.

▷ Coordinate, Operation method, Dwell time

▷ “Absolute, single-axis speed control” and “Incremental, single-axis speed control” execute same operation.

(c) Accelerating operation of speed control operates based on acceleration number on operation data, decelerating operation operates based on deceleration time of a command 「deceleration stop」.

(2) Operation Timing



(3) Restrictions

(a) Set the operation pattern of speed control as 'End' or 'Keep'. When it is set as "Continuous", error occurs (error code: 236) and can not execute speed control.

(b) In speed control, only when「M code mode」of extended parameter is "with", M code signal is "On". (If you use "After mode", M code signal will not be "On".)

(c) For a software upper/lower limit check during speed control, it varies according to the setting of the “Software limit detect”.

Item	Setting Value	Contents
Soft Upper/Lower Limit detect during speed control	0 : Don’t Detect	During Speed Control, do not operate to check the range of upper/lower limit of software
	1 : Detect	During Speed Control, operate to check the range of upper/lower limit of software

(4) Setting of XG-PM

Step NO.	Control Method	Operation Method	Target Position [pls]	Operation Speed [pls/s]	Accel NO.	Decel NO.	M Code	Dwell Time
1	Absolute Single-axis Speed Control	Single End	100	1000	1	1	0	0

9.2.5 Single-axis Feed Control

After executed by the start command (「Direct start」, 「Indirect start」, 「Simultaneous start」), it changes current stop position as '0' and operates until target position.

(1) Features of control

(a) The value set on target position is moving amount. That is, moving direction is decided by the sign of target position.

▷Forward direction : when position address is positive number (+) ("0" included)

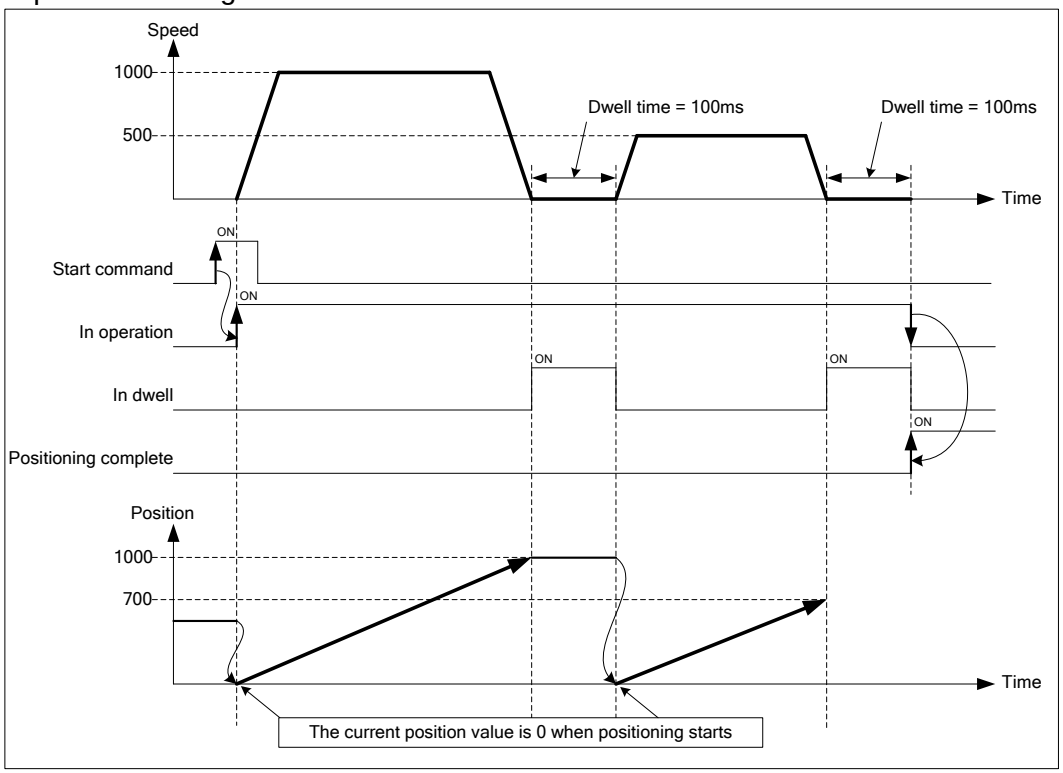
▷Reverse direction : when position address is negative number (-)

(b) In case of using Single-axis Feed Control, the following items of operation data do not affect.

▷ Coordinate

▷ "Absolute, single-axis speed control" and "Incremental, single-axis speed control" execute same operation.

(2) Operation Timing



(3) Restrictions

(a) Set the operation pattern of Feed control as 'End' or 'Keep'. When it is set as "Continuous", error occurs (error code: 230) and can not execute Feed control.

(4) Setting of XG-PM

Step NO.	Control Method	Operation Method	Goal Position [pls]	Operation Speed [pls/s]	Accel NO.	Decel NO.	M Code	Dwell Time
1	Absolute, Single-axis Feed Control	Single, Keep	1000	1000	1	1	0	100
2	Absolute, Single-axis Feed Control	Single End	700	500	1	1	0	100

9.2.6 Linear Interpolation Control with 2 axes

After executed by start command (「Indirect start」, 「Synchronous start」), then executes interpolation control from starting position to the target position with linear trajectory by using the interpolation axes set as the main axis and sub axis.

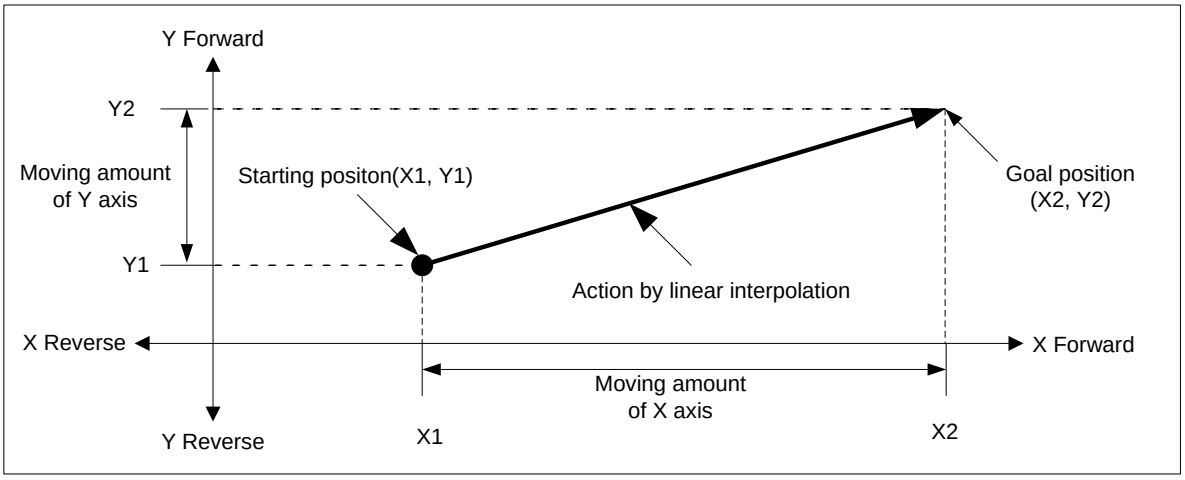
(1) Linear interpolation control with absolute coordinates (「Absolute, Linear Interpolation」)

(a) Executes linear interpolation from starting position to the target position designated on positioning data. Positioning control is carried out based on the position specified from homing.

(b) The direction of movement depends on the starting position and the target position for each axis.

■ Starting position < target position: Positioning operation in forward

■ Starting position > target position: Positioning operation in reverse



(c) Restrictions

Linear interpolation with 2 axes may not be executed in the case below.

■ 「Sub axis setting」 Error (error code : 253)

- 「Sub axis setting」 of operation data of the main axis is “Axis-undecided”
- 「Sub axis setting」 of operating data of the main axis is the same as main axis no.
- 「Sub axis setting」 of operating data of the main axis exceeds the settable axis no.

Note

Because more than 2 axes are in action, so need user to pay attention
(1) The commands available are as follows.
- Speed override, Dec. stop, Emg. stop, Skip operation, Continuous operation

(2) The commands unavailable in linear interpolation are as follows.
- Position/Speed switching control, Position override

(3) The parameter items which work depending on the value of each axis are as follows.
- Software high/low limit among extended parameter items

(d) Setting example of operation data

Setting items	Main-axis setting	Sub-axis setting	Description
Control method	Absolute, Linear interpolation	Absolute, single axis position control	When linear interpolation control is executed by the absolute coordinates method, set 「Absolute, Linear interpolation」 on the main axis and set the sub-axis coordinate as “Absolute”.
Operating method	Single, End	-*1	Set the operating method to execute linear interpolation
Target position [pls]	10000	5000	Set the target position on main-axis and sub-axis
Operation speed [pls/s]	1000	-	Speed of interpolation operation is determined by main axis speed. Set the main axis speed.
Acc. no.	No.1	-	Set acc. no. for acceleration (no.1 ~ no.4)
Dec. no.	No.2	-	Set dec. no. for deceleration. (no.1 ~ no.4)
M code	0	-	When you need to execute auxiliary work based on the interpolation operation, set the M code
Dwell time	500	-	Set dwell time(ms) needed to output the positioning completion signal
Sub-axis setting	Axis2	-	Set an axis to be used as sub-axis among settable axis in operating data of main-axis

- *1 : It does not need to be set. Whatever value is set, it does not affect the linear interpolation.

Note

Linear interpolation control is executed on the basis of operating data of main axis.
Only 「Target position」 item of sub-axis setting affects linear interpolation. In other word, whatever value is set for other items, it does not affect the operation and errors do not arise.
But, coordinate setting of sub-axis control method indicates whether target position is absolute coordinate value or incremental coordinate value. So in case of linear interpolation control by absolute coordinate method, set the coordinate of sub-axis as “Absolute”.

[Example] axis1 and axis2 are main and sub axis each. Executes linear interpolation with the following setting

■ Starting position (1000, 4000), target position (10000, 1000)

In this condition, the operation is as follows.

■ Setting example of XG-PM

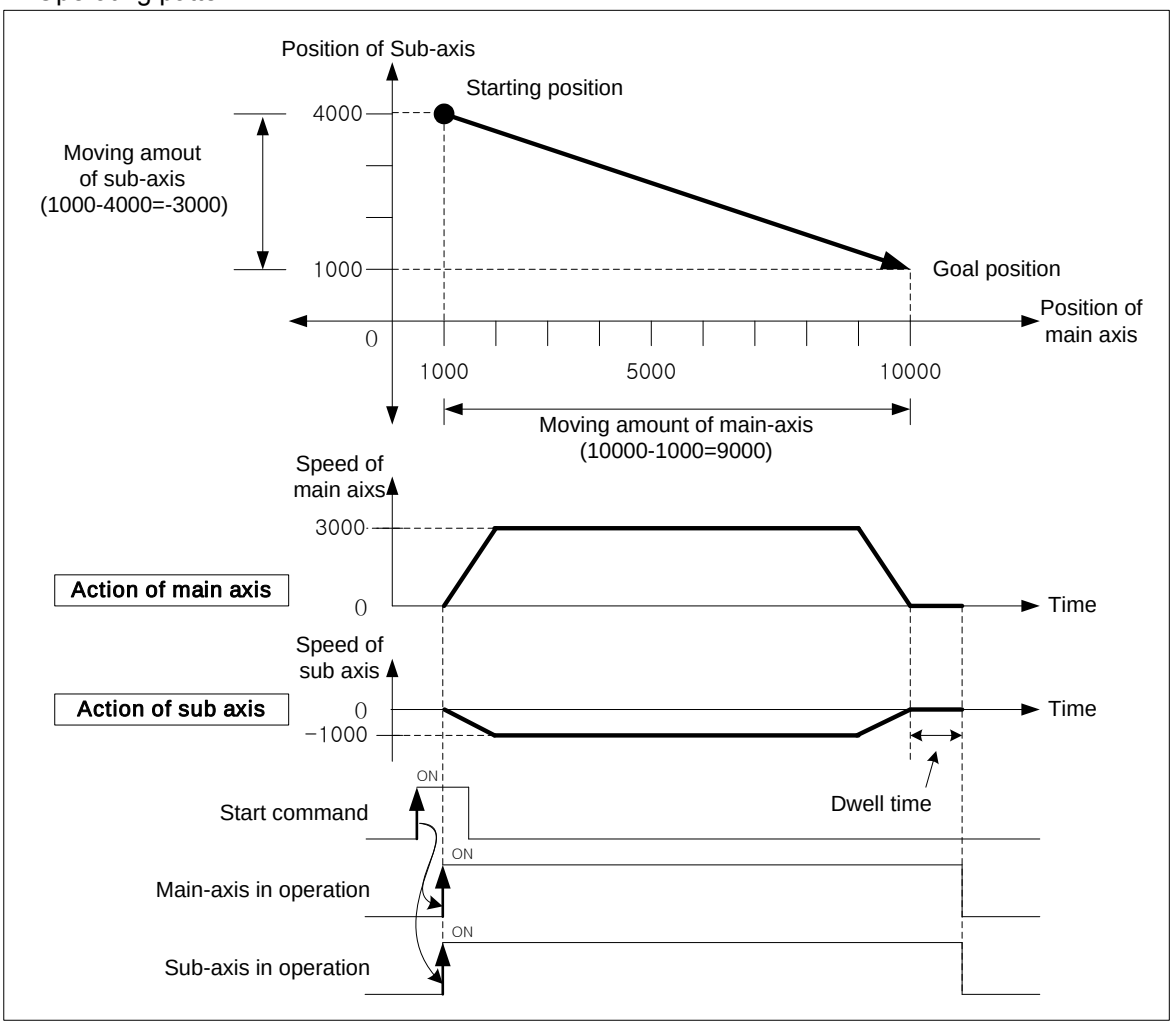
▪ Operation data of main-axis(1-axis)

Step no.	Control method	Operating method	Target position [pls]	Operating speed [pls/s]	Acc. no.	Dec. no.	M code	Dwell time	Sub axis setting
1	Absolute, Linear	Singular, End	10000	3000	No.1	No.1	0	100	Axis2

▪ Operation data of sub-axis(2-axis)

Step no.	Control method	Operation method	Target position [pls]	Operating speed [pls/s]	Acc. no.	Dec. no.	M code	Dwell time	Sub axis setting
1	Absolute, Single-axis position control	Single, End	1000	0	No.1	No.1	0	0	Axis-undecided

■ Operating pattern



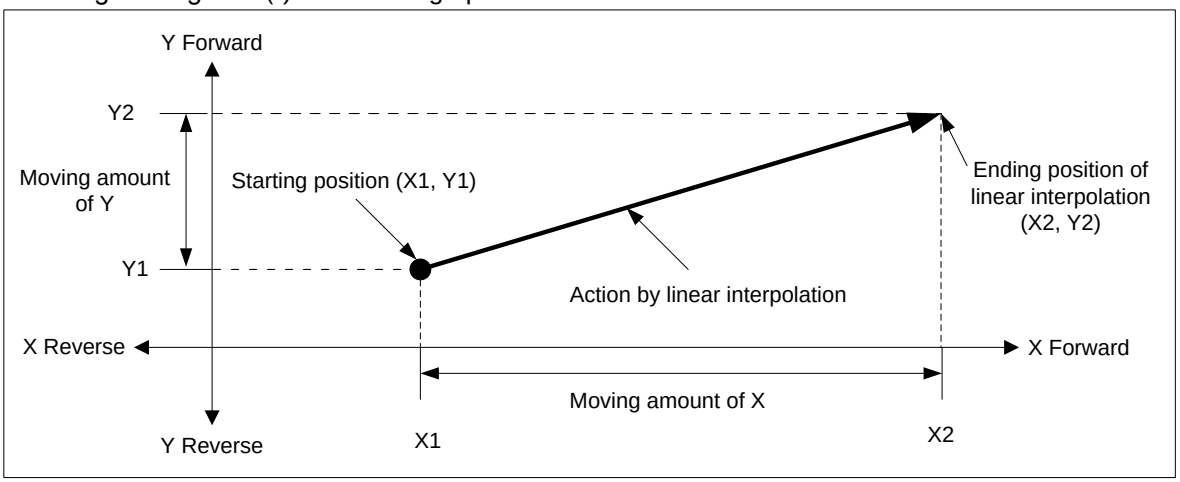
(2) Linear interpolation control with incremental coordinates (「Incremental, Linear Interpolation」)

(a) Executes 2 axes linear interpolation from starting position to the target position. Positioning control is carried out based on the current stop position.

(b) Moving direction depends on the sign of the target position (Moving amount)

■ The sign is positive (+ or nothing) : Positioning operation in forward

■ The sign is negative (-) : Positioning operation in reverse



(c) Restrictions

Linear interpolation with 2 axes may not be executed in the case below.

■ 「Sub-axis setting」error (error code : 253)

- 「Sub-axis setting」value of operation data of the main axis is “Axis-undecided”
- 「Sub-axis setting」value of operation data of the main axis is same as the main axis no.
- 「Sub-axis setting」value of operation data of the main axis exceeds settable axis no.

(d) Setting example of operation data

Setting items	Main-axis setting	Sub-axis setting	Description
Control method	Incremental, Linear interpolation	Incremental, single-axis position control	When linear interpolation control is executed by the incremental coordinate method, set「Incremental, Linear interpolation」on the main axis and set the sub-axis as “Incremental” coordinate.
Operating method	Single, End	-*1	Set the operation method to execute linear interpolation
Target position [pls]	10000	5000	Set the moving amount on the main & sub-axis
Operation speed [pls/s]	1000	-	Speed of interpolation operation is determined by main axis speed. Sets the main axis speed.
Acc. no.	No.1	-	Set acc. no. for acceleration (no.1 ~ no.4)
Dec. no.	No.2	-	Set dec. no. for deceleration. (no.1 ~ no.4)
M code	0	-	When you need to execute auxiliary work based on the interpolation operation, set the M code
Dwell time	500	-	Set dwell time(ms) needed to output the positioning completion signal
Sub-axis setting	Axis2	-	Set an axis to be used as sub-axis among settable axis in operating data of main-axis

- *1 : It does not need to be set. Whatever value is set, it does not affect linear interpolation.

Note

Linear interpolation control is executed on the basis of operation data of main axis.
Only 「Target position」item of sub-axis setting affect linear interpolation. In other word, whatever value is set for other items, it does not affect the operation and errors do not arise.
But, coordinate setting of sub-axis control method indicates whether target position is absolute coordinate value or incremental coordinate value. So in case of linear interpolation control by incremental coordinate method, set the coordinate of sub-axis as “Incremental”.

[Example] axis1 and axis2 are main and sub axis each. Executes linear interpolation with the following setting

■ Starting position (1000, 4000), Target position (9000, -3000)

In this case, the operation is as follows.

■ Setting example of XG-PM

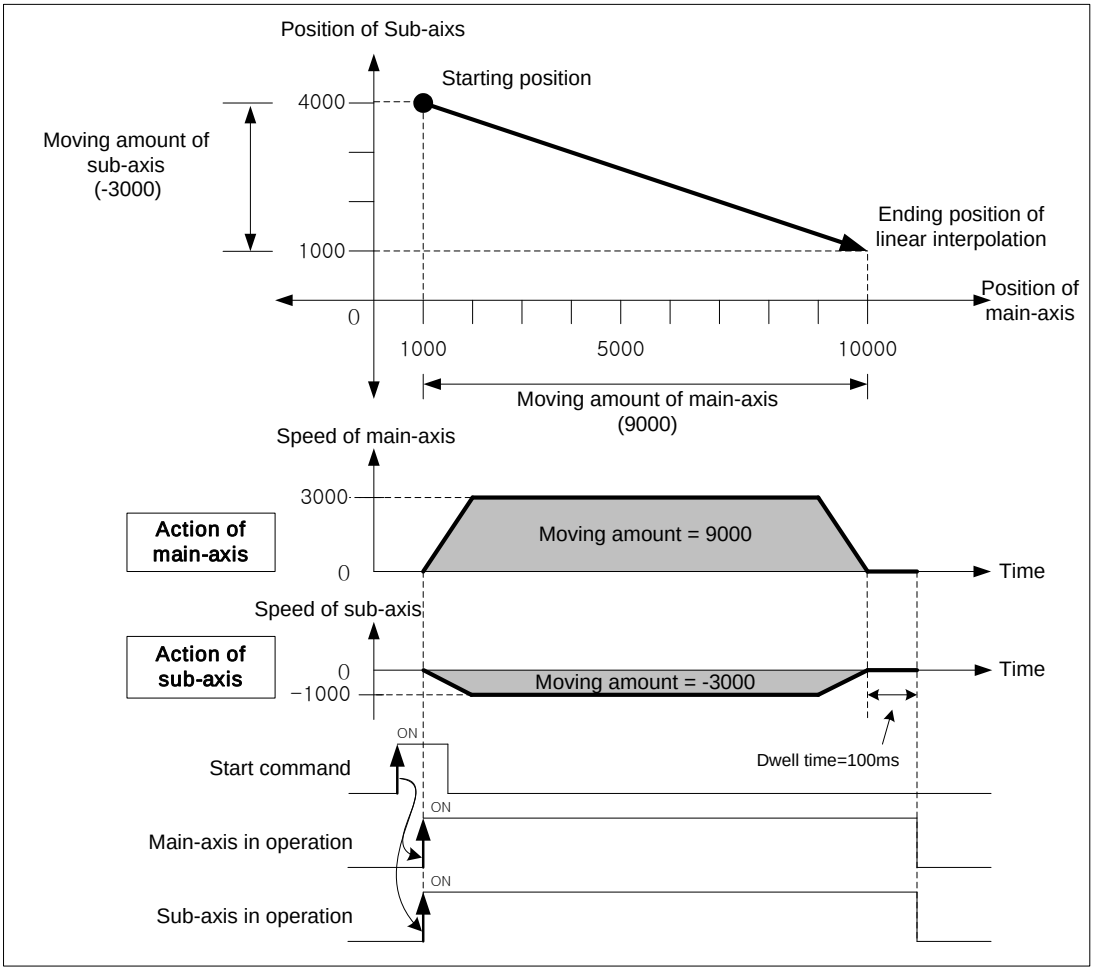
▪ Operation data of main-axis(axis1)

Step no.	Control method	Operation method	Target position [pls]	Operation speed [pls/s]	Acc. no.	Dec. no.	M code	Dwell time	Sub axis setting
1	Incremental, Linear	Single, End	9000	3000	No.1	No.1	0	100	Axis2

▪ Operation data of sub-axis(axis2)

Step no.	Control method	Operation method	Target position [pls]	Operation speed [pls/s]	Acc. no.	Dec. no.	M code	Dwell time	Sub axis setting
1	Incremental, Single axis position control	Single, End	-3000	0	No.1	No.1	0	0	Axis-undecided

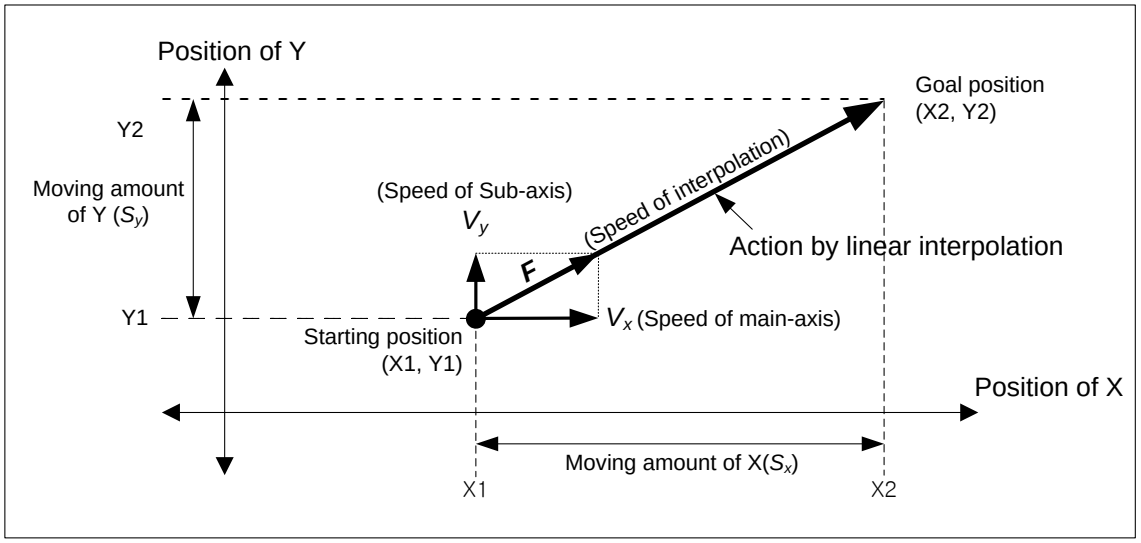
■ Operating pattern



(3) Speed in 2 axes linear interpolation control

Operation speed in linear interpolation is determined based on “Interpolation speed selection” option of extended parameter, main-axis speed or synthetic speed. If operation speed is set on command axis (main), positioning module calculates the speed of sub-axis based on the moving amount. Sub-axis speed and interpolation speed of the object are calculated as follows.

■ Speed in 2 axes linear interpolation (when main-axis speed is selected)



$$\text{Speed of sub}(V_y) = \text{Speed of main}(V_x) \times \frac{\text{Moving amount of Sub}(S_y)}{\text{Moving amount of Main}(S_x)}$$

$$\text{Interpolating speed}(F) = \sqrt{V_x^{\,2} + V_y^{\,2}}$$

[Example]

■ Starting position (2000, 1000)

■ Target position (6000, 4000)

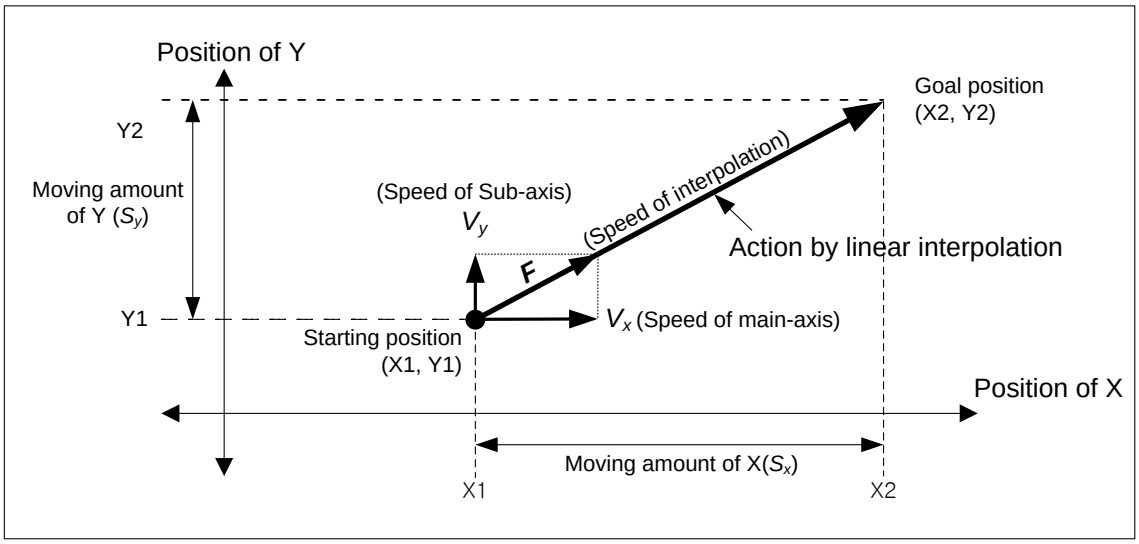
■ Operating speed : 400 [pls/s]

Sub-axis speed and interpolating speed are as follows.

Speed of sub-axis = $400 \times \frac{3000}{4000} = 300$ [pls/s]

Interpolating speed = $\sqrt{400^2 + 300^2} = 500$ [pls/s]

■ Speed in 2 axes linear interpolation (when synthetic speed is selected)



$$Interpolatingspeed\,(F) = Operationspeedsetinpositiondata$$

$$Interpolatingmovingamount\,(S) = \sqrt{S_x{}^2 + S_y{}^2}$$

$$Mainaxisspeed\,(V_x) = \text{int}\ erpolatingspeed\,(F) \times \frac{Mainaxismovingamount\,(S_x)}{Interpolatingmovingamount\,(S)}$$

$$Subaxisspæd\,(V_y) = Interpolatingspeed\,(F) \times \frac{Mainaxismovingamount(S_y)}{Interpolatingmovingamount\,(S)}$$

[Example]

- Starting position (2000, 1000),
- Target position (6000, 4000)
- Synthetic speed: 400 [pls/s]

Main-axis speed and sub-axis speed are as follows.

Interpolating moving amount = $\sqrt{4000^2 + 3000^2}$ = 5000

Main-axis speed = $400 \times \frac{4000}{5000} = 320$ [pls/s]

Sub-axis speed = $400 \times \frac{3000}{5000} = 240$ [pls/s]

Note

(1) Speed limit for Sub-axis when interpolation speed is main axis speed
When using linear interpolation control and moving distance of main < moving distance of sub, it is possible that sub-axis speed calculated by XGF-PN8A exceeds 「Speed limit」 of basic parameter. In this case, error (error code: 261) arises and main-axis speed is recalculated for sub-axis not to exceed "Speed Limit" and operates. To prevent errors, reduce the main-axis speed so that sub-axis speed doesn't exceed the "Speed Limit".

(2) The speed when the moving distance of main-axis is 0 and interpolation speed is main axis speed
When the moving distance of main-axis is 0, the operation speed of main-axis operation data becomes actual interpolating speed. In this case of 2 axes linear interpolation where the moving distance of main-axis is 0, only sub-axis operates at the speed set on command axis.

■ Setting example of XG-PM

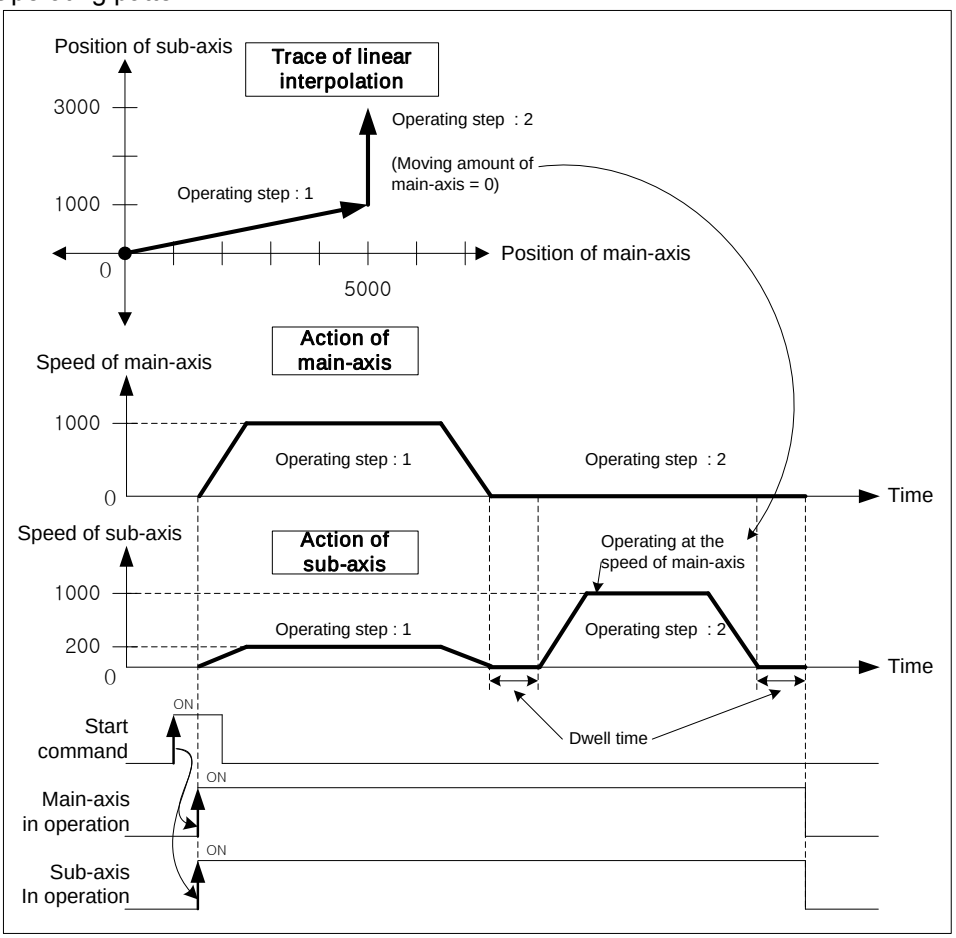
▪ Operating data of Main-axis

Step no.	Control method	Operation method	Target position [pls]	Operation speed [pls/s]	Acc. no.	Dec. no.	M code	Dwell time	Sub axis setting
1	Absolute, Linear interpolation	Single, Continuous	5000	1000	No.1	No.1	0	100	Axis2
2	Absolute, Linear interpolation	Single, End	5000	1000	No.1	No.1	0	100	Axis2

▪ Operating data of Sub-axis

Step no.	Control method	Operating method	Target position [pls]	Operation speed [pls/s]	Acc. no.	Dec. no.	M code	Dwell time	Sub axis setting
1	Absolute, single axis position control	Single, End	1000	0	No.1	No.1	0	0	Axis-undecided
2	Absolute, single axis position control	Single, End	3000	0	No.1	No.1	0	0	Axis-undecided

■ Operating pattern



(4) 2 axes linear interpolation continuous operation with circular arc insertion

When the operation method is set as “continuous” and the direction of movement changes rapidly, machine is possible to be damaged. When you need not position the object to the target position precisely, user can insert ‘circular interpolation operation’ between two trajectories to make operation softer and smoother.

(a) Operation order

1) Confirm whether to execute 2 axes linear interpolation continuous operation with circular arc insertion. It can be set in「Arc insertion」of extended parameter.

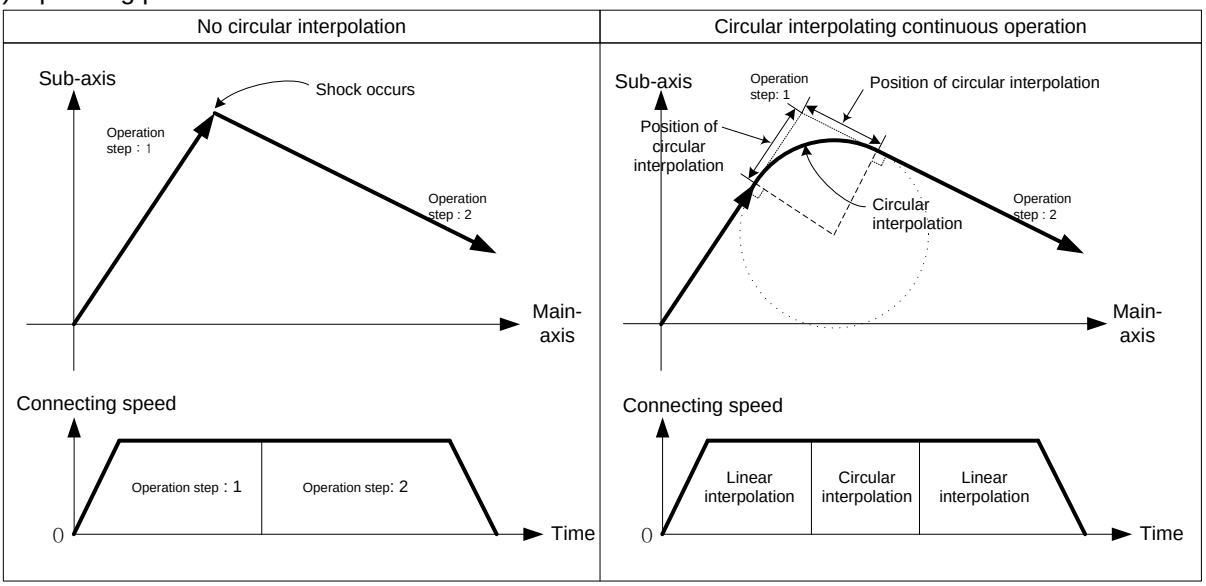
Setting items	Setting value	Description
Arc insertion	0 : Don’t insert	In case of 2 axes linear interpolation continuous operation, it doesn’t insert arc
	1 : Insert arc cont.	In case of 2 axes linear interpolation continuous operation, it inserts arc

2) It checks the position where arc will be inserted and resets the starting position of circular interpolation (target position of linear trajectory 1) and the target position (starting position of linear trajectory 1). The position where circular arc will be inserted can be set in「Arc insertion position」of extended parameter.

Setting items	Setting value	Description
Arc insertion position	0 ~ 2147483647	Set the position where circular arc will be inserted. This value means the incremental distance from the target position of linear trajectory 1.

3) After linear interpolation to the starting position of circular arc to be inserted, it executes circular interpolation at the same speed as linear interpolation. After finishing the circular interpolation, it executes linear interpolation to the target position of the next operation step again at the same speed.

(b) Operating pattern



(c) Restrictions

Circular arc is not inserted in the case below and it executes linear interpolation to the target position.

- Operating method of operation data is “End” or “Keep”
- Position of circular arc insertion is bigger than linear trajectory 1, 2 (Error code : 262)
- Trajectory of both linear interpolations are on the same line

[Example] Executes linear interpolation at the current position (0,0) when the extended parameter setting is as follows

Extended parameter	Setting value
Arc insertion	1 : Insert arc cont.
Arc insertion position	2000

■ Setting example of XG-PM

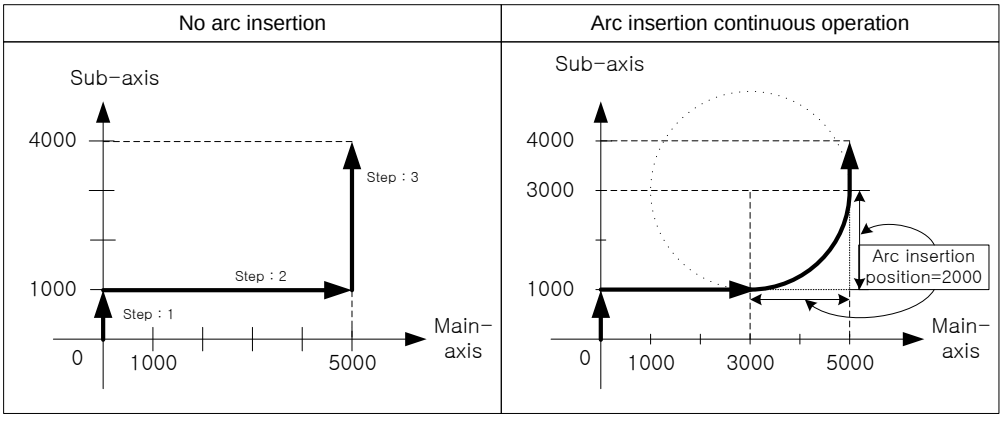
▪ Operating data of Main-axis

Step no.	Control method	Operating method	target position [pls]	Operating speed [pls/s]	Acc. no.	Dec. no.	M code	Dwell time	Sub axis setting
1	Absolute, Linear interpolation	single, continuous	0	3000	No.1	No.1	0	0	Axis2
2	Absolute, Linear interpolation	single, continuous	5000	3000	No.1	No.1	0	0	Axis2
3	Absolute, Linear interpolation	single, end	5000	3000	No.1	No.1	0	100	Axis2

▪ Operating data of Sub-axis

Step no.	Control method	Operating method	Target position [pls]	Operating speed [pls/s]	Acc. no.	Dec. no.	M code	Dwell time	Sub axis setting
1	Absolute, single axis position control	single, end	1000	0	No.1	No.1	0	0	Axis-undecided
2	Absolute, single axis position control	single, end	1000	0	No.1	No.1	0	0	Axis-undecided
3	Absolute, single axis position control	single, end	4000	0	No.1	No.1	0	0	Axis-undecided

■ Operating pattern



■ Description about action

When executing operation step no.1, executes linear interpolation to original target position (0,1000) without circular arc insertion because arc insertion position (2000) is bigger than the length of line 1(1000).

When finishing linear interpolation to target position of operation step no.1 and executing operation step no.2, because arc insertion position (2000) is smaller than line length of step no.2(5000) and no.3(3000), so it recalculates the starting position (target position of linear trajectory no.1) and the target position (Starting position of linear trajectory no.2) of circular interpolation.

It continues to execute linear interpolation to the recalculated target position of operation step no.2 (3000, 1000), and then executes circular interpolation to recalculated starting position of operation step no.3 (5000,3000).

After circular interpolation, it executes linear interpolation to the target position of operation step no.3 (5000,4000). And then positioning will be complete.

9.2.7 Linear Interpolation Control with 3 axes

After executed by start command (「Indirect start」, 「Synchronous start」), then executes interpolation control from starting position to the target position with interpolation axes set as the main axis and sub axes.

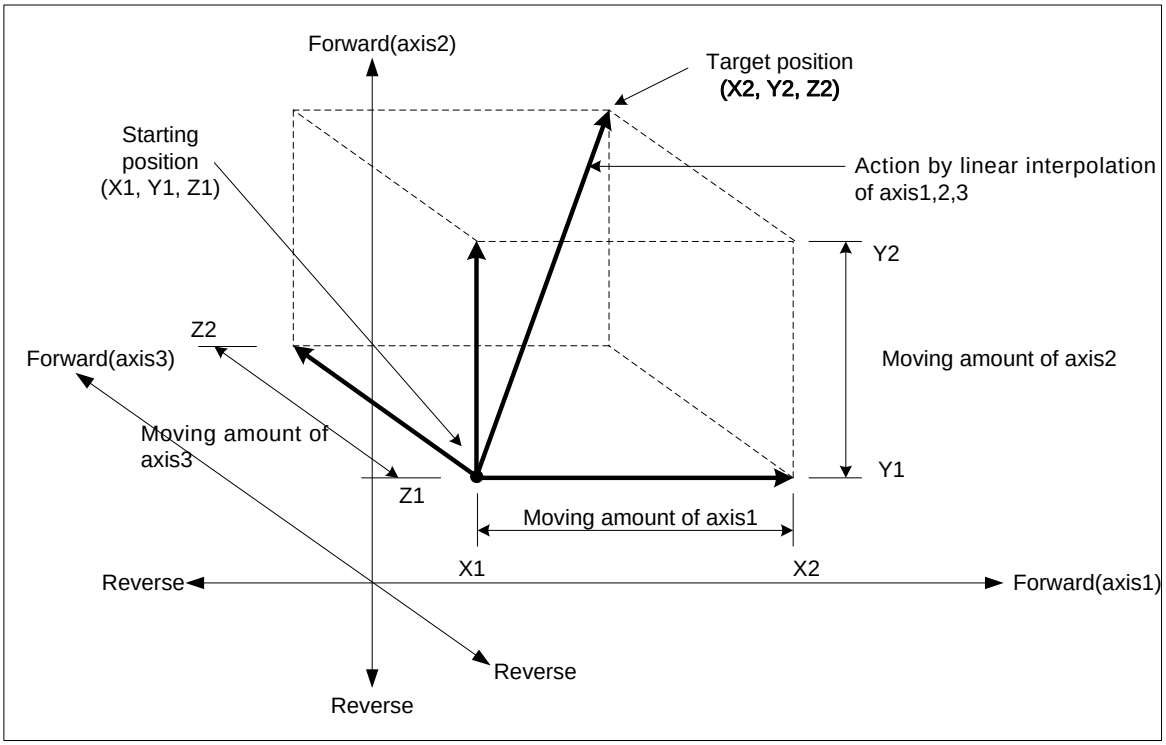
(1) Linear interpolation control with absolute coordinate (「Absolute, Linear Interpolation」)

(a) Executes linear interpolation with 3 axes from starting position to the target position based on positioning data. Positioning control is carried out based on origin point specified by homing.

(b) The direction of movement depends on the starting position and the target position.

■ Starting position < Target position : Positioning operation in forward

■ Starting position > Target position : Positioning operation in reverse



(c) Restrictions

Linear interpolation with 3 axes can not be executed in the case below.

■ 「Sub axis setting」 Error (error code : 253)

- 「Sub axis setting」 of operating data of main axis is “Axis-undecided”
- 「Sub axis setting」 of operating data of main axis is the same as main axis no.
- 「Sub axis setting」 of operating data of main axis exceeds the settable axis no.

■ If only one axis is set as sub axis, it will execute “linear interpolation control with 2 axes”.

(d) Setting example of operating data

Setting items	Main-axis setting (axis1)	Sub-axis setting(axis2)	Sub-axis setting(axis3)	Description
Control method	Absolute, Linear interpolation	Absolute, single axis position control	Absolute, single axis position control	When linear interpolation control is executed by the method of absolute coordinate, set「Absolute, Linear interpolation」on the main axis. Set the coordinate of sub-axis as "Absolute" too.
Operating method	Single, End	-	-*1	Set the operating method to execute linear interpolation
Target position [pls]	5000	6000	4000	Set the target position to position on main-axis and sub-axis
Operating speed [pls/s]	1000	-		Linear interpolation speed is determined by main axis speed
Acc. no.	No.1	-		Set acc. no. for acceleration (no.1 ~ no.4)
Dec. no.	No.2	-		Set dec. no. for deceleration. (no.1 ~ no.4)
M code	0	-		When you need to execute auxiliary work based on the interpolation operation, set the M code
Dwell time	500	-		Set dwell time(ms) needed to output the positioning completion signal
Sub-axis setting	Axis2, Axis3	-		Set axes to be used as sub-axis among settable axis in operating data of main-axis

- *1 : It does not need to be set. Whatever value is set as, it does not affect linear interpolation.

Note

Linear interpolation control is executed on the basis of operating data of main axis.
Only 「Target position」item of sub-axis setting affect linear interpolation. In other word, whatever value is set as, it does not affect the operation and errors do not arise.
Coordinate setting for sub-axis indicates whether target position of the sub-axis is absolute coordinate or incremental coordinate. So in case of linear interpolation control by incremental coordinate method, coordinate of sub-axis should be 「Incremental」

[Example] axis1 is main axis, axis2 and axis3 are sub axes. Executes linear interpolation with following settings.

■ Starting position (2000, 1000, 1000), target position (5000, 6000, 4000)
In this condition, the operation is as follows.

■ Setting example of XG-PM

▪ Operating data of main-axis(axis1)

Step no.	Control method	Operating method	Target position [pls]	Operating speed [pls/s]	Acc. no.	Dec. no.	M code	Dwell time	Sub axis setting
1	Absolute, Linear	Singular, End	5000	1000	No.1	No.1	0	100	Axis2

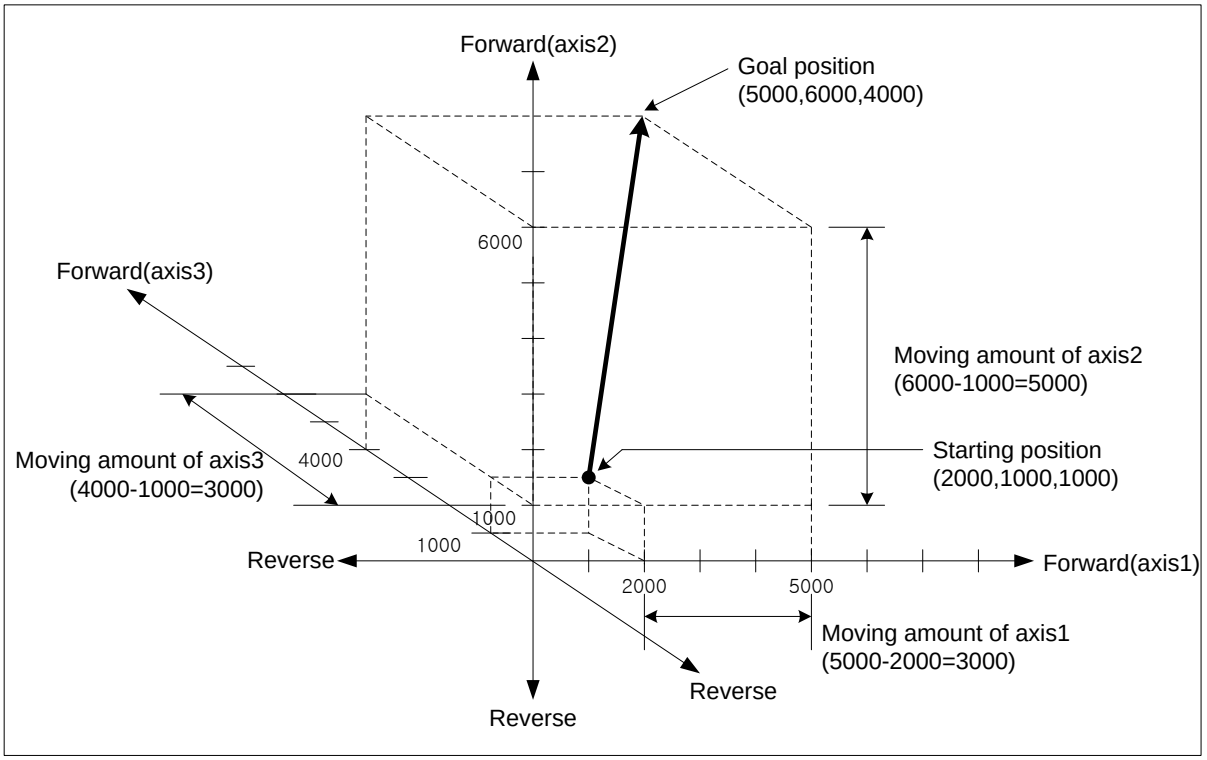
▪ Operating data of sub-axis1(axis2)

Step no.	Control method	Operating method	Target position [pls]	Operating speed [pls/s]	Acc. no.	Dec. no.	M code	Dwell time	Sub axis setting
1	Absolute, single-axis position control	Single, End	6000	0	No.1	No.1	0	0	Axis-undecided

▪ Operating data of sub-axis2(axis3)

Step no.	Control method	Operating method	Target position [pls]	Operating speed [pls/s]	Acc. no.	Dec. no.	M code	Dwell time	Sub axis setting
1	Absolute, single-axis position control	Single, End	4000	0	No.1	No.1	0	0	Axis-undecided

■ Operating pattern



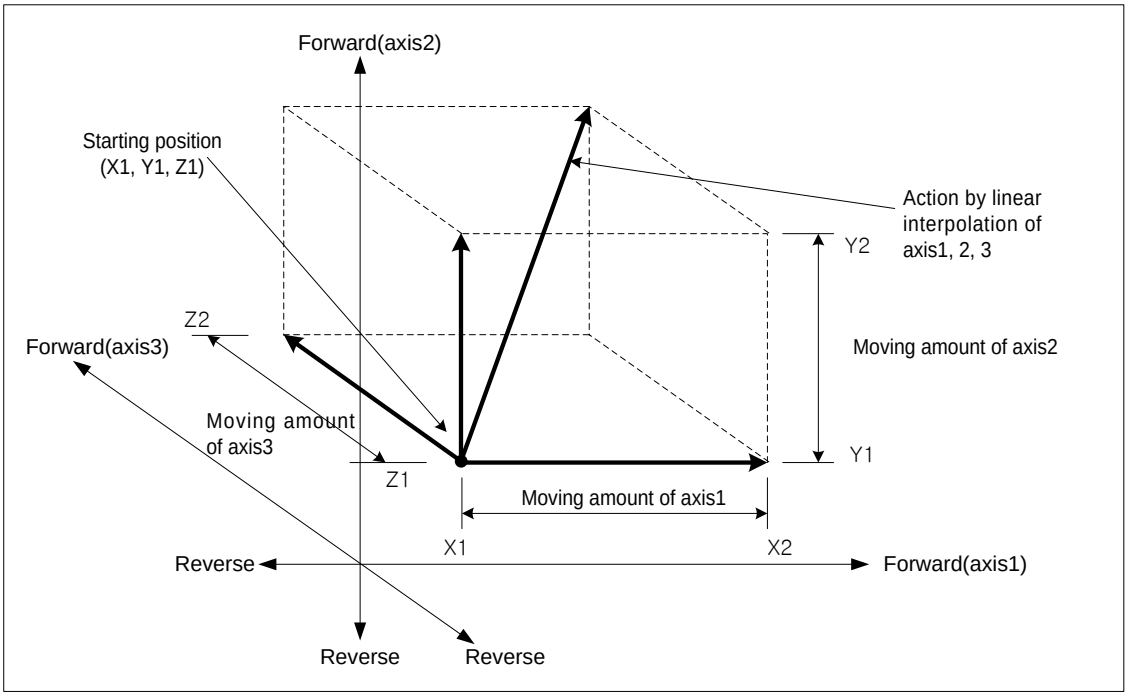
(2) Linear interpolation control with incremental coordinate (「Incremental, Linear Interpolation」)

(a) Executes 3 axes linear interpolation from starting position to the goal position. Positioning control is carried out based on the current stop position.

(b) Moving direction depends on the sign of the target position (Moving amount)

■ The sign is positive (+ or nothing) : Positioning operation in forward

■ The sign is negative (-) : Positioning operation in reverse



(c) Restrictions

Linear interpolation with 2 axes can not be executed in the case below.

■ 「Sub-axis setting」error (error code : 253)

- 「Sub-axis setting」value of operating data of main axis is “Axis-undecided”
- 「Sub-axis setting」value of operating data of main axis is same as the main axis no.
- 「Sub-axis setting」value of operating data of main axis exceeds settable axis no.

■ If only one axis is set as sub axis, it will execute “linear interpolation control with 2 axes”.

(d) Setting example of operating data

Setting items	Main-axis setting (axis1)	Sub-axis setting(axis2)	Sub-axis setting(axis3)	Description
Control method	Incremental, Linear interpolation	Incremental, single-axis position control	Incremental, single-axis position control	When linear interpolation control is executed by the incremental coordinate method, set「Incremental, Linear interpolation」on the main axis. Set the coordinate of sub-axis as "Incremental" too.
Operating method	Singular, End	-*1	-*1	Set the operating method to execute linear interpolation
Target position [pls]	5000	6000	4000	Set the target position to position on main-axis and sub-axis
Operating speed [pls/s]	1000	-		Interpolation speed is determined by main axis speed
Acc. no.	No.1	-		Set acc. no. for acceleration (no.1 ~ no.4)
Dec. no.	No.2	-		Set dec. no. for deceleration. (no.1 ~ no.4)
M code	0	-		When you need to execute auxiliary work based on the interpolation operation, set the M code
Dwell time	500	-		Set dwell time(ms) needed to output the positioning completion signal
Sub-axis setting	Axis2, Axis3	-		Set axes to be used as sub-axis among settable axis in operating data of main-axis

-*1 : It does not need to be set. Whatever value is set as, it does not affect linear interpolation.

Note

Linear interpolation control is executed on basis of operating data of main axis.
Only 「target position」item of sub-axis setting affect linear interpolation. In other word, whatever value is set as, it does not affect the operation and errors do not arise.

[Example] axis1 is main axis. axis2, 3 are sub axes. Executes linear interpolation with following settings.

■ Starting position (2000, 1000, 1000), Target position (10000, 5000, 5000)
In this condition, the operation is as follows.

■ Setting example of XG-PM

▪ Operating data of main-axis(axis1)

Step no.	Control method	Operating method	Target position [pls]	Operating speed [pls/s]	Acc. no.	Dec. no.	M code	Dwell time	Sub axis setting
1	Absolute, Linear	Single, End	10000	1000	No.1	No.1	0	100	Axis2

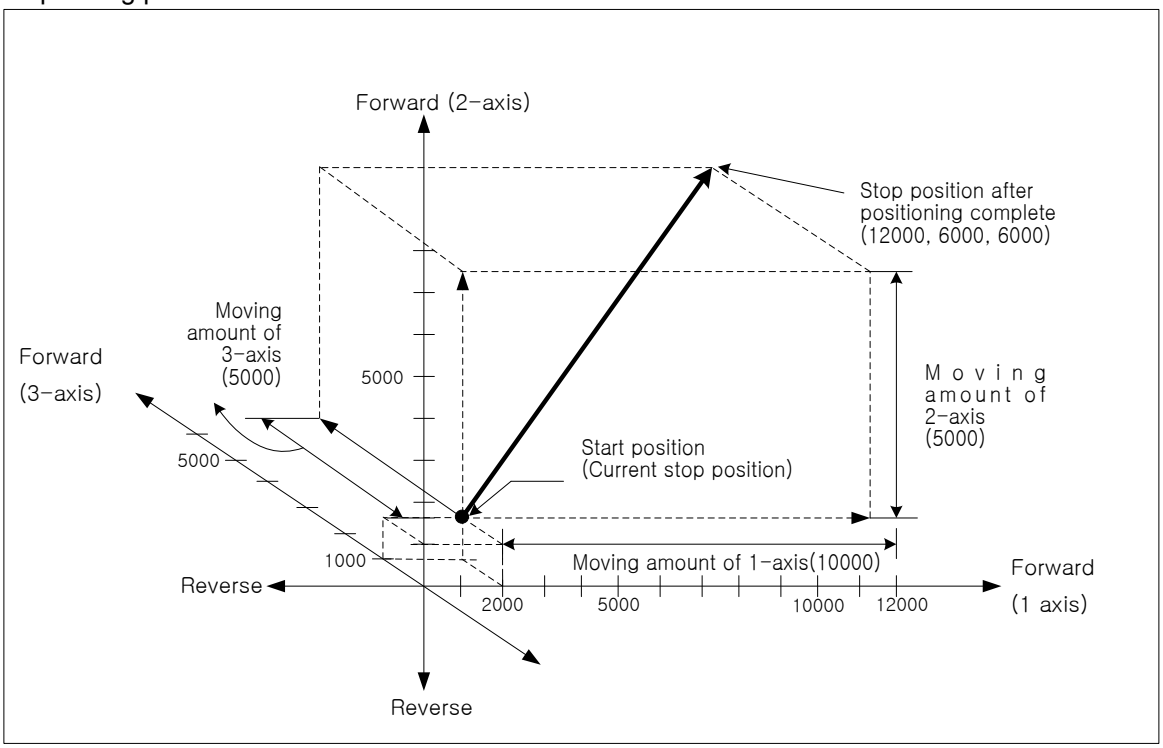
▪ Operating data of sub-axis1(axis2)

Step no.	Control method	Operating method	Target position [pls]	Operating speed [pls/s]	Acc. no.	Dec. no.	M code	Dwell time	Sub axis setting
1	Absolute, (SNG) POS	Single, End	5000	0	No.1	No.1	0	0	Axis-undecided

▪ Operating data of sub-axis2(axis3)

Step no.	Control method	Operating method	Target position [pls]	Operating speed [pls/s]	Acc. no.	Dec. no.	M code	Dwell time	Sub axis setting
1	Absolute, (SNG) POS	Single, End	5000	0	No.1	No.1	0	0	Axis-undecided

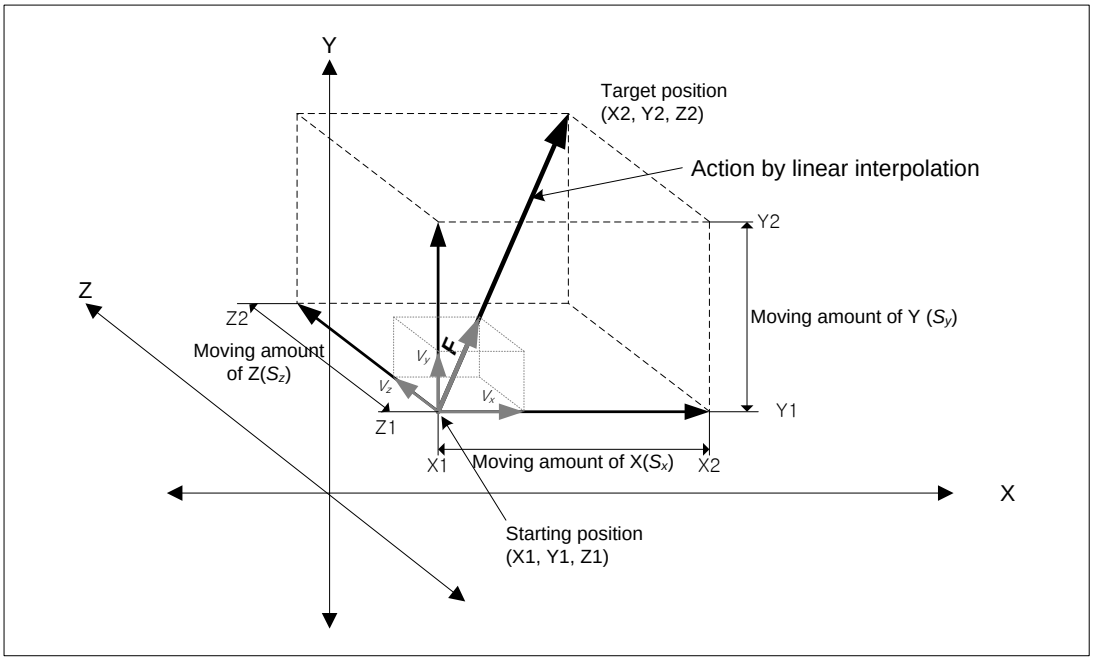
■ Operating pattern



(3) Speed in 3 axes linear interpolation control

Operation speed in linear interpolation is determined based on “Interpolation speed selection” option of extended parameter, main-axis speed or synthetic speed. If operation speed is set on command axis (main), positioning module calculates the speed of sub-axis based on the moving amount. Sub-axis speed and interpolation speed of the object are calculated as follows.

■ Speed in 3 axes linear interpolation (when main axis is selected as interpolation speed)



$$\text{Speed of sub}(V_y) = \text{Speed of main}(V_x) \times \frac{\text{Moving amount of Sub}(S_y)}{\text{Moving amount of Main}(S_x)}$$

$$\text{Speed of sub}(V_z) = \text{Speed of main}(V_x) \times \frac{\text{Moving amount of sub}(S_z)}{\text{Moving amount of main}(S_x)}$$

$$\text{Interpolating speed}(F) = \sqrt{V_x^{\,2} + V_y^{\,2} + V_z^{\,2}}$$

[Example]

- Starting position (2000, 2000, 1000)
- Target position (6000, 5000, 6000)
- Operating speed: 400 [pls/s]

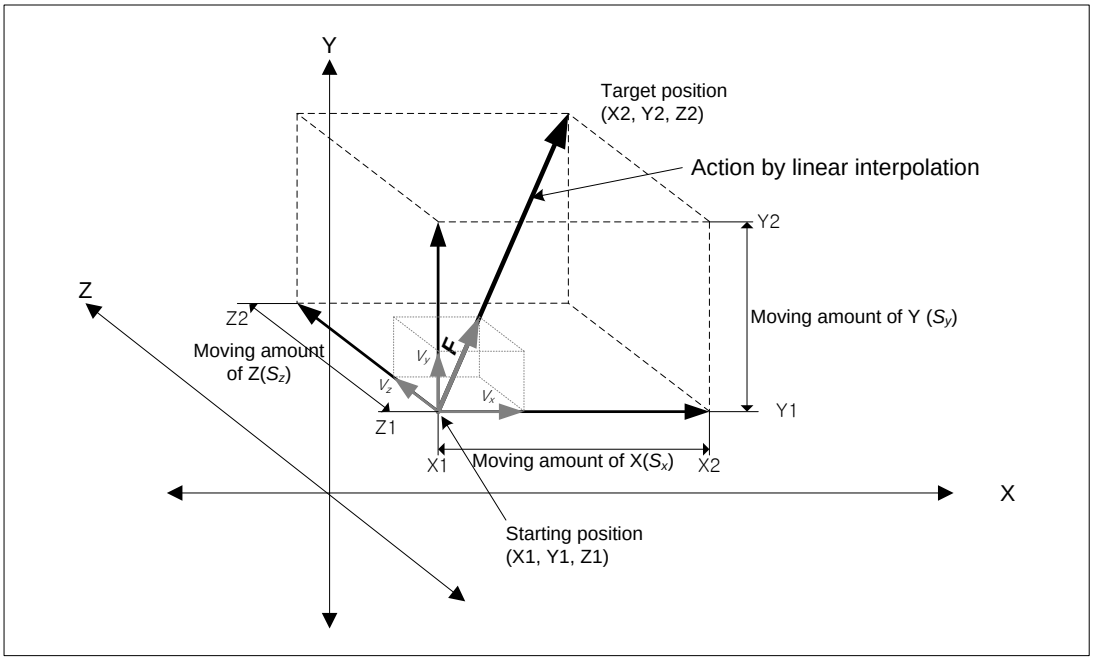
Speed of sub-axis and interpolating speed are as follows.

Speed of sub-axis1 = $400 \times \frac{3000}{4000} = 300$ [pls/s]

Speed of sub-axis2 = $400 \times \frac{5000}{4000} = 500$ [pls/s]

Interpolating speed = $\sqrt{400^2 + 300^2 + 500^2} \approx 707$ [pls/s]

■ Speed in 3 axes linear interpolation (when synthetic speed is selected as interpolation speed)



$$Interpolatinspeed\,(F) = Operationspeedsetinpositiondata$$

$$Interpolatingmovingamount(S) = \sqrt{S_x{}^2 + S_y{}^2 + S_z^2}$$

$$Mainaxisspeed(V_x) = Interpolatingspeed\,(F) \times \frac{Main\,axismovingamount(S_x)}{Interpolatingmovingamount\,(S)}$$

$$Sub-axis1\,\text{speed}\,(V_y) = Interpolatingspeed\,(F) \times \frac{Sub-axis1movingamount\,(S_y)}{Interpolatingmovingamount(S)}$$

$$Sub-axis2\,\text{speed}\,(V_z) = Interpolatingspeed\,(F) \times \frac{Sub-axis2\,movingamount\,(S_z)}{Interpolatingmovingamount\,(S)}$$

[Example]

- ■ Starting position (2000, 1000, 1000),
- ■ Target position (6000, 5000, 6000)
- ■ Synthetic speed: 400 [pls/s]

Main-axis speed and sub-axis speed are as follows. (X-axis: main-axis/ Y,Z-axis: sub-axis)

Interpolating moving amount = $\sqrt{4000^2 + 4000^2 + 5000^2} \approx 7549.8$

Main axis speed = $400 \times \frac{4000}{7549.8} \approx 211.9$

Sub-axis 1 speed = $400 \times \frac{4000}{7549.8} \approx 211.9$ [pls/s]

Sub-axis 2 speed = $400 \times \frac{5000}{7549.8} \approx 264.9$ [pls/s]

Note

(1) Speed limit for Sub-axis

When using linear interpolation control and moving distance of main < moving distance of sub and "Interpolation speed selection" is "main-axis speed", it is possible that sub-axis speed calculated by XGF-PN8A exceeds 「Speed limit」 of basic parameter. In this case, error (error code: 261) arises and main-axis speed is recalculated for sub-axis not to exceed "Speed Limit" and operates. To prevent errors, reduce the main-axis speed so that sub-axis speed doesn't exceed the "Speed Limit".

(2) The speed when the moving distance of main-axis is 0 and interpolation speed selection" is "main-axis speed

When the moving distance of main-axis is 0, the operating speed of main-axis operating data becomes actual interpolation speed.

In case of linear interpolation with more than 3 axes, the speed of sub-axis is calculated by the formula below.

$$Speed\ of\ \ sub-axis(V_y) = Interpolating\ \ speed(F) \times \frac{Moving\ amount\ of\ \ sub-axis(S_y)}{Merged\ moving\ \ amount\ \ (S_f)}$$

$$Speed\ of\ \ sub-axis(V_z) = Interpolating\ \ speed(F) \times \frac{Moving\ amount\ of\ \ sub-axis(S_z)}{Merged\ moving\ \ amount(S_f)}$$

9.2.8 Linear Interpolation Control with multiple axes

After executed by start command (「Indirect start」, 「Synchronous start」), then executes interpolation control from starting position to the target position with interpolation axes set as the main axis and sub axes.

There is no limit to the combination of interpolation axis and maximum 8 axes linear interpolation control is available. Characteristics of action are same as linear interpolation control with 3 axes. For the details, refer to linear interpolation control with 3 axes.

(1) Linear interpolation control with absolute coordinate (「Absolute, Linear Interpolation」)

(a) Executes multiple axes linear interpolation from starting position to the target position based on positioning data. Positioning control is carried out on the basis of the origin point specified from homing.

(b) The direction of movement depends on the starting position and the target position.

■ Starting position < Target position : Positioning operation in forward

■ Starting position > Target position : Positioning operation in reverse

(2) Linear interpolation control with incremental coordinate (「Incremental, Linear Interpolation」)

(a) Executes multiple axes linear interpolation from starting position to the target position. Positioning control is carried out on basis of the current stop position.

(b) Moving direction depends on the sign of the target position (Moving amount)

■ The sign is positive (+ or nothing) : Positioning operation in forward

■ The sign is negative (-) : Positioning operation in reverse

(3) Speed in multiple axes linear interpolation control

Operation speed in linear interpolation is determined based on “Interpolation speed selection” option of extended parameter, main-axis speed or synthetic speed. If operation speed is set on command axis (main), positioning module calculates the speed of sub-axis based on the moving amount. Sub-axis speed and interpolation speed of the object are calculated as follows.

■ Interpolation speed selection is main-axis speed

$$Sub-axis(\text{2axis})\ \text{speed}\ (V_2) = Main\ \text{axis speed}\ (V_1) \times \frac{Sub-axis\ movingamount(S_2)}{Main-axismovingamount\ (S_1)}$$

$$Sub-aixs(3axis)\ \text{speed}\ (V_3) = Main-axis\ speed\ (V_1) \times \frac{Sub-axismovingamount\ (S_3)}{Main-axismovingamount\ (S_1)}$$

$$\vdots$$

$$\vdots$$

$$Sub-axis\ (\text{8axis})\ \ \text{speed}\ (V_8) = Main-axisspeed\ (V\ ) \times \frac{Sub-axismovingamount\ (S_8)}{Main-axismovingamount\ (S_1)}$$

$$Interpolatingspeed(F) = \sqrt{V_1^{\ 2} + V_2^{\ 2} + V_3^{\ 2} + \ldots + V_8^{\ 2}}$$

■ Interpolation speed selection is synthetic speed

$$Interpolating\ speed\ (F) = Operation\ parameter\ speed\ setting$$

$$Interpolating\ moving\ amount\ (S) = \sqrt{S_1^{\,2} + S_2^{\,2} + S_3^{\,2} + \cdots + S_8^{\,2}}$$

$$Main-axis\ speed\ (V_1) = Interpolating\ speed\ (F) \times \frac{main-axis\ moving\ amount\ (S_1)}{Interpolating\ moving\ amount\ (S)}$$

$$Sub-axis1\ speed\ (V_2) = Interpolating\ speed\ (F) \times \frac{Sub-axis1\ moving\ amount\ (S_2)}{Interpolating\ moving\ amount\ (S)}$$

$$Sub-axis2\ \text{speed}\ (V_3) = Interpolating\ speed\ (F) \times \frac{Sub-axis2\ moving\ amount\ (S_3)}{Interpolating\ moving\ amount\ (S)}$$

$$\vdots$$

$$\vdots$$

$$Sub-axis7\ \text{speed}\ (V_8) = Interpolating\ speed\ (F) \times \frac{Sub-axis7\ moving\ amount\ (S_8)}{Interpolating\ moving\ amount\ (S)}$$

9.2.9 Middle point-specified Circular Interpolation

After started by start command (「Indirect start」, 「direct start」), executes interpolation operating following the circular path which passes middle point set by “Circular interpolation auxiliary point” using 2 axes.

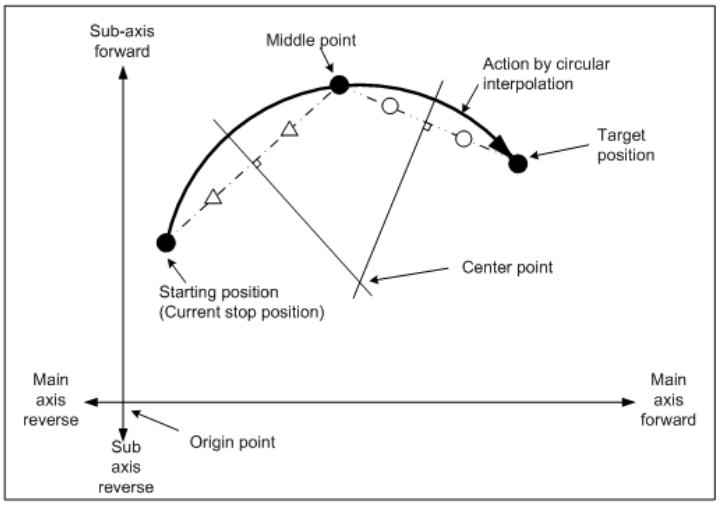
And, it can execute circular interpolation of over 360 degrees according to the “Circular interpolation turns” setting. There is no limit to the combination of 2 axes. User can randomly use 2 axes among 1~ 8-axis

(1) absolute coordinate, Middle point-specified Circular Interpolation (「Absolute, circular interpolation」)

(a) Executes circular interpolation from starting point to target point passing the middle point that is set on operation data.

(b) Circular trajectory is made using the crossing which is made by dividing between start position and middle point, and between middle point and target position perpendicularly and equally as center point.

(c) Movement direction is decided automatically depending on the target position and auxiliary point of circular interpolation.



(d) Condition

■ In the middle point-specified circular interpolation, you can’t draw the circle whose starting position is same as end position. If you want to draw the circle above, use the center point-specified circular interpolation.

■ You cannot execute the middle point-specified circular interpolation in the following cases.

- 「Sub axis setting」 error (Error code : 279)
  - 「Sub-axis setting」 value of operating data of main axis is “Axis-undecided”
  - 「Sub-axis setting」 value of operating data of main axis is same as the main axis no.
  - 「Sub-axis setting」 value of operating data of main axis is axis no. that is not connected to network.
- In case “degree” is set as control unit of main axis or sub axis, (Error code : 282(Main axis), 283(Sub axis))
- Middle point set on auxiliary point is same as starting position or target position. (Error code : 284)
- In case start position is same as target position (Error code : 285)
- In case calculated radius of circular exceeds 2147483647pls (Error code : 286)
- In case auxiliary position and target position is in a straight line from start position, (Error code : 287)

Note

Caution is needed, because 2 axes work simultaneously in the circular interpolation operation.
(1) Available auxiliary operations are as follows ;
- Speed override, Deceleration stop, Emergency stop, Skip operation

(2) Unavailable commands during circular interpolation operation are as follows ;
- Position/Speed switching control, Position override, Continuous operation

(3) The parameter items which are operated by the set value of each axis are as follows ;
- Software upper limit, software lower limit among extended parameter.

(e) Example of operation data setting

Setting item	Main axis (axis1) setting	Sub axis (axis 2) setting	Contents
Control method	Absolute, circular interpolation	Absolute, single-axis position control	When circular interpolation control is executed by the absolute coordinate method, set「Absolute, circular interpolation」on the main axis. Set the coordinate of sub-axis as "Absolute" too.
Operation method	Single, End	- *1	Set operation method for circular interpolation.
Target position [pls]	10000	0	Set the target position for positioning on the main, sub axes
Operation speed [pls/s]	1000	-	Circular interpolation uses the method of designating composition speed. Set the composition speed at the main-axis
Acceleration No.	No.1	-	Set Acc. No. for acceleration (no.1 ~ no.4)
Deceleration No.	No.2	-	Set Dec. No. for deceleration. (no.1 ~ no.4)
M code	0	-	When you need to execute auxiliary work based on the interpolation operation, set the M code
Dwell time	500	-	Set dwell time(ms) needed to output the positioning completion signal
Sub-axis setting	Axis 2	-	Set an axis to be used as sub-axis among settable axis in operating data of main-axis
Circular interpolation Auxiliary point	5000	5000	In case of middle point specified circular interpolation, set the position of the middle point where circular arc passes
Circular interpolation mode	Middle point	-	In case of middle point specified circular interpolation, select「middle point」on the main axis.
Circular interpolation turns	0	-	When user want to draw circle of over 360 degree, set the number of turns of circular arc.
Helical interpolation	Don't use	-	In case of circular interpolation, select 「Do not use」on the main axis.

- *1 : You need not set. Whatever you set, there is no effect to circular interpolation.

Note

The middle point specified circular interpolation is operated by operation data of main axis (command axis).
In case of the middle point specified circular interpolation, sub axis items except for「Target position」, 「circular interpolation auxiliary point 」don't affect the operation. That is, whatever you set, those don't affect the operation and error doesn't occur.
But, coordinate setting of sub-axis control method indicates whether target position is absolute coordinate or incremental coordinate. So in case of circular interpolation control by absolute coordinate method, set the coordinate of sub-axis as "absolute" too.

[Example] executes middle point-specified circular interpolation, absolute coordinate (main axis; axis 1, sub axis; axis 2)

■ In case of Start position (0, 0), Target position (10000, 6000) and Auxiliary point (2000, 6000), operation is as follows;

■ Example of setting in the XG-PM

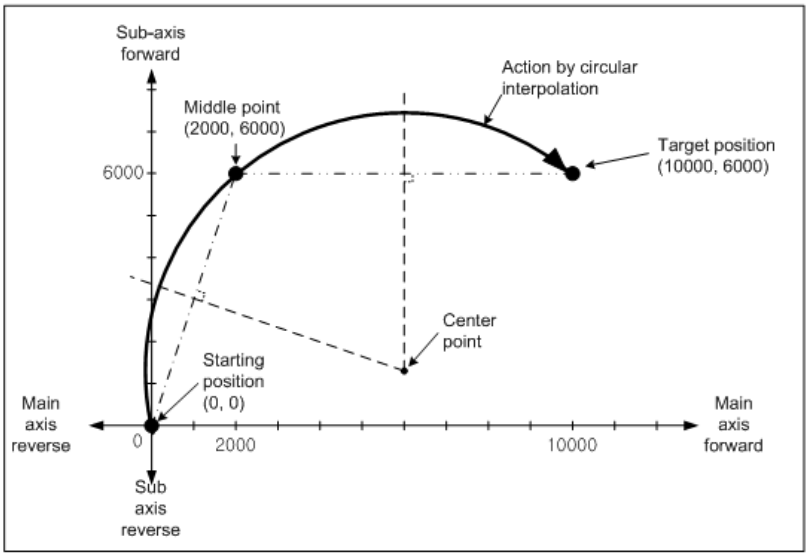
▪ Main axis(axis1) operation data

Step No.	Control Method	Operation method	Target position [pls]	Operation Speed [pls/s]	Acc. No.	Dec. No.	M code	Dwell time	Sub axis setting	Circular interpolation Auxiliary point	Circular interpolation mode	Circular interpolation turns	Helical interpolation
1	Absolute, Circular interpolation	Single, End	13000	1000	No. 1	No. 1	0	100	Axis 2	10000	Middle point	0	Do not use

▪ The axis(axis 2) of ordinates operation data

Step No.	Control Method	Operation method	Target position [pls]	Operation Speed [pls/s]	Acc. No.	Dec. No.	M code	Dwell time	Sub axis setting	Circular interpolation Auxiliary point	Circular interpolation mode	Circular interpolation turns	Helical interpolation
1	Absolute, Single0axis position control	Single, End	9000	0	No. 1	No. 1	0	0	none	7500	Middle point	0	Do not use

■ Operation pattern



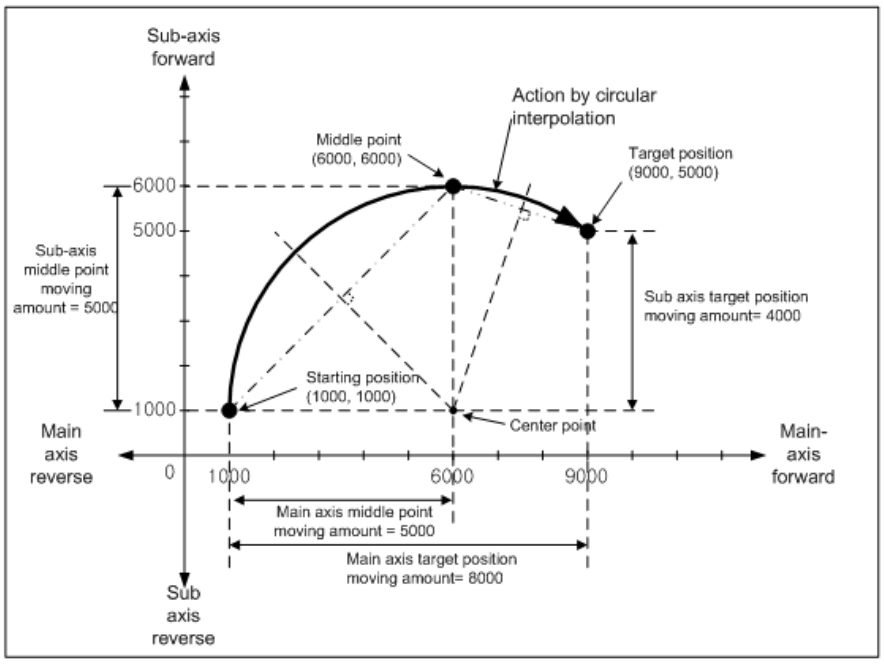
(2) Middle point specified Circular interpolation by incremental coordinate
(「Incremental, circular interpolation」)

(a) Operates circular interpolation from start position to target position as much as amount of set movement passing the middle.

(b) Middle point position is the position increased from current stop position as much as the set value on 「Circular interpolation auxiliary point」.

(c) The intersection of perpendicular bisectors between starting position and middle point and perpendicular bisectors between the current stop position and the position increased form current stop position as much as target position will be the center-point of the arc.

(d) Movement direction is decided by the set target position and circular interpolation auxiliary point.



(e) Condition

■ In the middle point-specified circular interpolation, you can't draw the circle whose starting position is same as end position. If you want to draw the circle above, use the center point-specified circular interpolation.

■ You cannot execute the middle point-specified circular interpolation in the following cases.

- 「Sub axis setting」 error (Error code : 279)
  - 「Sub-axis setting」value of operating data of main axis is "Axis-undecided"
  - 「Sub-axis setting」value of operating data of main axis is same as the main axis no.
  - 「Sub-axis setting」value of operating data of main axis is axis no. that is not connected to network.
- In case "degree" is set as control unit of main axis or sub axis, (Error code : 282(Main axis), 283(Sub axis))
- Middle point set on auxiliary point is same as starting position or target position. (Error code : 284)
- In case start position is same as target position (Error code : 285)
- In case calculated radius of circular exceeds 2147483647pls (Error code : 286)
- In case auxiliary position and target position is in a straight line from start position, (Error code : 287)

(f) Example of operation data setting

Setting item	Main axis (axis1) setting	Sub axis (axis 2) setting	Contents
Control method	Incremental, circular interpolation	Incremental, single-axis position control	When circular interpolation control is executed by the incremental coordinate method, set「incremental, circular interpolation」on the main axis. Set the coordinate of sub-axis as "incremental" too.
Operation method	Single, End	- *1	Set operation method for circular interpolation.
Target position [pls]	10000	0	Set the target position by incremental amount from current position
Operation speed [pls/s]	1000	-	Circular interpolation uses the method of composition speed. Set the composition speed at the main-axis
Acceleration No.	No.1	-	Set Acc. No. for acceleration (no.1 ~ no.4)
Deceleration No.	No.2	-	Set Dec. No. for deceleration. (no.1 ~ no.4)
M code	0	-	When you need to execute auxiliary work based on the interpolation operation, set the M code
Dwell time	500	-	Set dwell time(ms) needed to output the positioning completion signal
Sub-axis setting	Axis 2	-	Set an axis to be used as sub-axis among settable axis in operating data of main-axis
Circular interpolation Auxiliary point	5000	5000	Set the middle point position by incremental amount from current position
Circular interpolation mode	Middle point	-	In case of middle point specified circular interpolation, select「middle point」on the main axis.
Circular interpolation turns	0	-	When user want to draw circle of over 360 degree, set the number of turns of circular arc.
Helical interpolation	Don't use	-	In case of circular interpolation, select 「Do not use」on the main axis.

- *1 : You need not set. Whatever you set, there is no effect to circular interpolation.

Note

The middle point specified circular interpolation is operated by operation data of main axis (command axis).
In case of the middle point specified circular interpolation, sub axis items except for 「Coordinate」,「Target position」, 「circular interpolation auxiliary point 」don't affect the operation. That is, whatever you set, those don't affect the operation and error doesn't occur.
But, coordinate setting of sub-axis control method indicates whether target position is absolute coordinate or incremental coordinate. So in case of circular interpolation control by incremental coordinate method, set the coordinate of sub-axis as "incremental" too.

[Example] Operates middle pint-specified circular interpolation, incremental coordinate with axis 1 (main axis) and axis 2 (sub axis)

■ Start position : (1000, 1000)

Target position (amount of movement) setting : (8000, 4000)

Auxiliary point (amount of movement) setting : (5000, 5000)

In this case operation is as follows:

■ Example of setting XG-PM

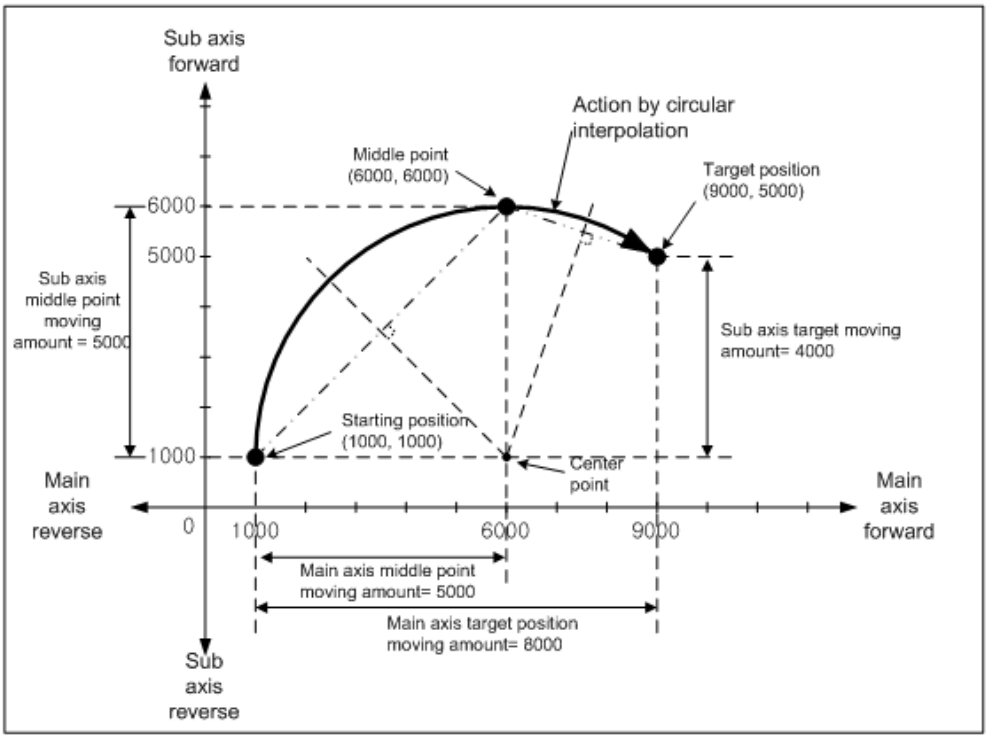
▪ Main axis(axis 1) Operation data

Step No.	Control Method	Operation method	Target position [pls]	Operation Speed [pls/s]	Acc. No.	Dec. No.	M code	Dwell time	Sub axis setting	Circular interpolation Auxiliary point	Circular interpolation mode	Circular interpolation turns	Helical interpolation
1	Incremental, Circular interpolation	Single, End	8000	1000	No. 1	No. 1	0	100	Axis 2	5000	Middle point	0	Do not use

▪ Sub axis(axis 2) Operation data

Step No.	Control Method	Operation method	Target position [pls]	Operation Speed [pls/s]	Acc. No.	Dec. No.	M code	Dwell time	Sub axis setting	Circular interpolation Auxiliary point	Circular interpolation mode	Circular interpolation turns	Helical interpolation
1	Absolute, single-axis position control	Single, End	4000	0	No. 1	No. 1	0	0	None	5000	Middle point	0	Do not use

■ Operation pattern



9.2.10 Center point - specified Circular interpolation

After operated by starting command (「indirect start」, 「Simultaneous Start」), it operates interpolation along the trace of the circle whose center is specified center point by using 2 axes in the set circular interpolation rotation direction.

Circular interpolation over 360 degrees is available according to 「Circular interpolation turns」.

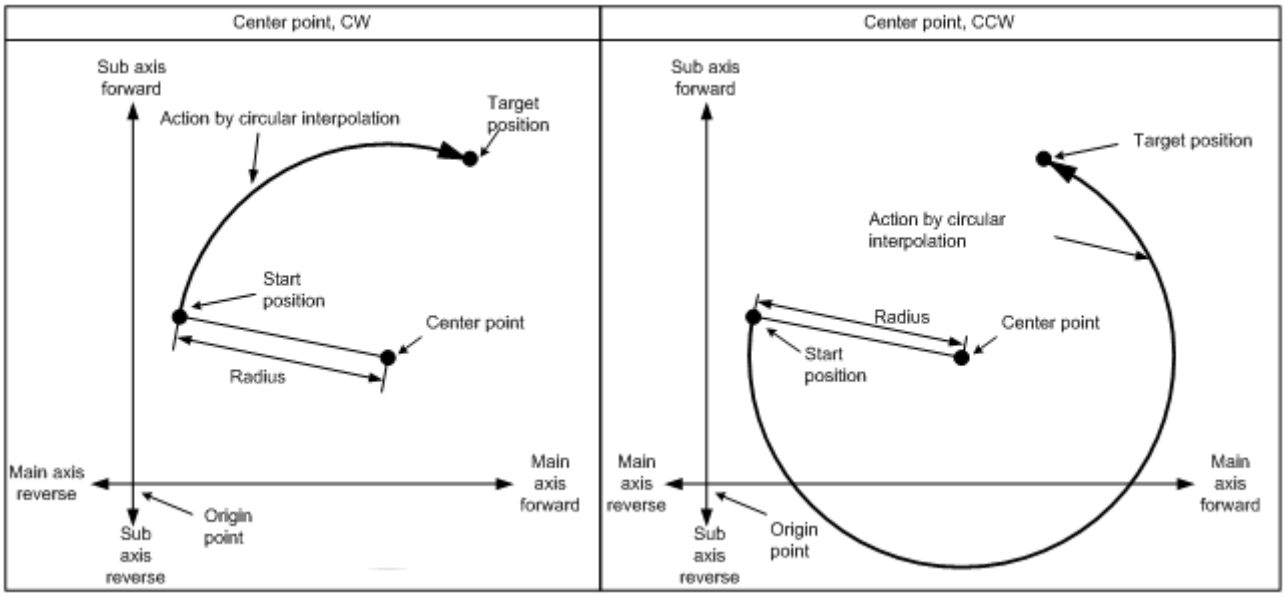
There is no limit to the composition of 2 axes. User can select 2 axes among 1~ 8-axis randomly.

(1) Center point-specified Circular interpolation, Absolute Coordinate (「Absolute, Circular interpolation」)

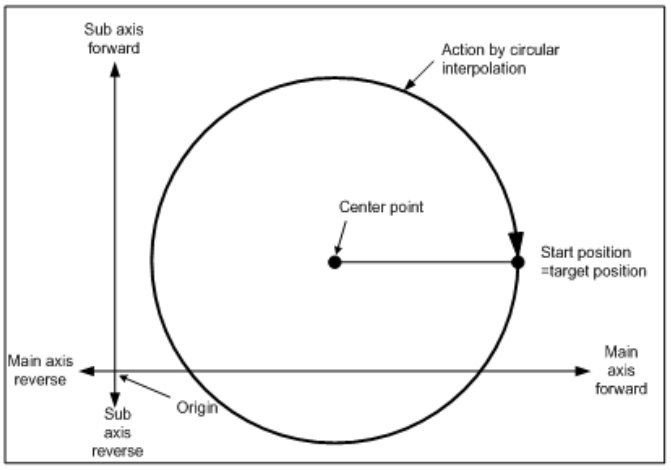
(a) Operates circular interpolation from start position to target position along the trace of circle whose radius is distance from center point to start position. 「Circular interpolation auxiliary point」 indicates the center point of the circle.

(b) Moving direction depends on the set direction on “circular interpolation mode” of operation data.

- 「Midpoint, CW」 - Circular interpolation going clockwise from current position.
- 「Midpoint, CCW」- Circular interpolation going counterclockwise from current position.



(c) If target position is same as start position, you can execute circular interpolation whose circle radius is distance from center point to starting position (=target position)



(d) Condition

■ You cannot execute the center point-specified circular interpolation in the following cases.

- 「Sub axis setting」error (Error code : 279)
  - 「Sub-axis setting」value of operating data of main axis is “Axis-undecided”
  - 「Sub-axis setting」value of operating data of main axis is same as the main axis no.
  - 「Sub-axis setting」value of operating data of main axis is axis no. that is not connected to network.
- In case “degree” is set as control unit of main axis or sub axis, (Error code : 282(Main axis), 283(Sub axis))
- In case center point set on auxiliary point is same as starting position or target position. (Error code : 284)
- In case calculated radius of circular exceeds 2147483647pls (Error code : 286)

Note

Be careful during starting circular interpolation, because 2 axes act at a time.
1. Available auxiliary operation is as follows:
   - Speed override, Deceleration stop, Emergency stop, Skip operation
2. Unavailable command with circular interpolation is as follows:
   - Position/Speed switching control, Position override, Continuous operation
3. The parameter item that it is operated by set value per each axes is as follows:
   - Software upper limit, Software lower limit among extended parameter items

(e) Example of operation data setting

Setting item	Main axis (axis1) setting	Sub axis (axis 2) setting	Contents
Control method	Absolute, circular interpolation	Absolute, single-axis position control	When circular interpolation control is executed by the absolute coordinate method, set「absolute, circular interpolation」on the main axis. Set the coordinate of sub-axis as "absolute" too.
Operation method	Single, End	- *1	Set operation method for circular interpolation.
Target position [pls]	10000	0	Set the target position for positioning on the main, sub axes
Operation speed [pls/s]	1000	-	Circular interpolation uses the method of composition speed. Set the composition speed at the main-axis
Acceleration No.	No.1	-	Set Acc. No. for acceleration (no.1 ~ no.4)
Deceleration No.	No.2	-	Set Dec. No. for deceleration. (no.1 ~ no.4)
M code	0	-	When you need to execute auxiliary work based on the interpolation operation, set the M code
Dwell time	500	-	Set dwell time(ms) needed to output the positioning completion signal
Sub-axis setting	Axis 2	-	Set an axis to be used as sub-axis among settable axis in operating data of main-axis
Circular interpolation Auxiliary point	5000	-5000	Set the position of the center point
Circular interpolation mode	Center point, CW	-	Select「Center point, CW」on the main axis.
Circular interpolation turns	0	-	When user want to draw circle of over 360 degree, set the number of turns of circular arc.
Helical interpolation	Don't use	-	In case of circular interpolation, select 「Do not use」on the main axis.

- *1 : You need not set. Whatever you set, there is no effect to circular interpolation.

Note

The center - point specified circular interpolation is operated by operation data of main axis (command axis).
In case of the center point - specified circular interpolation, sub axis items except for「Target position」, 「circular interpolation auxiliary point 」don't affect the operation. That is, whatever you set, those don't affect the operation and error doesn't occur.
But, coordinate setting of sub-axis control method indicates whether target position is absolute coordinate or incremental coordinate. So in case of circular interpolation control by absolute coordinate method, set the coordinate of sub-axis as "Absolute" too.

[Example] Operates center point - specified circular interpolation, absolute coordinate (main axis; 1-axis, sub axis; 2-axis)

■ Start position (0, 0), Target position (0, 0), Auxiliary point (1000, 1000), direction of rotation :CW

■ Example of setting in the XG-PM

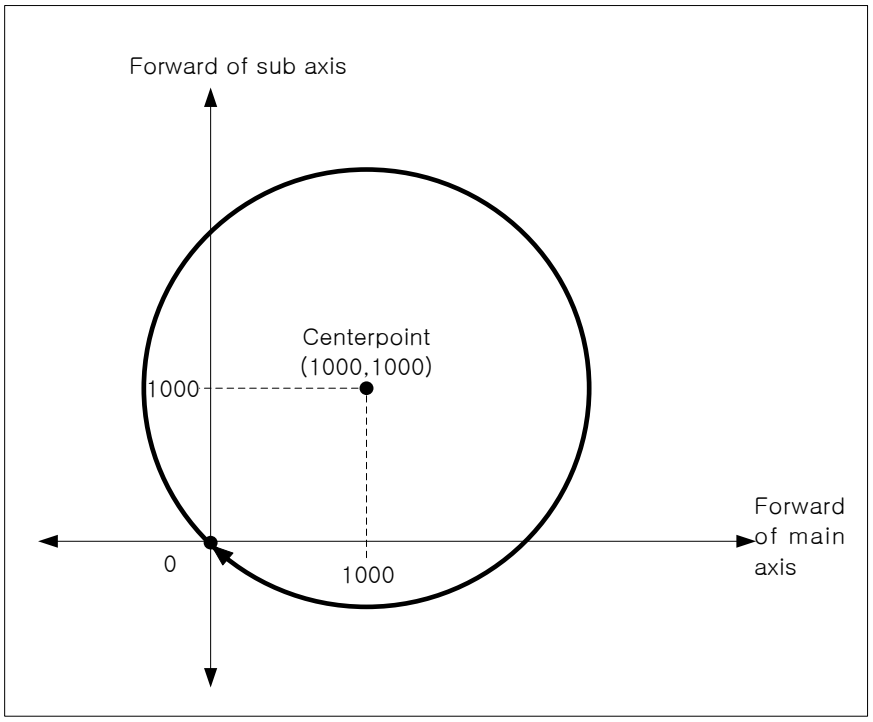
▪ Main axis (axis1) operation data

Step No.	Control Method	Operation method	Target position [pls]	Operation Speed [pls/s]	Acc. No.	Dec. No.	M code	Dwell time	Sub axis setting	Circular interpolation Auxiliary point	Circular interpolation mode	Circular interpolation turns	Helical interpolation
1	Absolute, Circular interpolation	Single, End	0	1000	No. 1	No. 1	0	100	Axis 2	1000	Center point ,CW	0	Do not use

▪ Sub axis (axis 2) operation data

Step No.	Control Method	Operation method	Target positio n [pls]	Operation Speed [pls/s]	Acc. No.	Dec. No.	M code	Dwell time	Sub axis setting	Circular interpolation Auxiliary point	Circular Interpolation mode	Circular interpolation turns	Helical interpolation
1	Absolute, single-axis position control	Single, End	0	0	No.1	No.1	0	0	None	1000	Center point, CW	0	Do not use

■ Operation pattern

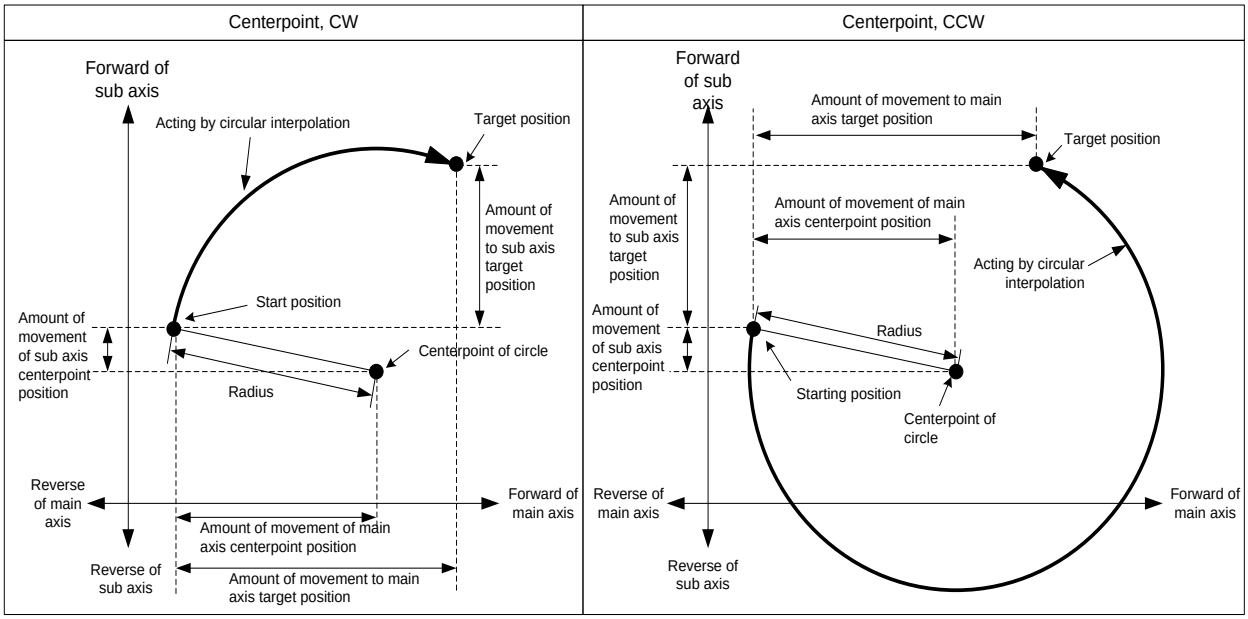


(2) Center point – specified Circular interpolation control, incremental coordinate
(「Incremental, Circular interpolation」)

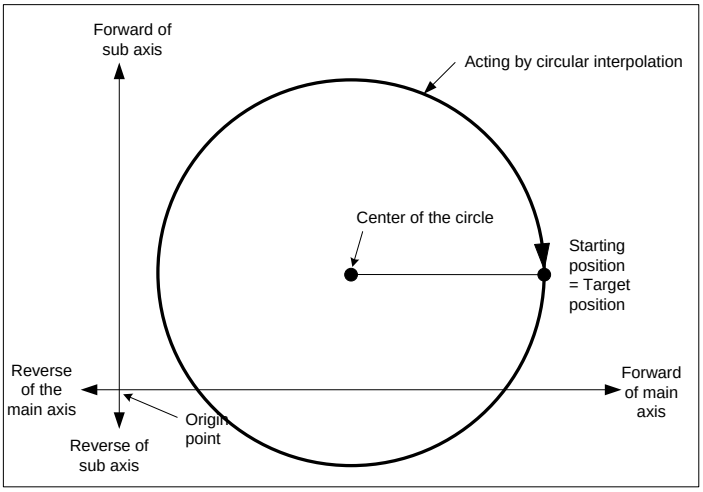
(a) Starts operation at starting position and then executes circular interpolation by already set moving amount, along the trace of the circle which has a distance between starting position and center point as radius. 「Circular interpolation auxiliary point」 means the moving amount between the current position and center point.

(b) Moving direction is decided to set direction on “circular interpolation mode” of operation data.

- 「Center point, CW」 - Circular interpolation going clockwise from current position.
- 「Center point, CCW」 - Circular interpolation going counterclockwise from current position.



(c) If you set target position of main axis and sub axis as “0”, starting position will be same as target position and can execute circular interpolation that it is drawing circle whose radius is distance from starting position to center-point.



(d) Condition

■ You cannot execute the center point-specified circular interpolation in the following cases.

- 「Sub axis setting」error (Error code : 279)
  - 「Sub-axis setting」value of operating data of main axis is “Axis-undecided”
  - 「Sub-axis setting」value of operating data of main axis is same as the main axis no.
  - 「Sub-axis setting」value of operating data of main axis is axis no. that is not connected to network.
- In case “degree” is set as control unit of main axis or sub axis, (Error code : 282(Main axis), 283(Sub axis))
- In case center point set on auxiliary point is same as starting position or target position. (Error code : 284)
- In case calculated radius of circular exceeds 2147483647pls (Error code : 286)

(e) Example of operation data setting

Setting item	Main axis (axis1) setting	Sub axis (axis 2) setting	Contents
Control method	Incremental, circular interpolation	Incremental, single-axis position control	When circular interpolation control is executed by the incremental coordinate method, set「incremental, circular interpolation」on the main axis. Set the coordinate of sub-axis as “incremental” too.
Operation method	Single, End	- *1	Set operation method for circular interpolation.
Target position [pls]	10000	0	Set the target position by incremental amount from current position
Operation speed [pls/s]	1000	-	Circular interpolation uses the method of composition speed. Set the composition speed at the main-axis
Acceleration No.	No.1	-	Set Acc. No. for acceleration (no.1 ~ no.4)
Deceleration No.	No.2	-	Set Dec. No. for deceleration. (no.1 ~ no.4)
M code	0	-	When you need to execute auxiliary work based on the interpolation operation, set the M code
Dwell time	500	-	Set dwell time(ms) needed to output the positioning completion signal
Sub-axis setting	Axis 2	-	Set an axis to be used as sub-axis among settable axis in operating data of main-axis
Circular interpolation Auxiliary point	5000	-5000	Set the center point position by incremental amount from current position
Circular interpolation mode	Center point, CW	-	Select「Center point, CW」on the main axis.
Circular interpolation turns	0	-	When user want to draw circle of over 360 degree, set the number of turns of circular arc.
Helical interpolation	Don’t use	-	In case of circular interpolation, select 「Do not use」on the main axis.

- *1 : You need not set. Whatever you set, there is no effect to circular interpolation.

Note

The center point specified circular interpolation is operated by operation data of main axis (command axis).
In case of the center point specified circular interpolation, sub axis items except for「Target position」, 「circular interpolation auxiliary point 」don't affect the operation. That is, whatever you set, those don't affect the operation and error doesn't occur.
But, coordinate setting of sub-axis control method indicates whether target position is absolute coordinate or incremental coordinate. So in case of circular interpolation control by incremental coordinate method, set the coordinate of sub-axis as "incremental" too.

[Example] Operates center point – specified circular interpolation, Incremental coordinate with axis 1 (main axis), with axis 2 (sub axis)

■ Start position: (0, 0)

Target position (amount of movement): (2000, 0)

Auxiliary point (amount of movement): (1000, 0)

Direction of rotations: CW

In this case, operation is as follows:

■ Example of setting XG-PM

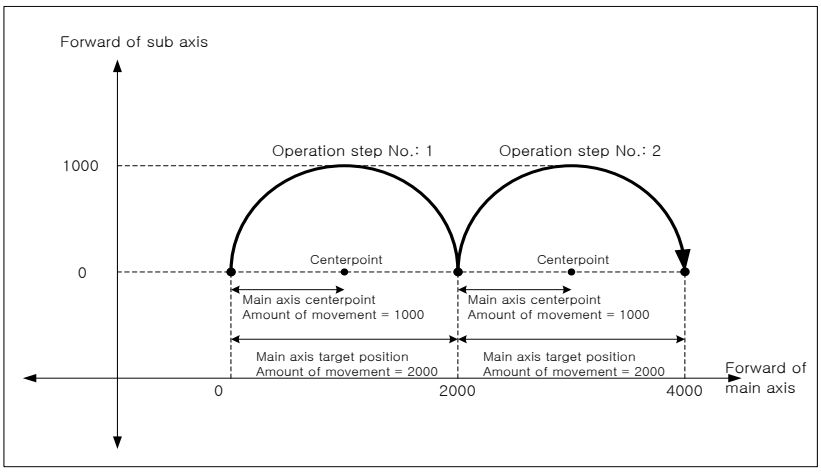
▪ Main axis (axis 1) Operation data

Step No.	Control Method	Operation method	Target position [pls]	Operation Speed [pls/s]	Acc. No.	Dec. No.	M code	Dwell time	Sub axis setting	Circular interpolation Auxiliary point	Circular Interpolation mode	Circular interpolation turns	Helical Interpolation
1	Incremental, Circular interpolation	Single, Keep	2000	1000	No. 1	No. 1	0	100	Axis 2	1000	Center-point ,CW	0	Do not use
1	Incremental, Circular interpolation	Single, End	2000	1000	No. 1	No. 1	0	100	Axis 2	1000	Center-point ,CW	0	Do not use

▪ Sub axis (axis 2) Operation data

Step No.	Control Method	Operation method	Target position [pls]	Operation Speed [pls/s]	Acc. No.	Dec. No,	M code	Dwell time	Sub axis setting	Circular interpolation Auxiliary point	Circular Interpolation mode	Circular interpolation turns	Helical interpolation
1	Absolute, single-axis position control	Single, End	0	0	No. 1	No. 1	0	0	None	0	Midpoint ,CW	0	Do not use
1	Absolute, single-axis position control	Single, End	0	0	No. 1	No. 1	0	0	None	0	Midpoint ,CW	0	Do not use

■ Operation pattern



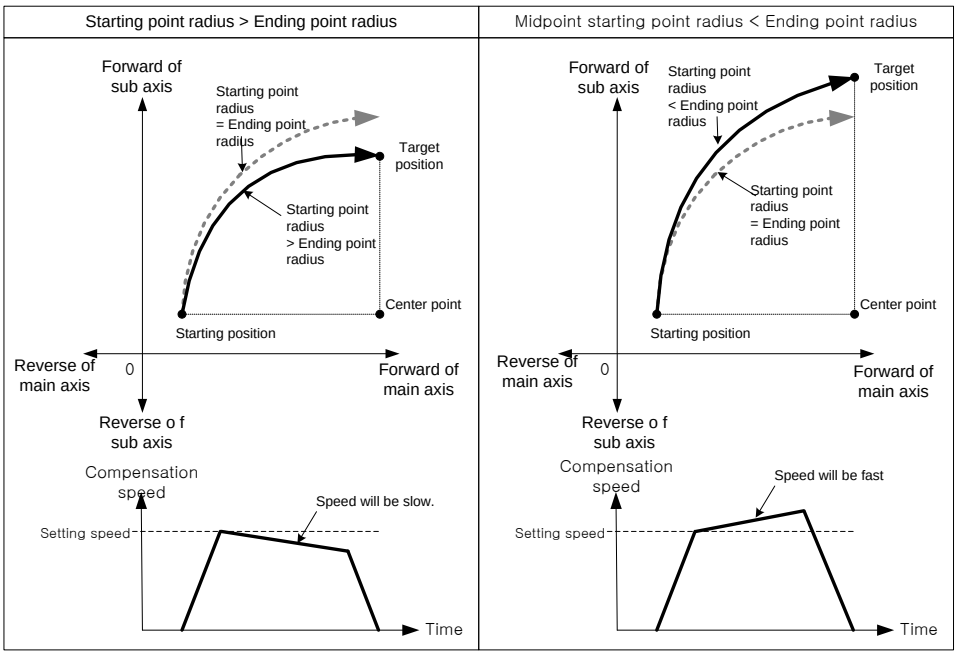
(3) Circular interpolation control whose radius of starting point is different with radius of ending point.

(a) According to set value of target position, distance A which it is distance from start point to center point may be different with distance B which it is distance from target position to center point (End point, Radius). At this time, normal circular arc operation is not available.

When starting point radius have a difference with end point radius, XGF-PN8A/XGF-PN8B calculates angular velocity from the set operation speed, and operates circular interpolation compensating a difference of radius in proportion to that angular velocity.

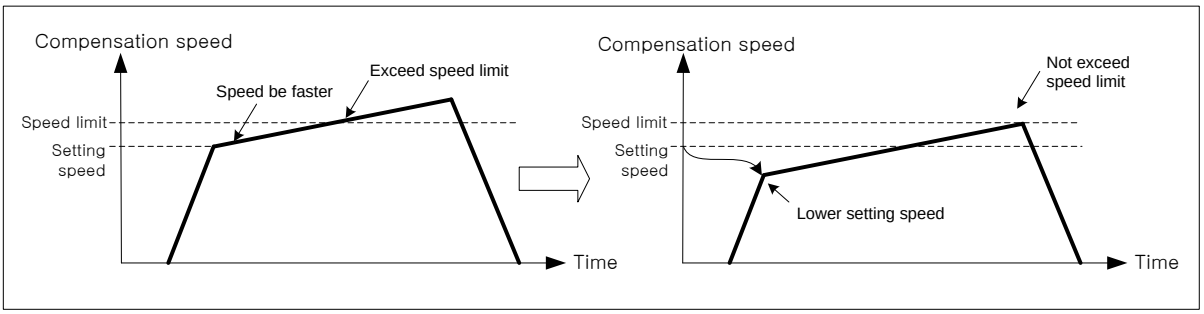
(b) In case of starting point radius has some difference with ending point radius, compensating speed is as follows:

- Radius of starting point > Radius of ending point: The more near from target position, the slower.
- Radius of starting point < Radius of ending point: The more near from target position, the faster.



Note

In case of “Starting point radius < Ending point radius”, the closer to target position the object gets, the faster speed is. Sometimes it exceeds 「Speed limit」 of parameter. When operating circular interpolation, in case starting point radius is shorter than ending point radius, XGF-PN8A lowers speed not to exceed「Speed limit」. With that method, even if it gets closer to target position, it can’t exceed the 「Speed limit」.



(4) The number of circular interpolation rotation in absolute coordinate

(a) In case of center point - specified circular interpolation, absolute coordinate, when setting “Circular interpolation turns” is more than 1, if you stop it by Dec. stop command and restart interpolation operation, it doesn’t operate along the circular arc set again at this stop point and operates along the circular arc set at the previous start position. That is, in absolute coordinate, center point – specified circular interpolation, it operates according to rotation number at start position.

(b) Even if it decelerates and stops, it operates original circular interpolation by restart.

(c) Condition

In the following case, current position changes after deceleration stop command. The number of circular interpolation rotation is not the number of absolute rotations. It operates by the number of incremental rotations.

- After executing positioning command except for current step indirect start (Directing start, Jog operation, Inching operation, Sync. operation, etc),
- After executing “Current position change” command
- After executing “Servo off” command

[Example] operates center-point circular interpolation, absolute coordinate with axis 1 (main axis), with axis 2 (sub axis)

■ Starting position (100, 500), Target position (400, 500), Auxiliary position (600, 500), Direction of rotations: CW, operation is as follows:

■ Example of setting XG-PM

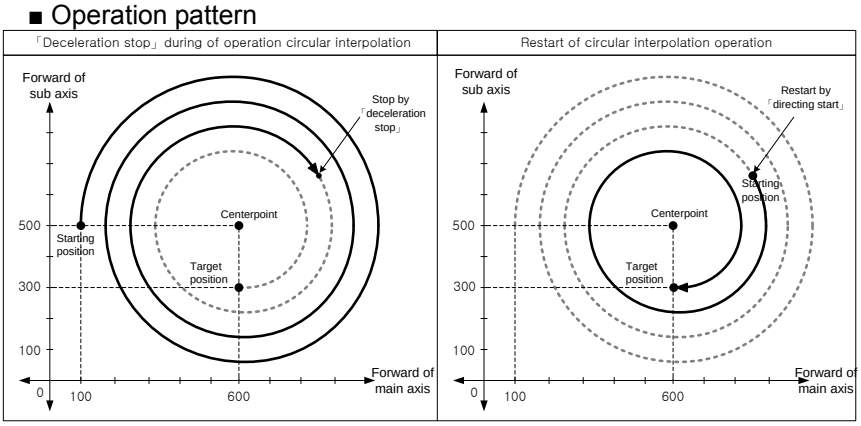
▪ Main axis (axis 1) operation data

Step No.	Control Method	Operation method	Target position [pls]	Operation Speed [pls/s]	Acc. No.	Dec. No,	M code	Dwell time	Sub axis setting	Circular interpolation Auxiliary point	Circular Interpolation mode	Circular interpolation turns	Helical interpolation
1	Absolute, circular interpolation	Single, End	600	1000	No.1	No.1	0	100	Axis 2	600	Center point, CW	3	Do not use

▪ Sub axis (axis 2) operation data

Step No.	Control Method	Operation method	Target position [pls]	Operation Speed [pls/s]	Acc. No.	Dec. No.	M code	Dwell time	Sub axis setting	Circular interpolation Auxiliary point	Circular interpolation mode	Circular interpolation turns	Helical interpolation
1	Absolute, single-axis position control	Single, End	300	0	No.1	No.1	0	0	None	500	Middle point	0	Do not use

■ Operation pattern



When you restart the same step number after stopping it by Dec. stop command, it doesn’t rotate 3 times at the stop position. Since it rotated 2 times previous operation, it executes circular interpolation of one time rotation to go target position.

9.2.11 Circular interpolation control with designated radius

After operated by starting command (「indirect start」, 「Simultaneous Start」), it operates interpolation along the trace of the circle made by the specified radius.

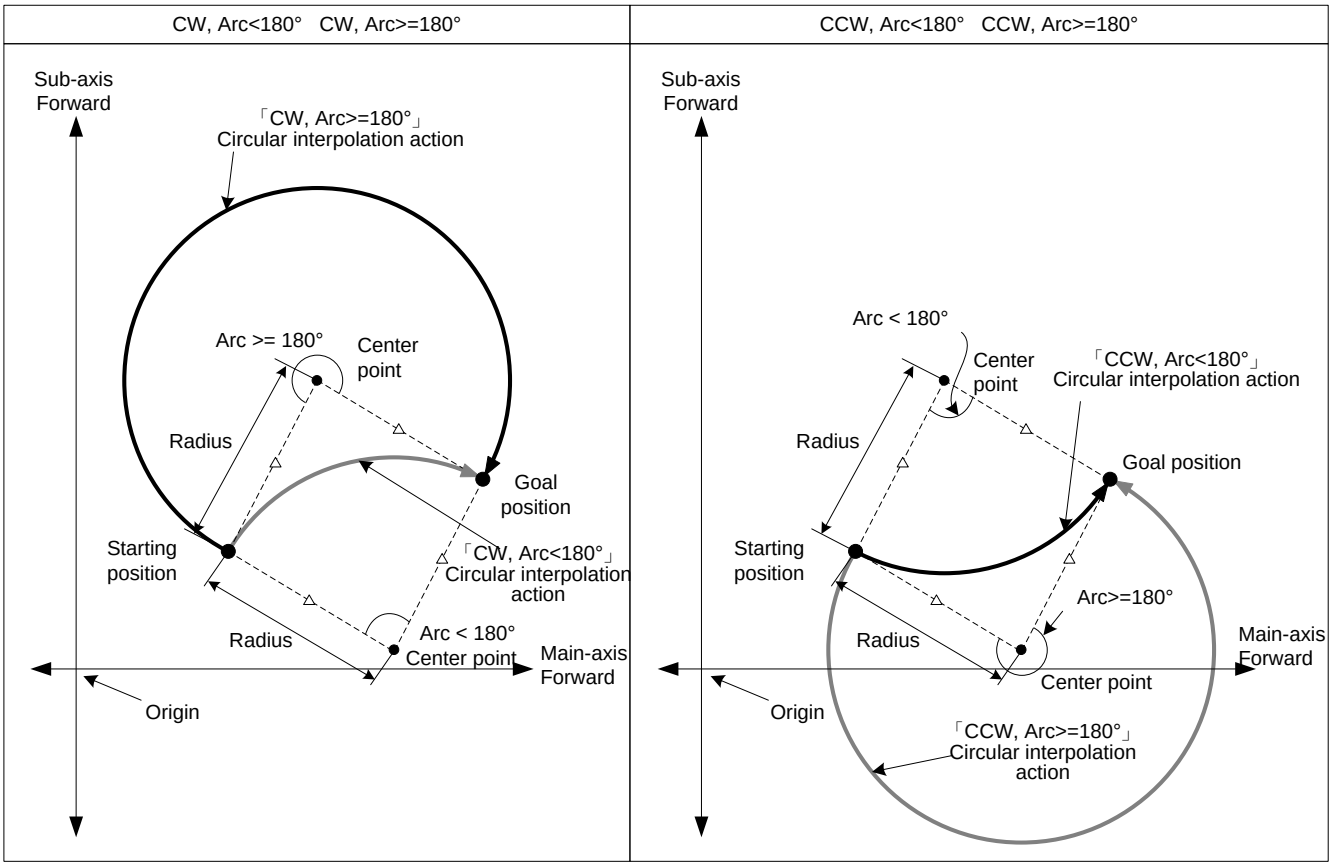
Circular interpolation over 360 degrees is available according to 「Circular interpolation turns」.

There is no limit to the composition of 2 axes. User can select 2 axes among 1~ 8-axis randomly.

(1) Radius specified Circular interpolation, absolute coordinate (「Absolute, Circular interpolation」)

(a) Starts operating at starting position and execute circular interpolation along the trace of the circle which has radius specified by auxiliary point of main-axis operation data. Center point of Circular arc depends on the turning direction (CW, CCW) of 「Circular interpolation mode」 and size setting of circular arc (Circular arc<180°, Circular arc>=180°).

Circular interpolation mode	Description
Radius, CW, Arc<180°	Executes circular interpolation in clockwise and the arc is smaller than 180°
Radius, CW, Arc>=180°	Executes circular interpolation in clockwise and the arc is bigger than 180°
Radius, CCW, Arc<180°	Executes circular interpolation in counterclockwise and the arc is smaller than 180° or same.
Radius, CCW, Arc>=180°	Executes circular interpolation in counterclockwise and the arc is bigger than 180° or same.



(b) Restrictions

■ Radius specified circular interpolation can not draw an exact circle that the starting position and ending position are same. If you want to draw that, use center point - specified circular interpolation.

■ In the cases below, error would arise and circular interpolation can not be executed.

▪「Sub-axis setting」error (error code: 279)

- Value of 「Sub-axis setting」is “Axis-undecided”
-「Sub axis setting」of main axis operating data is the same as main axis no.
-「Sub axis setting」of main axis operating data is the axis no. that is not connected to the network.

▪ Control unit of main or sub axis is set as “degree”. (error code : 282(main), 283(sub))

▪ Starting position and goal position are same (error code: 285)

▪ Radius value of circular interpolation of main-axis operating data is smaller than half of the length from starting position to target position

- When Radius < (R x 0.8) : Error (error code:270)
- When (R x 0.8) <= Radius < R

: Executes circular interpolation after reset the radius to R. In other words, executes circular interpolation by setting the center of the line from starting position to goal position as center point.

Note

If executing circular interpolation, 2 axes will operate at the same time. Pay attention.
(1) Available auxiliary operations are as follows.
▪ Speed override, Dec. stop, Emergent stop, Skip operation.
(2) The commands unavailable during circular interpolation operation are as follows.
▪ Position/Speed switching control, Position override, Continuous operation
(3) The parameter items operating by each axis setting are as follows.
▪ Software high limit, Software low limit among extended parameter

(c) Setting example of Operating data

Items	Main-axis setting	Sub-axis setting	Description
Control Method	Absolute, Circular interpolation	- *1	When executing circular interpolation with absolute coordinates, set「Absolute, Circular interpolation」on main. Set the coordinate of sub-axis as “Absolute” too.
Operating Method	Single, End	-	Set the method to execute circular interpolation
Target position [pls]	10000	0	Set the target position to execute on Main, Sub axis
Operation speed [pls/s]	1000	-	Circular interpolation uses the method of composition speed. Set the composition speed at the main-axis
Acc. no.	No.1	-	Set Acc. No. for acceleration (no.1 ~ no.4)
Dec. no.	No.2	-	Set Dec. No. for deceleration. (no.1 ~ no.4)
M code	0	-	When you need to execute auxiliary work based on the interpolation operation, set the M code
Dwell time	500	-	Set dwell time(ms) needed to output the positioning completion signal
Sub-axis setting	Axis2	-	Set an axis to be used as sub-axis among settable axis in operating data of main-axis
Auxiliary point	7000	-	Set the radius on main-axis
Circular interpolation mode	Radius, CW, Arc<180°	-	When using radius specified circular interpolation, set「Radius」on main-axis and set moving direction of arc and size of arc
Circular interpolation urns	-	-	Set the no. of turns of arc for making a circle bigger than 360°
Helical	Don’t use	-	When using circular interpolation, set it to「Don’t」

- *1 : It means that it need not be set. Whatever value it is, it dose not affect circular interpolation.

Note

(1) Radius specified circular interpolation is executed on the basis of the items set on operating data of main axis (command axis). When it is executed, only「Target position」 among sub axis items can affect circular interpolation. In other words, whatever value is set as, it does not affect the action and no errors arise. But, coordinate setting of sub-axis control method means whether target position is absolute coordinate or incremental coordinate. So in case of circular interpolation control by absolute coordinate method, set the coordinate of sub-axis as “Absolute” too.

(2) When setting the circular interpolating auxiliary point (radius) of main-axis, it must be bigger than the half of the length between starting position and target position. When it is smaller than the half(R), if the value is higher than 80% of R, circular interpolation which has middle point between starting position and goal position as center-point is executed, and if the value is lower than 80% of R, error (error code:270) arises and circular interpolation is not executed.

[Example] Axis1 is main-axis and Axis2 is sub-axis. Execute radius specified circular interpolation with incremental.

■ Starting position (1000, 1000), Target position (9000, 1000), Auxiliary point (5000, 0)
Moving direction of arc : CCW, Size of arc : Arc >= 180°
The action is as follows in the condition above

■ Setting example in XG-PM

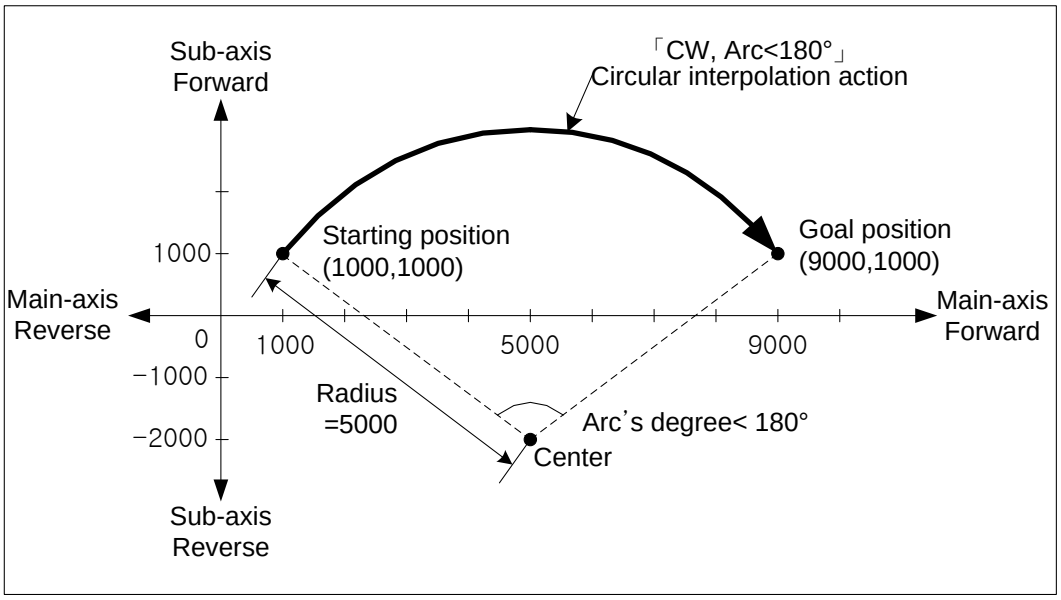
▪ Main-axis(Axis1) Operating data

Step No.	Control method	Operation Method	Target position [pls]	Operation speed [pls/s]	Acc. No,	Dec. No,	M Code	Dwell Time	Sub-axis Setting	Auxiliary Point	Circular interpolation mode	Circular interpolation turns	Helical interpolation
1	Absolute, Circular interpolation	Single, End	8000	1000	No.1	No.1	0	100	Axis2	5000	Radius, CW, Arc<180	0	Not use

▪ Sub-axis(Axis2) Operating data

Step No.	Control method	Operation Method	Target position [pls]	Operation speed [pls/s]	Acc. No,	Dec. No,	M Code	Dwell Time	Sub-axis Setting	Auxiliary Point	Circular interpolation mode	Circular interpolation turns	Helical interpolation
1	Absolute, single axis position control	Single, End	8000	1000	No.1	No.1	0	100	Axis2	5000	Radius, CW, Arc<180	0	Not use

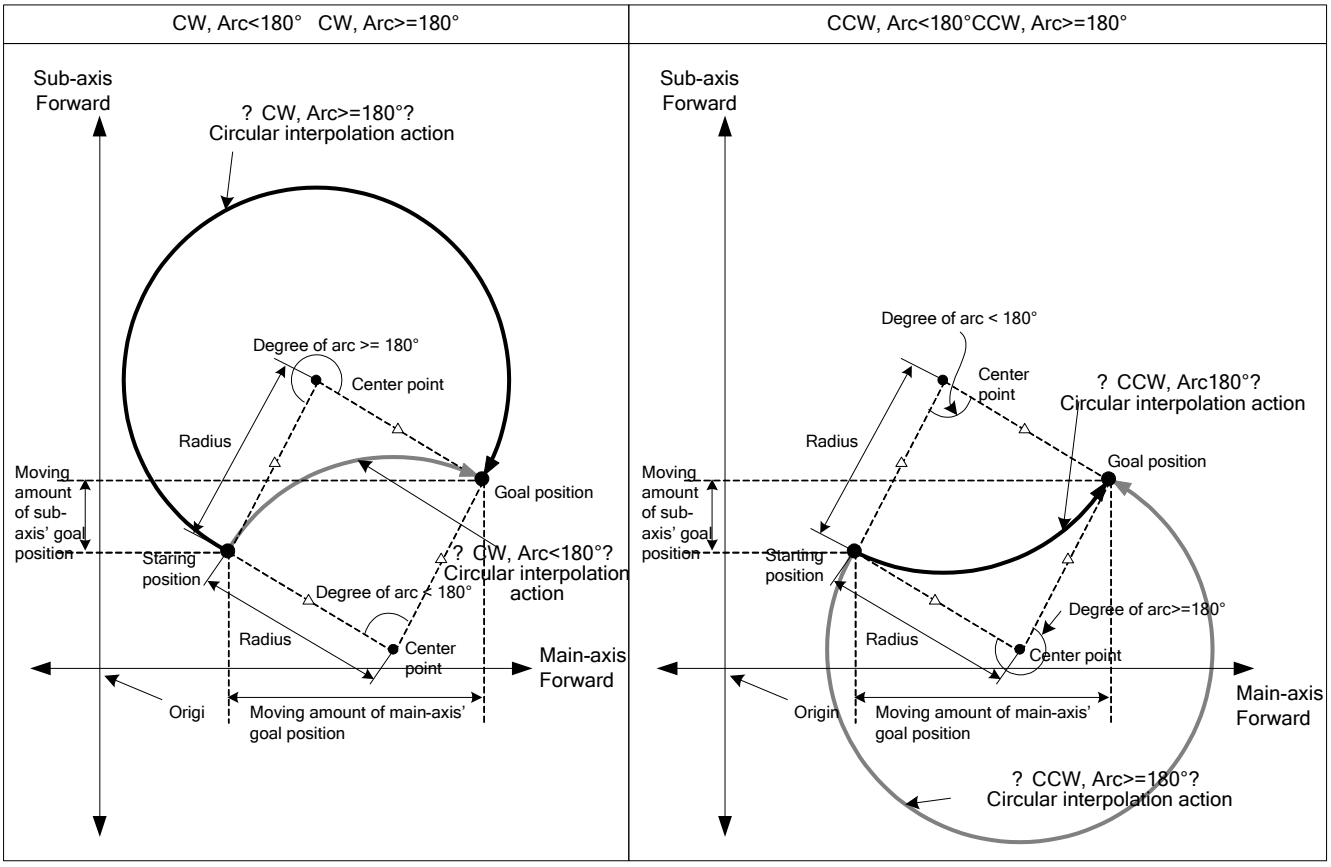
■ Operation pattern



(2) Radius specified circular interpolation, incremental coordinate
(「Incremental, Circular interpolation」)

(a) Starts operation from starting position and executes circular interpolation by the increment set on target position along the trace of the circle which has the value set on circular interpolation auxiliary point of main-axis operation data as a radius. Circular arc depends on the moving direction of「Circular interpolation mode」(CW, CCW) and setting of arc size(Arc<180°, Arc>=180°)

Circular interpolation mode	Description
Radius, CW, Arc<180°	Executes circular interpolation with center-point whose arc is smaller than 180° in CW direction
Radius, CW, Arc >=180°	Executes circular interpolation with center-point whose arc is bigger than 180° in CW direction
Radius, CCW, Arc<180°	Executes circular interpolation with center-point whose arc is smaller than 180° in CCW direction
Radius, CCW, Arc>=180°	Executes circular interpolation with center-point whose arc is bigger than 180° in CCW direction



(b) Restrictions

■ Radius specified circular interpolation can not draw an exact circle that the starting position and ending position are same. If you want to draw that, use center point specified circular interpolation.

■ In the cases below, error would arise and circular interpolation can not be executed.

▪「Sub-axis setting」error (error code: 279)

- Value of 「Sub-axis setting」is “Axis-undecided”
-「Sub axis setting」of main axis operating data is the same as main axis no.
-「Sub axis setting」of main axis operating data is axis no. that is not connected to the network.

▪ Control unit of main or sub axis is set as “degree”. (error code : 282(main), 283(sub))

▪ Starting position and target position are same (error code: 285)

▪ Radius value of circular interpolation of main-axis operating data is smaller than half of the length from starting position to target position

- When Radius < (R x 0.8) : Error (error code: 270)
- When (R x 0.8) <= Radius < R

: Executes circular interpolation after reset the radius to R. In other words, executes circular interpolation by setting the center of the line from starting position to target position as center point.

(c) Setting example of Operating data

Items	Main-axis setting	Sub-axis setting	Description
Control Method	Incremental, Circular interpolation	Incremental, single-axis position control	When executing circular interpolation with incremental coordinates, set「Incremental, Circular interpolation」on main. Set the coordinate of sub-axis as “Incremental” too
Operating Method	Single, End	-*1	Set the method to execute circular interpolation
Target position [pls]	10000	0	Set the target position by incremental amount from current position
Operation speed [pls/s]	1000	-	Circular interpolation uses the method of composition speed. Set the composition speed at the main-axis
Acc. no.	No.1	-	Set Acc. No. for acceleration (no.1 ~ no.4)
Dec. no.	No.2	-	Set Dec. No. for deceleration. (no.1 ~ no.4)
M code	0	-	When you need to execute auxiliary work based on the interpolation operation, set the M code
Dwell time	500	-	Set dwell time(ms) needed to output the positioning completion signal
Sub-axis setting	Axis2	-	Set an axis to be used as sub-axis among settable axis in operating data of main-axis
Auxiliary point	7000	-	Set the radius on main-axis
Circular interpolation mode	Radius, CW, Arc<180°	-	When using Radius specified circular interpolation, select “Radius”
Circular interpolation Turns	-	-	Set the no. of turns of arc for making a circle bigger than 360°
Helical interpolation	Don’t	-	When using circular interpolation, set it to「Don’t use」

- *1 : It means that it need not be set. Whatever value it is, it dose not affect circular interpolation.

Note

(1) Radius specified circular interpolation is executed on the basis of the items set on main axis operating data. When it is executed, only「Target position」 among sub axis items can affect circular interpolation. In other words, whatever value is set as, it does not affect the action and no errors arise. But, coordinate setting of sub-axis control method means whether target position is absolute coordinate or incremental coordinate. So in case of circular interpolation control by incremental coordinate method, set the coordinate of sub-axis as “Incremental” too.

(2) When setting the circular interpolation auxiliary point (radius) of main-axis, it must be bigger than the half of the length between starting position and goal position. When it is smaller than the (R), if the value is higher than 80% of R, circular interpolation which has middle point between starting position and target position as center-point is executed, and if the value is lower than 80% of R, error (error code:270) arises and circular interpolation is not executed.

[Example] Axis1 is main-axis and Axis2 is sub-axis. Executes Radius specified circular interpolation with incremental coordinates.

■ Starting position (1000, 1000), Target position (8000, 0), Auxiliary point (5000, 0)
Moving direction of arc : CCW, Size of arc : Arc >= 180°
The action is as follows in the condition above

■ Setting example in XG-PM

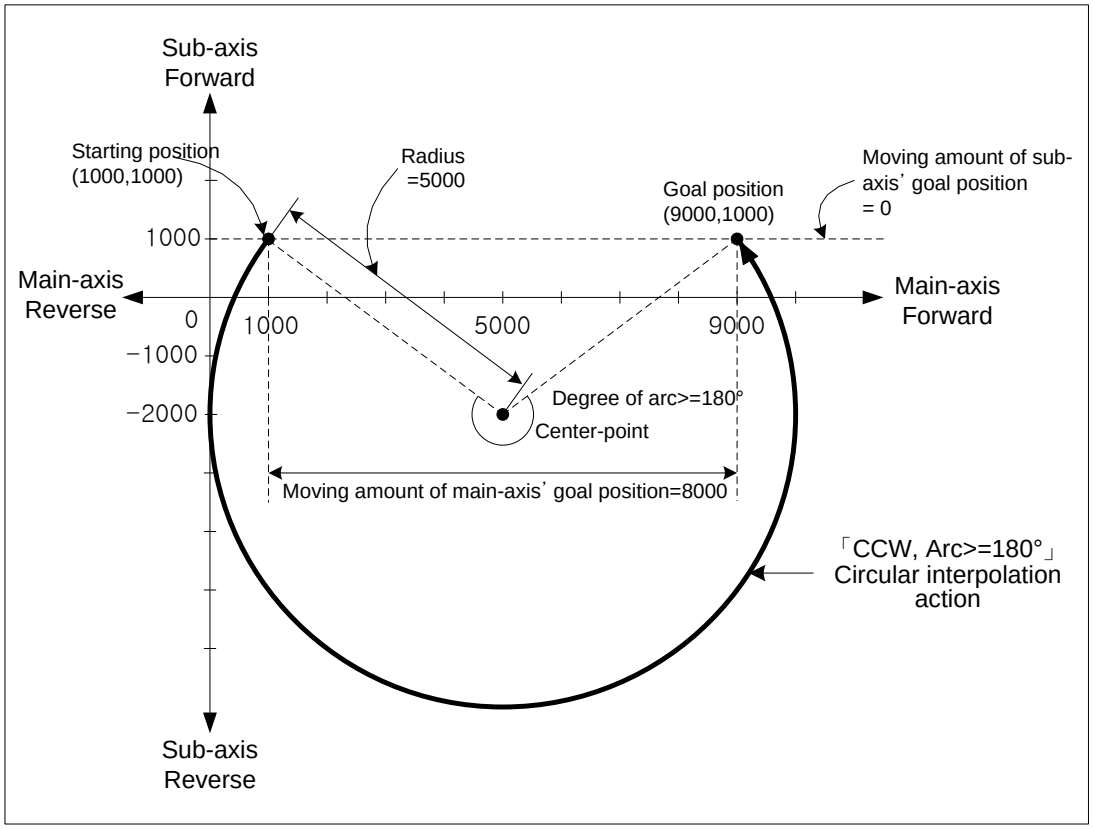
▪ Main-axis(Axis1) Operating data

Step No.	Control method	Operation Method	Target position [pls]	Operation speed [pls/s]	Acc. No,	Dec. No,	M Code	Dwell Time	Sub-axis Setting	Auxiliary Point	Circular interpolation mode	Circular interpolation turns	Helical interpolation
1	Incremental, Circular interpolation	Single, End	8000	1000	No.1	No.1	0	100	Axis2	5000	Radius, CCW, Arc>=180	0	Not use

▪ Sub-axis(Axis2) Operating data

Step No.	Control method	Operation Method	Target position [pls]	Operation speed [pls/s]	Acc. No,	Dec. No,	M Code	Dwell Time	Sub-axis Setting	Auxiliary Point	Circular interpolation mode	Circular interpolation turns	Helical interpolation
1	Absolute, single-axis position control	Single, End	1000	0	No.1	No.1	0	100	Axis2	0	Middle point	0	Not use

■ Operation pattern



9.2.12 Helical Interpolation Control

After executed by start command (Indirect start, Synchronous start), 2 axes move along the circular arc and an axis execute linear interpolation synchronizing with circular interpolation.

It can execute helical interpolation of over 360° according to “Circular interpolation turns” setting

There is no limit to the combinations of axes and 3 axes among axis1~axis8 are used.

(1) Characteristics of control

(a) After setting operating data for circular interpolation, if you set a helical interpolation axis on the item “Helical interpolation”, the helical interpolation will be executed.

(b) The direction of circular arc depends on the target position and the mode of circular interpolation, the direction of helical axis depends on the coordinates setting and the target position.

■ In case of「Absolute, Circular interpolation」

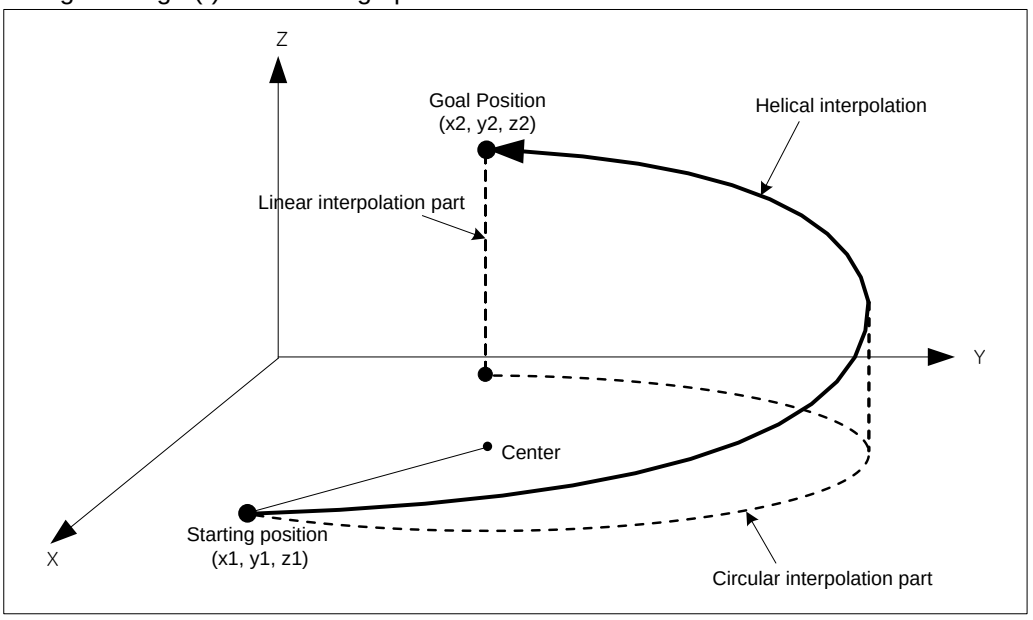
Starting position < Target position: Positioning operation in forward direction

Starting position > Target position: Positioning operation in reverse direction

■ In case of「Incremental, Circular interpolation」

Positive sign (+) or No sign : Positioning operation in forward direction

Negative sign (-) : Positioning operation in reverse direction



(2) Restrictions

(a) The restrictions of helical interpolation are same as various kinds of circular interpolation depending on the mode of circular interpolation.

(b) If you set「Helical Interpolation」as “Don’t use”, it will be same as the action of circular interpolation.

(c) If you set the target position of helical interpolation axis as the same starting position, it will be same as the action of circular interpolation.

Note

If you execute helical interpolation, 3 axes will operate at the same time. Pay attention.
(1) Available auxiliary operations are as follows.
▪ Speed override, Dec. stop, Emergent stop, Skip operation.
(2) The commands unavailable during helical interpolation operation are as follows.
▪ Position/Speed switching control, Position override, Continuous operation
(3) The parameter items operated by each axis setting are as follows.
▪ Software high limit, Software low limit among extended parameter.

(3) Example of operation data setting

Items	Main axis(axis1) Setting	Sub axis(axis2) Setting	Helical axis(axis3) setting	Description
Control method	Absolute, Circular interpolation	Absolute, single-axis position control	Absolute, single-axis position control	when executing helical interpolation, circular interpolation must be set
Operation method	Single, End	- *1	- *1	Set operation method for helical interpolation
Target position [pls]	10000	0	10000	Set the goal position on main, sub, helical axis for executing positioning.
Operation speed [pls/s]	1000	-	-	Helical interpolation uses composition speed of circular interpolation part
Acc. no.	No.1	-	-	Set Acc. No. for acceleration (no.1 ~ no.4)
Dec. no	No.2	-	-	Set Dec. No. for deceleration. (no.1 ~ no.4)
M code	0	-	-	When you need to execute auxiliary work based on the interpolation operation , set the M code
Dwell time	500	-	-	Set dwell time(ms) needed to output the positioning completion signal
Sub axis setting	Axis2	-	-	Set an axis to be used as sub-axis among settable axis in operating data of main-axis
Circular interpolation auxiliary point	5000	5000	-	Set auxiliary data of circular interpolation action
Circular interpolation mode	Middle point	-	-	Set circular interpolation mode to be used in circular action of helical interpolation
circular interpolation turns	0	-	-	Set the no. of turns of circular arc when user need to execute helical interpolation of over 360°
Helical interpolation	Axis3	-	-	Set an axis to be used as helical interpolation axis from settable axis on main axis operation data

- *1 : This item does not need to be set. Whatever it is set as, it dose not affect circular interpolation.

Note

Helical interpolation control is executed on the basis of item set on operation data of main axis.
When executing circular interpolation of helical interpolation, only “target position”, “Circular interpolation auxiliary point” items of sub axis setting and “Target position” item of helical axis setting affect helical interpolation. In other words, Whatever the setting value is, it does not affect operation and cause any errors. But, coordinate setting of sub-axis control method means whether target position is absolute coordinate or incremental coordinate. So in case of circular interpolation control by absolute coordinate method, set the coordinate of sub-axis as “Absolute” too.

[Example] Executes center point - specified helical interpolation, absolute coordinates with axis1 (main), axis2 (sub) and axis3(helical).

■ The action in the case (Starting point (650, 400, 0), Goal position (400, 1200, 350), Auxiliary point (800, 400)) is as follows.

■ Setting example of XG-PM

▪ Operation data of main axis(axis1)

Step no.	Control method	Operating method	Target position [pls]	Operating speed [pls/s]	Acc. no.	Dec. no.	M code	Dwell time	Sub axis setting	Circular interpolation auxiliary point	Circular interpolation mode	Circular interpolation turns	Helical interpolation
1	Absolute, circular interpolation	Single, End	400	1000	No.1	No.1	0	100	Axis2	800	Center point, CCW	0	Axis3

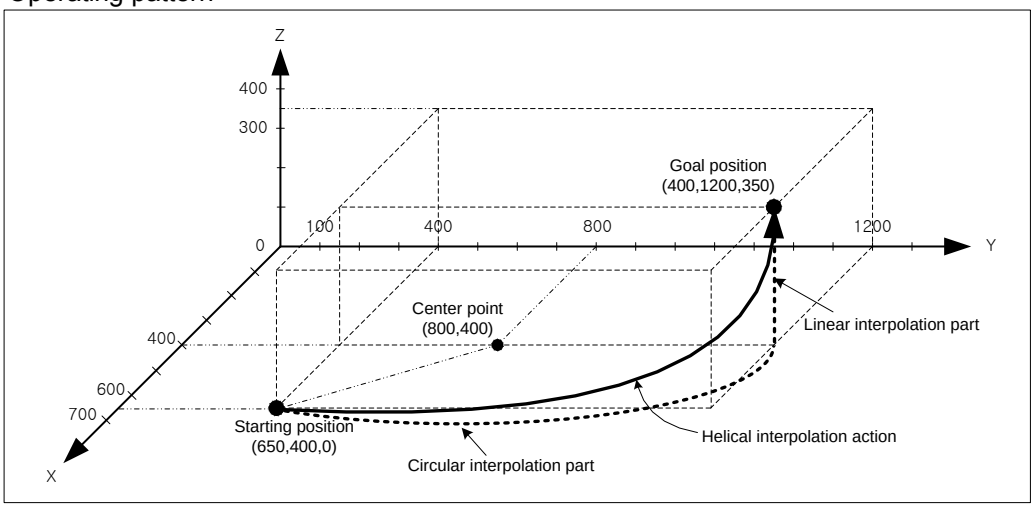
▪ Operation data of sub axis(axis2)

Step no.	Control method	Operating method	Target position [pls]	Operating speed [pls/s]	Acc. no.	Dec. no.	M code	Dwell time	Sub axis setting	circular interpolation auxiliary point	Circular interpolation mode	Circular interpolation turns	Helical interpolation
1	Absolute, single axis position control	Single, End	1200	0	No.1	No.1	0	100	-	400	Middle point	0	Not use

▪ Operation data of helical axis(axis3)

Step no.	Control method	Operating method	Goal position [pls]	Operating speed [pls/s]	Acc. no.	Dec. no.	M code	Dwell time	Sub axis setting	circular interpolation auxiliary point	Circular interpolation mode	Circular interpolation turns	Helical interpolation
1	Absolute, single axis position control	Single, End	350	0	No.1	No.1	0	100	-	0	Middle point	0	Not use

■ Operating pattern



9.2.13 Ellipse Interpolation Control

Executes ellipse interpolation by using circular interpolation operation data set on the 2 axes, and ellipse rate and moving angle, auxiliary data of 「Ellipse interpolation」 command.

There is no limit to the combinations of axes and 2 axes among axis1~axis8 are used.

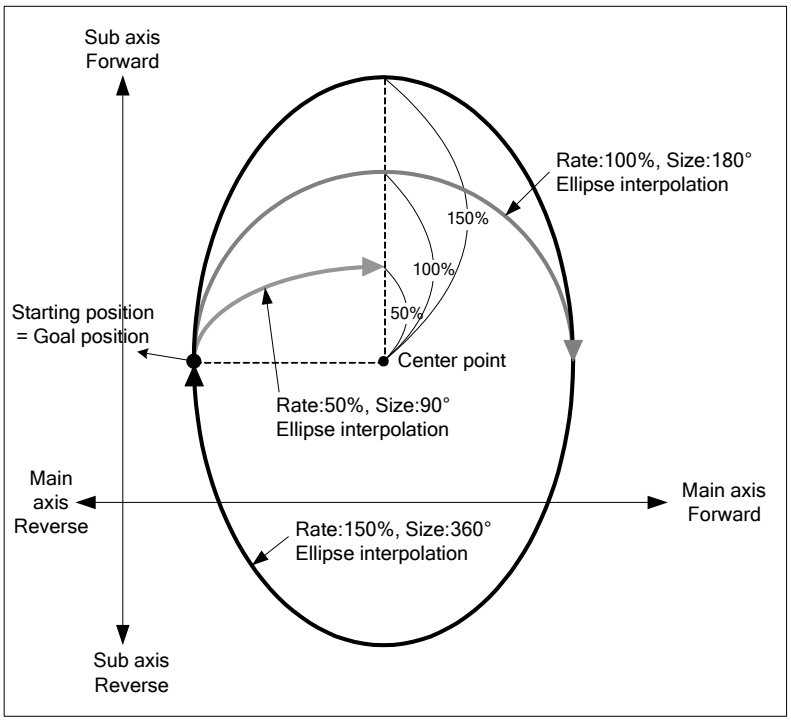
(1) Characteristics of Control

(a) For ellipse interpolation, set the operation data as “center point - specified circular interpolation” and set the rate and size of ellipse by auxiliary data of “ellipse interpolation command”

Auxiliary data	Setting value	Description
Ratio of ellipse (%)	0 ~ 65535	Set the ratio of horizontal axis and vertical axis (1 = 0.01%)
Size(Degree) of ellipse	0 ~ 65535	Set the ellipse’s moving degree (1 = 0.1°)

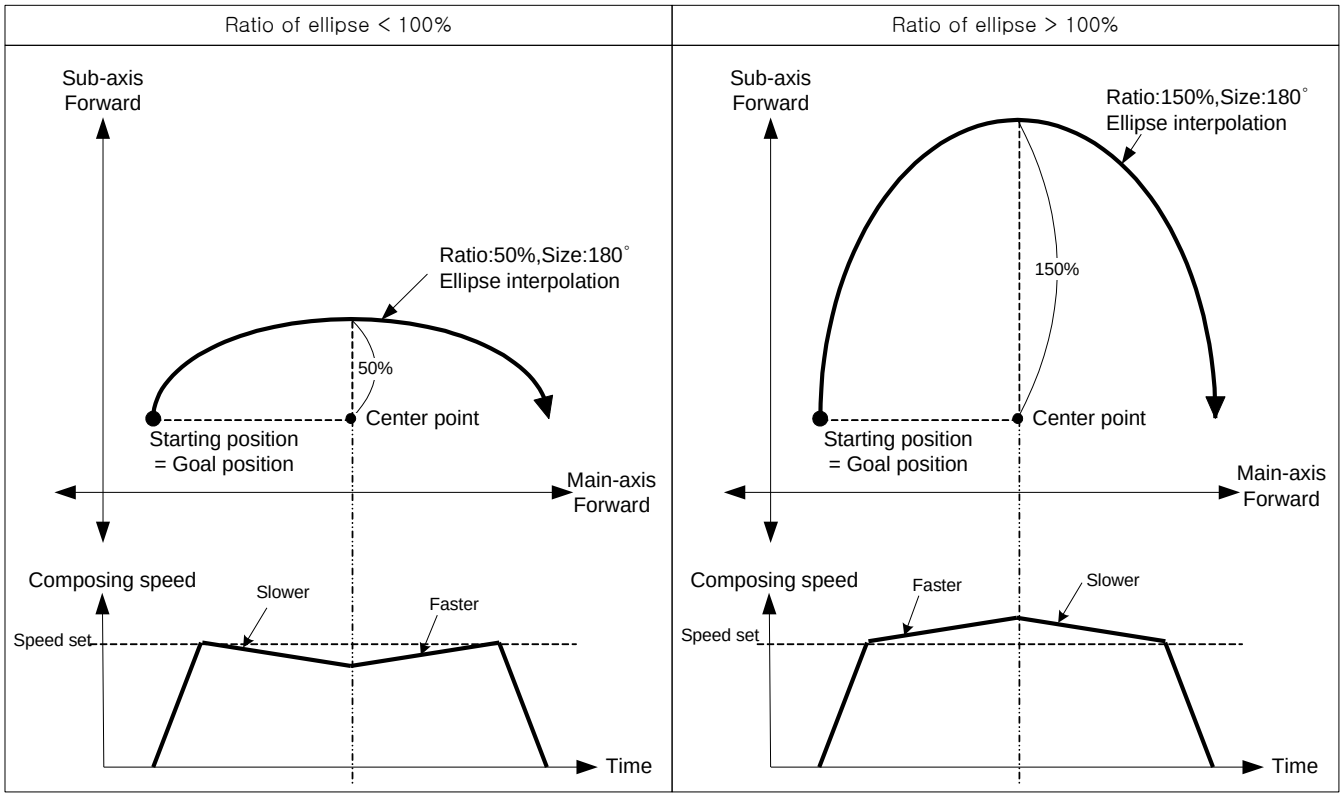
(b) Moving direction of ellipse is decided by the direction set by “circular interpolation mode” of operation data.

- 「Center point, CW」 - Executes ellipse interpolation in clockwise.
- 「Center point, CCW」 - Executes ellipse interpolation in counterclockwise.



(c) Starting position and target position must be same when executing ellipse interpolation.

(d) When executing ellipse interpolation, the radius changes continuously and composing speed also changes depending on the ratio of ellipse. When the ratio of ellipse is bigger than 100%, operating speed of sub axis and composing speed get faster. So it calls user's attention. Sub axis of ellipse interpolation is not limited by "speed limit", so you set the operating speed not to exceed the speed limit.



(2) Restrictions

(a) Ellipse interpolation can not be executed in the case below.

- 「Sub-axis setting」 Error (error code : 547)
  - The value of sub-axis setting of main axis operating data is "Axis-undecided".
  - The value of sub-axis setting of main axis operating data is same as the no. of main-axis.
  - The value of sub-axis setting of main axis operating data is axis no. that is not connected to the network.
  - An axis of helical interpolation is set.
- Control unit of main or sub axis is set as "degree". (error code : 551(main), 552(sub))
- The center point designated as auxiliary point is the same as starting position or goal position. (error code : 553)
- The radius of circular arc exceeds 2147483647pls. (error code : 554)
- The operating method is "continuous" or "Keep". (error code : 556)
  If user executes ellipse interpolation, End operation must be set before use.
- Staring position and Goal position are different. (error code : 558)
- Size of circular arc (Moving degree) is 0. (error code : 559)

Note

2 axes will operate at the same time. So pay attention.
1. Auxiliary operations available are as follows.
   ▪ Speed override, Dec. stop, Emergent stop, Skip operation
2. The commands unavailable during ellipse interpolation operation are as follows.
   ▪ Position/Speed switching control, Position override, Continuous operation
3. Parameter items operated by setting value of each axis are as follows.
   ▪ Software high limit, Software low limit among extended parameter.

(3) Setting example of operation data

Items	Main-axis setting	Sub-axis setting	Description
Control Method	Absolute, Circular interpolation	Absolute, single-axis position control	Set circular interpolation when executing ellipse interpolation
Operating Method	Single, End	-	“End” must be set when using ellipse interpolation
Target position[pls]	10000	0	Set the goal position to execute on Main, Sub axis
Operation speed[pls/s]	1000	-	Designate composing speed for circular interpolation part in ellipse interpolation
Acc. no.	No.1	-	Set Acc. No. for acceleration (no.1 ~ no.4)
Dec. no.	No.2	-	Set Dec. No. for deceleration. (no.1 ~ no.4)
M code	0	-	When you need to execute auxiliary work based on the interpolation operation, set the M code
Dwell time	500	-	Set dwell time(ms) needed to output the positioning completion signal
Sub-axis setting	Axis2	-	Set an axis to be used as sub-axis among settable axis in operating data of main-axis
Auxiliary point	5000	5000	Set the center point of ellipse
Circular interpolation	Center point, CW	-	Center point must be set when using ellipse interpolation
Circular interpolation turns	-	-	The no. of turns is not operated in ellipse interpolation
Helical interpolation	Don’t use	-	Set axis of helical interpolation as “Don’t Use” when using ellipse interpolation

- *1 : It means that no need to be set. Whatever value it is, it dose not affect circular interpolation.

Note

Ellipse interpolation control is executed based on the operating data of main-axis. When executing ellipse interpolation, only「Target position」and「circular interpolation auxiliary point 」affect the operation of ellipse interpolation. In other words, whatever value is set, it does not affect operation and no errors arise. But, coordinate setting of sub-axis control method means whether target position is absolute coordinate or incremental coordinate. So in case of circular interpolation control by absolute coordinate method, set the coordinate of sub-axis as “Absolute” too.

[Example] Executes ellipse interpolation with 20% of ellipse ratio, 360°of movement degree and incremental coordinate

■ Starting position (100, 100),
Setting of goal position : (0, 0)
Setting of auxiliary point : (500, 200)
Direction of operation : CW

■ Example setting in XG-PM

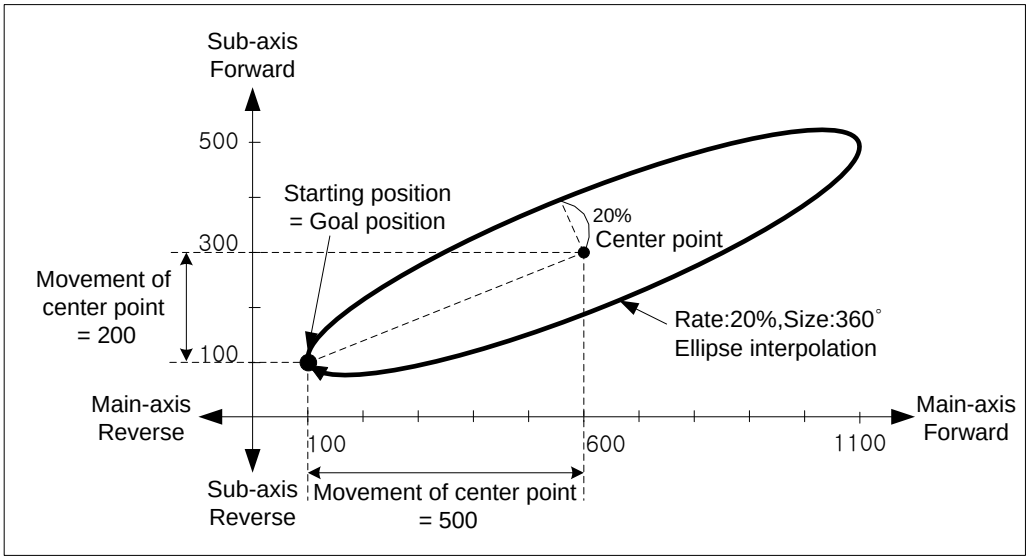
▪ Operation data of Main-axis(axis1)

Step no.	Control method	Operating method	Target position [pls]	Operating speed [pls/s]	Acc. No.	Dec. No.	M code	Dwell Time	Setting Sub axis	circular interpolation auxiliary point	Circular interpolation mode	Circular interpolation turns	Helical interpolation
1	Incremental, circular interpolation	Single, End	0	1000	No.1	No.1	0	100	Axis2	800	Center point, CW	0	Don't use

▪ Operation data of Sub-axis(axis2)

Step no.	Control method	Operating method	Target position [pls]	Operating speed [pls/s]	Acc. No.	Dec. No.	M code	Dwell Time	Setting Sub axis	circular interpolation auxiliary point	Circular interpolation mode	Circular interpolation turns	Helical interpolation
1	Incremental, single-axis position control	Single, End	0	0	No.1	No.1	0	0	None	400	Middle point	0	Don't use

■ Operating pattern



Note

(1) If the degree of ellipse is not 360°, the target position and actual position after stop are not same.

(2) If the ratio of ellipse is 0%, the trace of ellipse interpolation is shown as straight line. Ratio of ellipse need to be set to above 0.

9.2.14 Speed/Position Switching Control

The setting axis carries out the speed control and is switched from speed control to position control when speed/position switching signal is entered to the positioning module inside or outside, and then carries out the positioning according to the target position.

(1) Characteristics of Control

(a) Set control method of operating data as “Single-axis speed control” and execute 「Speed/Position Switching」 command during speed control operation.

(b) Direction of movement depends on the sign of value.

■ Forward: The position value is Positive(+)

■ Reverse: The position value is Negative(-)

(c) On order to use the external command as “Speed/position switching signal”, you have to set “External command selection” item and “External command” item of extended parameter.

Item	Setting value	Description
External command selection	0 : External speed/position control switching	In case there is external command input, it is used as “External speed/position control switching” signal
	1 : External stop command	In case there is external command input, it is used as “External stop command” signal
External command	0: Disable	External command signal is ignored and it does not affect operation
	1: Enable	In case there is external command input, it operates according to “External command selection” item.

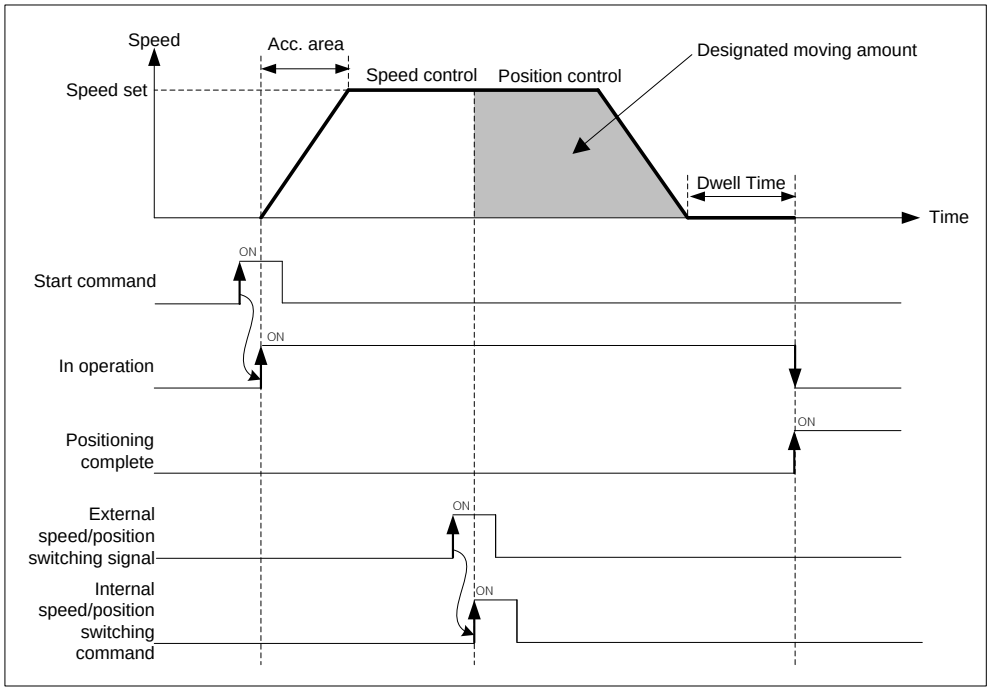
(d) In case of speed/position switching, this item determines whether to consider the set value as absolute coordinate value or incremental coordinate value.

Item	Setting value	Description
Speed/position switching coordinate	0 : incremental	The object moves as far as the set value from the position where command is executed.
	1 : absolute	It considers the set value as the absolute coordinate value and the object moves to the set absolute position.

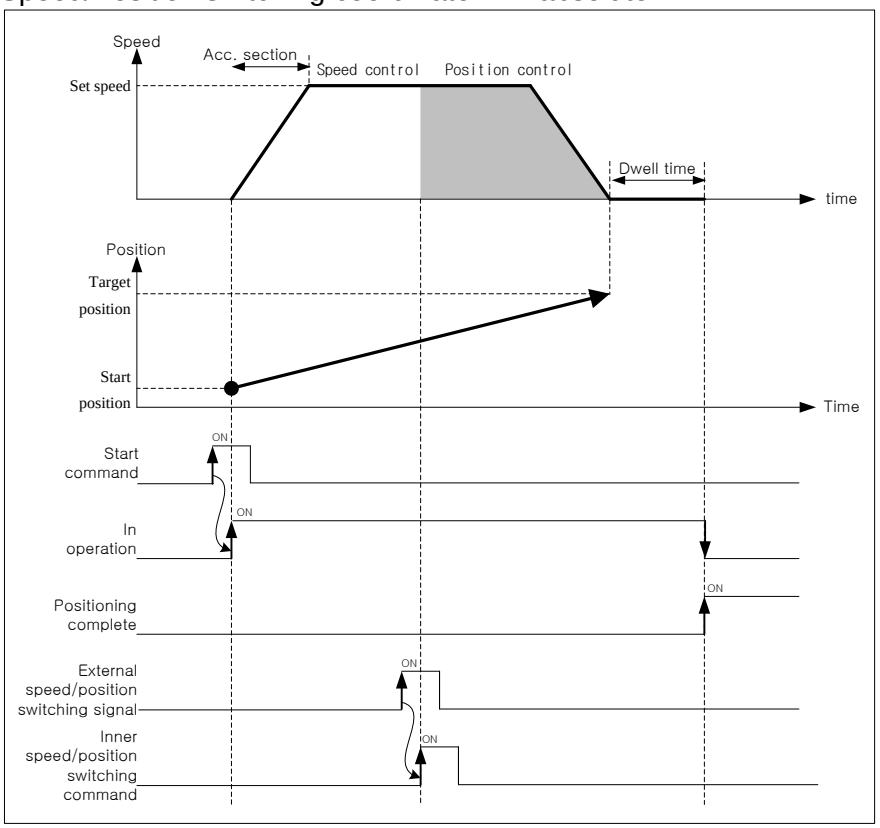
(e) The coordinate setting specified when starting the speed control doesn’t affect the operation. Namely, operation of “ABS, single-axis speed control” is same as that of “INC, single-axis speed control”.

(2) Operation timing

1) Speed/Position switching coordinate = 0: incremental



2) Speed/Position switching coordinate = 1: absolute



(3) Restrictions

(a) Operation pattern of speed control has to be set as “End” or “Keep”. If that is set as “Continuous”, error (error code:236) arises and speed control can not be executed.

(b) In case speed/position switching coordinate = “”0: incremental”, if target position of operation data or Direct start command is 0, speed/position switching command is not executed and error (error code: 304) appears. At this time, it keeps speed control.

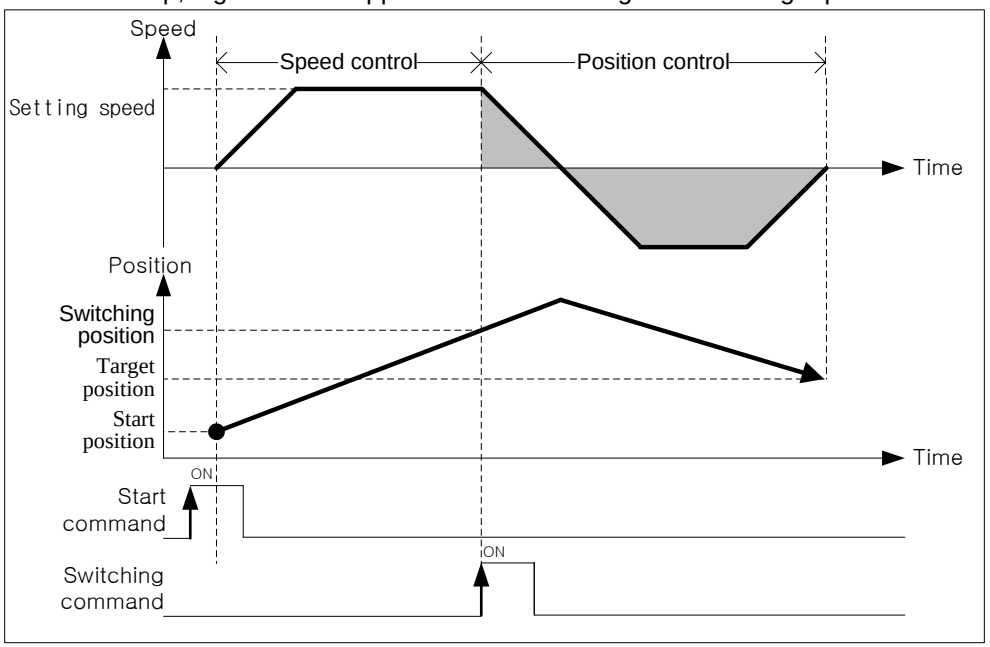
(4) Setting example of operation data

Items	Setting value	Description
Control method	Absolute, single-axis speed control	When executing speed/position switching control, set single-axis speed control
Operating method	Single, End	When executing speed/position switching control, set “End” or “Keep”
Target position [pls]	10000	Set the position value to be used for positioning after speed/position switching command.
Operating speed [pls/s]	1000	Set the operating speed of speed/position switching control
Acc. no.	No.1	Set acc. no. used in acceleration (no.1~4)
Dec. no.	No.2	Set dec. no. used in deceleration (no.1~4)
M code	0	Set when you need to execute another auxiliary work based on the speed/position switching control
Dwell time	500	Set dwell time(ms) needed to output the positioning completion signal after positioning

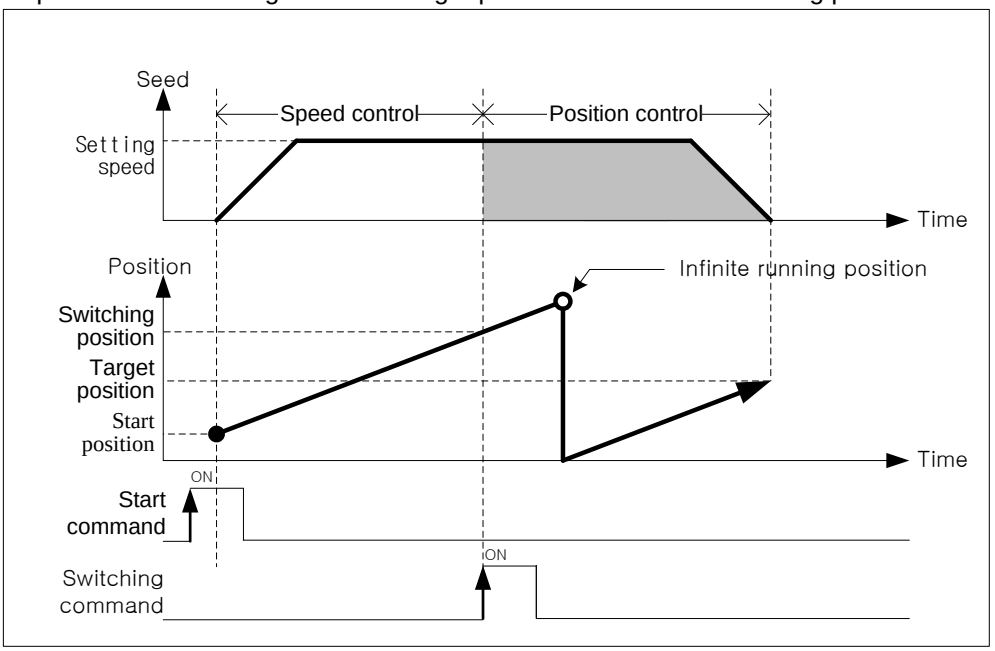
Note

In case speed/position switching coordinate is 1: ABS and target position is smaller than current position, its operation is different according to “infinite running repeat” setting.

1. When infinite running repeat = 0: disable
   - After dec. stop, it goes to the opposite direction and gets to the target position.



2. When infinite running repeat = 0: enable
- It keeps its direction and goes to the target position within infinite running position



9.2.15 Position specified Speed/Position Switching Control

The setting axis carries out the speed control and is switched from speed control to position control when position specified speed/position switching signal is entered to the positioning module, and then carries out the positioning according to target position.

(1) Characteristics of Control

(a) Set control method of operating data as “Single axis speed control” and execute 「Position specified Speed/Position Switching」 during speed control operation.

(b) In case of speed/position switching, this determines whether to consider the set position value as absolute coordinate value or incremental coordinate value.

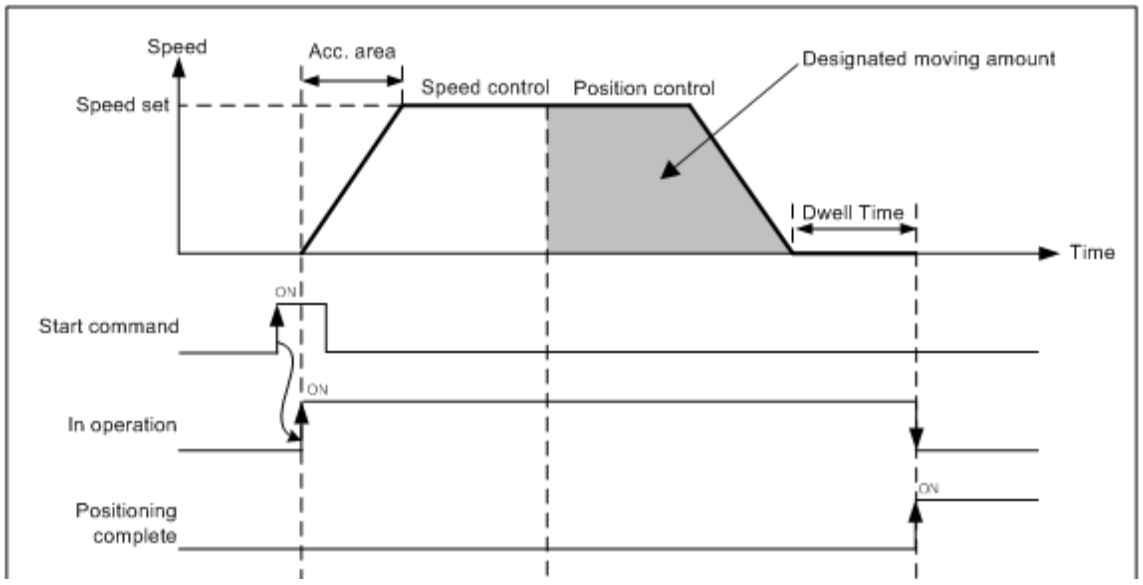
Item	Setting value	Description
Speed/position switching coordinate	0 : incremental	The object moves as far as the set value from the position where command is executed.
	1 : absolute	It considers the set value as the absolute coordinate value and the object moves to the set absolute position.

(c) In speed/position switching control, the value of coordinate specified when starting speed control has no affection. In other words, action of “Absolute, single axis speed control” and “incremental, single axis speed control” are same.

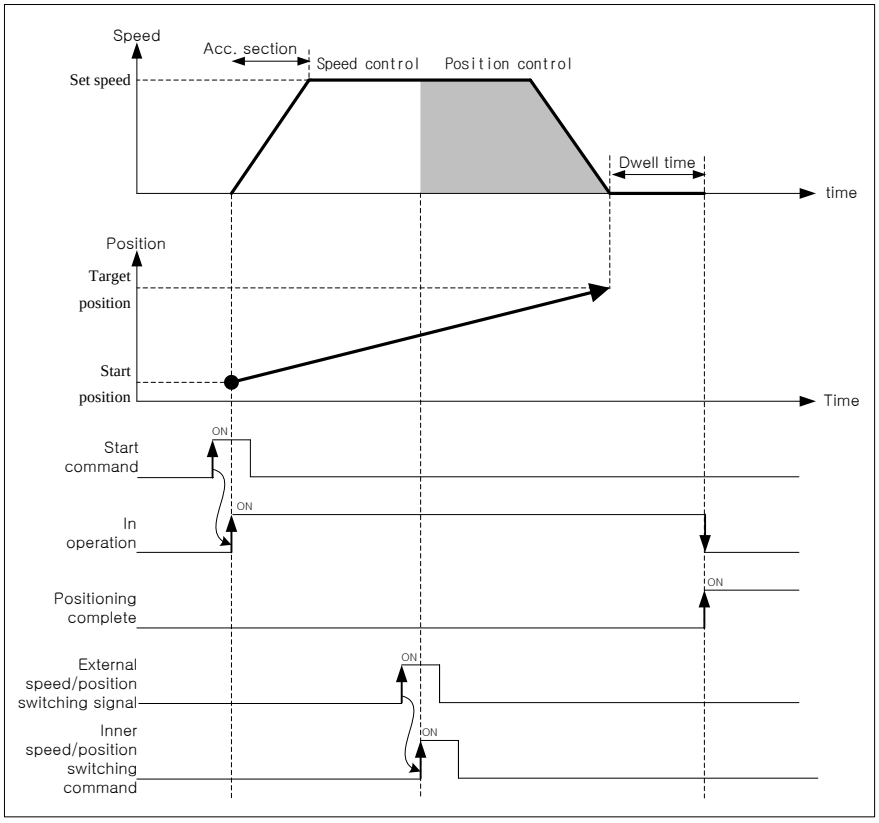
(d) In Position specified speed/position control, a target position set in the operation data or Direct start command is ignored and it moves according to target position operand of 「Position specified speed/position switching control」 command

(2) Operation timing

1) Speed/Position switching coordinate = 0: incremental



2) Speed/Position switching coordinate = 1: absolute



(3) Restrictions

(a) Operation pattern of speed control has to be set as “End” or “Keep”. If that is set as “Continuous”, error (error code:236) arises and speed control can not be executed.

(b) If the value of target position is 0, position specified speed/position switching command can not be executed. In this case, it continues to operate with speed control.

(c) In case infinite running repeat = 1: Enable and speed/position switching coordinate = 1: Absolute, if you set the position value which make the object go to the opposite direction as position operand, error (error code 306) appears and it keep its speed control.

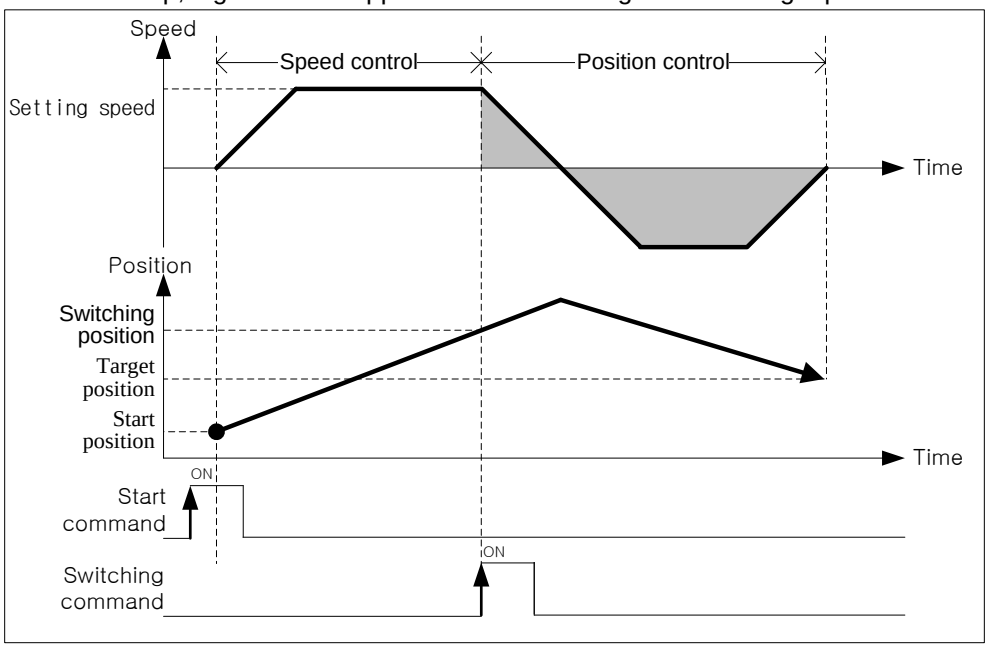
(4) Setting example of operation data

Items	Setting value	Description
Control method	Absolute, Single-axis speed control	When executing speed/position switching control, set single axis speed control
Operating method	Single, End	When executing speed/position switching control, set “End” or “Keep”
Target position [pls]	10000	Set the position value to be used for positioning after speed/position switching command. In case of position specified speed/position switching command, the target position set here is ignored and the target value set as the operand of the position specified speed/position switching command is used for positioning
Operating speed [pls/s]	1000	Set the operating speed of speed/position switching control
Acc. no.	No1	Set acc. no. used in acceleration (no.1~4)
Dec. no.	No.2	Set dec. no. used in deceleration (no.1~4)
M code	0	Set when you need to execute another auxiliary work based on the position specified speed/position switching control.
Dwell time	500	Set dwell time(ms) needed to output the positioning completion signal after positioning.

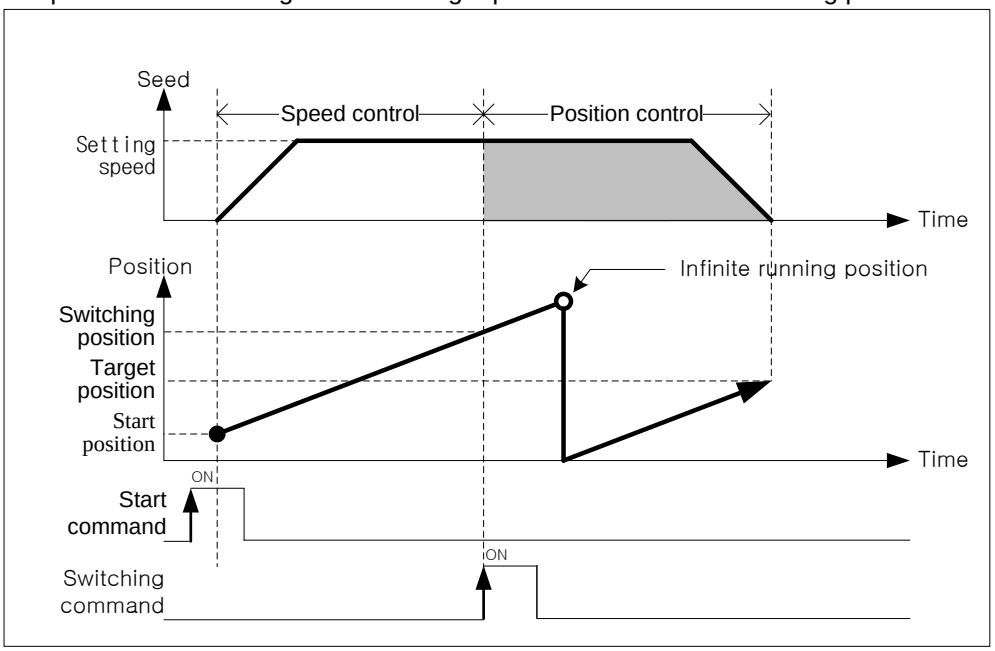
Note

In case speed/position switching coordinate is 1: ABS and target position is smaller than current position, its operation is different according to “infinite running repeat” setting.

1. When infinite running repeat = 0: disable
   - After dec. stop, it goes to the opposite direction and gets to the target position.



2. When infinite running repeat = 0: enable
- It keeps its direction and goes to the target position within infinite running position



9.2.16 Position/Speed Switching Control

The setting axis carries out the position control and is switched from position control to speed control when position/speed switching signal is entered to the positioning module inside, and then it stops by “Dec. stop” or “SKIP operation”, or continues next operation.

(1) Characteristics of Control

(a) Set control method of operating data as “Single axis position control” and change position control to speed control with「Position/Speed Switching」 command

(b) Direction of movement depends on the sign of value and coordinates

■ 「Absolute, Single axis position control」

▪ Starting position < Target position : Positioning in forward direction

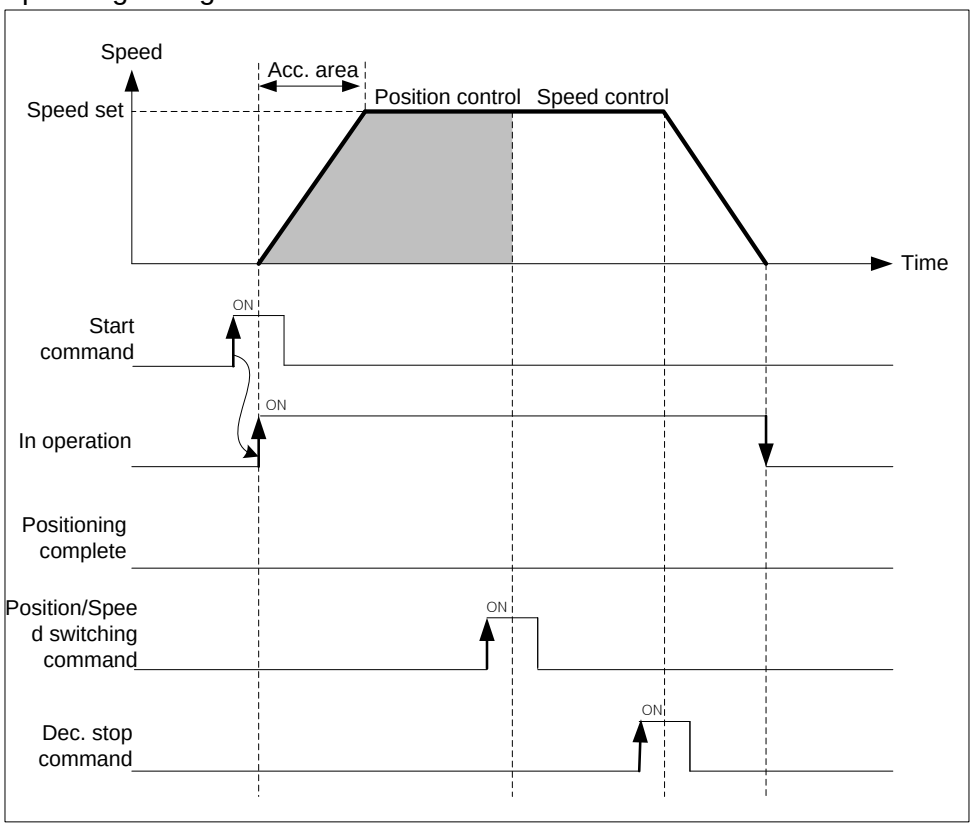
▪ Starting position > Target position : Positioning in reverse direction

■ 「Incremental, Single axis position control」

▪ The value of target position has positive sign (+) : Positioning in forward direction

▪ The value of target position has negative sign (-) : Positioning in reverse direction

(2) Operating timing



(3) Restrictions

(a) If position/speed switching command is not inputted before getting to the target position, it stops and finishes the positioning.

(b) After position/speed switching, software upper/lower limit check during speed control depends on “Soft ware upper/lower limit detect” of extended parameter.

Items	Setting value	Description
Software upper/lower limit detect	0 : Don’t detect	Doesn’t execute checking for software upper/lower limit during speed control
	1 : Detect	Executes checking for software upper/lower limit during speed control

(4) Setting example of operation data

Items	Setting value	Description
Control method	Absolute, Single axis speed control	When executing position/speed switching control, set single-axis speed control
Operating method	Single, End	Set operating method for position control
Target position [pls]	10000	Set the value of target position for position control
Operating speed [pls/s]	1000	Set the operating speed of position/speed switching control
Acc. no.	No.1	Set acc. no. used in acceleration (no.1~4)
Dec. no.	No.2	Set dec. no. used in deceleration (no.1~4)
M code	0	Set when you need to execute another auxiliary work based on the position/speed switching control
Dwell time	500	Set dwell time(ms) needed to output the positioning completion signal after positioning

9.2.17 Position/Torque Switching Control

The setting axis t carries out the position control and is switched from position control to torque control when position/torque switching signal is entered to the positioning module inside, and then it stops by “Dec. stop” or “SKIP operation”, or continues next operation.

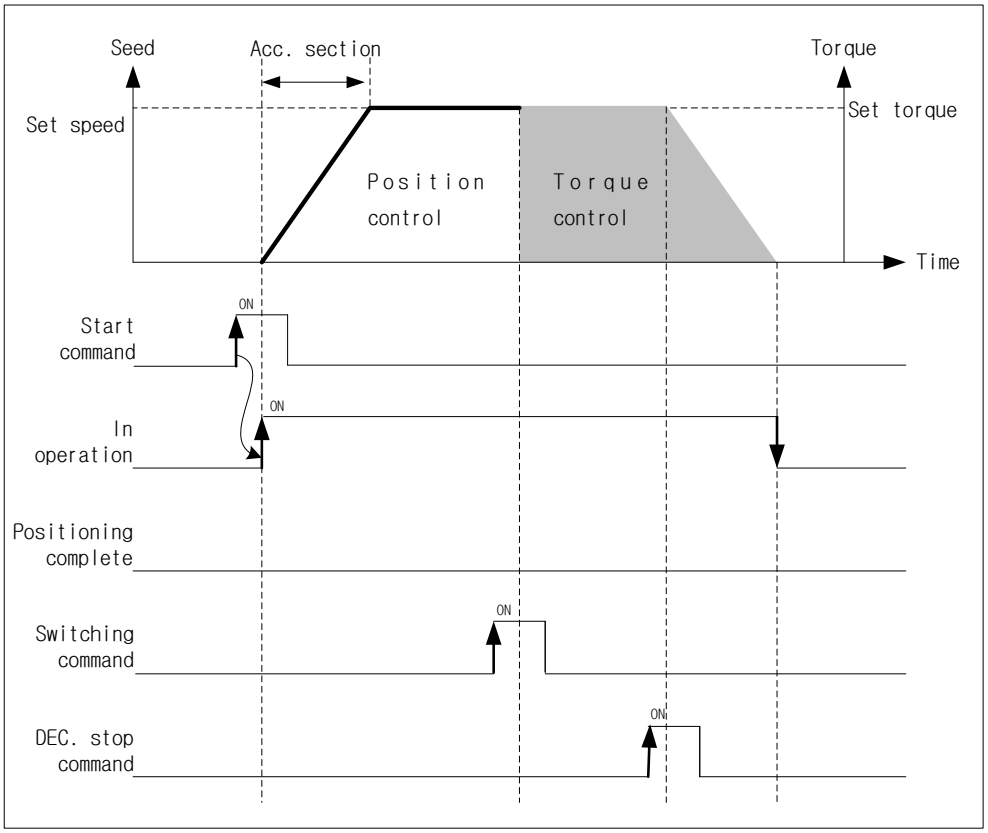
(1) Characteristics of Control

(a) Set control method of operating data as “single-axis position control” and change position control to torque control with「Position/Torque Switching」 command

(b) Direction of movement depends on the sign of torque value, auxiliary data of position/torque switching command

- When torque value is positive value (+) : Positioning in forward direction
- When torque value is negative value (-) : Positioning in reverse direction

(2) Operating timing



(3) Restrictions

(a) If there is no position/torque switching command input until the object gets to the target position, it slows down and stops. Then positioning is complete.

(4) Setting example of operation data

Items	Setting value	Description
Control method	Absolute, Single axis position control	When executing position/torque switching control, set single axis position control
Operating method	Single, End	Set operating method for position control
Target position [pls]	10000	Set the value of target position for position control
Operating speed [pls/s]	1000	Set the operating speed of position/torque switching control
Acc. no.	No.1	Set acc. no. used in acceleration (no.1~4)
Dec. no.	No.2	Set dec. no. used in deceleration (no.1~4)
M code	0	Set when you need to execute another auxiliary work based on the position/torque switching control
Dwell time	500	Set dwell time(ms) needed to output the positioning completion signal after positioning

9.2.18 Start of Positioning

When it stops by stop factor during operation, it can execute positioning again by start. There are general start, Simultaneous start, and point operation in start. When executing start, “In operation” signal have to be “OFF”.

(1) Direct start

(a) Does not use operation data, directly inputs positioning data and performs positioning control.

(b) Setting auxiliary data of direct start.

Setting item	Contents
Target position	Set target position of control.
Operating speed	Set operating speed of control.
Dwell time	Set dwell time(ms) needed to output the positioning completion signal after positioning (0~65535)
M code	Set when you need to execute another auxiliary work based on the operation (0~65535)
Acceleration time No.	Set acceleration number for acceleration. (No.1 ~ No.4)
Deceleration time No.	Set reduction number for deceleration. (No.1 ~ No.4)
Coordinate	Set coordinate of target position.(absolute, incremental)
Control method	Set type of control (0:Position control, 1:Speed control, 2:Feed control, 3: Shortest distance control)

Note

Direct start only can be used when it is single -axis operation. In case of Interpolation operation, use indirect start.

(2) Indirect Start

(a) Starts positioning control by designating step number of operation data saved in positioning module.

(b) Setting auxiliary data of indirect start

Setting item	Contents
Operation step	Set step number of operation data what you want to operate. (0 or 1 ~ 400)

Note

If you set ‘0’ as operation step of Indirect start and carry out command of indirect start, it starts operation step saved in the current step number.

(3) Simultaneous start

(a) According to axis information and step setting, it starts positioning operation data of 2-axis ~8-axis simultaneously.

(b) When you input the stop command, only corresponding axis stops. If you input the start command again, in case Simultaneous start setting step number is current operation step, it starts positioning operation according to incremental coordinate, absolute coordinate.

(c) Condition

In these cases, it can not operate all of the axes set on simultaneous start, because of error.

▪ When error occurs in operation data of any one axis among simultaneous start setting axes.
- Outputs error code to the corresponding axis
- Outputs error code: 297 to the axis where Simultaneous start command is executed.
- All axes set by Simultaneous start don't start.

▪ When setting of simultaneous start command axis is wrong. (Error code : 296)
- Only set command axis (You have to set more than 2 axes.)
- There is an axis not being connected to the network among setting axes.
- When there is linear interpolation or circular interpolation among position data of setting axes, the axis same as simultaneous setting axis is included in sub-axis of corresponding position data

[Example] Executes Simultaneous start of axis 1, axis 2 and axis 3 with the follow settings;

■ Current position of axis 1: 0, Operation step: 1
Current position of axis 2: 0, Operation step: 3
Current position of axis 3: 0, Operation step: 10

■ Example of setting XG-PM

▪ Operation data of axis 1

Step No.	Control method	Operation method	Target position [pls]	Operation speed [pls/s]	Acc. No.	Dec. No.	M code	Dwell time
1	Absolute, single-axis position control	Single, Continuous	1000	1000	1	1	0	0
2	Absolute, single-axis position control	Single, End	1800	800	1	1	0	100

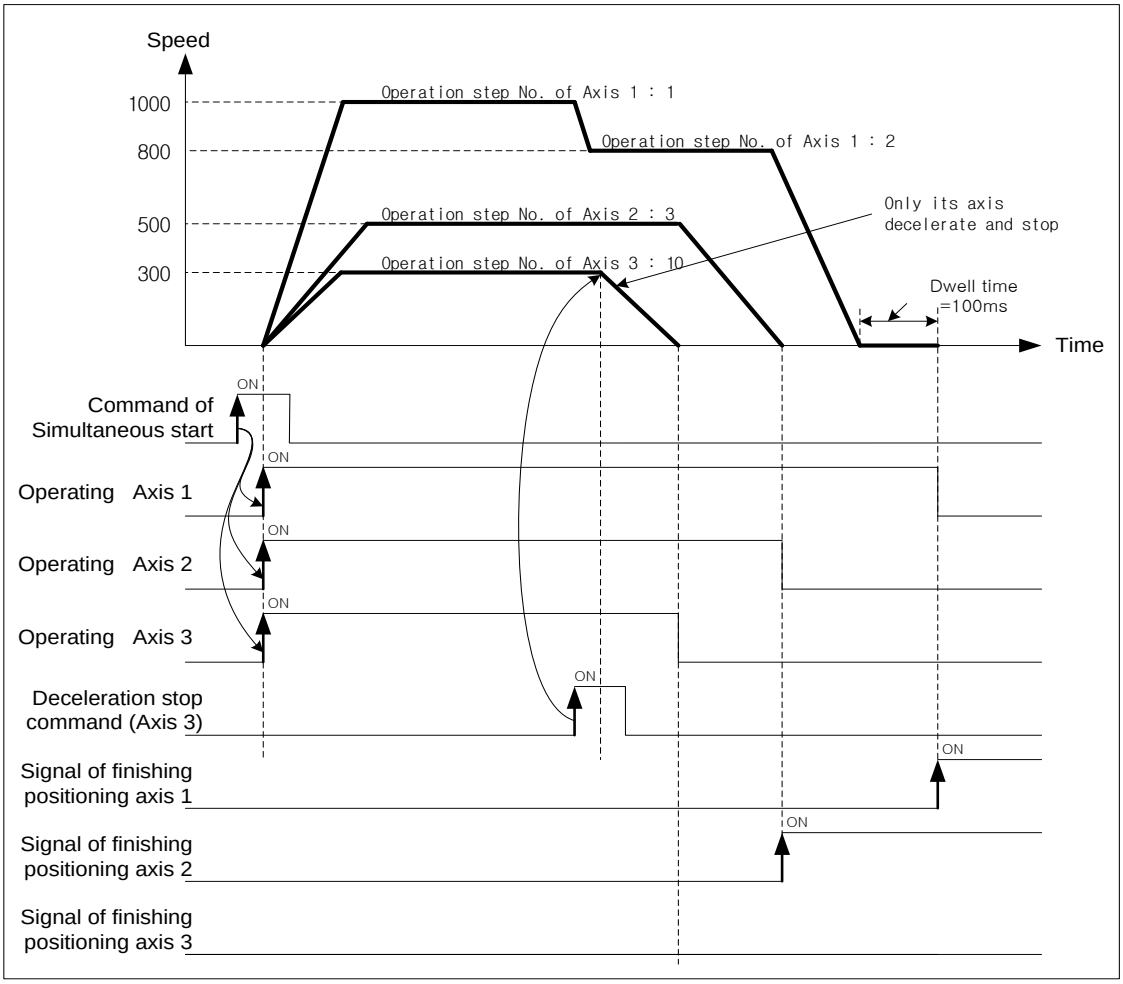
▪ Operation data of axis 2

Step No.	Control method	Operation method	Target position [pls]	Operation speed [pls/s]	Acc. No.	Dec. No.	M code	Dwell time
3	Absolute, single-axis position control	Single, End	900	500	2	2	0	0

▪ Operation data of axis 3

Step No.	Control method	Operation method	Target position [pls]	Operation speed [pls/s]	Acc. No.	Dec. No.	M code	Dwell time
10	Absolute, single-axis speed control	Single, End	1000	300	3	3	0	100

■ Operation pattern



(4) Point operation

(a) Point operation is positioning operation executing operation data of user-specified step number sequentially wit one time start command. That is also known as PTP (Point To Point) start.

(b) You can specify up to 20 steps for point operation.

(c) Executes Point operation as much as the set point number form the set step (Point 1) regardless of operation mode such as End, Keep, continuous. In case of Keep or Continuous operation mode, specify the step which starts first.

[Example] Point operation of axis 1 is as follows;

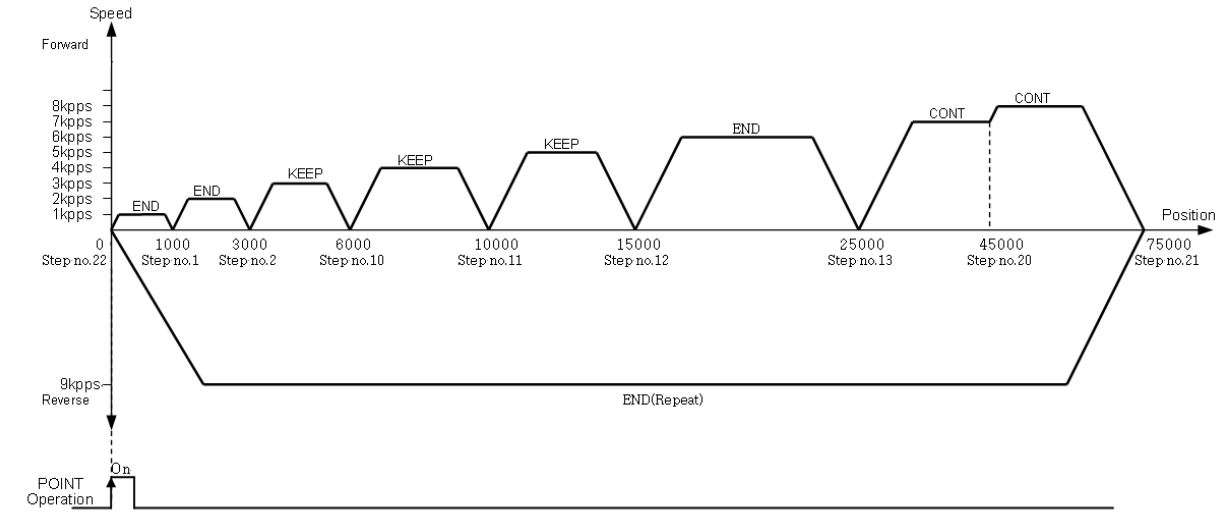
■ The number of point operation: 4

Point operation step No. : 1, 2, 10, 20

Current position of Axis 1 : 0

■ Example of setting XG-PM

Step No.	Control method	Operation method	Target position [pls]	Operation speed [pls/s]	Acc. No.	Dec. No.	M code	Dwell time
1	Absolute, single axis position control	Single, End	1000	1000	1	1	0	20
2	Absolute, single axis position control	Single, End	3000	2000	1	1	0	20
10	Absolute, single axis position control	Single, Keep	6000	3000	1	1	0	20
11	Absolute, single axis position control	Single, Keep	10000	4000	1	1	0	20
12	Absolute, single axis position control	Single, Keep	15000	5000	1	1	0	20
13	Absolute, single axis position control	Single, End	25000	6000	1	1	0	20
20	Absolute, single axis position control	Single, Continue	45000	7000	1	1	0	0
21	Absolute, single axis position control	Single, Continue	75000	8000	1	1	0	0
22	Absolute, single axis position control	Repeat, End	0	9000	1	1	0	0



9.2.19 Positioning stop

Here describes factor which stops axis during operation.

(1) Stop command and Stop factor

Command and Stop factor which stop positioning operating are as follows. Those don't stop all axes and just stop the corresponding axis.

(a) When stop command is "On" or there are some stop factors at each axis, the corresponding axis will stop. But, in case of interpolation control (linear interpolation, Circular interpolation, helical interpolation, elliptic interpolation), when there is a stop command or stop factor on main axis, all axes of interpolation control stop.

Stop factor \ Status		Positioning *1	Home return *2	Jog Operation	Speed synchronous Cam control	Status of axis after stop	Status of "M code On" signal
Parameter setting *3	Exceed soft upper limit	Emg. stop	No Detection	Emg.stop		Error (Error501)	No change
	Exceed soft lower limit	Emg. stop	No Detection	Emg. stop		Error (Error502)	No change
Sequence program *4	Dec. stop command	Dec. stop	Dec. stop	Error 322 (Keeps operating)	Dec. stop *5	Stop status "On"	No change
	Emg. stop command	Emg. Stop				Error (Error481)	"Off"
External signal	External upper limit "On"	Emg. stop		Forward operation, Emg. stop	Emg. stop *6	Error (Error492)	No change
	External lower limit "On"	Emg. stop		Reverse operation, Emg. stop	Emg. stop	Error (Error493)	No change
	External emergency stop "On"	Emg. Stop				Error (Error491) Output inhibited	"Off"
	External stop "On" *7	Dec. stop	Dec. stop	Error322 (Keeps operating)	Dec. stop	Stop status "On"	No change
XG-PM Software	Deceleration stop command	Dec. stop	Dec. stop	Error322 (Keeps operating)	Dec. stop	Stop status "On"	No change
	Emergency stop command	Emg. stop				Stop status "On"	"Off"

Note

*1 : Positioning means position control, speed control, interpolation control, speed/position switching control, position/speed switching control, position/torque control by positioning data.
*2 : After complete homing, DOG and HOME signal do not effect to positioning control.
*3 : Software high/low limit check during speed control operation mode only works when "Software limit detect" is set as "1: detect".
*4 : Sequence program means XGT program type.
*5 : It decelerates according to Dec. stop time, auxiliary data of Dec. stop command, and speed becomes 0.
*6 : It decelerates according to Dec. time for emg. Stop of basic parameter, and speed becomes 0.
*7 : It is valid when the 「External command selection」 of extended parameter is "1: External stop command and 「External command」 is "1:Enable".

(2) Deceleration Stop

(a) If meet emergency stop while operate indirect start, direct start, simultaneous start, start operation, homing operation, inching operation, it will sudden stop.

(b) Deceleration stop command not different at these sections: acceleration section, constant section, deceleration section.

(c) If it is decelerated and stopped by deceleration stop command, will not be completed positioning operation as set target position. And….

- No signal for completely positioning
- M code signal cannot be “On” during “After” mode of “M code” mode.

(d) If it receives order for indirect start command (step No. = current step No.) while it is stop,

- Positioning of absolute coordinate method: Operate amount of the position reminder which it isn’t outputted on the current operation step.
- Positioning of relative coordinate method: Operate as set movement at the target position.

(e) There are two type of deceleration stop: Internal/external deceleration stop.

- Internal deceleration stop command

  It decelerate and stop by XG-PM and「deceleration stop」command of sequence program as set support data.

- External deceleration stop signal

  In case of input signal of external emergency stop/deceleration stop to be “On”, it will be decelerated and stopped by set deceleration time in current positioning operation.

  Have to set item of “select external emergency stop/deceleration stop” of expansion parameter for using input signal of external emergency stop/deceleration stop as external deceleration stop command.

Item	Setting value	Contents
External command selection	0: external speed/position control switching	When there is external command input, it is used as “External speed/position control switching” signal
	1: external stop command	When there is external command input, it is used as “External stop command” signal
External command	0: Disable	External signal is ignored and doesn’t affect the operation.
	1: Enable	Where there is external command input, it is operated as the signal specified “External command selection” item.

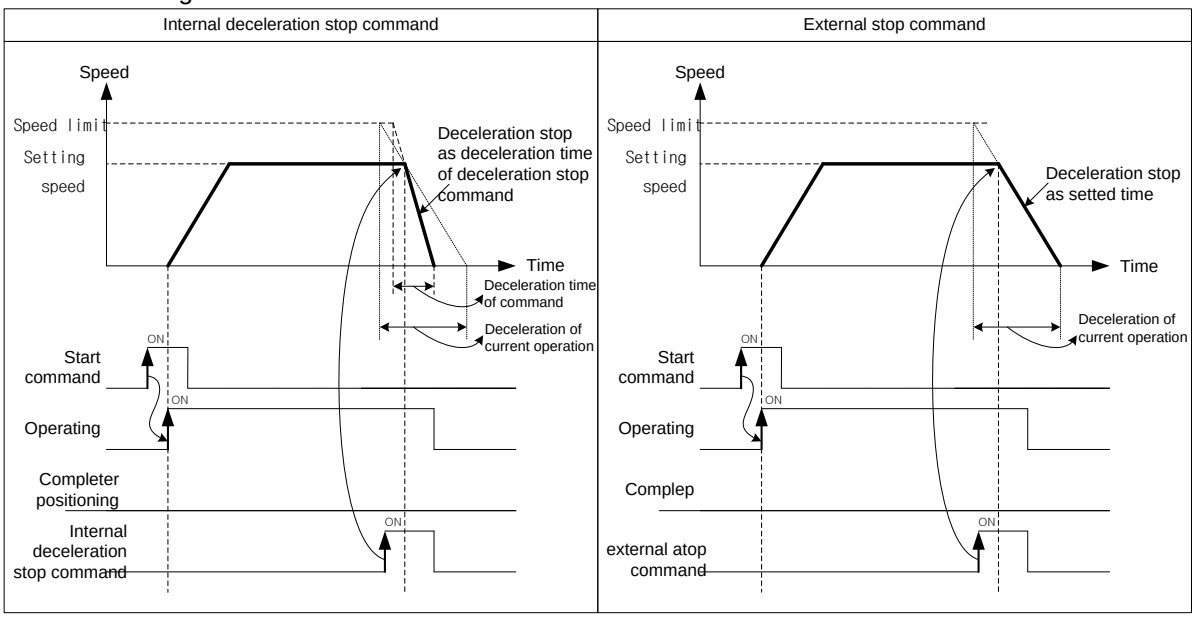
(f) Condition

- When command internal deceleration stop

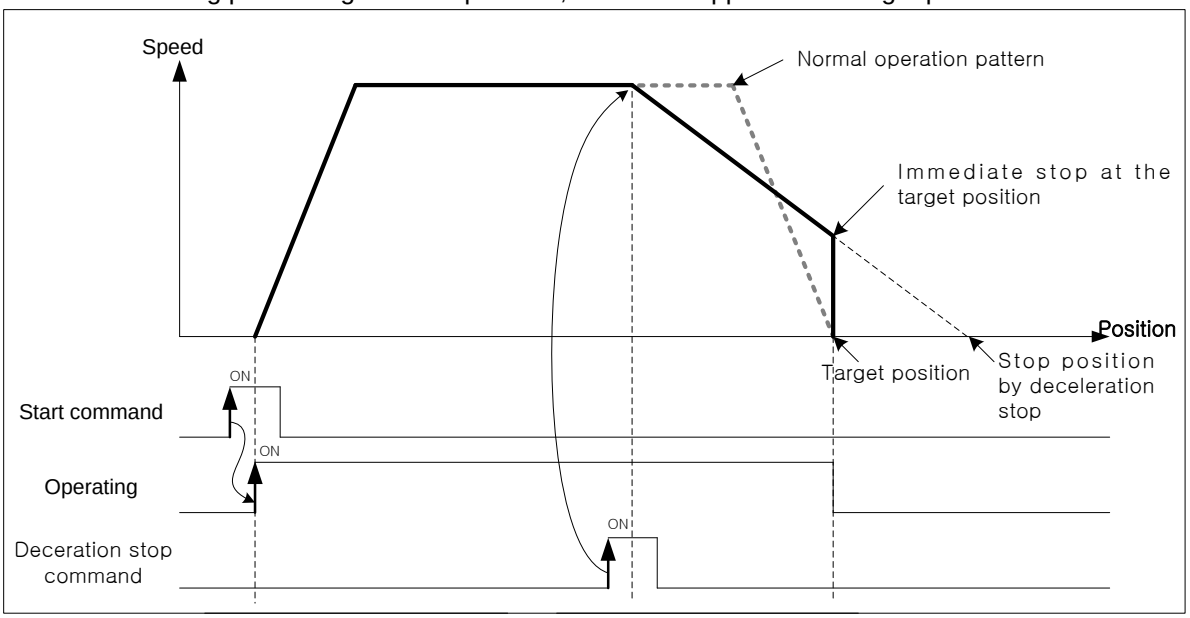
  The value of deceleration time can bigger than set value of deceleration time by auxiliary data.

- If deceleration stop command is inputted while operate Jog, error (error code: 322) will be made. Use “Stop Jog” command for Jog operation stop.
- If Dec. stop command is executed during stop, Dec. stop command will be ignored without error.

(g) Movement Timing



■ If the deceleration distance is longer than distance to target position when input deceleration stop command during positioning control operation, it will be stopped at the target position.



(3) Emergency Stop

(a) It will be decelerated, stopped and occurred error as set time in「deceleration time when it is suddenly stopped」during indirect start, direct start, start at the same time, synch. operation, homing operation, jog operation, inching operation, when it be emergency stopped during operation.

(b) In case of internal emergency stop, error 481 will occur and in case of external emergency stop, error 491 will occur.

(c) M code signal will be "Off" after Emergency stop.

(d) There are two type of Emergency stop: External emergency stop and Internal emergency stop.

▪ Internal emergency stop command

To be decelerated and stopped by「emergency stop」command of XG-PM & Sequence program as set time in「deceleration time when it is suddenly stopped」, and error will be occurred.

▪ External emergency stop signal

In case of inputting signal of external emergency stop/ deceleration stop to be "On", it will be decelerated, stopped and error will be occurred as set time in 「deceleration time when it is suddenly stopped」of basic parameter.

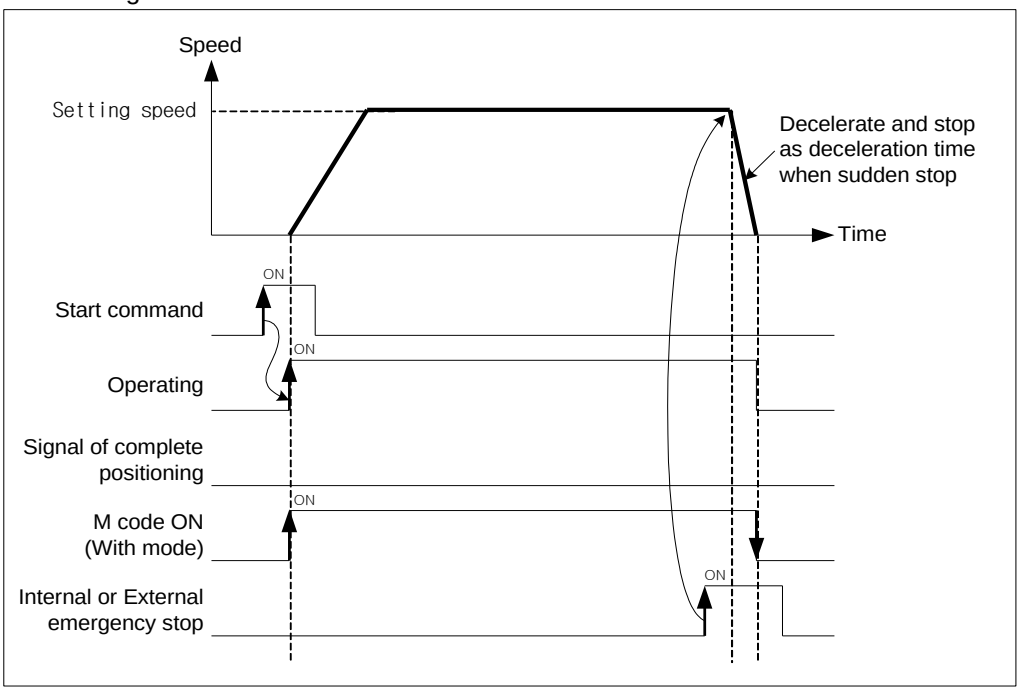
Have to set "select external emergency stop/deceleration stop" of expansion parameter for using signal of inputting external emergency stop/deceleration stop as "external emergency stop command"

Item	Setting value	Contents
Select external emergency stop/ deceleration stop	0 : Emergency stop	Use as "emergency stop" signal when input external signal
	1 : Deceleration stop	Use as "deceleration stop" signal when input external signal

■ Setting related parameter (Basic parameter)

Item	Setting value	Contents
When sudden stop, deceleration time	0 ~ 2147483647 [ms]	Set deceleration time for using when detect hardware high/low limit signal. Deceleration time express needed time for deceleration as bias speed at speed limit, when suddenly stop.

(e) Motion timing



(4) Stop hardware by high/low limit

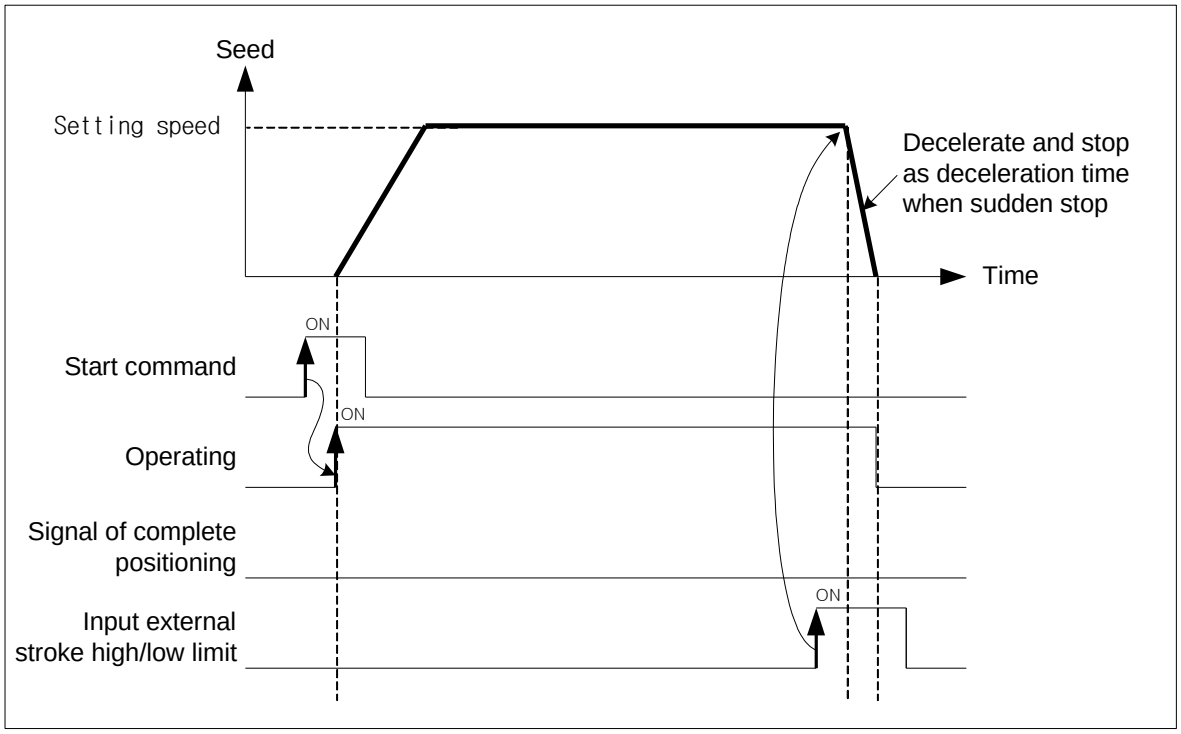
(a) When positioning control, if the signal of hardware high/low limit is inputted, then stop positioning control and it will be decelerated and stopped as set time at 「deceleration time when it is suddenly stopped」, and error will be occurred.

(b) In case of external input stroke high limit error, error 492 will occur and in case of external input stroke low limit error, error 493 will occur.

■ Setting related parameter (basic parameter)

Item	Setting value	Content
When sudden stop, deceleration time	0 ~ 2147483647 [ms]	Set deceleration time for using when detect hardware high/low limit signal. Deceleration time express needed time for deceleration as bias speed at speed limit, when suddenly stop.

(c) Motion timing



(5) Stop by software high/lower limit

(a) When positioning control, if value of current command position out of set value of expansion parameter in 「software high limit」 and 「software low limit」 , it will promptly be stopped without outputting value of command position.

(b) If value of command position to be out of software high limit range, will occur error 501, and if it to be out of software low limit range, will occur error 502.

■ Setting related parameter (expansion parameter)

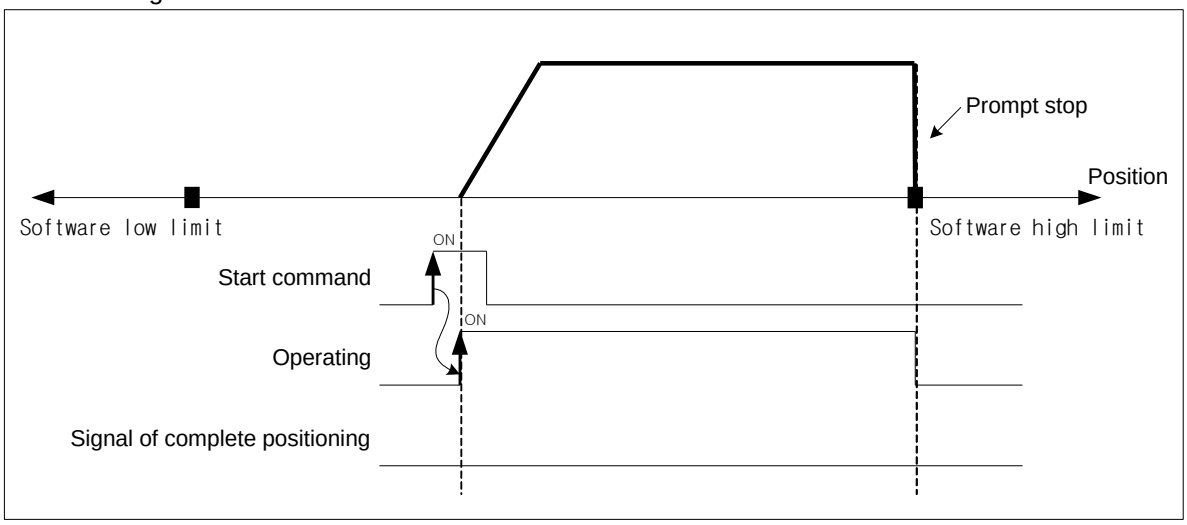
Item	Setting value	Contents
Software high limit	-2147483648 ~ 2147483647	Set position of software high limit.
Software low limit	-2147483648 ~ 2147483647	Set position of software low limit.

(c) Condition

Software high/low limit not to be checked in the following case:

- In case of setting Software high/low limits as maximum (2147483647), minimum (-2147483648)
- In case of “Software high limit = Software low limit”

(d) Motion timing



(6) The priority of stop process

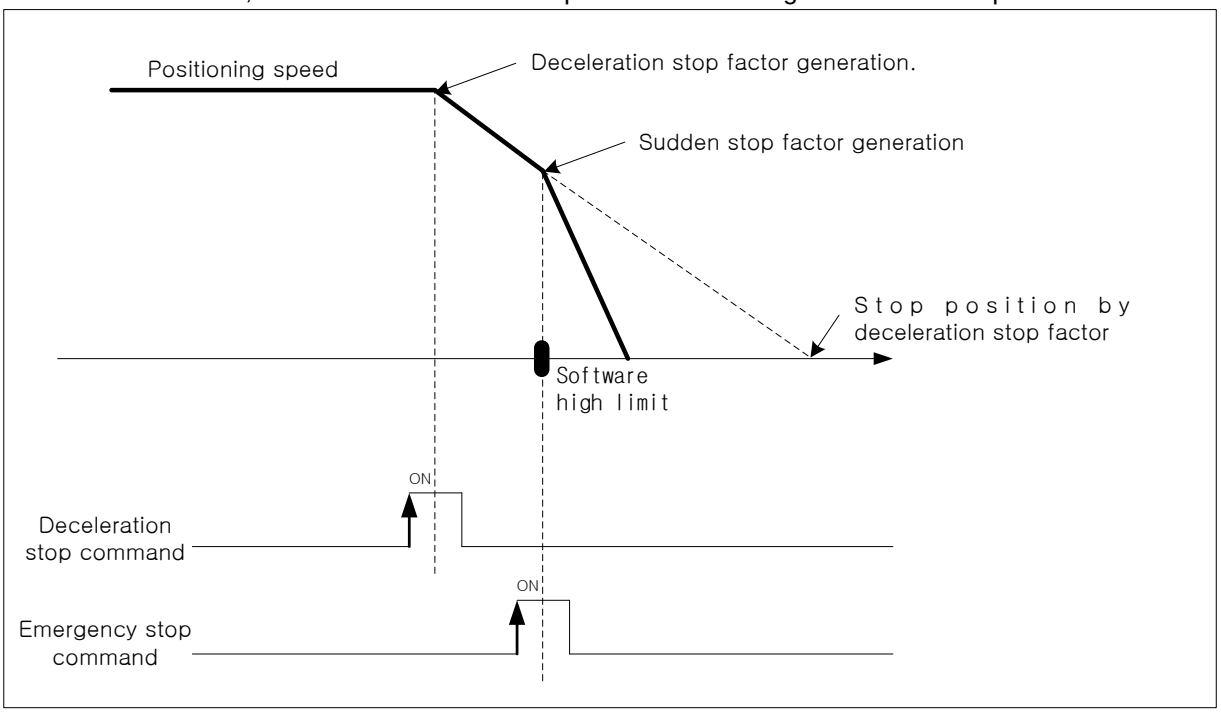
The priority of stop process of positioning module is as follows:

Deceleration stop < Sudden stop

When encounter factor of sudden stop in deceleration stop of positioning, it will be suddenly stopped. In case of sudden top deceleration time bigger than deceleration stop time, it will be decelerated and stopped as set deceleration stop time.

Note

Process is as follows, when factor of sudden stop is occurred during deceleration stop.



The factor of sudden stop : Emergency stop command or software high/low limit

(7) Stop command under interpolation operation

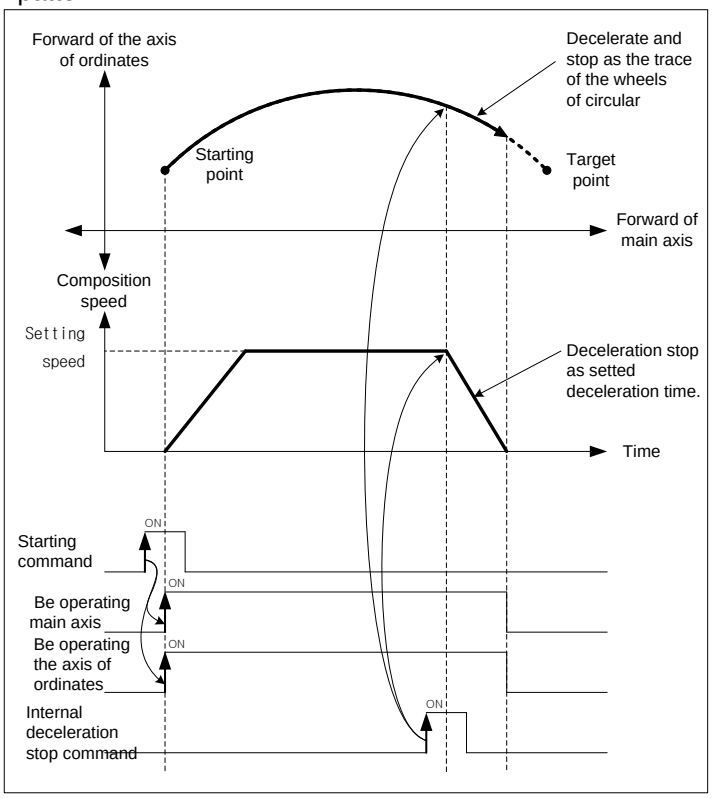
(a) If encounters stop command during interpolation operation (linear interpolation, circular interpolation, helical interpolation, elliptic interpolation), it carries out the deceleration stop. It depends on the trace of wheels of origin.

(b) When it restarts after deceleration stop, indirect start command carries out operation to target position of positioning. And then, operation depends on absolute coordinate and relative coordinate.

(c) Stop command during interpolation operation can external/internal deceleration stop.

(d) Deceleration stop command should be progressed at main axis which is operating for interpolation.

(e) Operation pattern



(8) Restart after Positioning stop

(a) Deceleration stop

When indirect start after deceleration stop, operate positioning as set operation step.

In case of using with mode, Signal “On” of M code has to “Off” for restart.

Signal On of M code have to be changed “Off” by 「Cancellation M code (XMOF)」 command.

(b) Restart after Internal/External emergency stop

In case of emergency stop, signal On of M code will automatically be “Off”, therefore can operate positioning as set operation step, when it operate indirect start.

9.3 Manual Operation Control

Manual control is a function that execute random positioning according to user's demand without operation data Manual operations include Jog operation, Manual pulse generator operation, inching operation, previous position movement of manual operation etc.

9.3.1 Jog Operation

(1) Characteristic of Control

(a) Jog Operation is

▪Execute positioning control at jog high/low speed depending on the signal of high/low speed during forward/reverse jog start signal is being ON.

▪Positioning is started by Jog command from the state that the origin is determined. The value of positioning stars changing, user can monitor it.

▪This is a way of manual operation that can be executed before determination of origin.

(b) Acceleration/Deceleration process and Jog speed

The acceleration/deceleration processing is controlled based on the setting time of Jog acceleration/ deceleration time from XG-PM manual operation parameter setting.

Set the Jog speed on Jog high/low speed of XG-PM manual operation parameter setting.

If Jog speed is set out of the setting range, error will occur and the operation does not work.

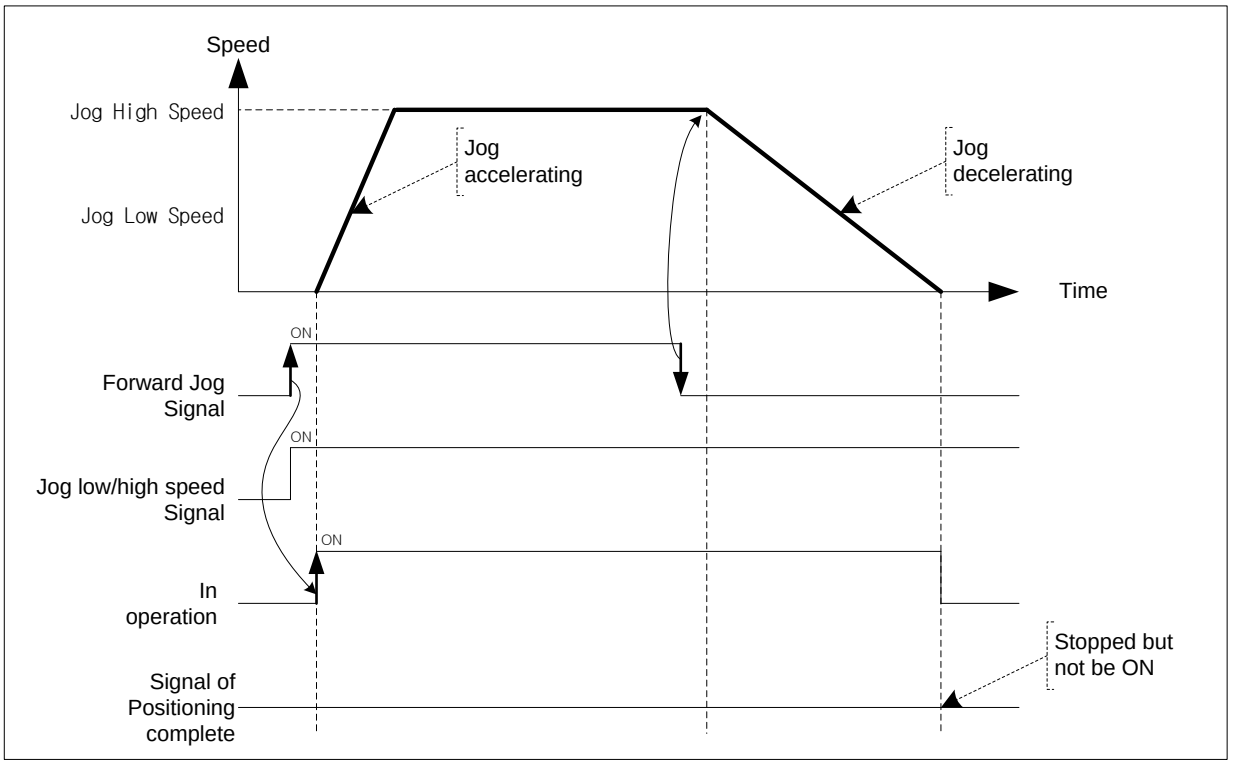
■ Parameter setting (Manual Parameter)

Item	Setting value	Description
Jog High Speed	1 ~ Speed limit	Set Jog speed. Jog high speed must be set below limit
Jog Low Speed	1 ~ Jog High Speed	Set Jog speed. Jog low speed must be set below Jog high speed
Jog Acc. Time	0 ~ 2147483647	Set the acc. Time used in acceleration of Jog operation
Jog Dec. Time	0 ~ 2147483647	Set the dec. time used in deceleration of Jog operation

Note

If "Jog Acc. Time" is 0, it operates at "Acc. Time1" of basic parameter.
If "Jog Dec. Time" is 0, it operates at "Dec. Time1" of basic parameter.

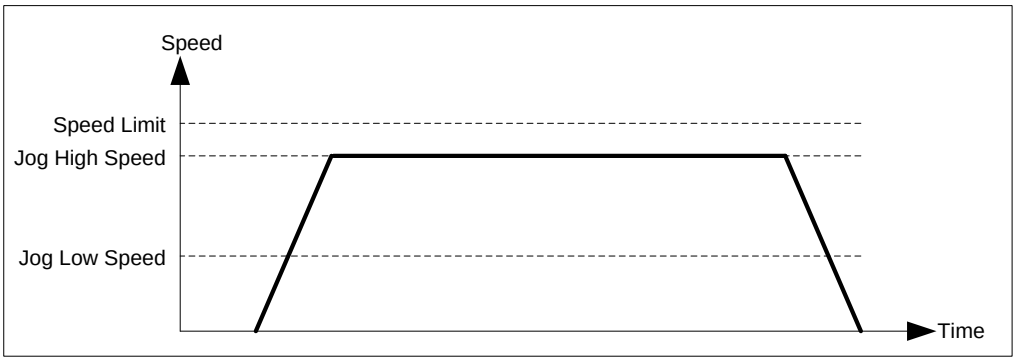
(2) Operation Timing



Note

Notices for setting Jog speed are as follows.

Jog Low Speed ≤ Jog High Speed ≤ Speed Limit



(3) Restrictions

You can not execute Jog operation in the case as follows.

(a) Value of Jog High Speed exceeds the speed limit of basic parameter (Error code : 121)

(b) Value of Jog Low Speed exceeds the value of Jog high speed. (Error code : 122)

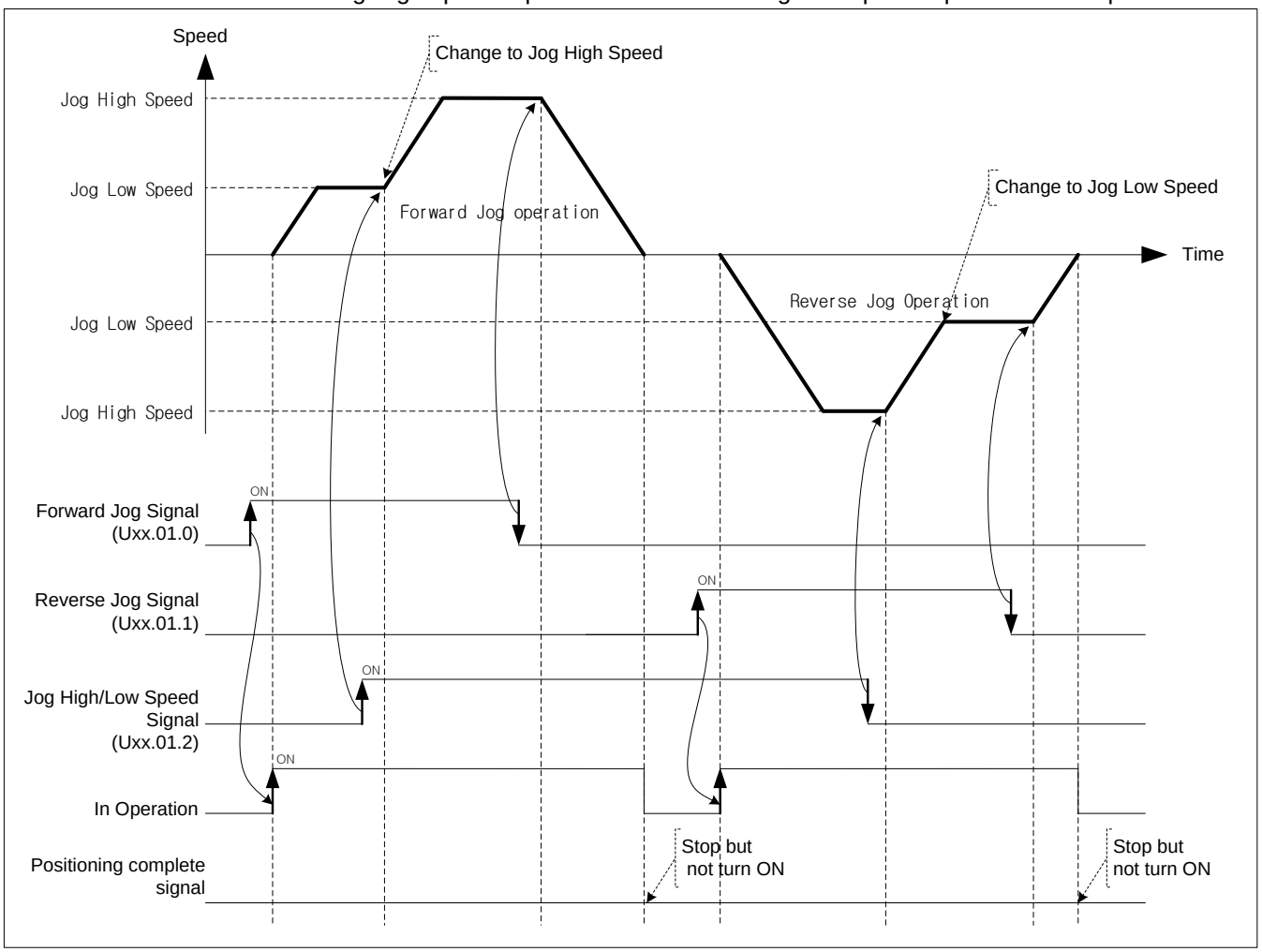
(4) Jog Operation Start

Jog operation start consists of Start by XG-PM and Start by Sequence program. The start by sequence program is that execute Jog operation with output contact of CPU.

Axis	Direction of Signal : CPU -> Positioning module	
	Output Signal	Description
Axis1	UXX.01.0	Axis1 Forward Jog
	UXX.01.1	Axis1 Reverse Jog
	UXX.01.2	Axis1 Jog Low/High Speed
	UXX.01.3	-
Axis2	UXX.01.4	Axis2 Forward Jog
	UXX.01.5	Axis2 Reverse Jog
	UXX.01.6	Axis2 Jog Low/High Speed
	UXX.01.7	-
Axis3	UXX.01.8	Axis3 Forward Jog
	UXX.01.9	Axis3 Reverse Jog
	UXX.01.A	Axis3 Jog Low/High Speed
	UXX.01.B	-
Axis4	UXX.01.C	Axis4 Forward Jog
	UXX.01.D	Axis4 Reverse Jog
	UXX.01.E	Axis4 Jog Low/High Speed
	UXX.01.F	-
Axis5	UXX.02.0	Axis5 Forward Jog
	UXX.02.1	Axis5 Reverse Jog
	UXX.02.2	Axis5 Jog Low/High Speed
	UXX.02.3	-
Axis6	UXX.02.4	Axis6 Forward Jog
	UXX.02.5	Axis6 Reverse Jog
	UXX.02.6	Axis6 Jog Low/High Speed
	UXX.02.7	-
Axis7	UXX.02.8	Axis7 Forward Jog
	UXX.02.9	Axis7 Reverse Jog
	UXX.02.A	Axis7 Jog Low/High Speed
	UXX.02.B	-
Axis8	UXX.02.C	Axis8 Forward Jog
	UXX.02.D	Axis8 Reverse Jog
	UXX.02.E	Axis8 Jog Low/High Speed
	UXX.02.F	-

[Example] Execute Jog start in the order as follows.

■ Forward Jog Low speed Operation -> Forward Jog High speed Operation -> Stop
Reverse Jog High speed Operation -> Reverse Jog Low speed Operation -> Stop



Note

Dec. stop command will not be executed in Jog Operation.
Jog operation will stop if turn the Jog signal of the current operating direction Off.

9.3.2 Inching Operation

This is a kind of manual operation and executing positioning at the speed already set on manual operation parameter as much as the amount of movement already set on the data of inching operation command.

(1) Characteristics of Control

(a) While the operation by ON/OFF of Jog signal is difficult in moving to the correct position as the operation starts and stops according to the command, the inching command enables to set the desired transfer amount easily and reach the goal point.

(b) Thus, it is available to reach the correct goal position by moving fast near the working position by Jog command and operating the detail movement by inching command.

(c) The setting range is –2147483648 ~2147483647 Pulse.

(d) The direction of moving depends on the amount of inching.

■ The amount is POSITIVE(+) : Positioning operation in forward direction

■ The amount is NEGATIVE(-) : Positioning operation in reverse direction

(e) Acc./Dec process and Inching speed

Use Jog acc./dec. Time of manual operation as acc./dec. time of Inching operation.

Set Jog acc./dec. time on “Jog acc./dec. time” of manual operation parameter setting of XG-PM.

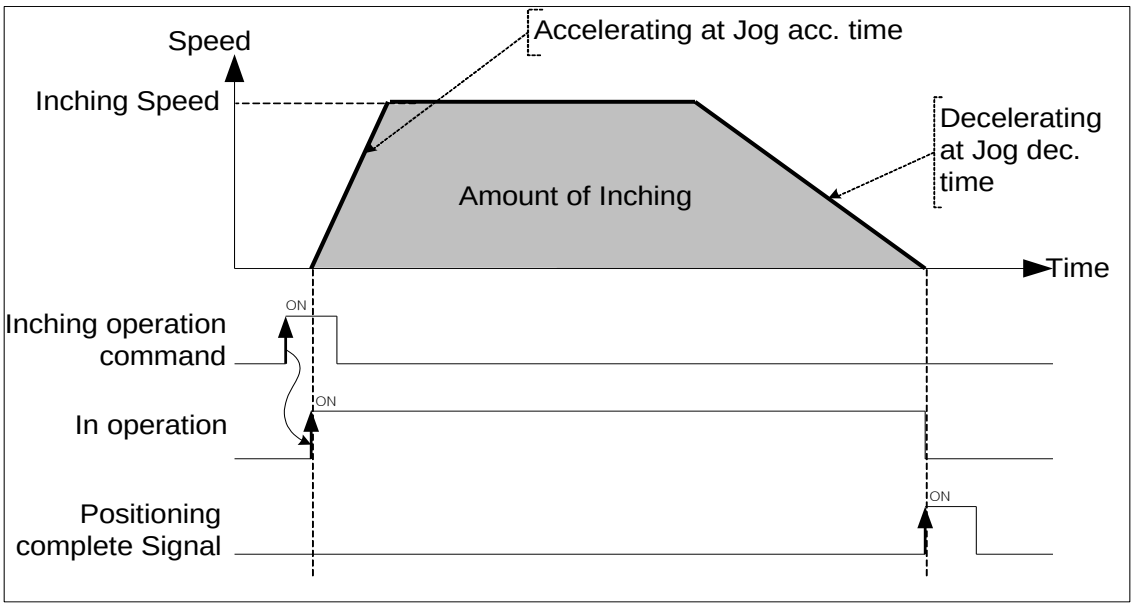
Set Inching speed on “Inching speed” of manual operation parameter setting.

If inching speed is set out of the setting range, error will occur and the operation does not work.

■ Related parameter setting (Manual operation parameter)

Items	Setting value	Description
Jog acc. Time	0 ~ 2147483647	Set the accelerating time for acceleration of Inching operation
Jog dec. Time	0 ~ 2147483647	Set the decelerating time for deceleration of Inching operation
Inching Speed	1 ~ Speed limit	Set the speed of Inching operation

(2) Operation Timing



9.3.3 Return to the position before manual operation

This positioning control function is used to return to the position address that the positioning is completed before manual operation when the position is changed by manual operation (Jog operation, inching operation).

(1) Characteristic of Control

(a) Direction of moving depends on the current position and the previous position of manual operation.

■ Starting position < The previous position of manual operation : Forward direction

■ Starting position < The previous position of manual operation : Reverse direction

(b) Acc./Dec. process and the speed of return

Acc./Dec. time of returning is the same as homing acc./dec. time of homing parameter.

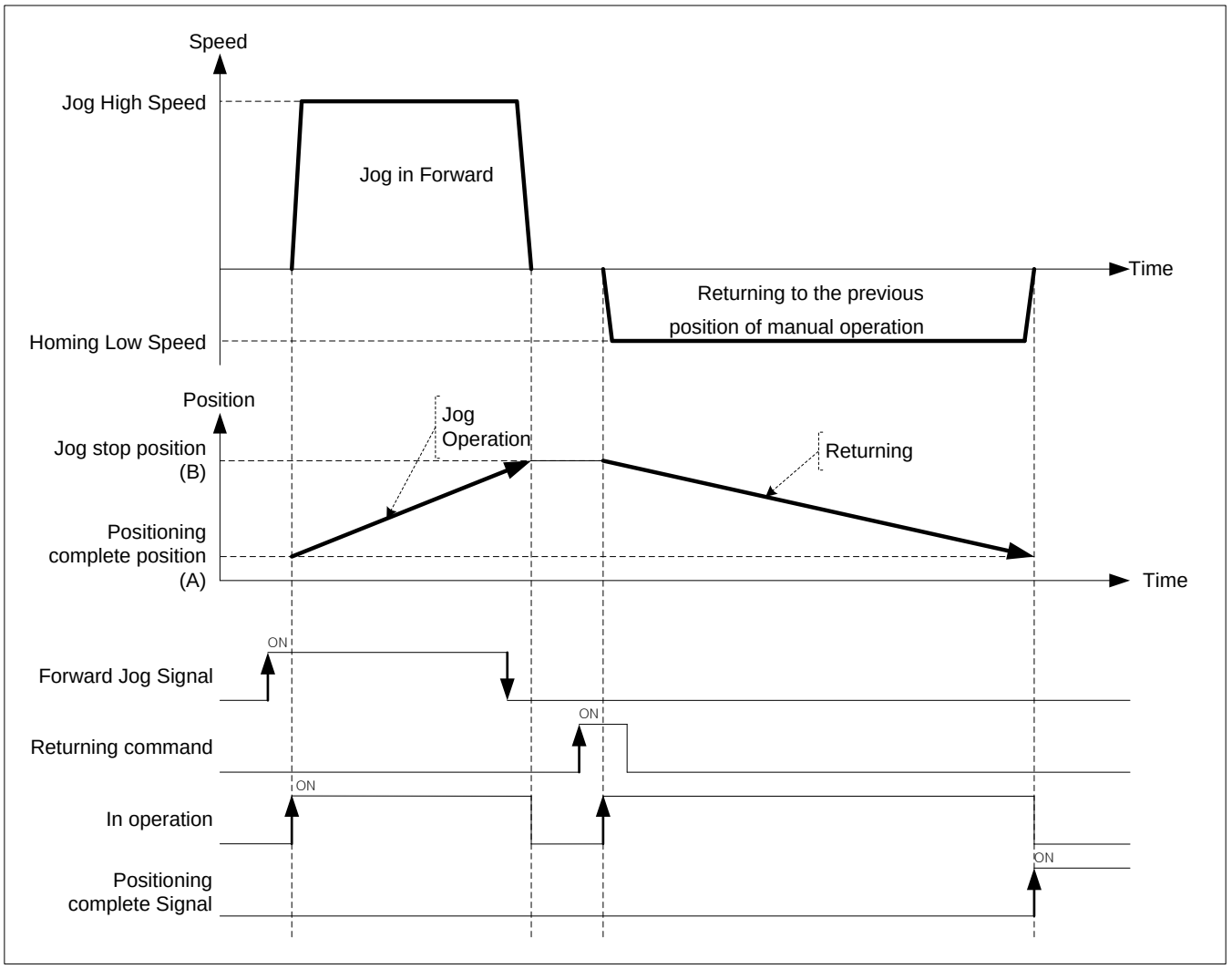
Set acc./dec. time on homing acc./dec, time of homing parameter of XG-PM.

If returning speed is set out of the setting range, error will occur and the operation does not work.

■ Related parameter setting (Manual Operation Parameter)

Item	Setting value	Description
Homing speed	1 ~ Speed limit	Set returning speed
Homing acc. time	0 ~ 2147483647	Set acc. time used in return
Homing dec. time	0 ~ 2147483647	Set dec. time used in return

(2) Operation timing



If value of the current position is “A” after positioning control operation and the positioning value changed by Jog operation is “B”, execute positioning to “A” when executing the returning to the previous position of manual operation.

9.4 Synchronous Control

This is the command that control the operation synchronizing with the main axis or operating of encoder.

9.4.1 Speed Synchronous Control

This is the command that synchronize with sub axis in speed and control operation depending on speed synchronous rate already set when main axis starts.

(1) Characteristic of Control

(a) Start and Stop is repeated depending on operating of main axis after execution of speed synchronous command. The operating direction of sub axis and the main's are same.

(b) The operating direction of sub axis depends on the ratio of speed sync. $(\frac{SubAxis}{MainAxis})$. If it is positive, the direction is forward. If it is negative, the direction is reverse.

(c) If execute speed sync. command, it will be the state of operating and remain in the state of speed sync. operation before release of speed sync. command.

(d) Auxiliary data of speed sync. command

The auxiliary data used in speed sync. command is as follows.

Item	Setting value	Description
Main Axis	1(axis1) ~ 8(axis8), 9(Encoder1), 10(Encoder2)	Set the main axis of speed sync.
Ratio of Main axis	-32768 ~ 32767	Set the ratio of main axis at speed sync. ratio.
Ratio of Sub axis	-32768 ~ 32767	Set the ratio of sub axis at speed sync. ratio..

Ratio of Speed sync. is calculated as follows.

$$Ratio = \frac{SubAxis}{MainAxis}$$

It is possible to set like "Ratio of Main axis(Absolute) < Ratio of Sub axis(Absolute)" at setting ratio of speed sync.

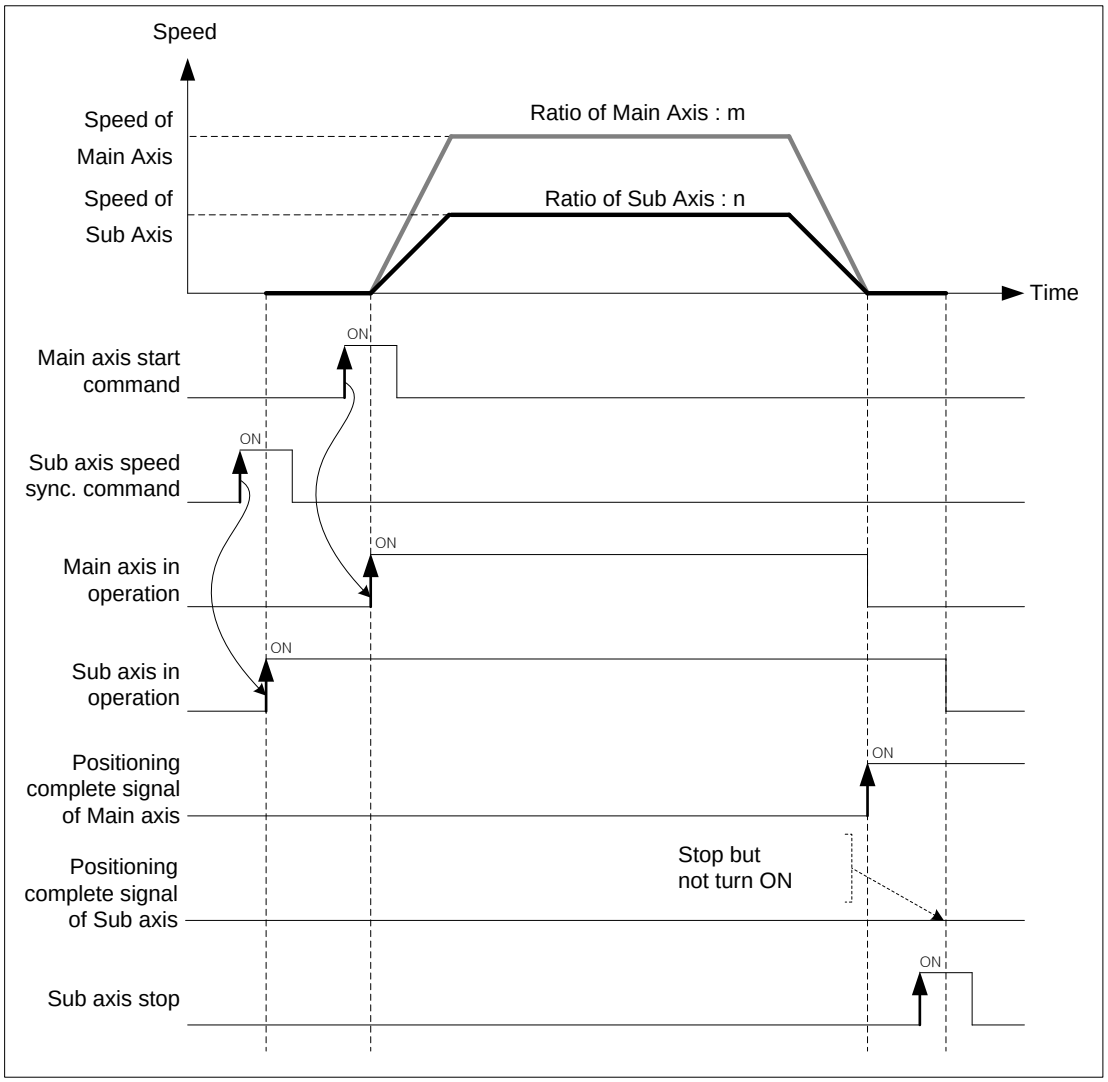
Operating speed of sub axis is calculated as follows.

$$Operaing\ \ speed\ \ of\ \ SubAxis\ = Operating\ \ Speed\ \ of\ \ MainAxis \times Ratio\ \ of\ \ speed\ \ sync.$$
$$= Operating\ \ Speed\ \ of\ \ MianAxis \times \frac{Ratio\ \ of\ \ SubAxis}{Ratio\ \ of\ \ MainAxis}$$

(e) Modifying the ratio of speed sync. in operation is available.

When modify the ratio, if there is too big gap between the former ratio and the current ratio, the machine is possible to be damaged.

(2) Operation Timing



(3) Restrictions

You can not execute Jog operation in the case as follows.

(a) If speed sync. is executed in being On of M code signal, error (code:353) arises. Make M code “off” with M code release command (XMOF) before use.

(b) In the case that the axis set as main axis is not the axis can be set or the case that the setting of main axis is the same as the setting of command axis, error (code”355) arises. Set the main axis among the axis available to be set.

(c) If the speed of main axis exceeds the speed limit, error (code:357) arises. In the case, the speed of main axis has to be down below the speed limit.

In the case that the speed of main axis exceeds the speed limit, error arises and it decelerate in “Dec. time of “emergent stop”.

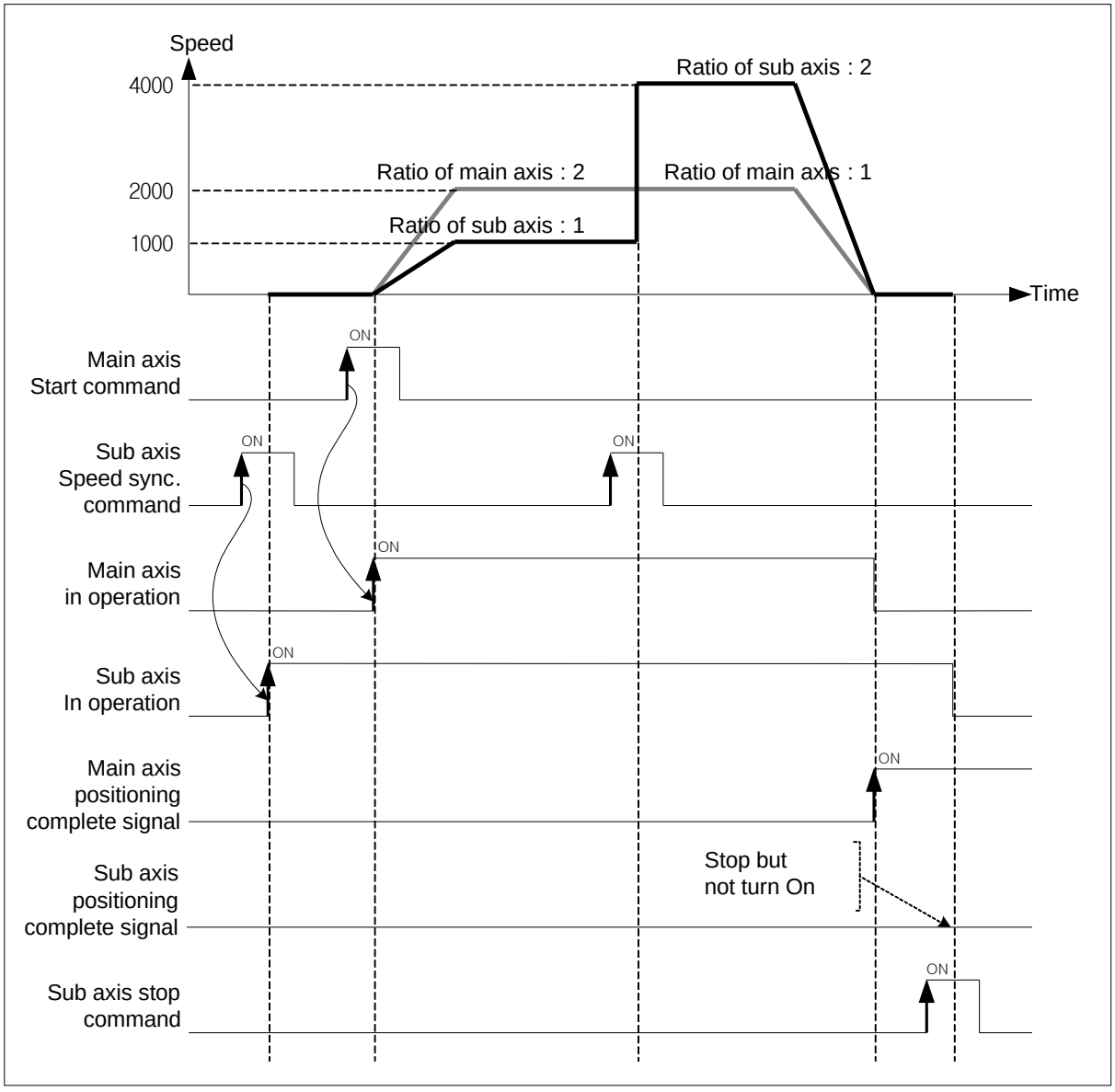
[Example] axis1 is main axis, axis2 is sub axis. Operate at "ratio of main axis : ratio of sub axis = 2 : 1" at the beginning and then execute speed sync. control changing the ratio to "ratio of main axis : ratio of sub axis = 1 : 2"

■ Example of setting in XG-PM

▪Operation data of main axis(axis1)

Step no.	Control method	Operation method	Goal Position [pls]	Operating speed [pls/s]	Acc. no.	Dec. no.	M code	Dwell Time
1	Incremental, Reduction position control	Single, End	10000	2000	No. 1	No. 1	0	0

■ Operating pattern



(4) Speed synchronous control with encoder

(a) Set encoder as the main axis of speed sync. and execute positioning control by ratio of speed sync. that consists of pulse speed from encoder, ratio of main axis and ratio of sub axis.

(b) This command is used in the case that executing thorough positioning manually.

(c) After executed speed sync. command, when the pulse string is inputted, speed sync. control starts.

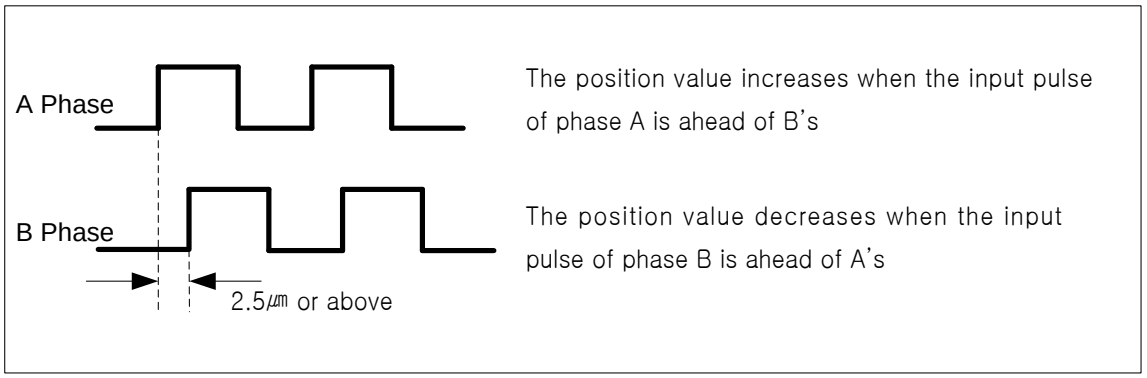
(d) Operate regardless of the state of origin.

(e) The pulse inputted by encoder increase of decrease the position value of encoder.

(f) The direction of moving depends on encoder pulse input mode and ratio of speed sync,

■ Positioning in forward direction : Input pulse of A phase is ahead of B's

■ Positioning in reverse direction : Input pulse of B phase is ahead of A's



- The operating direction of sub axis depends on $Ratio\ of\ speed\ sync.(\frac{Ratio\ of\ SubAxis}{Ratio\ of\ MainAxis})$. If it is positive, operating direction will be forward direction of encoder. If it is negative, operating direction will be reverse direction of encoder.

(g) Related parameter (Common Parameter)

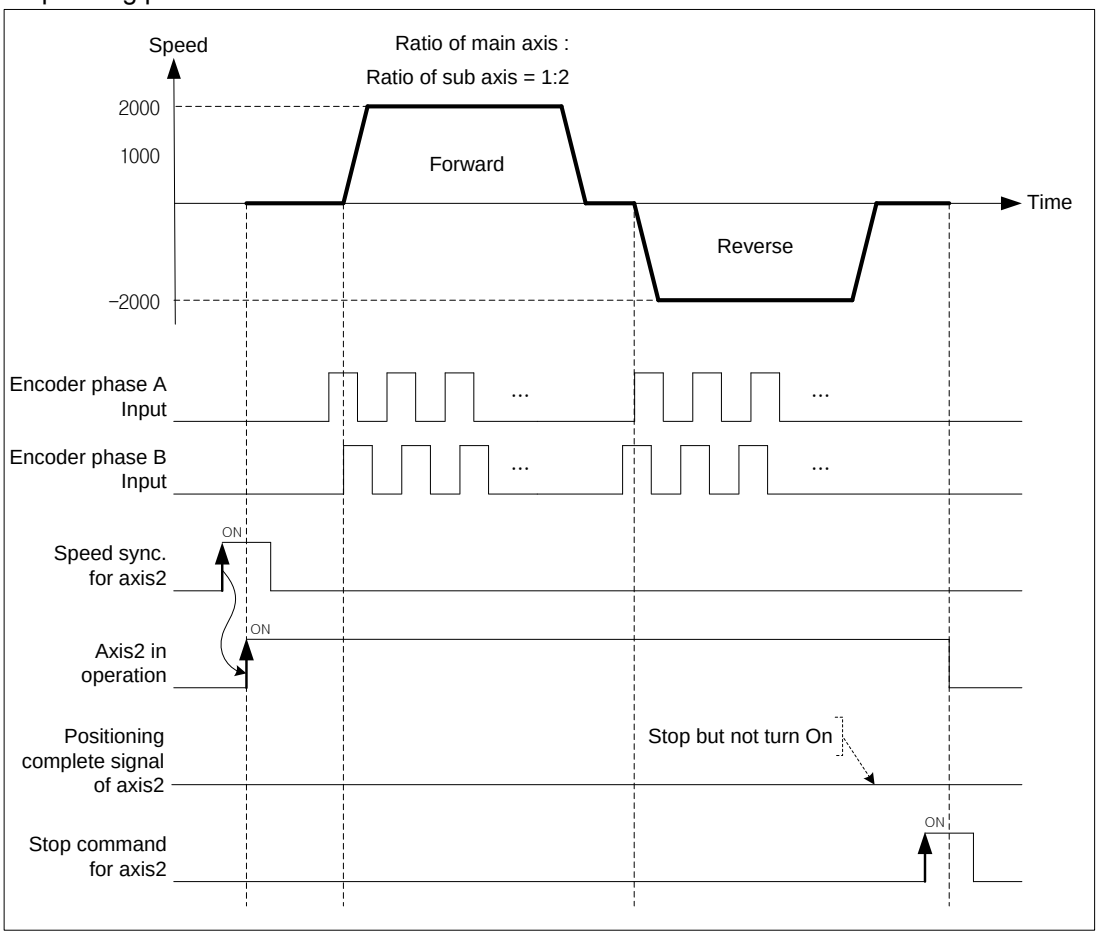
Set parameter related to encoder on common parameter.

Item	Setting Value	Description
Encoder1 Pulse Input	0 : CW/CCW 1 multiplying 1 : PULSE/DIR 1 multiplying 2 : PULSE/DIR 2 multiplying 3 : PHASE A/B 1 multiplying 4 : PHASE A/B 2 multiplying 5 : PHASE A/B 4 multiplying	Set the encoder type to be used as input of encoder1
Encoder1 Z phase clear	0: Disable 1: Enable	Set whether to use Z phase input of Encoder1 as counter clear signal or not
Encoder2 Pulse Input	0 : CW/CCW 1 multiplying 1 : PULSE/DIR 1 multiplying 2 : PULSE/DIR 2 multiplying 3 : PHASE A/B 1 multiplying 4 : PHASE A/B 2 multiplying 5 : PHASE A/B 4 multiplying	Set the encoder type to be used as input of encoder2
Encoder2 Z phase clear	0: Disable 1: Enable	Set whether to use Z phase input of Encoder1 as counter clear signal or not
Encoder1 max. value	-2147483647 ~ 2147483647	With encoder1 max. and min. value, it sets the count range
Encoder1 min. value	-2147483647 ~ Encoder1 max. value	
Encoder2 max. value	-2147483647 ~ 2147483647	With encoder2 max. and min. value, it sets the count range
Encoder2 min. value	-2147483647 ~ Encoder2 max. value	

[Example] Execute speed sync. control with encoder (main axis), axis2(sub axis) at "the ratio of main axis : the ratio of sub axis = 1 : 2".
(Hypothesize that the input speed of encoder is 1Kpps)

When the direction of encoder is forward, the operating direction of sub axis is reverse. When the direction of encoder is reverse, the operating direction of sub axis is forward.

■ Operating pattern



(5) Position-specified speed sync. control

(a) The basic operation of positioning speed sync. control is similar to speed synchronization. After executing positioning speed sync. command, start and stop are repeated depending on operation of main axis. The direction of sub axis and the direction of main axis are same.

(b) The operating direction of sub axis depends on $Ratio\ of\ speed\ sync.(\frac{Ratio\ of\ SubAxis}{Ratio\ of\ MainAxis})$. If it is positive, operating direction will be forward direction of main axis. If it is negative, operating direction will be reverse direction of main axis.

(c) If give speed sync. command to sub axis, it will be changed to the operating state and stay at operating state until release command.

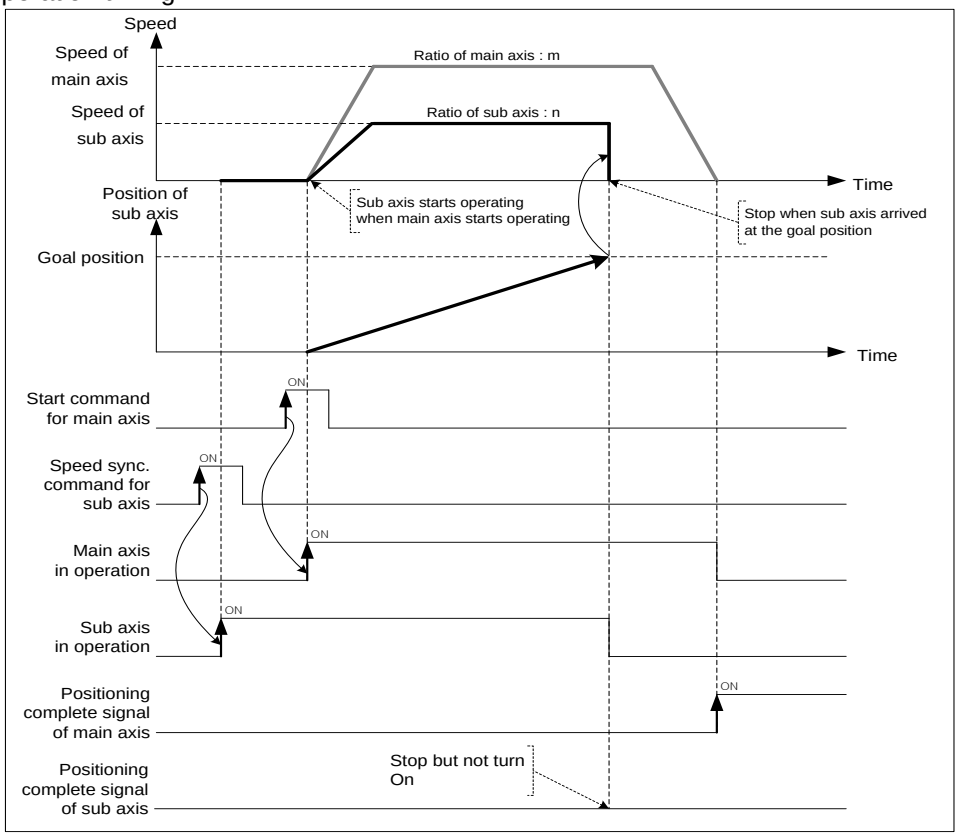
(d) If the current position of sub axis become the goal position, it stops speed sync. and stay there. For the details, refer to “Speed sync. control”.

(e) Auxiliary data of positioning speed sync. command.

The auxiliary data used in speed sync. is as follows.

Items	Setting value	Description
Main axis	1(axis1) ~ 4(axis4), 9(Encoder)	Set main axis
Ratio of main axis	-32768 ~ 32767	Set ratio of main axis
Ratio of sub axis	-32768 ~ 32767	Set ratio of sub axis
Goal position	-2147483648 ~ 2147483647	Set the goal position of positioning speed sync.

(f) Operation timing



9.4.2 Position synchronous control

Start positioning with step no. and operation data when the current position of main axis is same as the position set in position sync.

(1) Characteristics of control

(a) Synchronous Start by Position (SSP) command is carried out only in case that the main axis is in the origin determination state.

(b) SSP command starts by the synchronization of the subordinate axis according to the current position of the main axis.

(c) SSP carries out the SSP command at the subordinate axis.

(d) If SSP command is executed, it becomes the state in operation and the actual operation is carried out at the subordinate axis where the current position of the main axis is the setting position of the position synchronous start.

(e) In case of cancellation after executing the SSP command at the subordinate axis, if you execute the stop command, the SSP command shall be released.

(f) The auxiliary data of position sync. command

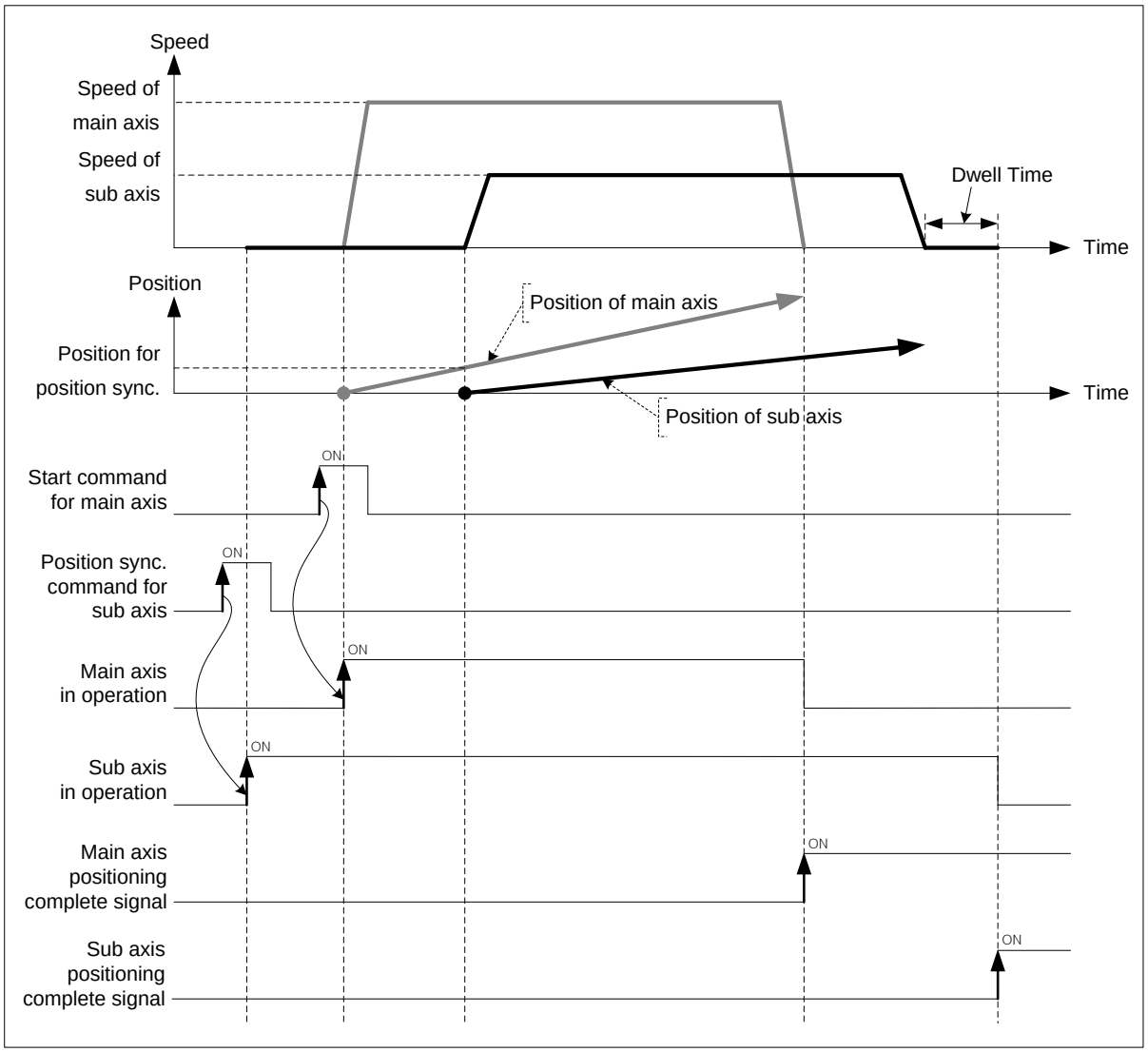
The auxiliary data used in position sync. is as follows.

Items	Setting Value	Description
Position of position sync.	-2147483648 ~ 2147483647	Set the position of main axis in position sync. control
Operation step	1 ~ 400	Set the step no. to be executed when the main axis arrives at the position for position sync.
Main axis	1(axis1) ~ 8(axis8), 9(Encoder1), 10(Encoder2)	Set the main axis of position sync.

Note

Even though the current position of main axis and the setting value set on position sync. are not exactly same, if the current position of main axis is at between the position of main axis of previous scan and the current position of main axis, the sub axis will be executed with the positioning data of step no. set on operation step.

(2) Operation timing



(3) Restrictions

Position sync. control can be executed in the case below.

(a) If position sync. command is executed in M code signal is On, error (code:343) arises. Use it after making M code “Off” with M code release command(XMOF).

(b) If the current main axis is not the axis can be set on the current module or main axis and command axis are the same axis, error (code:355) arises. Set the main axis among one of the axis can be set on module.

[Example] Axis1 is main axis, axis2 is sub axis. The position of main axis for position sync. is 1000, execute position sync. with operation data no.10.

■ The current position of axis1 : 0

The current position of axis2 : 0

■ Example in XG-PM

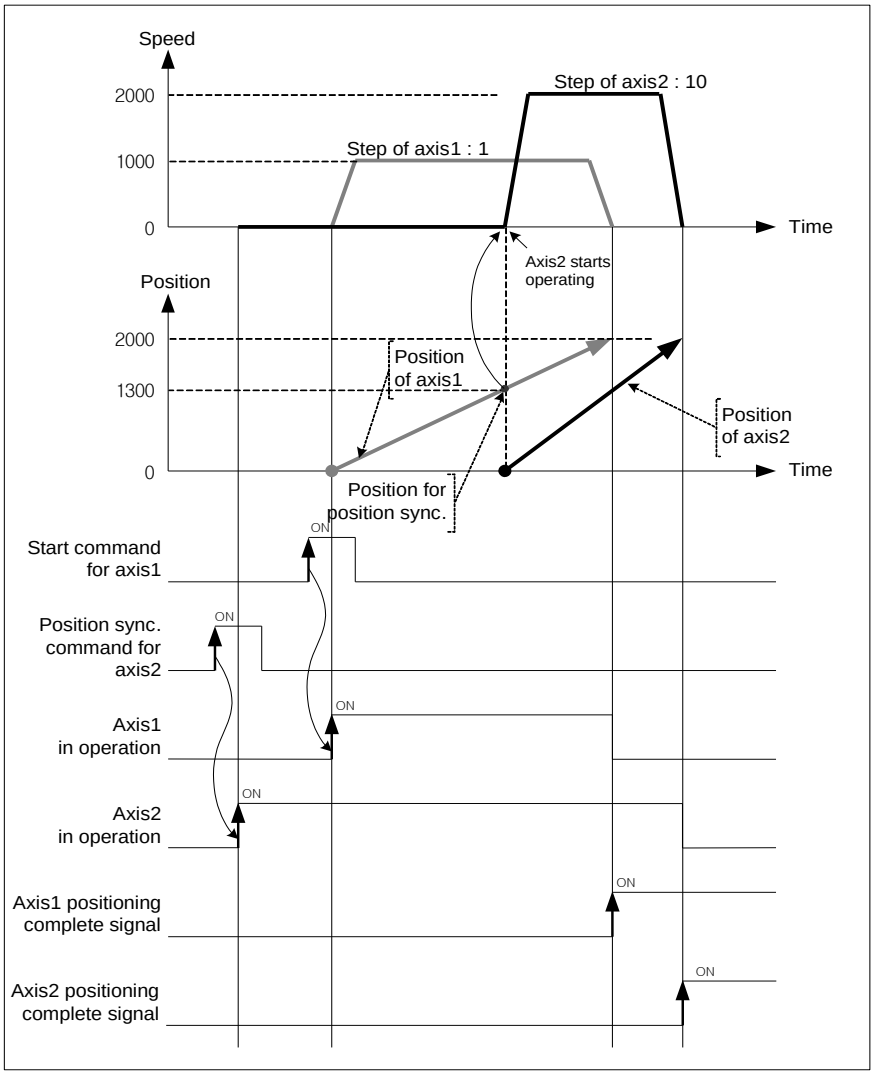
▪ Main axis (axis1) Operation data

Step no.	Control method	Operation	Goal position [pls]	Operating speed [pls/s]	Acc. no.	Dec. no.	M code	Dwell time
1	Incremental, single-axis position control	Single, End	2000	1000	No. 1	No. 1	0	0

▪ Sub axis (axis2) Operation data

Step no.	Control method	Operation	Goal position [pls]	Operating speed [pls/s]	Acc. no.	Dec. no.	M code	Dwell time
10	Incremental, single-axis position control	Single, End	2000	2000	No. 2	No. 2	0	0

■ Operating pattern

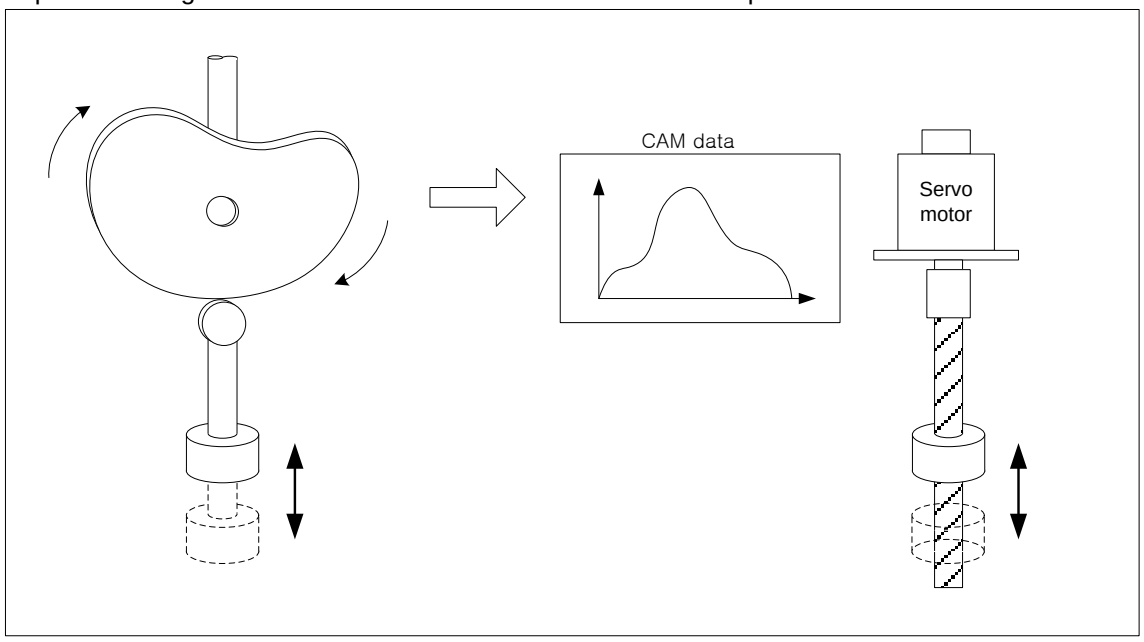


9.4.3 CAM Operation

This is the command that convert mechanical work to CAM data displayed with CAM curve and then execute CAM axis control synchronizing with the position of main motor.

(1) Characteristics of Control

(a) Replace existing mechanical work of CAM with software CAM operation



(b) You may write max. 9 CAM data blocks and apply it to each axis.

(c) Each block consists of 2048 CAM data.

(d) Auxiliary data of CAM command

Auxiliary data used in CAM command is as follows.

Item	Setting value	Description
Main Axis	1(Axis1) ~ 8(Axis8)	Set the main axis of CAM operation
CAM block	1(no.1) ~ 9(no.9)	Set CAM block no.
Main axis offset	-2147483648 ~ 2147483647	Set the position of main-axis position as offset value if main-axis reaches this position, the sub-axis starts CAM operation.

Encoder can not be used as main axis.

You may set different CAM block no. for each axis. In addition, it is possible to execute CAM operation with the same CAM block. In order to use user CAM operation, you have to set up CAM block number as 9.

(e) You can make sub-axis start the CAM operation at the specified position of main-axis by setting the “Main axis offset”. Main axis offset setting is available at “Offset specified CAM start command **(**XCAMO, XPM_CAMO**).**

(f) Create CAM data by setting CAM parameter on XG-PM to use CAM.

(g) After main axis is operated, input the calculated value per CAM block setting and point unit based on the current value per rotation of main axis. For the detail description, refer to “(3) Principle of CAM operation”.

(h) If CAM operation is executed on sub axis, it become ‘operating status’ and keep executing CAM operation with CAM data according to the position of main axis until stop command.

(2) CAM Parameter

The table below describes the parameter items for writing CAM data.

Item		Setting Range	Description
Main/Sub axis parameter	Unit	pulse, mm, inch, degree	Set unit of main/sub axis
	Transfer distance per 1 rotation	Depending on Unit	Set the transfer distance of main/sub axis per 1 rotaiton
	No. of Pulse per 1 rotation	1 ~ 200000000	Set no. of pulse of main/sub axis per 1 rotation
CAM control mode	Control method	Repeat, Increase	Set CAM control method
	Point unit	No. of pulse per 1 rotation	Set the resolution ability of CAM data
CAM block data	Starting position of main axis	Depending on Unit	Set the CAM position of sub axis corresponding to main axis
	Ending position of main axis		
	Starting position of sub axis		
	Ending position of sub axis		
	CAM curve	Straight Line ~ 7th curve	Set the curve of each CAM data step

(a) Main/Sub parameter setting

1) Unit

Set the control unit of main/sub axis. Set the same as the value already set on “Unit” of basic parameter.

Item	Setting Range	Remarks
Unit of main axis	pulse, mm, inch, degree	-
Unit of sub axis	pulse, mm, inch	Degree may not be used.

2) Transfer distance per 1 rotation

Set the transfer distance per 1 rotation of main/sub axis. The unit of transfer distance is according to 1).

If the unit is “mm” or “inch”, this value is the maximum last position of main/sub axis.

Transfer distance per 1 rotation is depending on unit.

■ Setting range for transfer distance per 1rotation

Unit	Setting Range	Remarks
pulse	-	No need to set
mm	0.1 ~ 20000000.0 um	The maximum last position of main/sub axis
inch	0.00001 ~ 2000.00000 inch	The maximum last position of main/sub axis
degree	360.00000 Fixation	No need to set The maximum last position of main/sub axis

3) No. of pulse per 1rotation

Set the no. of pulse per 1rotation of main/sub axis.

If the unit is “pulse”, the value is the maximum last position of main/sub axis.

(b) CAM control mode setting

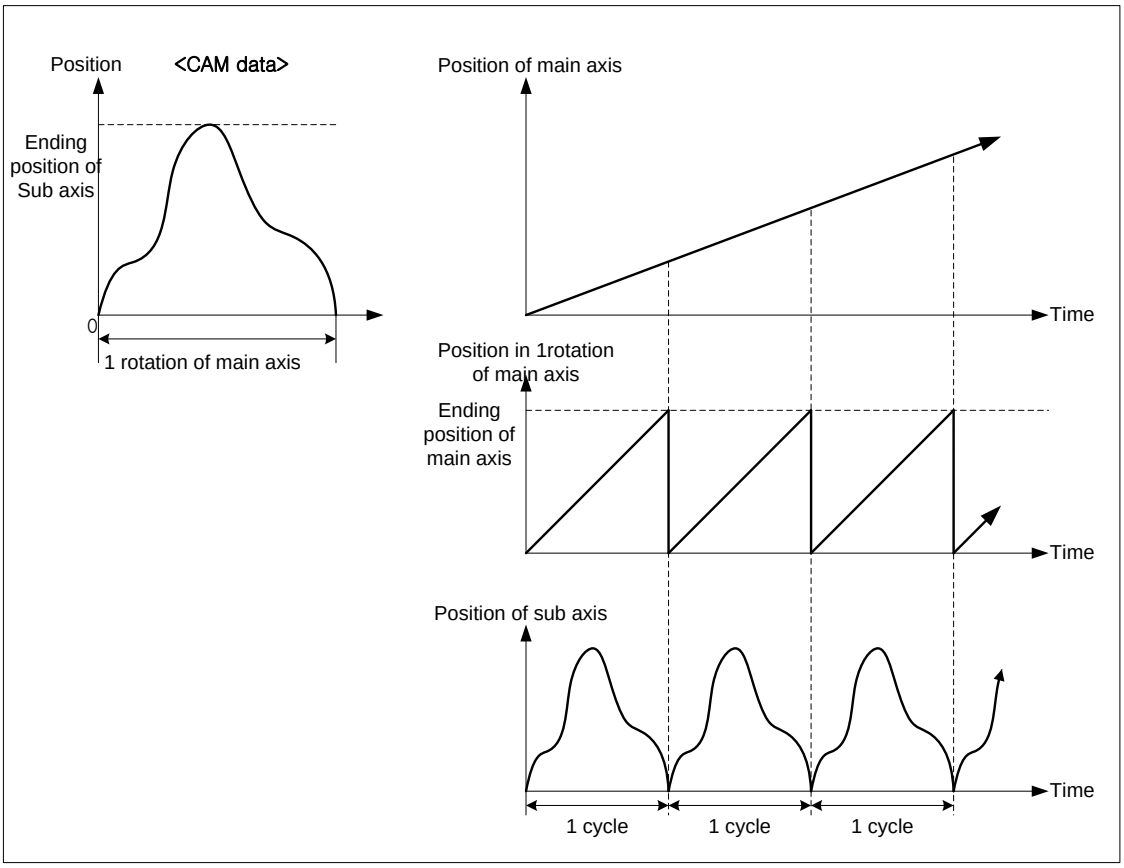
1) Control method

Set the form of CAM repeat pattern. “Repeat mode” and “Increase mode” may be set.

▪ Repeat (Two-way mode)

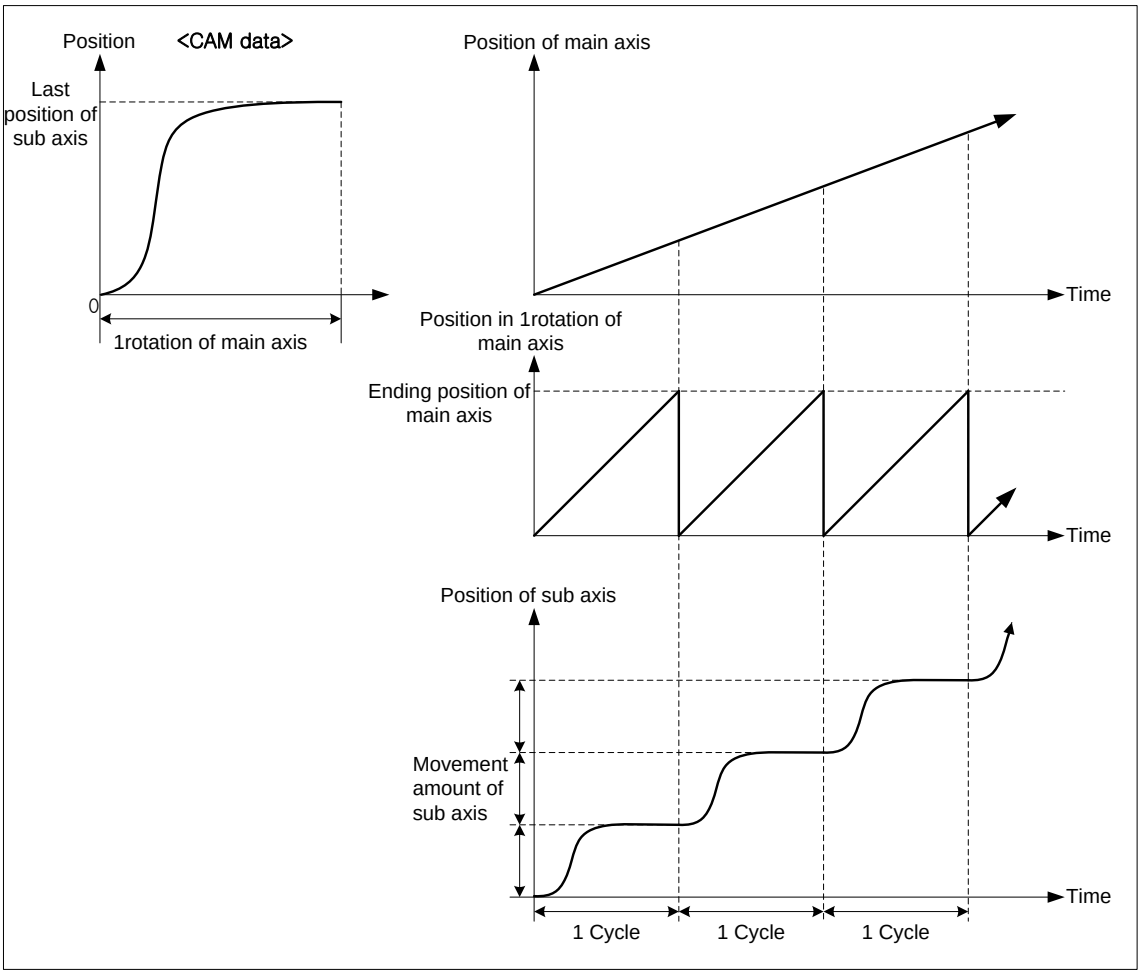
Execute round-trip motion repeatedly in the range already set from starting position of sub axis to ending position according to the position of main axis in 1 rotation.

When CAM data is created in repeat, the ending position of the last step of sub axis user last set must be set as 0.



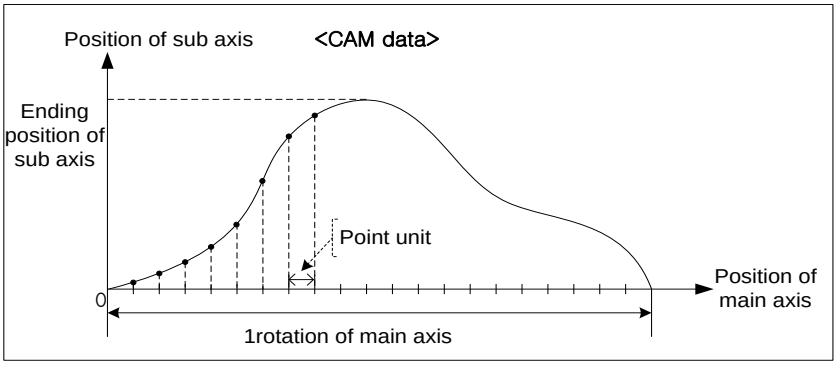
▪ Increase (Feed mode)

Execute CAM operation from starting position of sub axis to ending position according to the position in 1rotation of main axis.



2) Point unit

Set the resolution ranging from starting position of main axis to ending position of main axis on each step data of CAM block data setting. When CAM data is created, calculate the position of sub axis corresponding to the position of main axis from the starting position of main axis by point unit. The smaller point unit is, the more no. of CAM data is, so you may execute much smoother CAM operation. However, if point unit is small, no. of CAM data exceeds 2048, so there is a chance that user can not create CAM data.



Note

When set CAM block data after point unit setting, “Ending position of main axis” must be set as positive multiple number of point unit. For example, if the unit of main axis is “degree” and point unit is 10, “Ending position of main axis” must be set as multiple number of 10 like 40, 90, 180, ···.

(c) CAM block data setting

20 data sections may be set in a CAM block and every section may have specific curve.

1) Starting position of main axis

Set the starting position of main axis in designated section. Starting position of main axis is the same as the ending position of main axis in previous section.

2) Ending position of main axis

Set ending position of main axis in designated section. The ending position of main axis in the last section must be set as much as the transfer distance per 1rotation set on main/sub axis parameter.

3) Starting position of sub axis

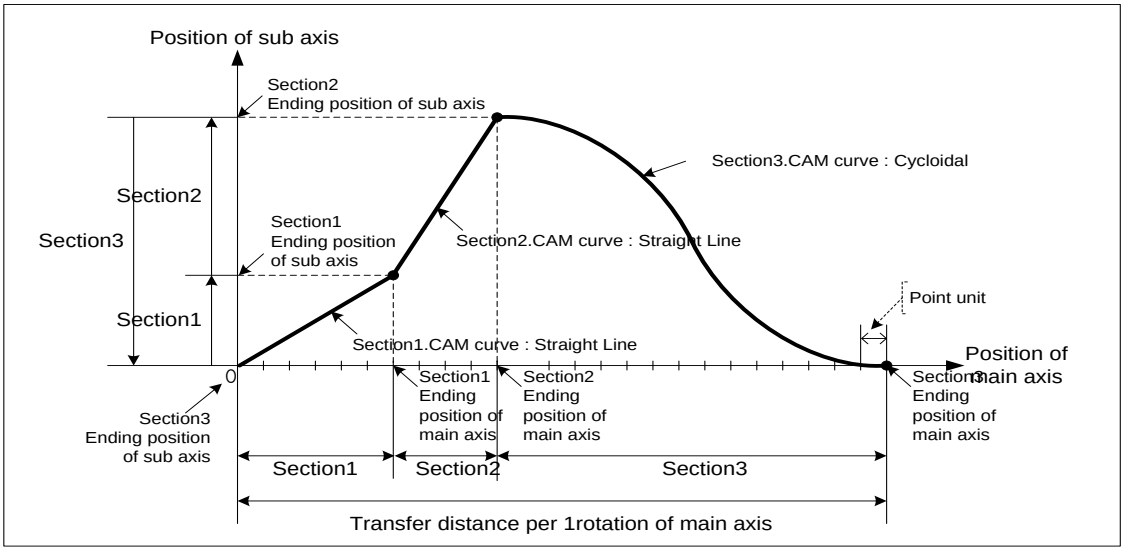
Set the starting position of sub axis corresponding to the starting position of main axis in the designated section. Starting position of sub axis is the same as the ending position of sub axis in previous section.

4) Ending position of sub axis

Set ending position of sub axis corresponding to the ending position of main axis in the designated section. If control method is “Repeat (Two-way mode), the ending position of sub axis in the last section must be 0. If control method is “Increase(Feed mode)”, the ending position of sub axis in the last section generally has to be set as much as the transfer distance per 1rotation set on main/sub axis parameter.

5) CAM curve

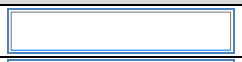
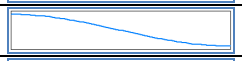
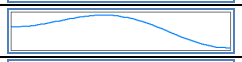
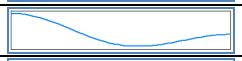
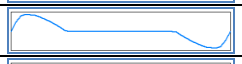
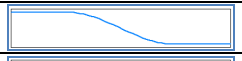
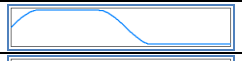
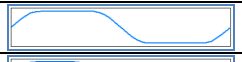
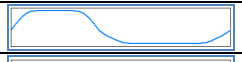
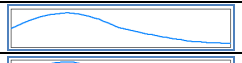
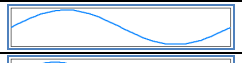
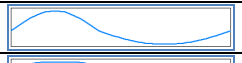
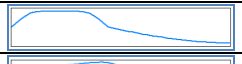
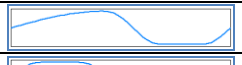
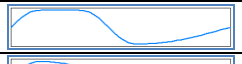
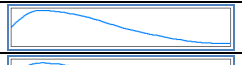
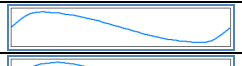
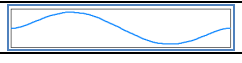
Set CAM specific curve to create data ranging from starting position of sub axis to ending position of sub axis in the designated section. The position of sub axis is calculated by characteristic of selected CAM curve, the position of main axis increase by point unit at the same time.



There are 22 kinds of CAM curve.

Describe characteristic of each CAM curve on next page.

■ Characteristic of CAM curve

Name	Acc. type	Position (S_{max})	Speed (V_{max})	Acc. (A_{max})	Jerk (J_{max})
Straight Line		1.00000	0.00000	0.00000	0.00000
Constant Acceleration		1.00000	2.00000	4.00000	0.00000
Simple Harmonic		1.00000	1.57076	4.93409	2.46735
No-Dwell Simple Harmonic		1.00000	1.57076	4.93409	2.46735
Double Harmonic		1.00000	2.04047	5.55125	0.10285
Reverse Double Harmonic		1.00000	2.04048	9.86605	4.93455
No-Dwell Modified Constant Velocity		1.00000	1.22203	7.67383	3.83881
Modified Constant Velocity		1.00000	1.27526	8.00947	0.98712
No-Dwell Modified Trapezoid		1.00000	1.71788	4.19885	2.09942
One-Dwell Modified Trapezoid		1.00000	1.91589	4.43866	55.77788
Modified Trapezoid		1.00000	1.99975	4.88812	0.30562
Asymmetrical Modified Trapezoid		1.00000	1.99982	6.11015	0.47620
One-Dwell Cycloidal		1.00000	1.75953	5.52756	0.17345
Cycloidal		1.00000	1.99985	6.28273	0.19715
Asymmetrical Cycloidal		1.00000	1.99989	7.85304	0.30783
One-Dwell Trapecloid		1.00000	1.73636	4.91007	0.30699
Reverse Trapecloid		1.00000	2.18193	6.16975	0.38579
Trapecloid		1.00000	2.18193	6.17044	0.38579
One-Dwell Modified Sine		1.00000	1.65978	5.21368	0.32603
Modified Sine		1.00000	1.75953	5.52697	0.34562
5th Curve		1.00000	1.87500	5.77350	60.00000
7th Curve		1.00000	2.18750	7.51283	41.99646

(3) Principle of CAM operation

(a) When CAM operation command is executed, the current position of main axis is recognized as 0.

(b) When the main axis starts operating, “the current position in 1rotation of main axis” increase to “no. of pulse per 1rotation (-1)” then become 0. The position value (0~“no. of pulse per 1rotation (-1)”) is repeated.

(c) Calculate CAM data step no. corresponding to “the current position per 1rotation” with “point unit” of CAM parameter.

$$\text{Cam Data Step no.} = \frac{\text{Current Positio per 1rotation of Main Axis}}{\text{Point Unit}}$$

For example, if the position of main axis at the beginning of CAM operation is 1000, the current position is 1073 and point unit is 10, the step no. of CAM data is as follows.

$$\text{Cam Data Step no.} = \frac{\text{Current Positio per 1rotation of Main Axis}}{\text{Point Unit}}$$

$$= \frac{1073 - 1000}{10}$$

$$= 7.3$$

(d) Calculate update position of sub axis with CAM data step. If main axis is forward direction, calculate the position of sub axis with the position corresponding to “the part of positive number of CAM data step no.” and the position corresponding to “the part of positive number of CAM data step no. +1”.

Position of sub axis
= {(Step position of CAM data +1) – (Step position of CAM data)} x Decimal part of CAM data step no.
+ (Step position of CAM data)

For example, if position value of sub axis of step 7 is 395 and step 8’s is 475, the position of sub axis is as follows.

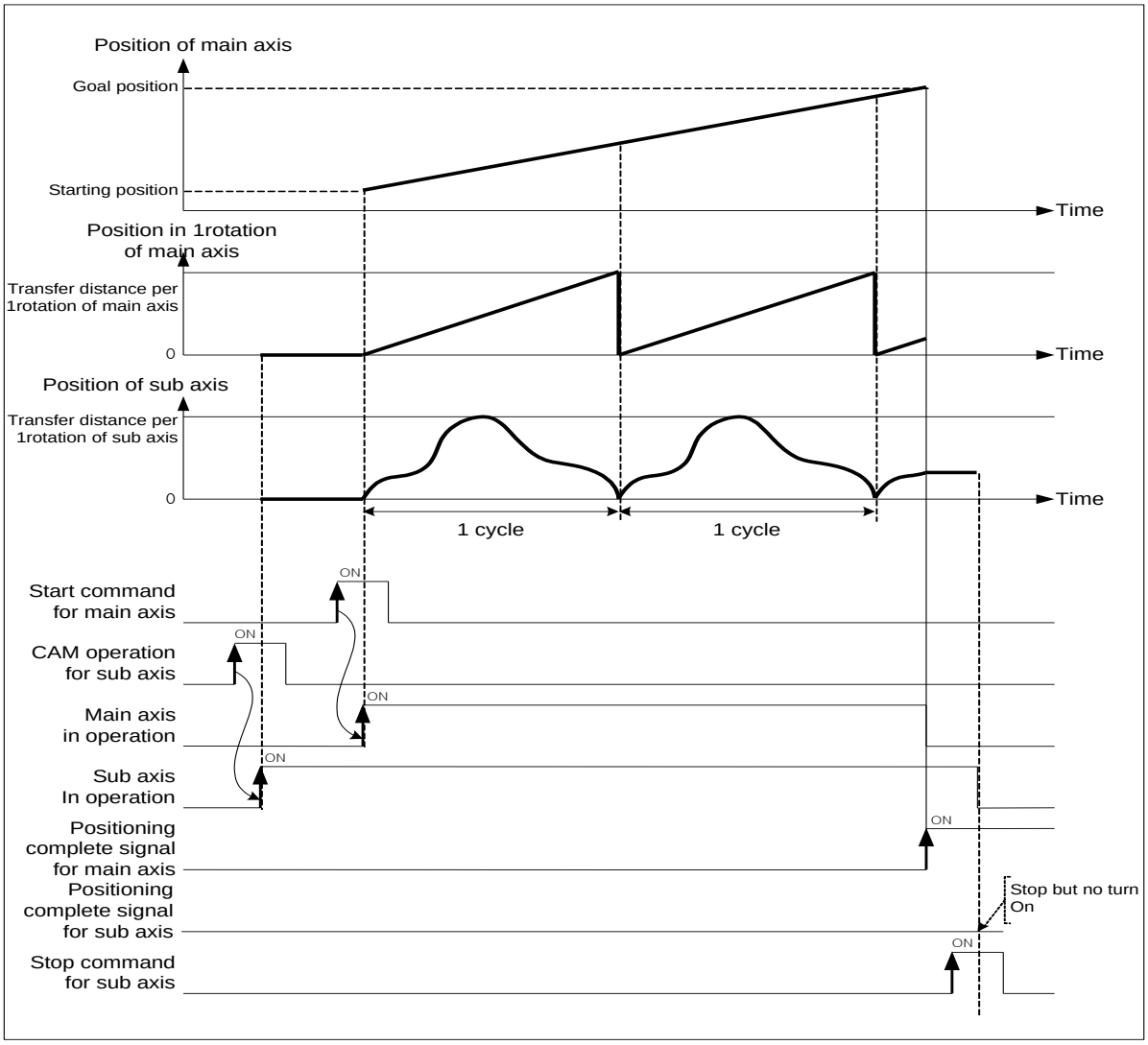
$$\text{Position of sub axis} = 395 + (475 - 395) \times 0.3$$

$$= 395 + 24$$

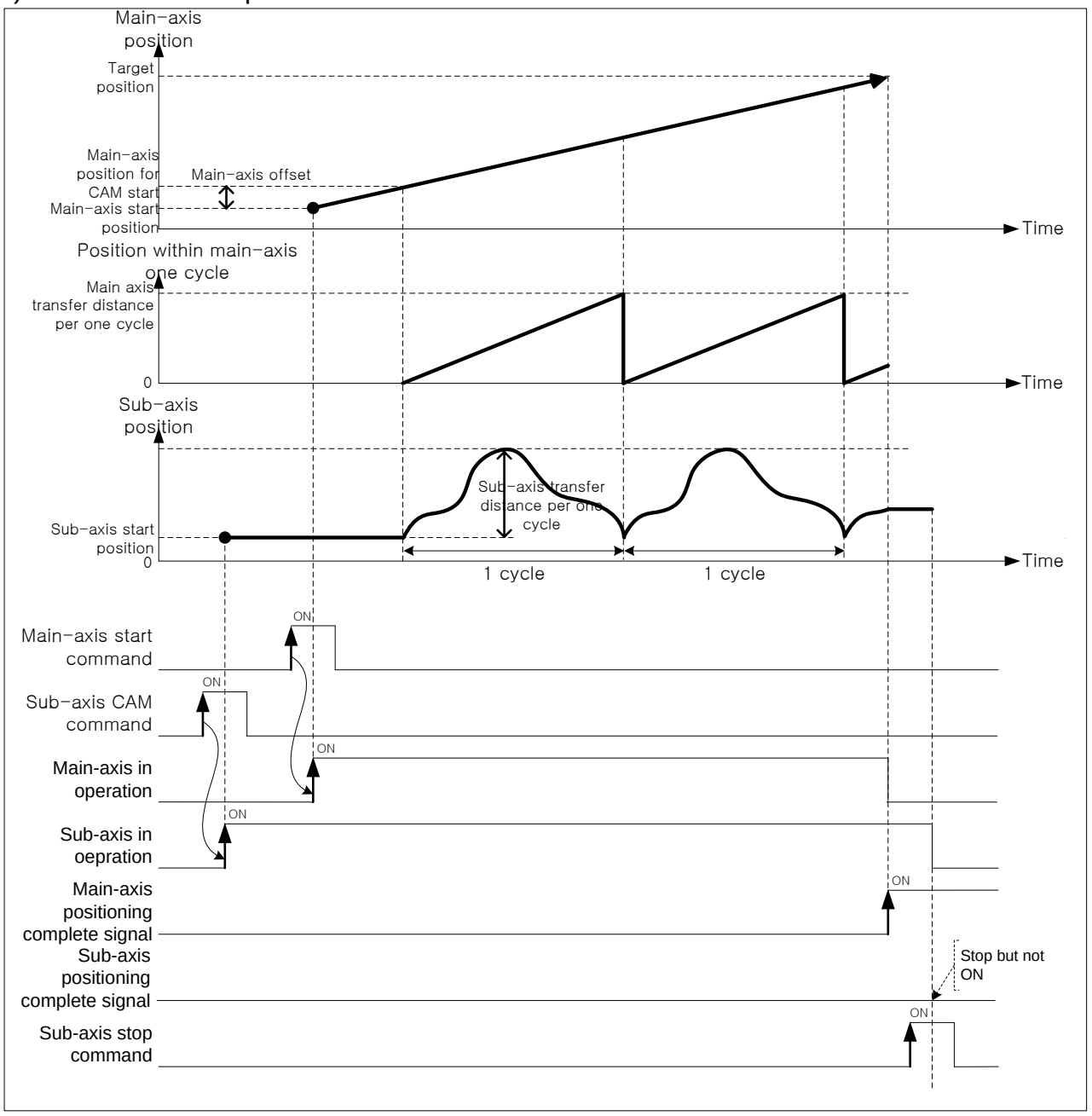
$$= 419$$

(4) Operation timing

(a) General CAM start command



(b) Main-axis offset-specified CAM start command



(5) Restrictions

CAM operation command may not be executed in the cases below.

(a) If execute CAM operation command in being On of M code, error (code:702) arises. Make M code “OFF” with “M code release (XMOF)” command before use.

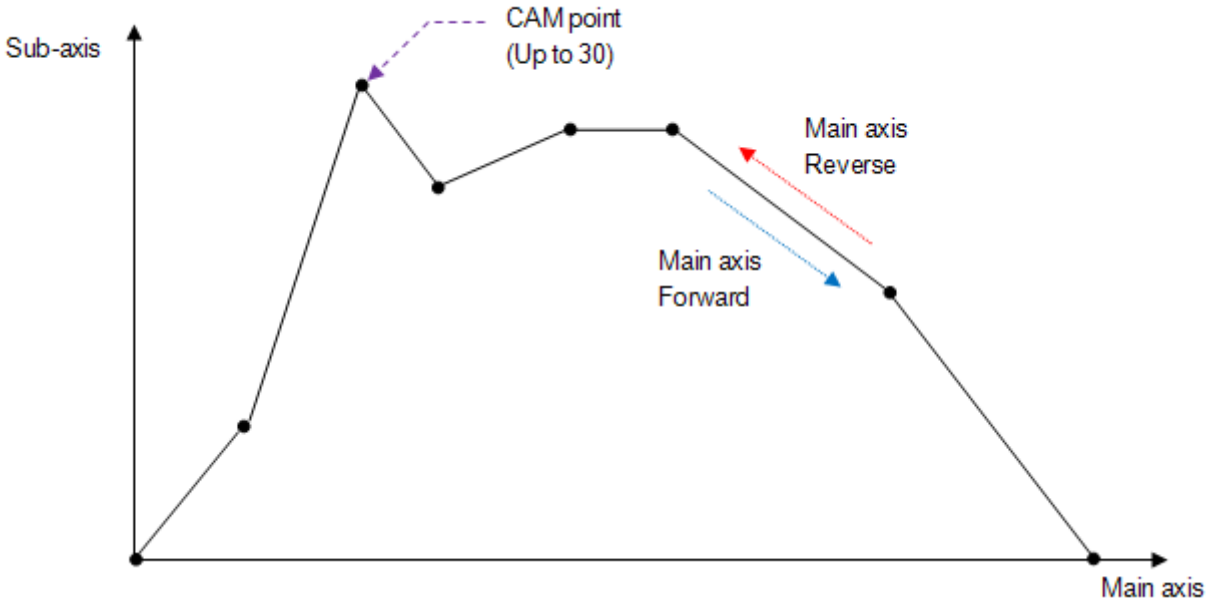
(b) If the current main axis is not the axis can be set on the current module or main axis and command axis are the same axis, error (code:704) arises. Set the main axis among one of the axis can be set on module.

(c) If speed of main axis is too fast and speed of sub axis exceeds speed limit, error (code:708) arises. In this case, you have to lower the operation speed.

9.4.4 User CAM Operation

User CAM operation, like CAM operation, executes CAM axis control in which CAM data shown as CAM curve synchronize with position of the motor set as main-axis. The difference with CAM operation is that user sets up CAM data not in XG-PM but in PLC program (XG5000), and the number of CAM data is 30.

1) Operation



Like figure above, you can set up maximum 30 CAM data points, and it operates CAM curve between CAM points with straight line. CAM point data is set up at sub-axis and as type of (main-axis position, sub-axis position). CAM data point can be saved at the specified memory address of each axis by using XVWR command. For memory address to save CAM data point of each axis, refer to appendix 2.11 User CAM data memory address.

9.5 Modification Function of Control

9.5.1 Floating Origin Setting

This is used to force to set the current position as the origin without carrying out the homing action of the machine.

(1) Characteristic of Control

(a) Modify the current position into “Homing end position” of homing parameter and become Origin-decided status.

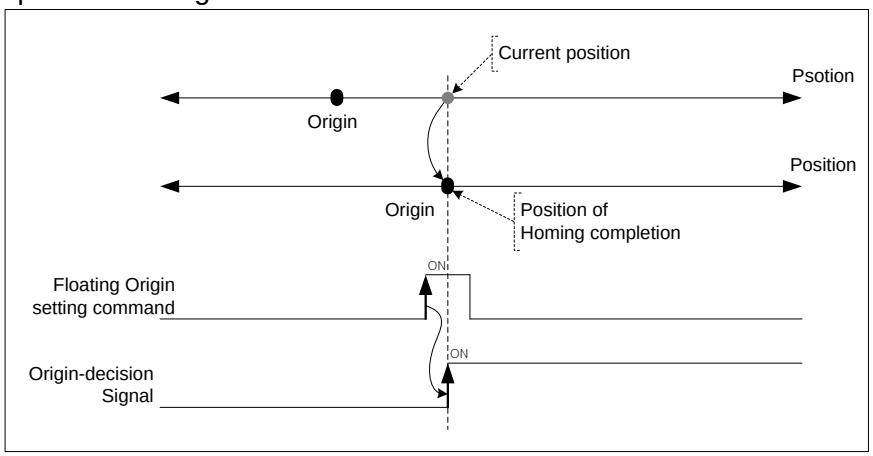
(b) After floating origin setting command is executed, the current position is changed to “0”

(c) Related parameter (Homing Parameter)

Note

Floating origin setting just executes forced origin-decision from the current position to origin completion position. So user need to take notice as follows.
(1) When error arose, clear the cause of error and reset,
(2) set floating origin again,
(3) change the operation step no. to operate with start step no. change command and then execute.

(2) Operation timing



(3) Restrictions

If drive ready signal is in “OFF”, floating origin setting command is not executed but error (code:212)arises. When drive ready signal is in “ON”, execute floating origin setting command.

9.5.2. Continuous Operation

Execute positioning control changing the current operation step no. to the next one.

(1) Characteristics of Control

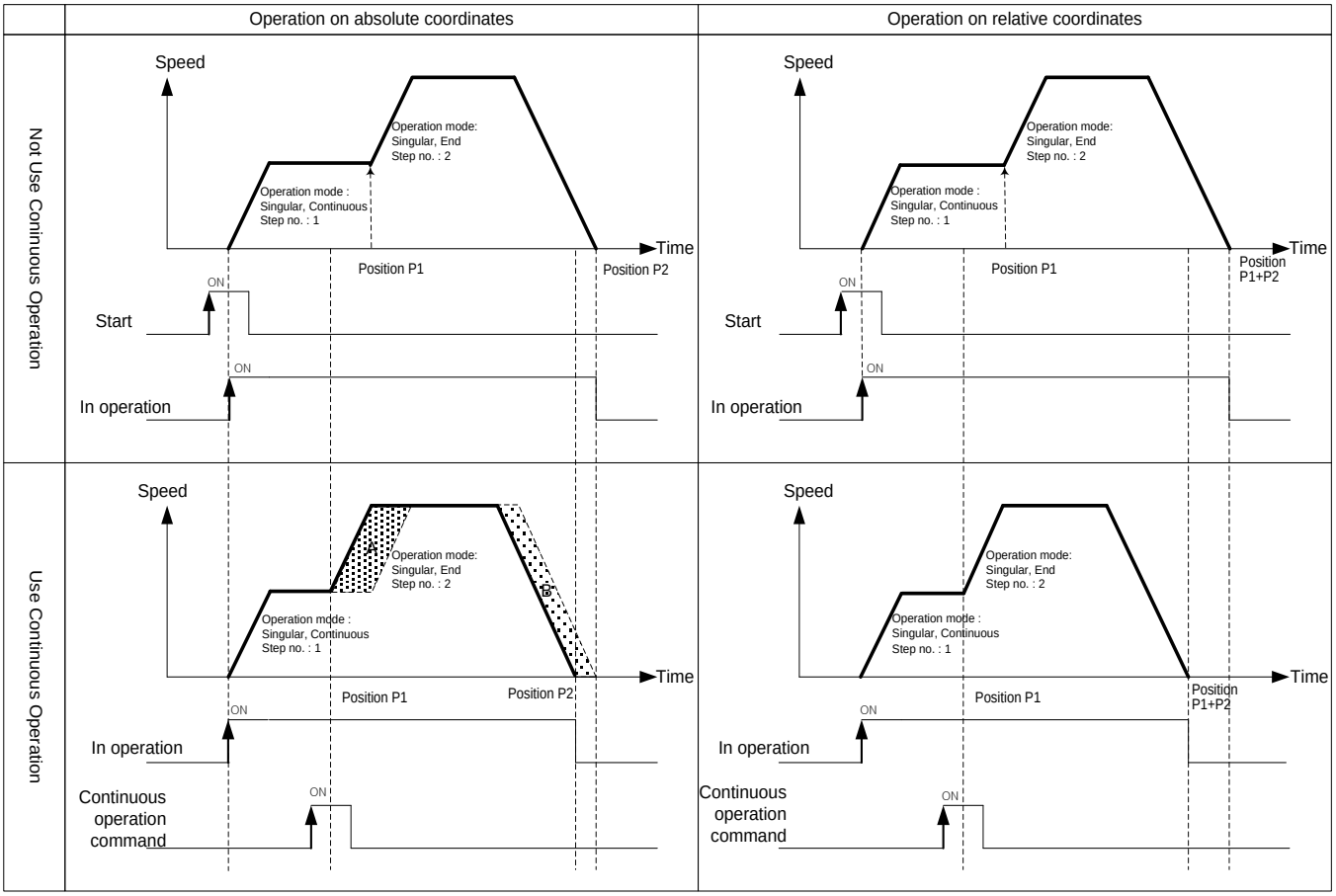
(a) When continuous operation command is executed, operating speed is changed into the speed of next operation step directly.

(b) This command may be used in End, Go on, Continuous mode and used at Acc.,Dec.,Steady speed section.

(c) If continuous operation command is executed in operation, the current operation step no. is changed to the next step no. and keep operating.

(d) There are differences of operation depending on between absolute coordinates and relative coordinates.

(2) Operation timing



■ The goal positions of continuous operation on absolute coordinates are same, so the goal position is the same as the position before and after continuous operation. Therefore, the current position positioned by continuous operation is P2. (A area and B area both are same size)

■ When continuous operation is executed on relative coordinates, the movement amount between current position and goal position is the real goal position. Therefore, the goal position is different from the one without continuous operation. The position positioned by continuous operation is P1 + P2.

(3) Restrictions

In the cases below, continuous operation is not executed and previous operation is being kept.

(a) Acc./Dec. pattern of extended parameter is “S-curve operation”. (error code : 390)

(b) It is in dwell. (error code : 392)

(c) The current control is not shortcut position control or linear interpolation. (error code : 393)

(d) Speed data value of operation step to be executed next is 0 or exceeds the speed limit. (error code : 394)

(e) Execute continuous operation command on sub axis. (error code : 395)

User has to execute continuous operation command on main axis in linear interpolation.

(f) Execute continuous operation command on axis in circular interpolation. (error code : 396)

(g) Execute continuous operation on sub axis in sync. operation. (error code : 397)

(h) The current operation step no. is the last step(400) of operation data. (error code : 399)

(i) The current axis in operation is executed by direct start command. (error code : 400)

[Example] Execute continuous operation on axis1 operating by absolute, shortcut position control

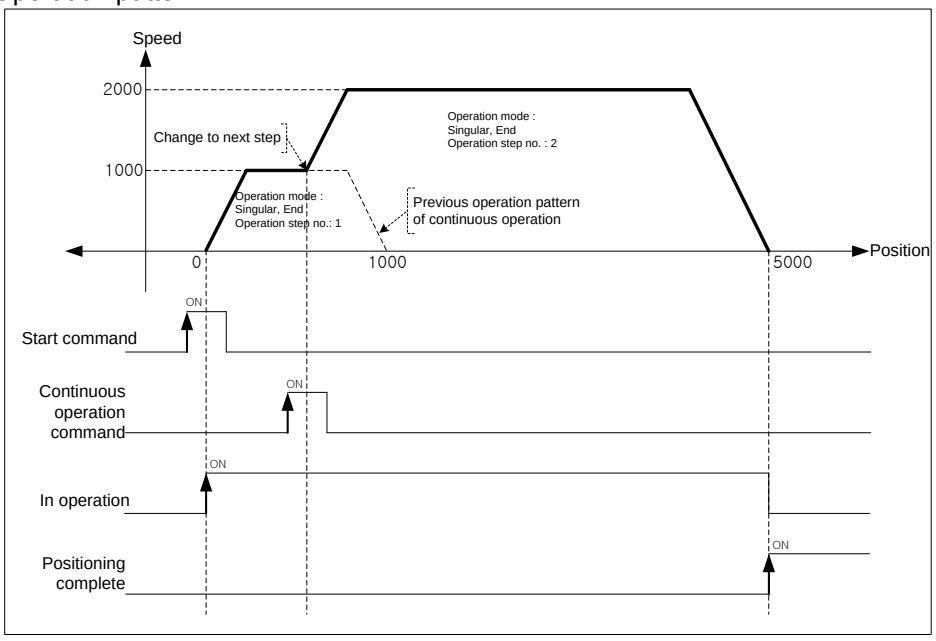
■ Current position of Axis1 : 0

■ Setting example in XG-PM

▪ Operation data of axis1

Step no.	Control method	Operation	Goal position [pls]	Operation speed [pls/s]	Acc. no.	Dec. no.	M code	Dwell time
1	Absolute, shortcut position control	Singular, end	1000	1000	No.1	No.1	0	0
2	Absolute, shortcut position control	Singular, end	5000	2000	No.1	No.1	0	0

■ Operation pattern



9.5.3 Skip Operation

Decelerate and stop the current operation step and change to the operation data of next operation step no., then execute positioning control.

(1) Characteristics of Control

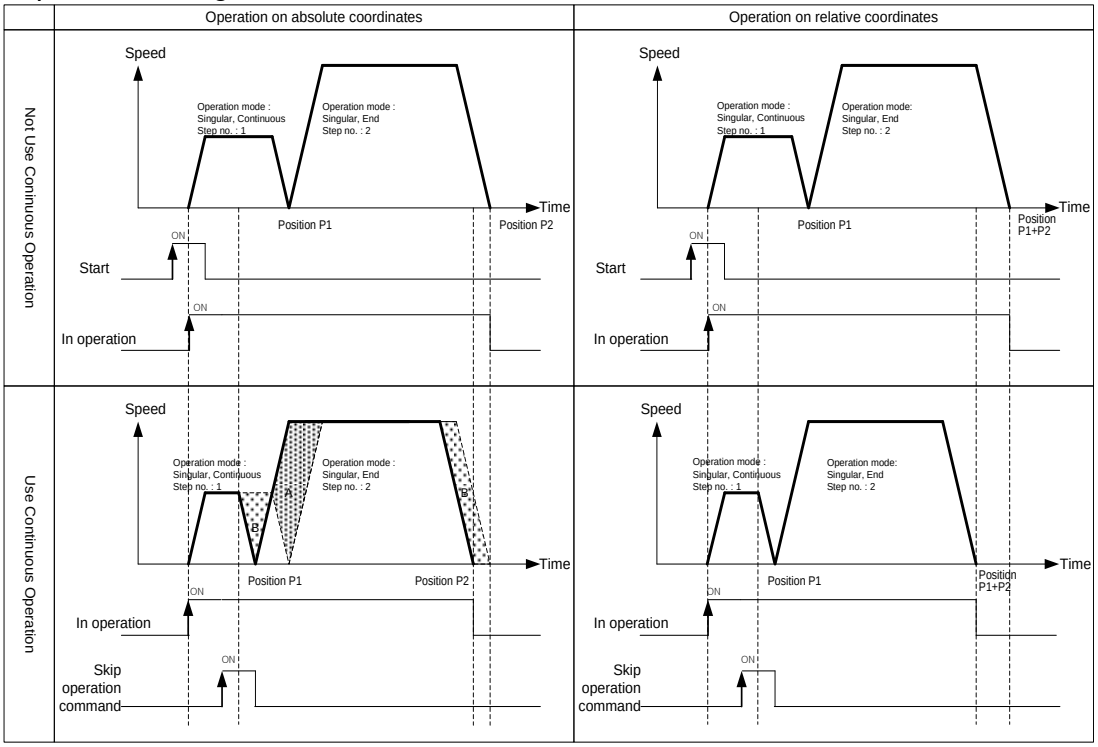
(a) SKIP operation command stops the operation and carries out the operation of next step after executing the command other than Continuous operation command (Next Move).

(b) This is used in case that the operation mode is End, Go-on, Continuous and the operation pattern is in Acceleration, Constant speed, Deceleration section.

(c) If SKIP operation command is executed in the status that the operation data of next step is not yet set, Error 151 will occur.

(d) When set position data, there would be differences on skip operation command depending on absolute coordinates and relative coordinates,

(2) Operation timing



■ The goal position of next operation step after skip operation command is executed on absolute coordinates is the same as the case did not execute skip operation. Therefore, current position positioned by skip operation is P2. (A area and B area both are same size)

■ When skip operation is executed on relative coordinates, the movement amount between current position and goal position is the real goal position. Therefore, the goal position is different from the one without continuous operation. The position positioned by skip operation is P1 + P2.

(3) Restrictions

In the cases below, skip operation is not executed and previous operation is being kept.

(a) Execute skip operation command on the sub axis of linear interpolation. (error code:332)
Skip operation in linear interpolation operation must be executed on main axis.

(b) Execute skip operation command on the sub axis of sync. operation. (error code:333)

(c) Execute skip operation command on the axis in Jog operation. (error code:335)

(d) The current axis is executed by direct start. (error code:336)

(e) Execute skip operation on the axis in Inching operation. (error code:337)

(f) Execute skip operation on the sub axis of circular interpolation. (error code:338)
Skip operation in circular interpolation operation must be executed on main axis.

[Example] Execute skip operation command on axis1 operating by absolute and shortcut position control.

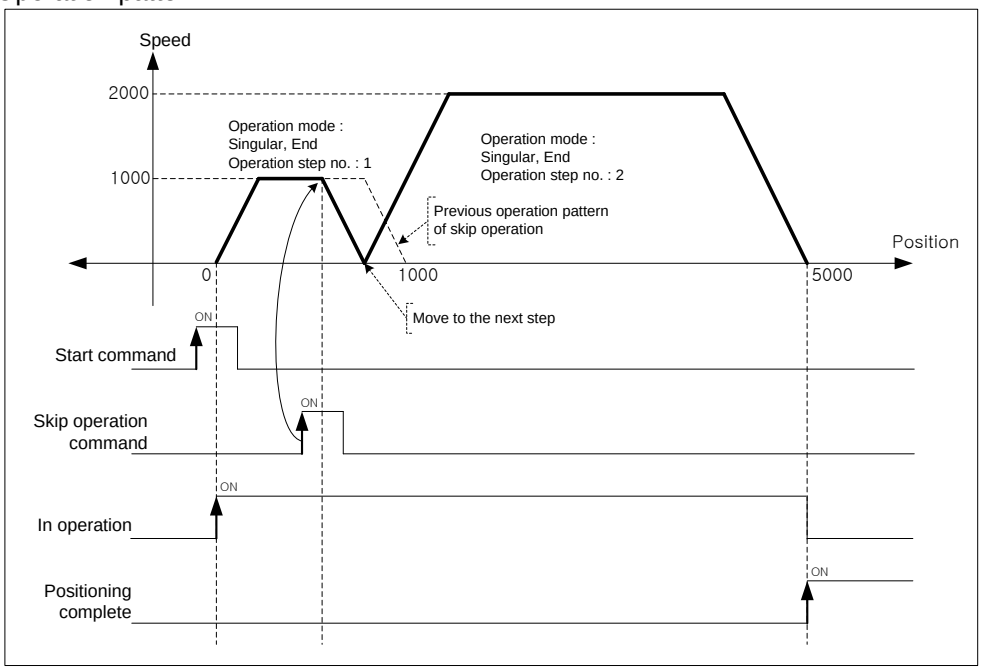
■ Current position of axis1 : 0

■ Setting example in XG-PM

▪ Operation data of axis1

Step no.	Control method	Operation method	Goal position [pls]	Operating speed [pls/s]	Acc.no.	Dec.no.	M code	Dwell time
1	Absolute, single-axis position control	Singular,End	1000	1000	No.1	No.1	0	0
2	Absolute, Single-axis position control	Singular,End	5000	2000	No.1	No.1	0	0

■ Operation pattern



9.5.4 Position Override

This is used to change the goal position during positioning operation by positioning data.

(1) Characteristics of Control

(a) Position override command is used in the operation pattern (Acceleration, Constant speed, Deceleration section) and the available operation mode is End operation, Go-on operation, Continuous operation.

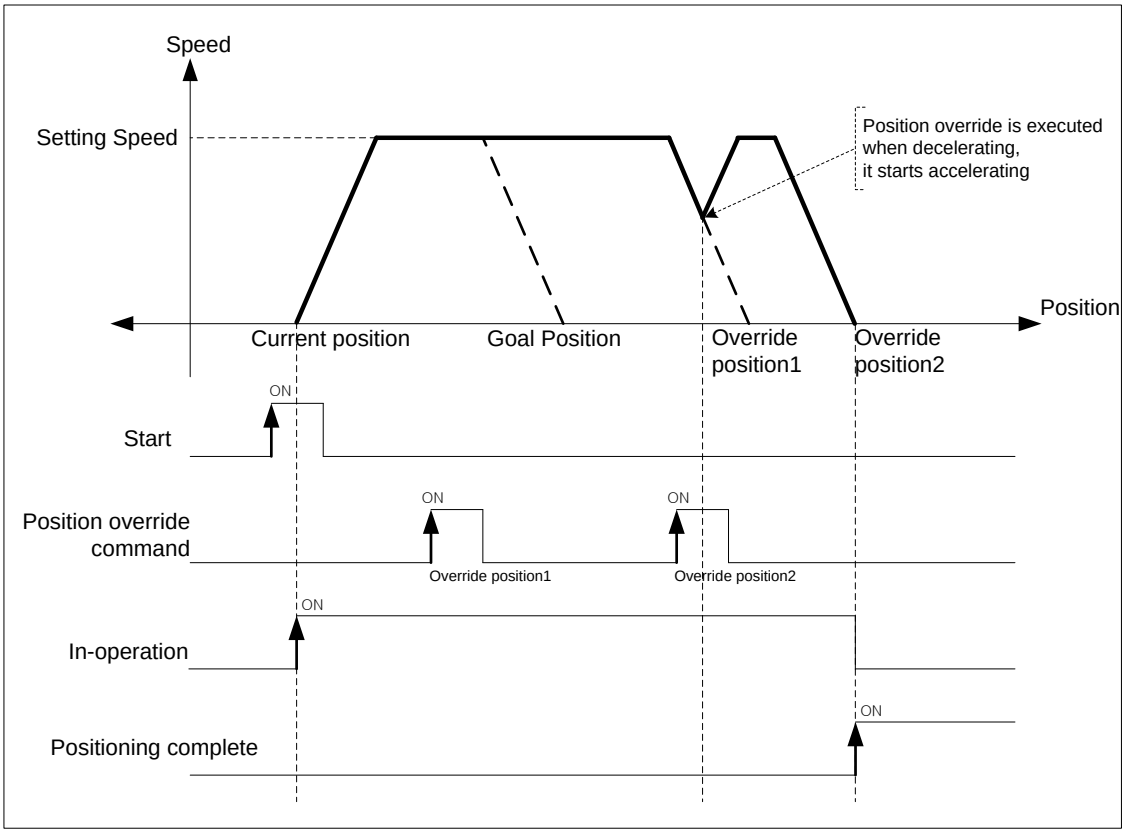
(b) Position setting range is –2147483648 ~ 2147483647 Pulse.

(c) As the operation is different according to Position Override command during operation, cares should be taken in using.

In other words, if position of position override at the moment of commanding position override is bigger than the position it stopped at, the positioning direction would be forward. If it is smaller, the direction would be reverse.

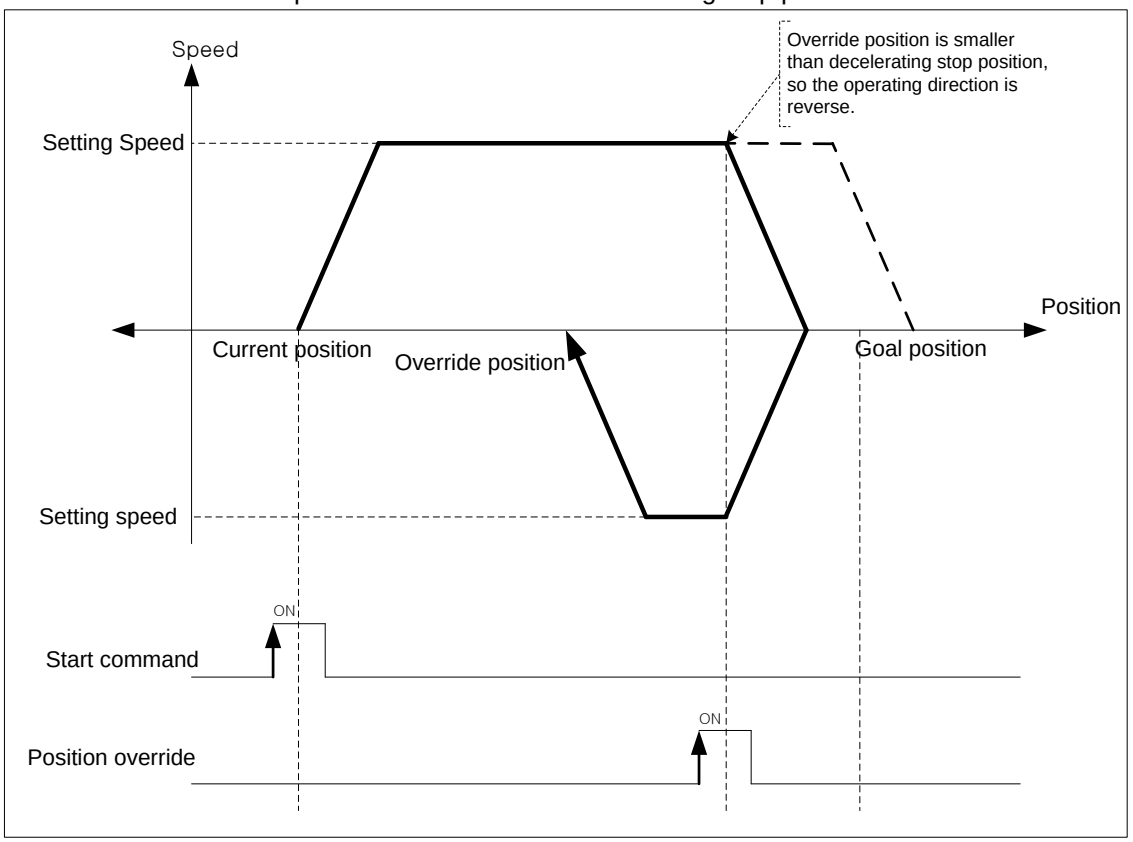
(d) This command may be executed several times in operation.

(2) Operation timing



If position override is executed in operation, the goal position is changed to override position1 and keep operating. If position override for override position2 is executed at dec. area, positioning is finished by acc. speed already set at override position2.

■ The case that override position is smaller than decelerating stop position.



(3) Restrictions

In the cases below, position override is not executed and previous operation is being kept.

(a) Execute position override in dwell. (error code:362)

(b) Current operation is not positioning control(shortcut positioning, Inching operation). (error code:363)

(c) Execute position override on the axis operating linear interpolation. (error code:364)

(d) Execute position override on the axis operating circular interpolation. (error code:365)

(e) Execute position override on the sub axis of sync. operation. (error code:366)

[Example] Execute position override on axis1 operating by absolute, shortcut positon control.

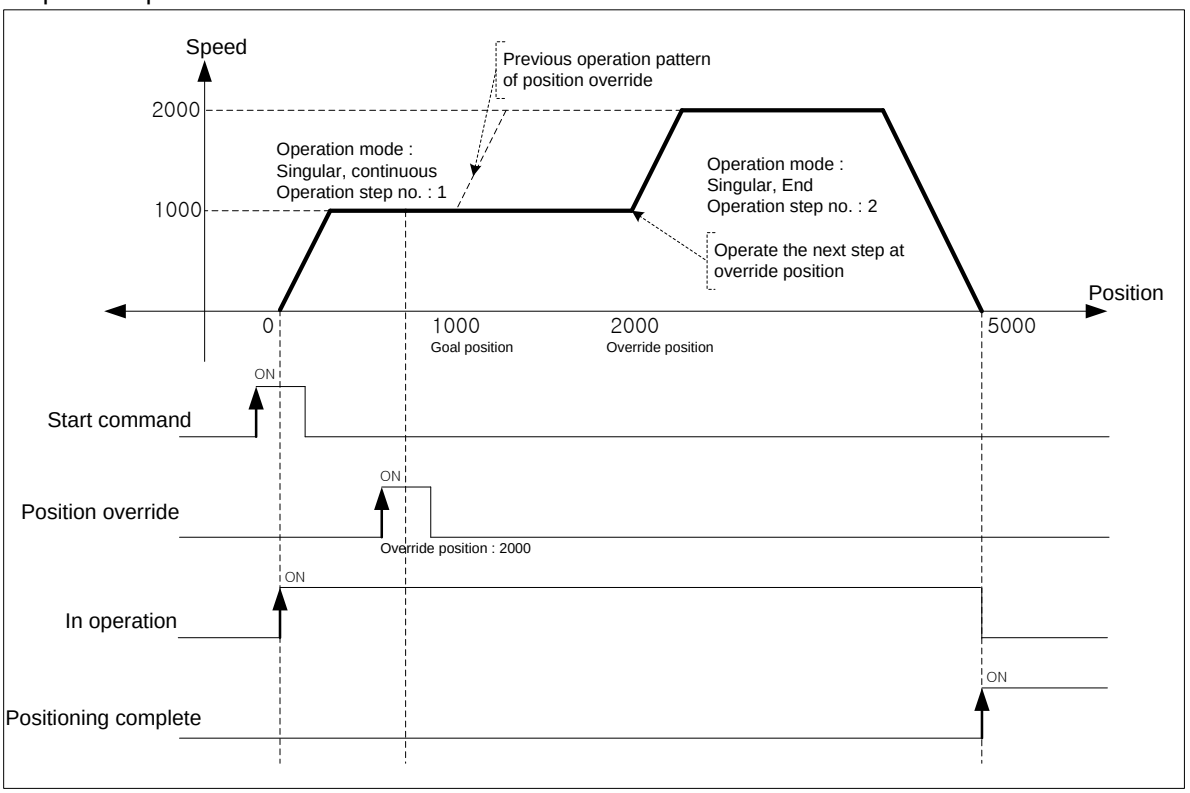
■ Current position of axis1 : 0

■ Setting example in XG-PM

▪ Operation data of axis1

Step no.	Control method	Operation method	Goal position [pls]	Operation speed [pls/s]	Acc.no.	Dec.no.	M code	Dwell time
1	Absolute single axis position control	Singular, End	1000	1000	No.1	No.1	0	0
2	Absolute single axis position control	Singular, End	5000	2000	No.1	No.1	0	0

■ Operation pattern



Note

If operation pattern is “continuous” and override position is bigger than goal position, keep operating at current speed then continue to operate the next step. If override position is smaller than goal position, execute decelerating stop and position in reverse direction, then continue to operate the next step.

9.5.5 Speed Override

When user wants to change the operation speed of positioning control, user may change the speed with speed override command.

(1) Characteristics of Control

(a) Speed override command is available in acc./steady speed area and available operation modes are “end”, “go on” and “continuous”.

(b) It may be executed several times in operation.

(c) User may set speed override value as “%setting” or “speed setting” on [Speed override] of common parameter.

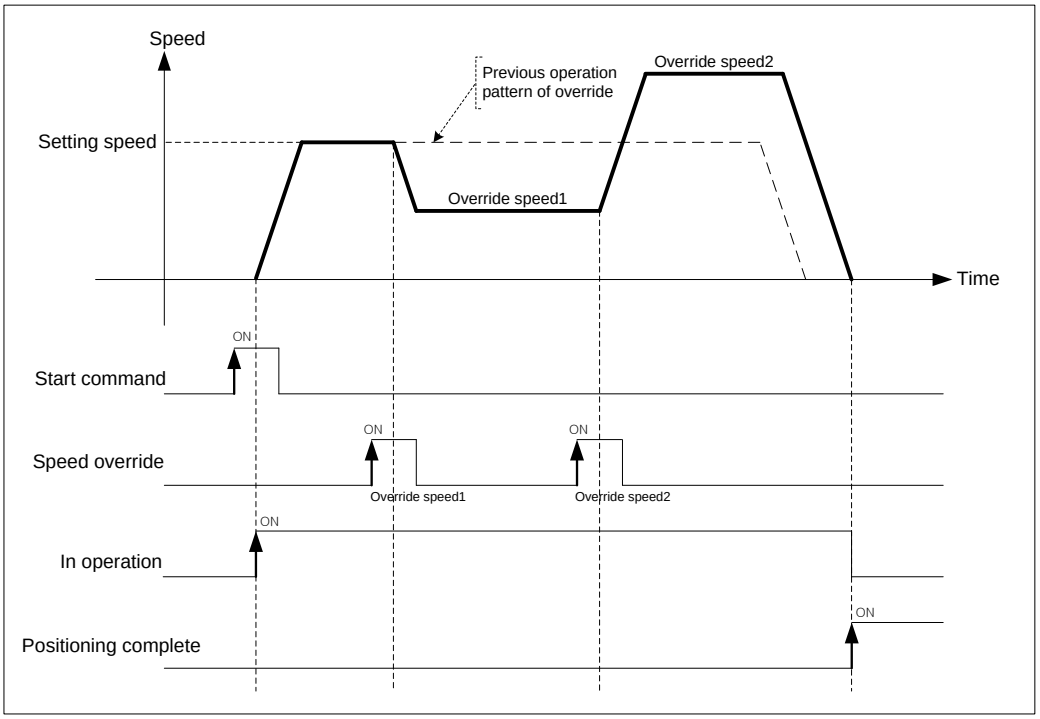
(d) Related parameter setting (common parameter)

Items	Setting value	Description
Speed override	0 : %setting	Set the speed override setting value by %
	1 : speed setting	Set the speed override setting value with exact number

(e) Auxiliary data of speed override command setting

Items	Setting value	Description
Speed	1 ~ 65535 (1=0.01%)	Set the speed override setting value with percentage (If it is 100%, set 10000)
	1 ~ Speed limit	Set the speed override setting value directly

(2) Operation timing



(3) Restrictions

In the cases below, speed override is not executed and previous operation is being kept.

(a) Value of speed override exceeds speed limit of basic parameter. (error code:372)
Speed value of Speed override must be below speed limit.
Override speed of linear interpolation for each axis need to be below speed limit.

(b) Execute speed override on the sub axis of linear interpolation. (error code:373)
In linear interpolation, speed override must be executed on main axis.

(c) Execute speed override on the sub axis of circular interpolation. (error code:374)
In circular interpolation, speed override must be executed on main axis.'

(d) Execute speed override on sub axis of sync. operation. (error code:375)

(e) Execute speed override in dec. area. (error code:377)

(f) In the case that acc./dec. pattern of extended parameter is "S-curve operation". (error code:378)

[Example] Execute speed override(50%→100%→200%→150%) on axis1 operating by absolute, shortcut position control.

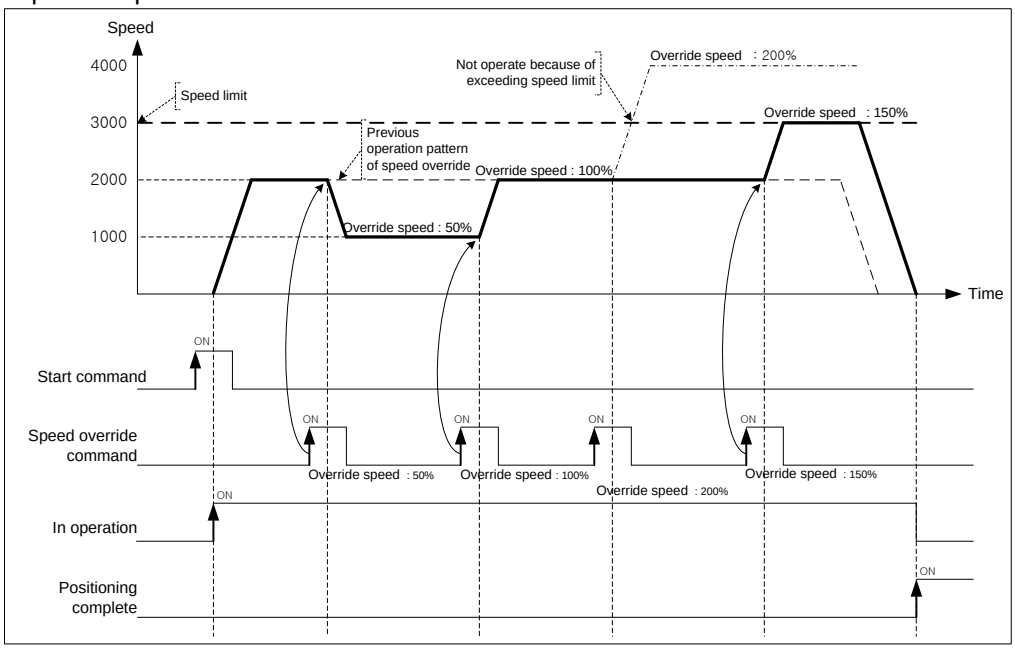
■ Current position of axis1 : 0
"Speed override" of common parameter : Set %
"Speed limit" of basic parameter : 3000 [pls/s]

■ Setting example of XG-PM

▪ Operation data of axis1

Step no.	Control method	Operation method	Goal position [pls]	Operation speed [pls/s]	Acc.no.	Dec.no.	M code	Dwell time
1	Absolute, single-axis position control	Singular, End	1000	2000	No.1	No.1	0	0

■ Operation pattern



9.5.6 Positioning Speed Override

This is the command to operate by the changed operation speed if it reaches the setting position during positioning operation.

(1) Characteristics of Control

(a) This command is used only in Acceleration and Constant speed section from operation pattern and the available operation mode is End, Go-on, Continuous operation.

(b) As this command is not carried out in Deceleration section, cares should be taken in using.

(c) The position setting range is –2147483648 ~ 2147483647 Pulse.

(d) User may set speed override value as “%setting” or “speed setting” on [Speed override] of common parameter.

(e) User may select that consider the designated position value on “coordinates of positioning speed override” of extended parameter as an absolute position or a relative position.

(f) Related parameter setting

■ Common parameter

Items	Setting value	Description
Speed override	0 : Set %	Set the value of speed override by %
	1 : Set speed	Set the value of speed override with exact number

■ Extended parameter

Items	Setting value	Description
Coordinates of positioning speed override	0 : Absolute	Speed override is executed in the designated absolute position
	1 : Incremental	Start speed override from the position increment added

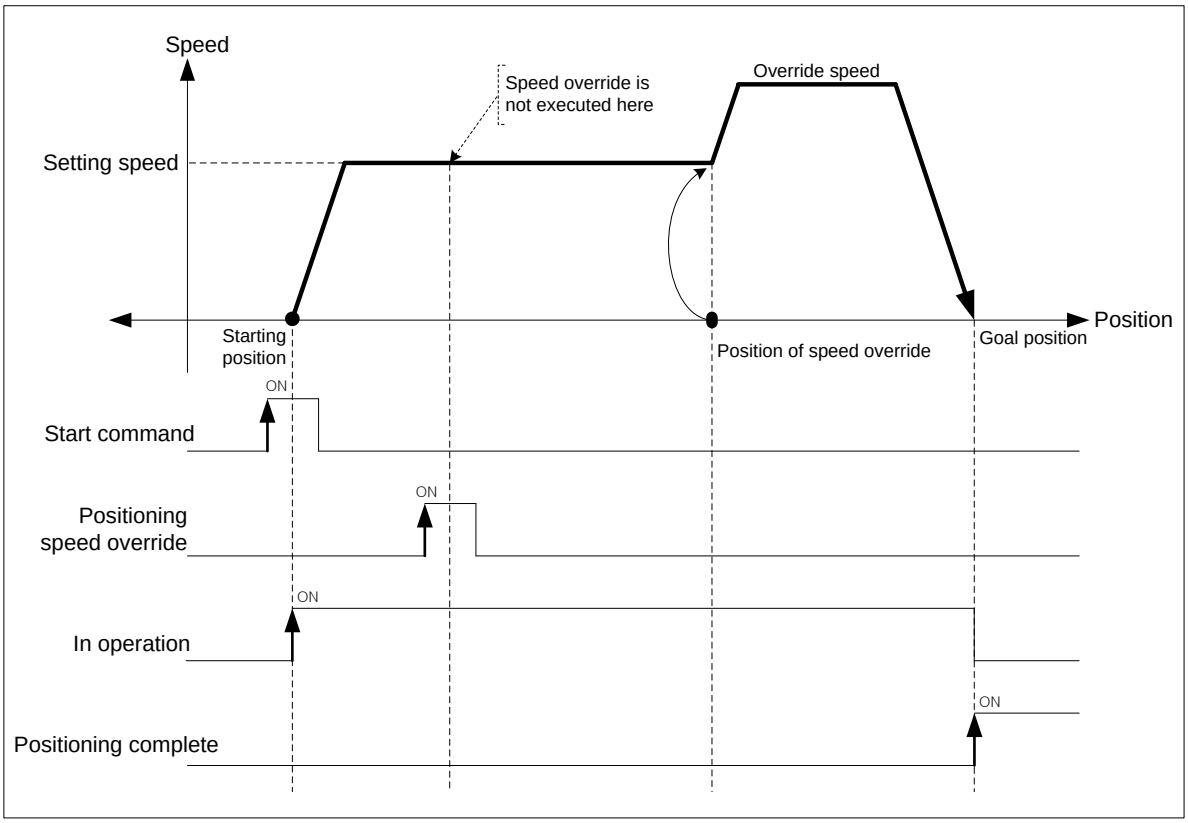
(g) Auxiliary data setting of positioning speed override command

Items	Setting value	Description
Position	-2147483648 ~ 2147483647	Set the position to start speed override
Speed	1 ~ 65535 (1=0.01%)	If speed override is “%”, set the speed by % (100% is 10000)
	1 ~ Speed limit	If speed override is “Exact number”, set the speed with exact number

Note

While the current position is not exactly same as the value set on speed override, if the position of speed override is at between previous scan and current scan, speed override is executed at the speed set.

(2) Operation timing



(3) Restrictions

In the cases below, positioning speed override is not executed and previous operation is being kept.

(a) Current operation is not positioning (shortcut position control, Inching operation) control. (error code:382)

(b) The value of speed override exceeds speed limit of basic parameter. (error code:383)
The speed value of speed override must be below speed limit.
Override speed of linear interpolation for each axis need to be below speed limit.

(c) Execute positioning speed override on the sub axis of linear interpolation. (error code:384)
In linear interpolation, positioning speed override must be executed on main axis.

(d) Execute speed override on the sub axis of circular interpolation. (error code:385)
In circular interpolation, positioning speed override must be executed on main axis.'

(e) Execute speed override on sub axis of sync. operation. (error code:386)

(f) In the case that acc./dec. pattern of extended parameter is "S-curve operation". (error code:389)

(g) If execute positioning speed override in dec. area., although error does not arise but speed override is not executed. However, execute positioning speed override command in non-dec. area and speed override is executed when it is decelerating, error arises. (error code:377)

[Example] Execute positioning speed override at 4000 [pls/s] at 2000(position of speed override) on axis1 operating by absolute, shortcut position control.

■ Current position of axis1 : 0

「Speed override」of common parameter : Speed setting

「Speed limit」of basic parameter : 5000 [pls/s]

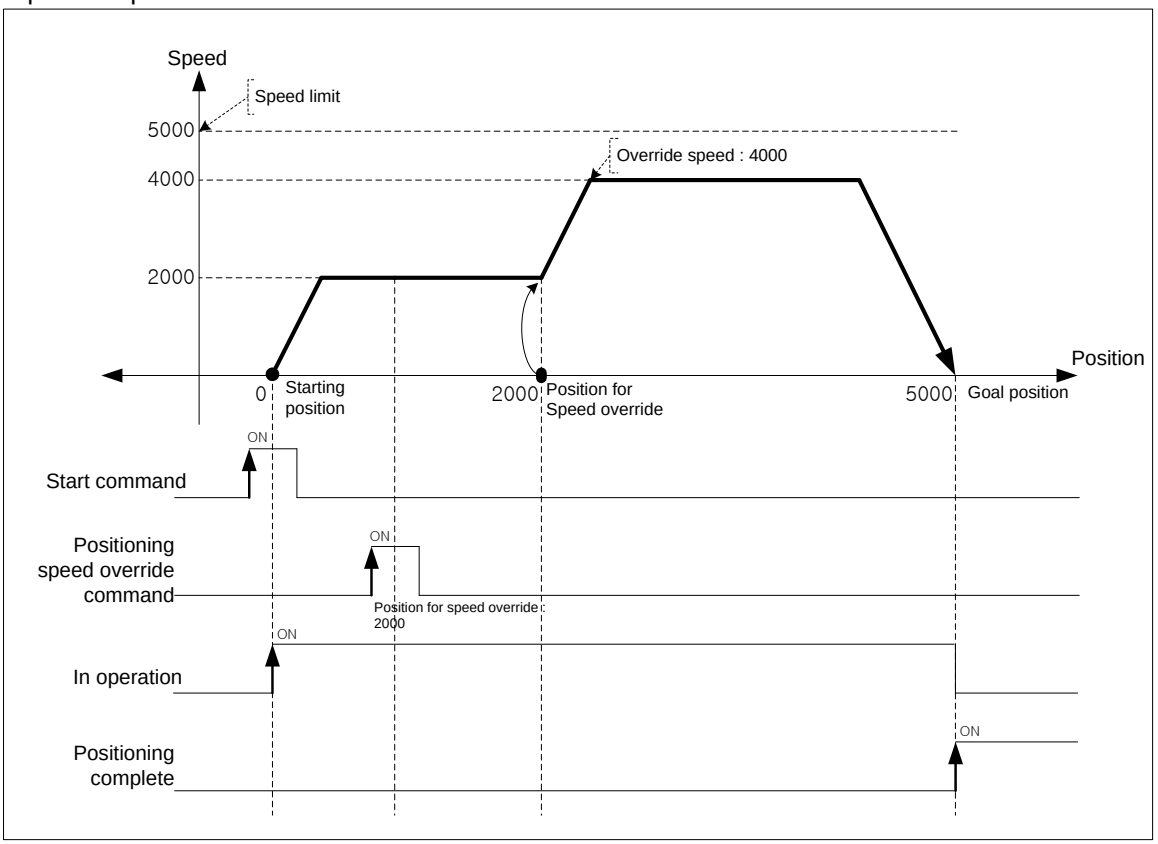
「Coordinates of positioning speed override」of extended parameter : Absolute

■ Setting example in XG-PM

▪ Operation data of axis1

Step no.	Control method	Operation method	Goal position [pls]	Operation speed [pls/s]	Acc.no.	Dec.no.	M code	Dwell time
1	Absolute single axis position control	Singular, End	5000	2000	No.1	No.1	0	0

■ Operation pattern



9.5.7 Current Position Preset

This command is for changing the current position value to the value at user's pleases.

(1) Characteristics of Control

(a) If user uses this command, the origin-undecided status becomes origin-decided status.

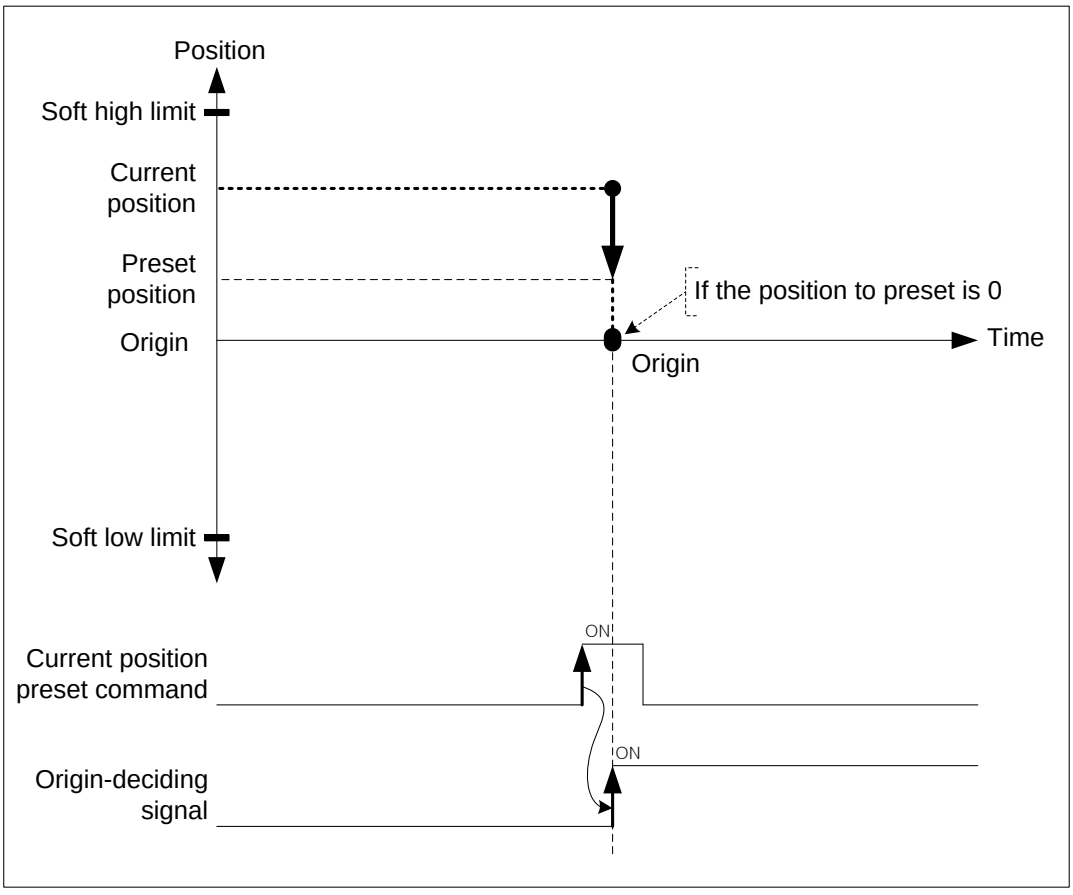
(b) When the current position is changed by position changing command, the mechanical origin position is changed. If user wants to use the mechanical origin again, has to execute homing command.

(c) The current position preset command may not be executed in operation.

(d) Auxiliary data setting of current position preset command.

Items	Setting value	Description
Position	-2147483648 ~ 2147483647	Set the position to change

(2) Operation timing



(3) Restrictions

In the cases below, current position preset is not executed and error arises.

(a) Setting value of current position preset exceeds soft high/low limit of extended parameter. (error code:452)

9.5.8 Encoder Preset

This command is for changing the value of current encoder position to the value at user's pleases.

(1) Characteristics of Control

(a) User may change the current position value.

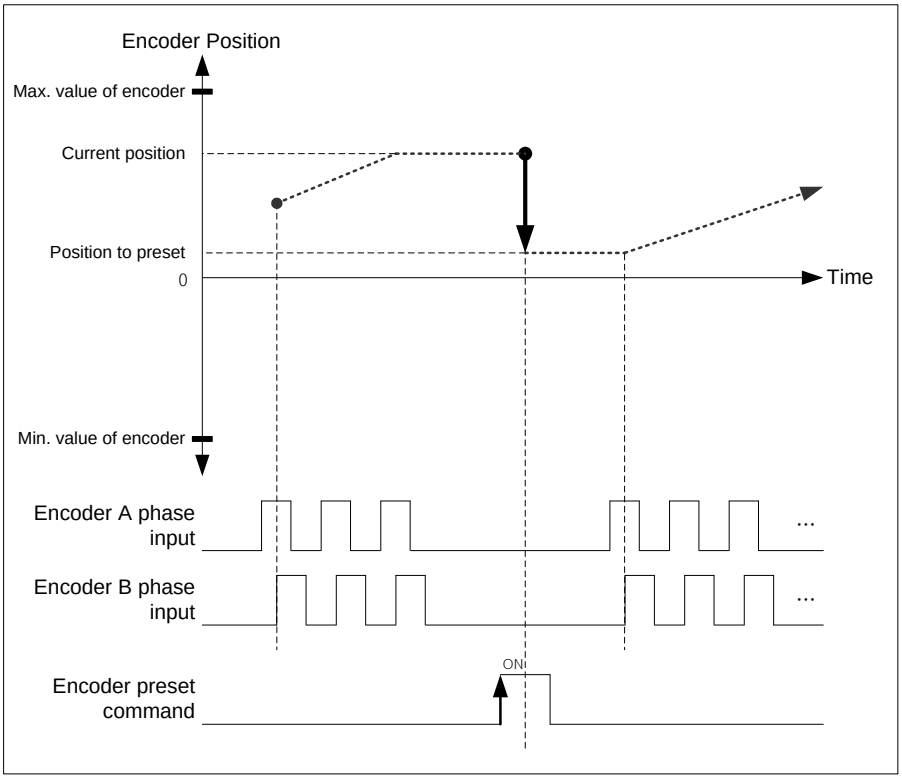
(b) If there is an encoder being main axis, the speed of sub axis is possible to be changed dramatically, so encoder preset command may not be executed.

(c) Encoder preset command should be executed in the status that external encoder pulse input is not entered.

(d) Auxiliary data setting of encoder preset command

Items	Setting value	Description
Position	-2147483648 ~ 2147483647	Set the encoder position to change on selected encoder
Types	0 : Encoder1 1: Encoder2	Select encoder to change

(2) Operation timing



(3) Restrictions

In the cases below, encoder preset command may not be executed and error arises.

(a) There is an encoder 1 operating as a main axis (error code: 532)

(b) There is an encoder 2 operating as a main axis (error code: 533)

(c) Position value of encoder1 preset exceeds the max./min. value of encoder1 of common parameter. (error code:534)

(d) Position value of encoder2 preset exceeds the max./min. value of encoder2 of common parameter. (error code:535)

9.5.9 Start Step no. Change

This command is for changing the current step no. when executing indirect start command.

(1) Characteristics of Control

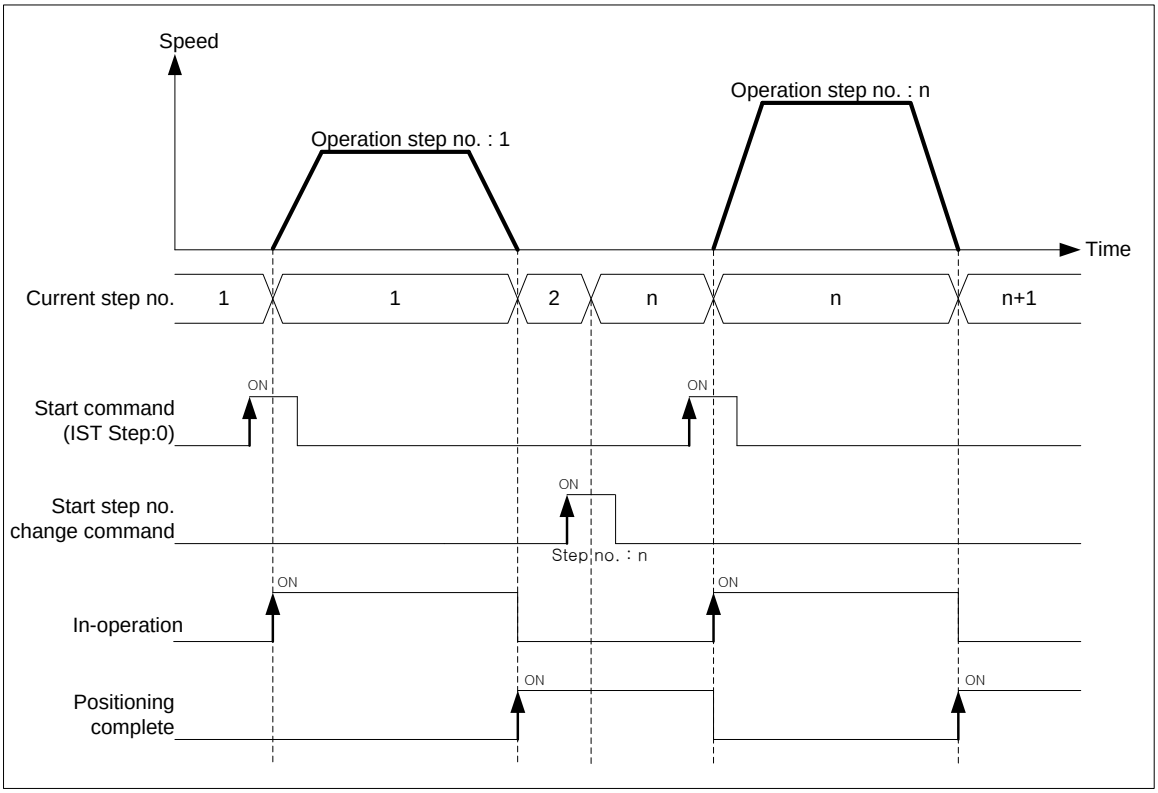
(a) When starting with setting step no. as 0 in indirect start command, current operation step no. is executed. The current step no. may be changed by start step no. change command.

(b) This command may be only executed in stop motion or error arises.

(c) Auxiliary data setting of start step no. change command.

Items	Setting value	Description
Step	1 ~ 400	Set the step no. to change

(2) Operation timing



(3) Restrictions

In the case below, start step no. change command is not executed.

(a) Step no. to change is out of 0 ~ 400. (error code:442)

If step no. is 0, keep the current step no.

9.5.10 Repeat Operation Step no. Change

This command is for changing the repeat operation step no will be executed next.

(1) Characteristics of Control

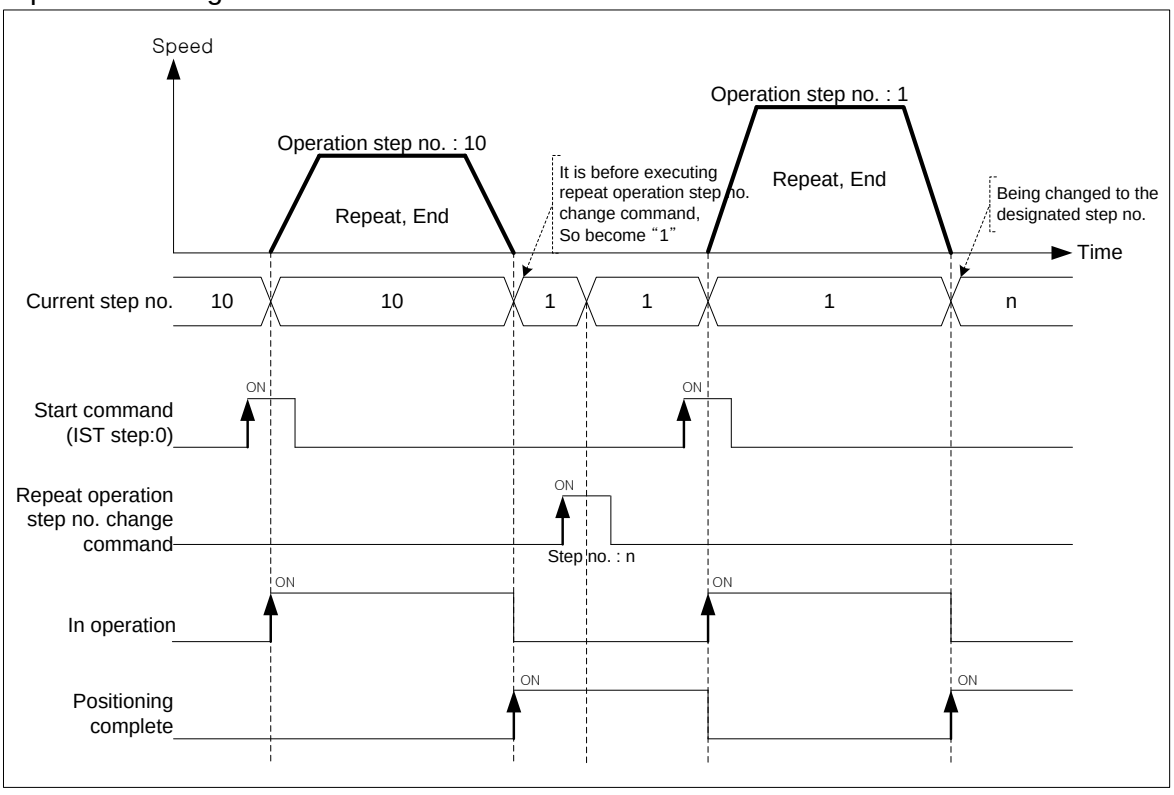
(a) In case of repeat operation mode setting (End, Go-on, Continuous operation), the current operation step no. will be changed automatically to operate the step no.1 when repeat operation mode setting step completes the positioning operation but if start step no. change command is executed in repeat operation, the step no. will be changed with the assigned step no. not the step no.1 .

(b) The repeat operation step no. change command can be executed during positioning operation.

(c) Auxiliary data setting of repeat operation step no. change command

Items	Setting value	Description
Step	1 ~ 400	Set the repeat operation step no. to change

(2) Operation timing



Note

The current operation step is not changed at the moment of executing the command. After "Repeat" positioning data operation is finished, it is changed to the step designated by repeat operation step no. change command.

(3) Restrictions

In the case below, repeat operation step no. change command is not executed.

(a) Step no. to change is out of 0 ~ 400. (error code:442)

If the step no. is 0, keep the previous step no.

[Example] Execute repeat operation step no. change command on axis1 operating by absolute, shortcut position control.

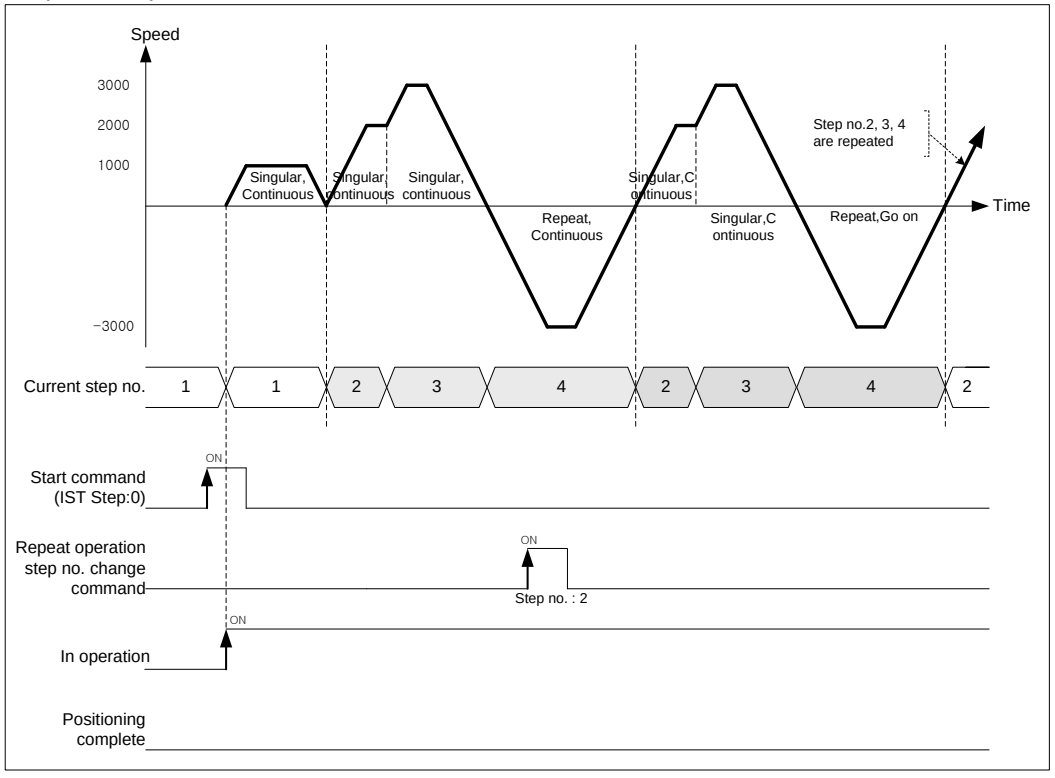
■ Current position of axis1 : 0

■ Setting example in XG-PM

▪ Operation data of axis1

Step no.	Control method	Operation method	Goal position [pls]	Operation speed [pls/s]	Acc. no.	Dec. no.	M code	Dwell time
1	Absolute single axis position control	Singular, Go on	1000	1000	No.1	No.1	0	0
2	Absolute single axis position control	Singular, continuous	2000	2000	No.1	No.1	0	0
3	Absolute single axis position control	Singular, continuous	4000	3000	No.1	No.1	0	0
4	Absolute single axis position control	**Repeat**, Continuous	2000	3000	No.1	No.1	0	0
5	Absolute single axis position control	Singular, End.	5000	2000	No.1	No.1	0	0

■ Operation pattern



9.5.11 Infinite Running Repeat Function

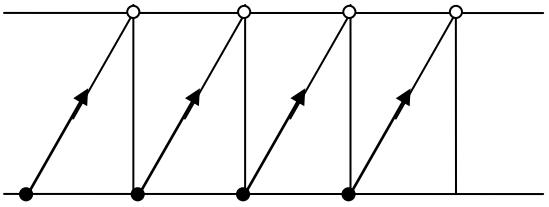
Infinite Running Repeat Function means the function refreshing the command position and current position value automatically and periodically with the value specified “Infinite Running Repeat Position” at extended parameter. If you use this function, positioning with repeated position value for the same direction is available.

(1) Characteristics of Control

(a) If you set “Infinite Running Repeat” of the Extended parameter as “1: Enable”, you can use “Infinite Running Repeat” function.

(b) Set the position value to be refreshed automatically at “Infinite Running Repeat position” of the extended parameter.

(c) When “Infinite Running Repeat” parameter is “1: Enable”, command position and current position value are expressed as 0 ~ “Infinite Running Repeat - 1”



(d) When setting “Infinite Running Repeat” parameter as “1: Enable”, if current position is out of the range of Infinite Running Repeat, it will be changed into the value within the range of Infinite Running Repeat automatically.

[Ex1] In case current position is 32100, infinite running repeat position is 10000,
When setting “Infinite Running Repeat” parameter as “1: Enable”, current position will be 2100.

[Ex2] In case current position is −32100, infinite running repeat position is 10000,
When setting “Infinite Running Repeat” parameter as “1: Enable”, current position will be 7900.

. (e) Setting the extended parameter related with infinite running repeat function

Item	Setting value		Description
Infinite running repeat position	pulse	1～2147483647[pulse]	Sets the repeated position value to be refreshed automatically.
	㎜	1～2147483647[X10^{-4}㎜]	
	Inch	1～2147483647[X10^{-5}Inch]	
	degree	1～2147483647[X10^{-5}degree]	
Infinite running repeat	0: Disable 1: Enable		Sets whether to enable Infinite running repeat function or not.

(f) Shortest distance control

1) In case of absolute coordinate positioning, it automatically selects the rotation direction that makes the object reach the target position through shortest distance

2) Shortest distance control operates only when Control method of Direct Start Command (XDST, XPM_DST) is set as “3: Shortest Distance Control”.

3) Restriction

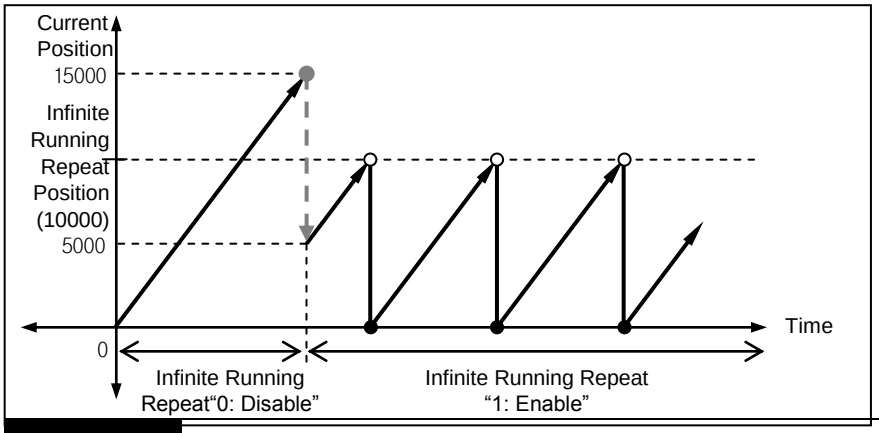
In the following case, Shortest Distance Control can’t be executed.

a) When coordinate is set as incremental coordinate (Error code: 266).

b) When target position value is out of 0~Infinite Running Repeat Position (Error code: 227)

(g) If Infinite Running Repeat function is enabled, you can’t execute single-axis continuous operation and interpolation control.

(2) Operation Diagram



Note

You can’t change Infinite Running Repeat setting during operation. If you enable Infinite Running Repeat setting during stop state, in case current position is larger than Infinite Running Repeat position, current position will be changed to the value within Infinite Running Repeat position.

(3) Restriction

When Infinite Running Repeat function is set as “1: Enable”, in the following case, error occurs.

(a) When starting the operation step which is set as “Single-axis position control”, “Continuous” (Error code: 239)

(b) When starting the operation step which is set as “Linear interpolation” or “Circular interpolation” (Error code: 240)

(4) Operation Example

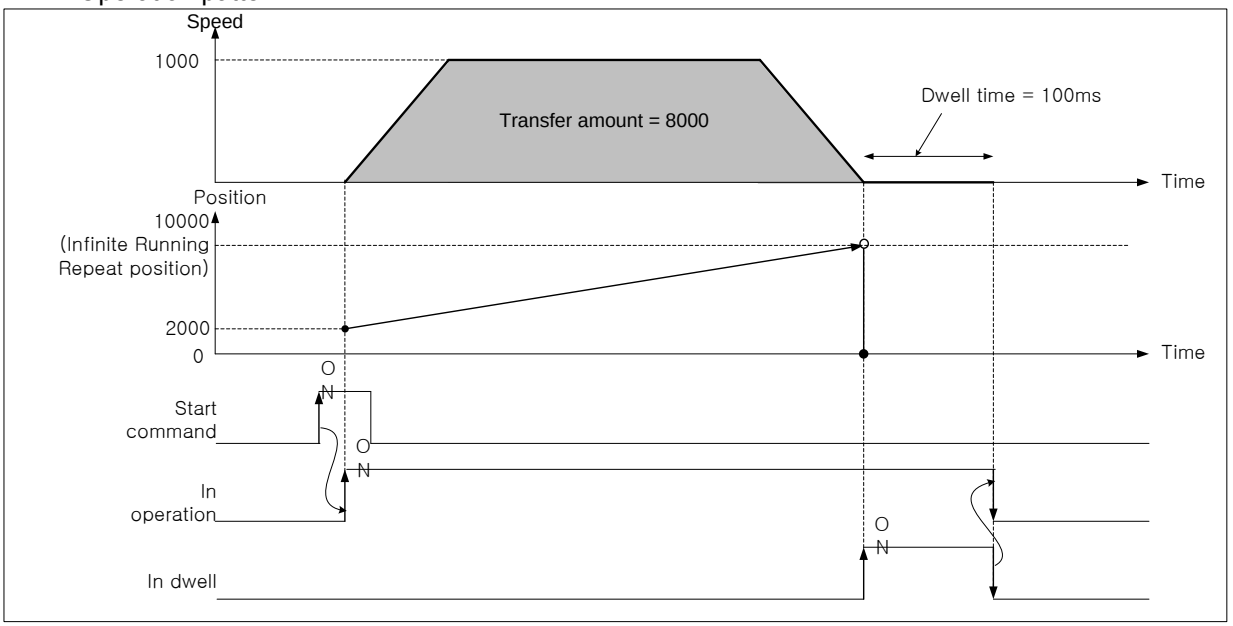
[EX1] It executes absolute, single-axis position control with the following settings while Infinite Running Repeat = 10000 pulse, Infinite Running Repeat “1: Enable”

■ Start position : 2000 pulse, target position : 10000 pulse

■ Setting example of XG-PM

Step No.	Control type	Operation type	Target position [pls]	Operation speed [pls/s]	Acc. No.	Dec. No.	M code	Dwell time
1	Absolute, single-axis position control	Single, End	10000	1000	No. 1	No. 1	0	100

■ Operation pattern



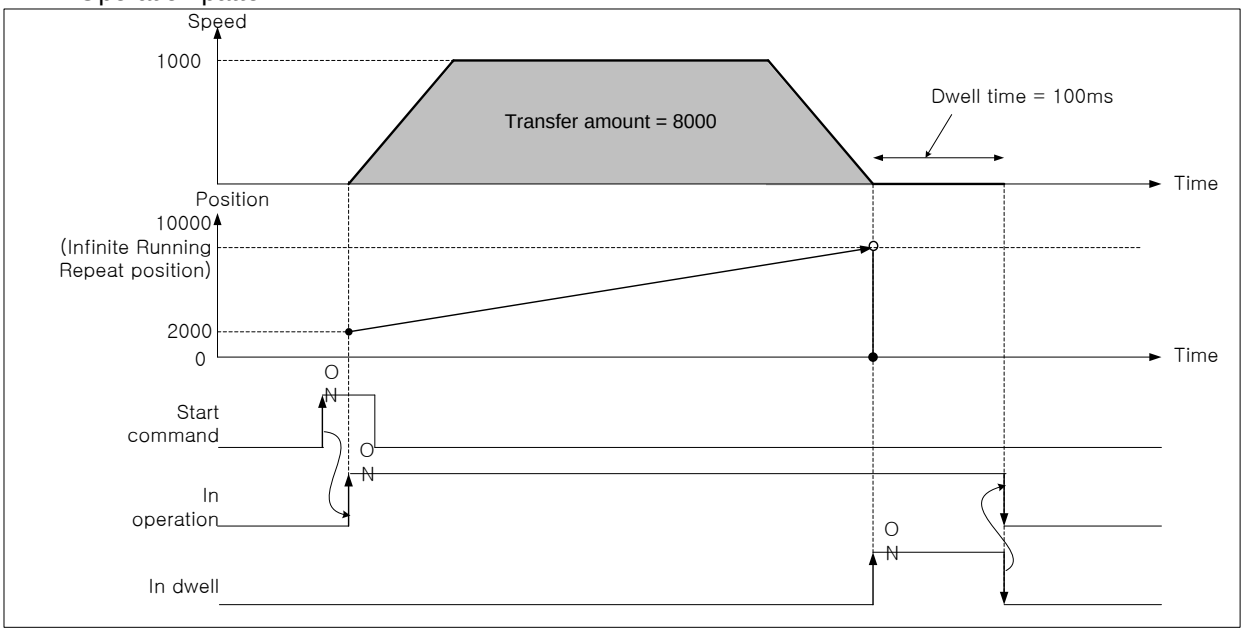
[EX2] It executes absolute, single-axis position control with the following settings while Infinite Running Repeat = 10000 pulse, Infinite Running Repeat "1: Enable"

■ Start position : 2000 pulse, target position : -15000 pulse

■ Setting example of XG-PM

Step No.	Control type	Operation type	Target position [pls]	Operation speed [pls/s]	Acc. No.	Dec. No.	M code	Dwell time
1	Absolute, single-axis position control	Single, End	-15000	1000	No. 1	No. 1	0	100

■ Operation pattern



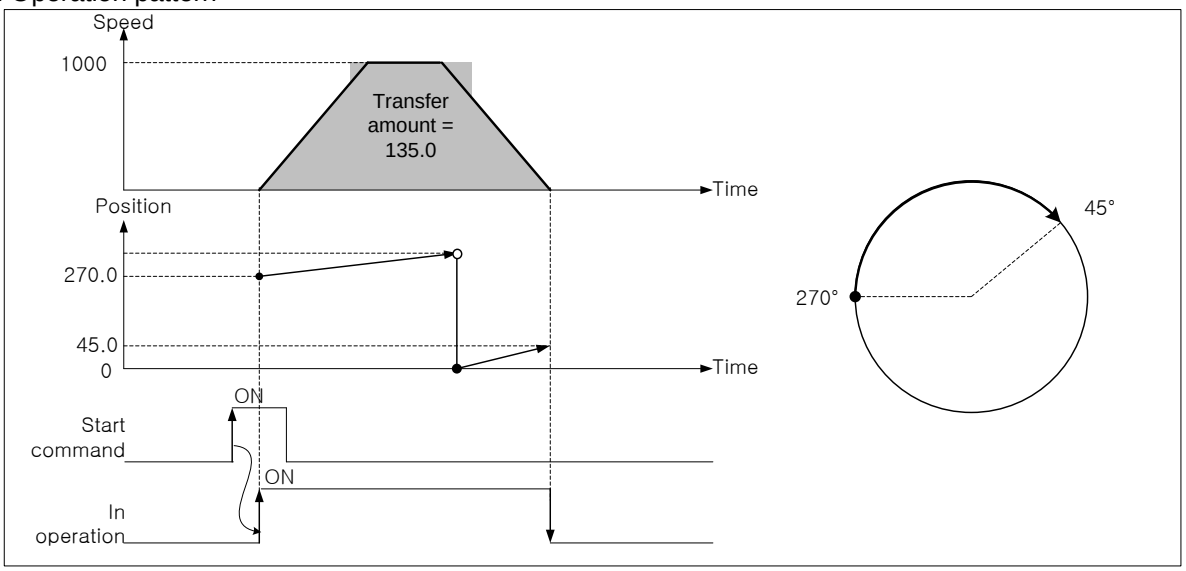
[EX3] It executes absolute, single-axis position control with the following settings while Infinite Running Repeat = 360.0 degree, Infinite Running Repeat "1: Enable"

■ Start position : **270.0 ˚**, target position : **45.0 ˚, operation speed: 1000**

1) Direct start control word setting = Absolute, shortest distance control

15 ~ 12	11 ~ 10	9 ~ 8	7 ~ 5	4	3 ~ 2	1 ~ 0
-	Dec. Time	Acc. Time	-	0:absolute coordinate	-	3:shortest distance control

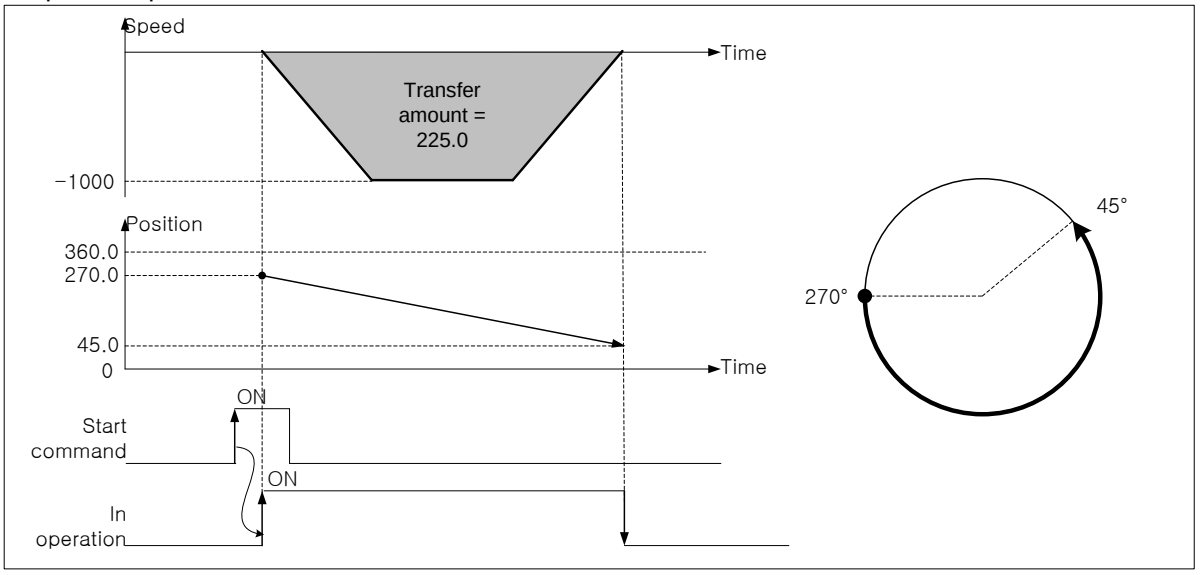
■ Operation pattern



2) Direct start control word setting = Absolute, 0: Position control

15 ~ 12	11 ~ 10	9 ~ 8	7 ~ 5	4	3 ~ 2	1 ~ 0
-	Dec. Time	Acc. Time	-	0:absolute coordinate	-	0: Position control

■ Operation pattern



9.6 Auxiliary Function of Control

9.6.1 High/Low limit

Positioning module includes Hardware high/low limit and Software high/low limit.

(1) Hardware High/Low Limit

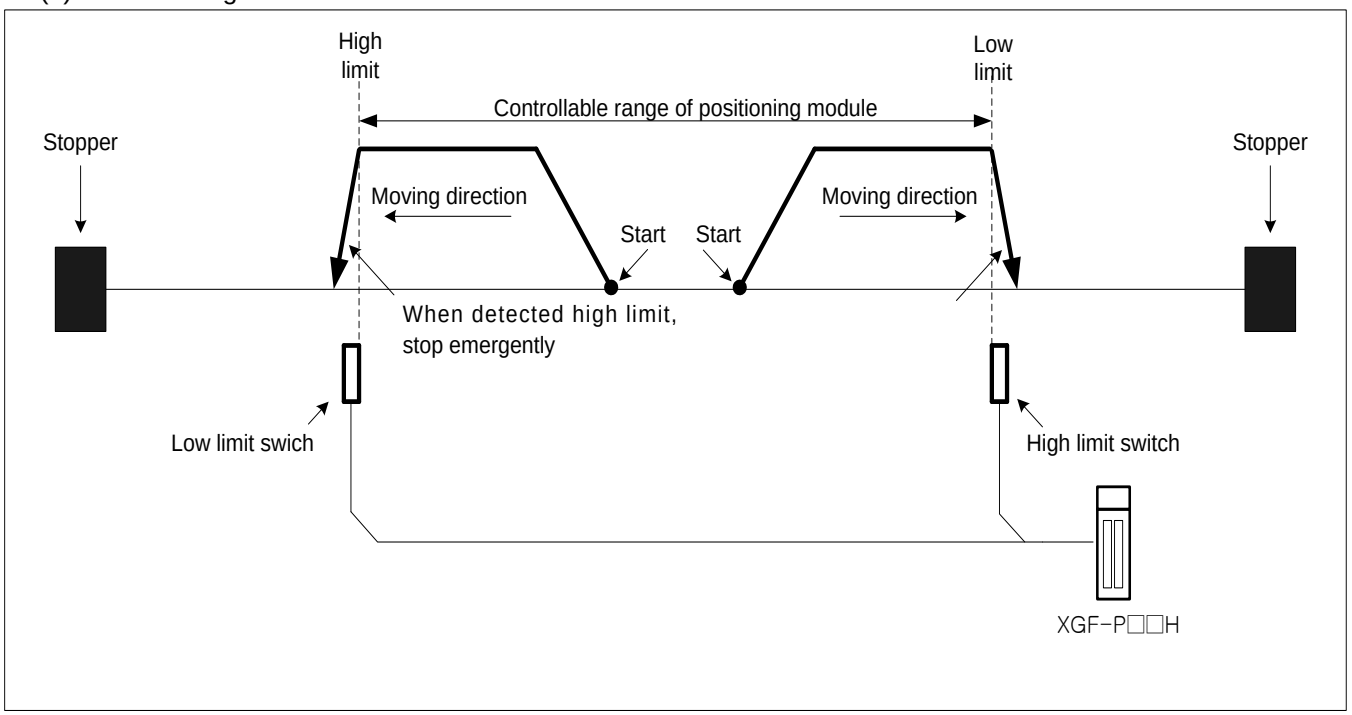
(a) This is used to stop the positioning module promptly before reaching Stroke limit/Stroke End of the Driver by installing the stroke limit of positioning module inside Stroke limit/Stroke end of the Driver. In this case, if it is out of the high limit, Error 492 will occur and if it is out of the low limit, Error 493 will occur.

(b) Input of high/low limit switch is connected to input/out terminal block.

(c) When positioning module is not in the controllable area, positioning operation is not executed.

(d) If it is stopped by hardware high/low limit detection, move it into the controllable area with Jog operation in reverse direction of detected signal.

(e) Hardware high/low limit is shown as follows.



(f) Emergent stop when hardware high/low limit is detected

When hardware high/low limit is detected, stop the current positioning control and then decelerate within “Dec. time for Emergent stop”.

■ Related parameter setting (Basic parameter)

Items	Setting value	Description
Dec. time of Emergent stop	0 ~ 2147483647 [ms]	Set the dec. time for emergent stop. Dec. time for emergent stop means the time needed at decelerating by bias speed.

(2) Software High/Low Limit

(a) This command is for setting the movable range of machine as software high/low limit. If it is out of the range in operation, stop emergently within dec. time for emergency. In other words, this command is for preventing errors, malfunctions and being out of range.

(b) If it is out of the range of software high/low limit, set external input high/low limit for use.

(c) Checking range of software high/low limit is executed at the beginning.

(d) If software high/low limit is detected, error arises. (High limit error:501, Low limit error:502)

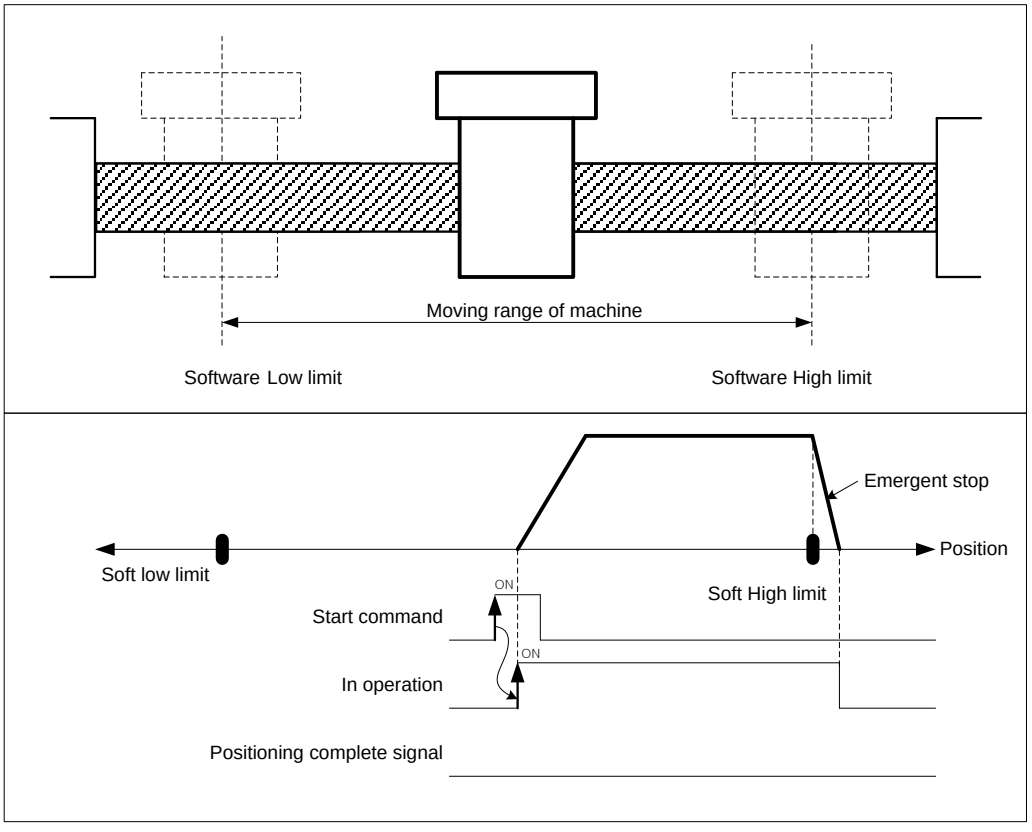
(e) User may set the position value of high/low limit on extended parameter.

■ Related parameter setting (Extended parameter)

Items	Setting value	Description
Soft High Limit	-2147483648 ~ 2147483647	Set the position of soft high limit
Soft Low Limit	-2147483648 ~ 2147483647	Set the position of soft low limit

(f) When an object stops because of detection of software high/low limit, move the object within control area by using JOG operation.

(g) Software high/low limit is shown as follows.



(h) In the case below, software high/low limit are not detected.

- The value of soft high limit 2147483647, the value of soft low limit is -2147483648
- The value of soft high and low limit are same. (High limit = Low limit)

Note

(1) It does not detect software high/low limit in origin-undecided state

(2) Not to detect software high/low limit

If the value of current position becomes 2147483647 in forward operation, the current position becomes -2147483646 and keeps operating in forward direction.

If the value of current position becomes -2147483647 in reverse operation, the current position becomes 2147483646 and keeps operating in reverse direction.

(3) After EMG. Stop by detection of software upper limit, if position value exceeds position max. value 2147483647 and becomes (-) position value, when executing JOG reverse operation, software lower limit error occurs. In this case, set the software upper/lower limit as max/min value so software limit is not detected and move the object within control area with JOG reverse operation. Then reset the software limit.

(4) After EMG. Stop by detection of software upper limit, if position value exceeds position min. value -2147483647 and becomes (+) position value, when executing JOG forward operation, software upper limit error occurs. In this case, set the software upper/lower limit as max/min value so software limit is not detected and move the object within control area with JOG forward operation. Then reset the software limit.

9.6.2 M code

This is used to confirm the current operation step no. and carry out the auxiliary work (Clamp, Drill rotation, Tool change etc.) by reading M Code from the program.

(1) Characteristics of Control

(a) M code should be set in the M code item of operation data.(Setting range : 1 ~ 65535)

(b) If M code is set as “0”, M code signal will not occur.

(c) If M code occurs, M code no.(1 ~ 65535) and M code signal (On) will occur simultaneously.

(d) In case of Go-on operation mode, if M code no. and M code signal occur, it becomes standby for the next step; if executing M code release (APM_MOF) command, it carries out Go-on operation to the next step without start command.

(e) In continuous operation mode, even if M code no. and M code On signal occur, not to wait but execute continuous operation to the next step.

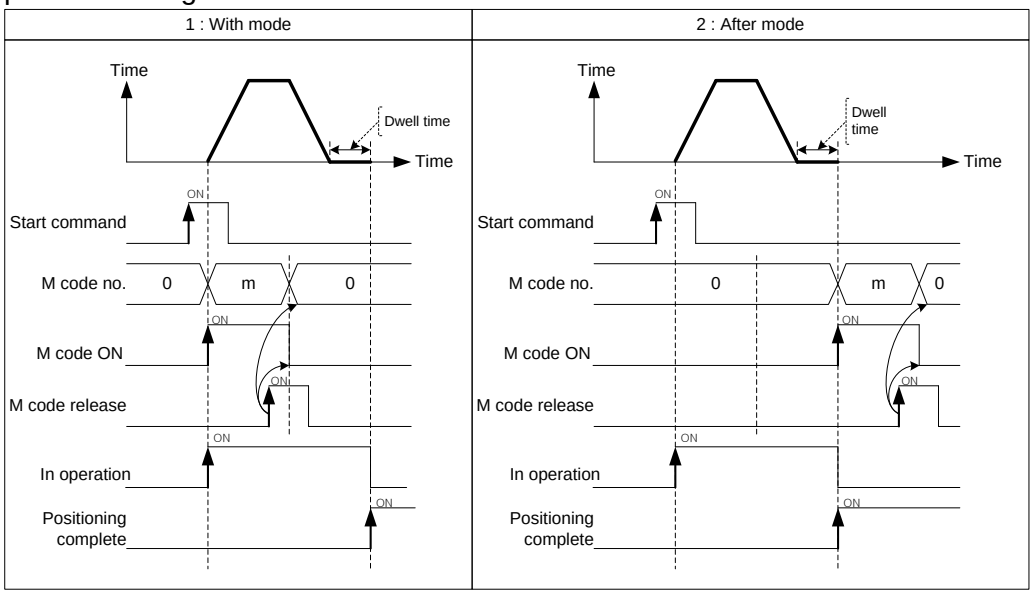
(f) User may turn M code signal off and set M code no. to 0 with M code release command. M code release command can be used even during operation.

(g) M code mode is set from M code output item of extended parameter. (0 : NONE, 1 : WITH, 2 : AFTER)

■ Related parameter setting (Extended parameter)

Items	Setting value	Description
M code mode	0 : None	Not to output M code signal and M code no.
	1 : With	Start and turn M code signal on at the same time, then output M code no. set in operation data.
	2 : After	After finishing positioning by start command, turn M code signal on and then output M code no. set in operation data.

(2) Operation timing



[Example] Set M code no. in operation data as follows and execute absolute, shortcut positioning control.

■ Current position of axis1 : 0

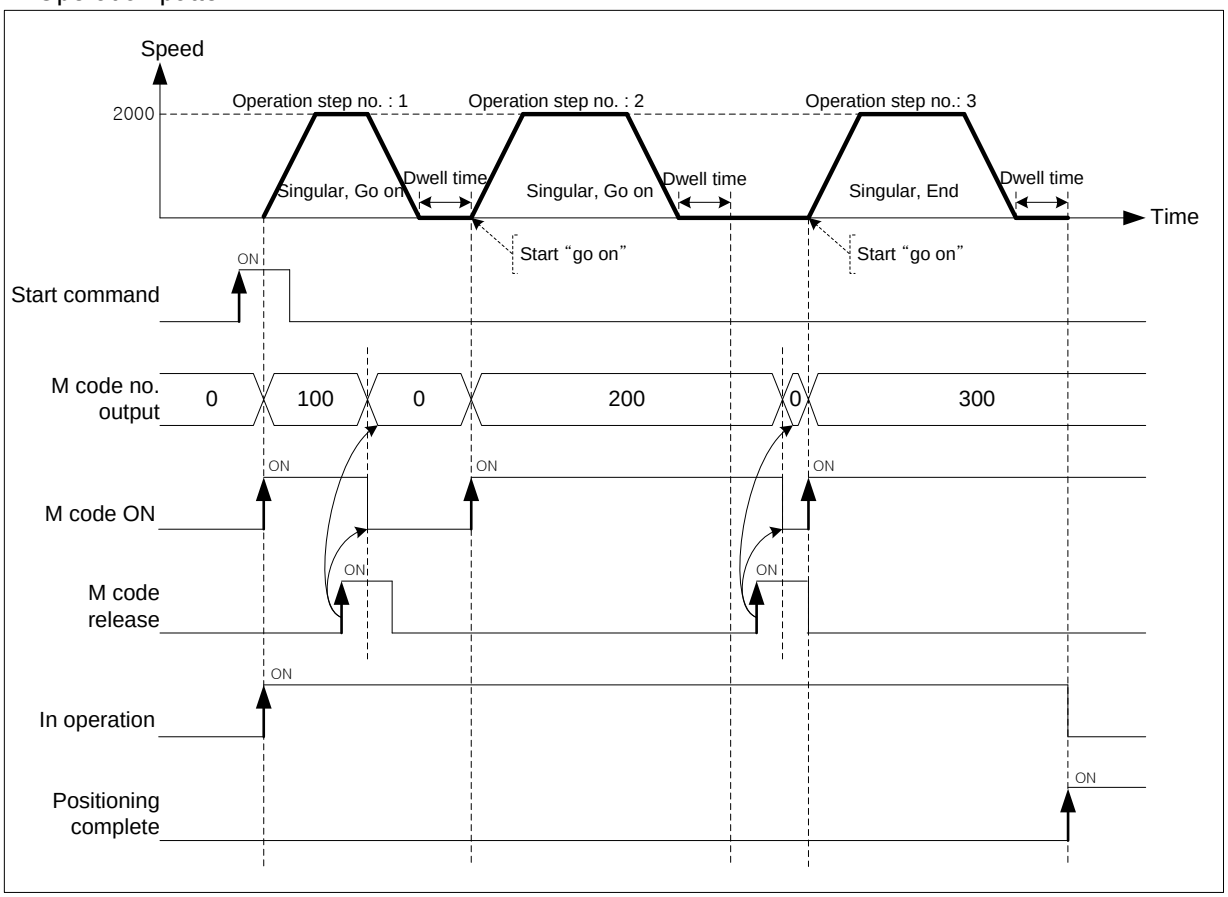
M code mode of basic parameter : With

■ Setting example in XG-PM

▪ Operation data of axis1

Step no.	Control method	Operation method	Goal position [pls]	Operation speed [pls/s]	Acc. no.	Dec. no.	M code	Dwell time
1	Absolute, single-axis positioning control	Singular, continuous	1000	2000	No.1	No.1	100	100
2	Absolute, single-axis positioning control	Singular, continuous	3000	2000	No.1	No.1	200	100
3	Absolute, single-axis positioning control	Singular, continuous	5000	2000	No.1	No.1	300	100

■ Operation pattern



9.7 Data Modification Function

This function is for changing operation data and operation parameter of APM module.

9.7.1 Teaching Array

User may change the operating speed and the goal position of the step user designated with teaching command but without XG-PM.

(1) Characteristics of Control

(a) This command is for changing operating speed or the goal position on several steps.

(b) User may change maximum 16 data.

(c) RAM teaching and ROM teaching are available depending on the saving position.

■ RAM teaching

When executing teaching to operation data of APM module and operating APM module in power connection, user may change speed value or position value but the speed value and position value are not saved in non-power connection.

■ ROM teaching

When executing teaching to operation data of APM module and operating APM module in power connection, user may change speed value or position value and operation data is saved permanently even in non-power connection.

(d) The value of goal position being changed is position teaching, the value of operating speed being changed is speed teaching.

(e) The axis in operation may be the subject of position teaching or speed teaching.

(f) If user changes the value of goal position or operating speed frequently, this command is very useful for it.

(g) Auxiliary data setting of teaching array command

Items	Setting value	Description
Step	0 ~ 400	Set the step no. for teaching
Position	0 : RAM teaching 1 : ROM teaching	Set the method of teaching
Data	0 : Position 1 : Speed	Set the data items for teaching
The No.	1 ~ 16	Set the number of operating step

Note

The teaching data must be set in the data setting area for teaching array before teaching array command is executed. Refer to the teaching array command XTWR.

(2) Restrictions

Teaching array command may not be executed in the case as follows.

(a) Execute teaching to the axis in operation.

- If it is position teaching, (Error code: 461)
- If it is speed teaching, (Error code: 463)

(b) The number of teaching array is out of the range (1~16). (Error code: 462)

(c) Teaching step no. is out of the range (1~400). (Error code: 465)

Total number (Teaching step no. + The number of Teaching) must be below 400.

9.7.2 Parameter Change from Program

User may modify the operation parameter set on XG-PM with teaching command for each parameter.

(1) Characteristics of Control

(a) There are 6 kinds of parameter teaching command. (Basic, Extended, Manual operation, Homing, External signal, common parameter teaching)

(b) Parameter teaching is not available in operation.

(c) RAM teaching and ROM teaching are available depending on the saving position.

■ RAM teaching

When executing teaching to operation data of APM module and operating APM module in power connection, user may change speed value or position value but the speed value and position value are not saved in non-power connection.

■ ROM teaching

When executing teaching to operation data of APM module and operating APM module in power connection, user may change speed value or position value and operation data is saved permanently even in non-power connection.

(2) Basic Parameter Teaching

(a) Change the setting value of designated item from basic parameter of XPM-PN8A module into teaching data.

(b) Auxiliary data setting of basic parameter teaching command

Item	Setting value		Description	
Teaching data	Refer to “setting range”		Set the teaching value of parameter selected	
			Setting range	
Teaching item	1	Speed limit	1 ~ 2147483647	Choose the parameter item to do execute teaching
	2	Acc.time 1	0 ~ 2147483647	
	3	Acc.time 2		
	4	Acc.time 3		
	5	Acc.time 4		
	6	Dec.time 1		
	7	Dec.time 2		
	8	Dec.time 3		
	9	Dec.time 4		
	10	Emergent Dec.time		
	11	Demultiply ouput pulse/rotation	1 ~ 200000000	
	12	Transferring distance/rotation	Depend on “Unit”	
	13	Unit	0:pulse 1:mm 2:inch 3:degree	
	14	Double precision of unit	0:x1 1:x10 2:x100 3:x1000	
	15	Speed unit	0: unit/time 1: rpm	
	16	Encoder selection*	0: incremental encoder 1: abolute encoder	
Teaching method	0 : RAM Teaching 1 : ROM Teaching		Set the teaching method	

* : only for XGF-PN8B

For the details about basic parameter items and setting value, refer to “Chapter 4 parameter and operation data”.

(3) Extended Parameter Teaching

(a) Change the setting value of designated item from extended parameter of XGF-PN8A module into teaching data.

(b) Auxiliary data setting of extended parameter teaching command

Items	Setting value		Description	
Teaching data	Refer to “Setting range		Set the teaching value of parameter selected	
			Setting value	
Teaching items	1	Soft high limit	-2147483648 ~ 2147483647	Select the parameter item to execute teaching
	2	Soft low limit	-2147483648 ~ 2147483647	
	3	-	-	
	4	Positioning complete Output time	0 ~ 65535	
	5	Ratio of S-curve	1 ~ 100	
	6	In-position width	0 ~ 2147483647	
	7	2 axes linear interpolation continuous operation arc insertion position	0 ~ 2147483647	
	8	Acc./Dec. Pattern	0 : Trapezoid operation 1 : S-curve operation	
	9	M code mode	0 : None 1 : With 2 : After	
	10	Soft high/low limit In speed control	0 : Don’t detect 1 : Detect	
	11	Condition for positioning complete	0 : Dwell time 1 : In-position signal 2 : Dwell time AND In-position signal 3 : Dwell time OR In-position signal	
	12	Positioning method of interpolation continuous operation	0 : Pass the goal position 1 : Pass near position	
	13	2 axes linear interpolation continuous operation arc insertion	0 : Don’t insert arc 1: Insert arc	
	14	External command selection #	0 : External speed/position control switching 1 : External stop	
	15	External command #	0 : Enable 1 : Disable	
	16	Position-specified speed override coordinate	0 : Absolute 1 : Incremental	
	17	Infinite running repeat position	mm: 1 ~ 2147483647[X10^{-4} ㎜] Inch: 1 ~ 2147483647[X10^{-5}Inch] degree: 1 ~ 2147483647[X10^{-5}degree] pulse: 1 ~ 2147483647[pulse]	
	18	Infinite running repeat	0: disable, 1: enable	
	19	Speed/position switching coordinate	0: incremental, 1: absolute	
	20	Interpolation speed selection	0: main-axis speed 1: synthetic speed	
Teaching method	0 : RAM teaching 1 : ROM teaching		Set the teaching method	

#: only for XGF-PN8A

For the details about basic parameter items and setting value, refer to “Chapter 4 parameter and operation data”.

(4) Manual Operation Parameter Teaching

(a) Change the setting value of designated item from manual operation parameter of APM module into teaching data.

(b) Auxiliary data setting of manual operation parameter teaching command

Items	Setting value		Description	
Teaching data	Refer to “setting range”		Set the teaching value of parameter selected	
			Setting range	
Teaching items	1	Jog high speed	1~ Speed limit	Select the parameter item to execute teching
	2	Jog low speed	1 ~ Jog high speed	
	3	Jog acc. time	0 ~ 2147483647	
	4	Jog dec. time		
	5	Inching speed	1 ~ Speed limit	
Teaching method	0 : RAM teaching 1 : ROM teaching		Set the teaching method	

For the details about basic parameter items and setting value, refer to “Chapter 4 parameter and operation data”.

(5) Common Parameter Teaching

(a) Change the setting value of designated item from common parameter of APM module into teaching data.

(b) Auxiliary data setting of common parameter teaching command

Items	Setting value		Description	
Teaching data	Refer to “setting range”		Set the teaching value of parameter selected	
			Setting range	
Teaching items	1	Speed override	0 : % setting 1 : speed setting	Select the parameter item to execute teching
	2	Encoder1 pulse input	0 : CW/CCW 1 multiplying 1 : PULSE/DIR 1 multiplying 2 : PULSE/DIR 2 multiplying 3 : PHASE A/B 1 multiplying 4 : PHASE A/B 2 multiplying 5 : PHASE A/B 4 multiplying	
	3	Max. value of encoder1	-2147483648 ~ 2147483647	
	4	Min. value of encoder1		
	5	Encoder1 Z phase clear	0: Disable 1: Enable	
	6	Encoder2 pulse input	0 : CW/CCW 1 multiplying 1 : PULSE/DIR 1 multiplying 2 : PULSE/DIR 2 multiplying 3 : PHASE A/B 1 multiplying 4 : PHASE A/B 2 multiplying 5 : PHASE A/B 4 multiplying	
	7	Max. value of encoder2	-2147483648 ~ 2147483647	
	8	Min. value of encoder2		
	9	Encoder2 Z phase clear	0: Disable 1: Enable	
Teaching method	0 : RAM teaching 1 : ROM teaching		Set the teaching method	

For the details about basic parameter items and setting value, refer to “Chapter 4 parameter and operation data”.

9.7.3 Data Change from Program

User may modify the positioning operation data set on XG-PM with operation data teaching command.

(1) Characteristics of Control

(a) Change setting value of designated step and item from APM module's operation data into teaching data.

(b) Parameter teaching is not available in operation.

(c) RAM teaching and ROM teaching are available depending on the saving position.

■ RAM teaching

When executing teaching to operation data of APM module and operating APM module in power connection, user may change speed value or position value but the speed value and position value are not saved in non-power connection.

■ ROM teaching

When executing teaching to operation data of APM module and operating APM module in power connection, user may change speed value or position value and operation data is saved permanently even in non-power connection.

(d) Auxiliary data setting of operation data teaching command

Items	Setting value		Description	
Teaching data	Refer to “Setting range”		Set the teaching value of parameter selected Setting range	
Teaching items	1	Goal position	-2147483648 ~ 2147483647	Select the parameter item to execute teching
	2	Auxiliary point of Circular interpolation	-2147483648 ~ 2147483647	
	3	Operating speed	1 ~ Speed limit	
	4	Dwell time	0 ~ 65535	
	5	M code	0 ~ 65535	
	6	Set a sub axis	Set it on Bit 0 ~ Bit 7 0 : Not be set 1 : Be set	
	7	Helical interpolation	0 : Not use 1 ~ 8 : axis1 ~ axis8	
	8	No. of circular interpolation turn	0 ~ 65535	
	9	Coordinate	0 : Absolute 1 : Incremental	
	10	Control method	0 : Single-axis position control 1 : Single-axis speed control 2 : Single-axis Feed control 3 : Linear interpolation control 4 : Circular interpolation control	
	11	Operating method	0 : Single 1 : Repeat	
	12	Operating pattern	0 : End 1 : Keep 2 : Continuous	
	13	Size of circular arc	0 : Circular arc < 180 1 : Circular arc >= 180	
	14	Acc. no.	0 ~ 3	
	15	Dec. no.	0 ~ 3	
	16	Method of circular interpolation	0 : Middle point 1 : Center point 2 : Radius	
	17	Direction of circular interpolation	0 : CW 1 : CCW	
Step no.	0 ~ 400		Set the step no. of operation data to execute teaching	
Teaching method	0 : RAM Teaching 1 : ROM Teaching		Set the teaching method	

For the details about basic parameter items and setting value, refer to “Chapter 4 parameter and operation data”.

9.7.4 Write/Read Variable Data

Parameter, operation data, CAM data can be read by “Read Variable Data” command and written by “Write Variable Data” command directly.

(1) Read Variable Data

(a) You read data you want by designating module internal memory address of parameter, operation data, CAM data directly.

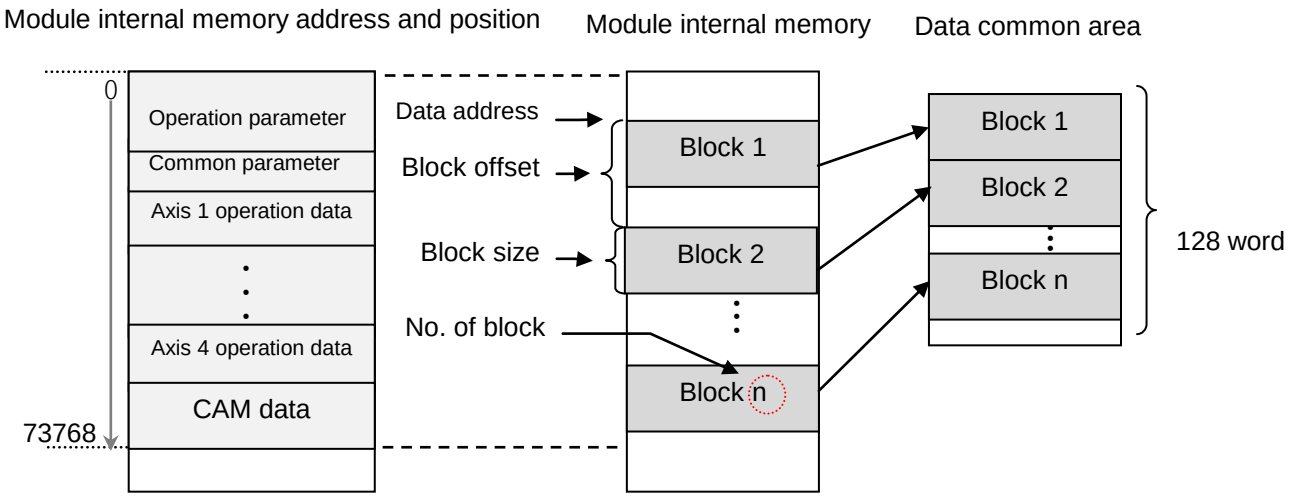
(b) Reads data as many as “Block size” starting position set in “Read address” with WORD unit to CPU among parameter, operation data, CAM data. In case “CNT” is higher than 2, reads blocks with interval of “Block offset” starting “Read address” as many as “CNT”-1.

(c) Max. data size (block size x No. of block) you can read with one command is 128 WORD

(d) “Read Variable Data” command can’t be executed in operation.

(e) Auxiliary data setting of “Read Variable Data” command

Item	Setting value	Description
Read address	0 ~73768	Sets head address of Read Data
Block offset	0 ~73768	Sets offset between blocks of Read Data
Block size	1 ~ 128	Sets size of block
No. of block	1 ~ 128	Sets No. of Read Block



(f) Restriction

In the following case, error occurs and can’t execute “Read Variable Data” command

■ Data setting error (Error code: 711)

▪ Read data size (Block size x No. of block) is 0 or higher than 128 WORD.

▪ Read data address [Read address + {block offset x (No. of block -1)} + Block size is higher than last address value (73768)

Note

If you execute “Read Variable Data” command in XGK PLC, Read data from positioning module is saved in common area. To save in device for using in PLC program, use GETM command [Read address: 0, data size: Read data size (DWORD)]
In XGI/XGR PLC, Read data is saved in register set in Function Block automatically.

(2) Write Variable Data

(a) You write data you want by designating module internal memory address of parameter, operation data, CAM data directly.

(b) Writes data set in PLC program as many as “Block size” starting position set in “Write address” with WORD unit among parameter, operation data, CAM data of positioning module. In case “No. of block” is higher than 2, writes blocks with interval of “OFFSET” starting “Write address” as many as “CNT”-1.

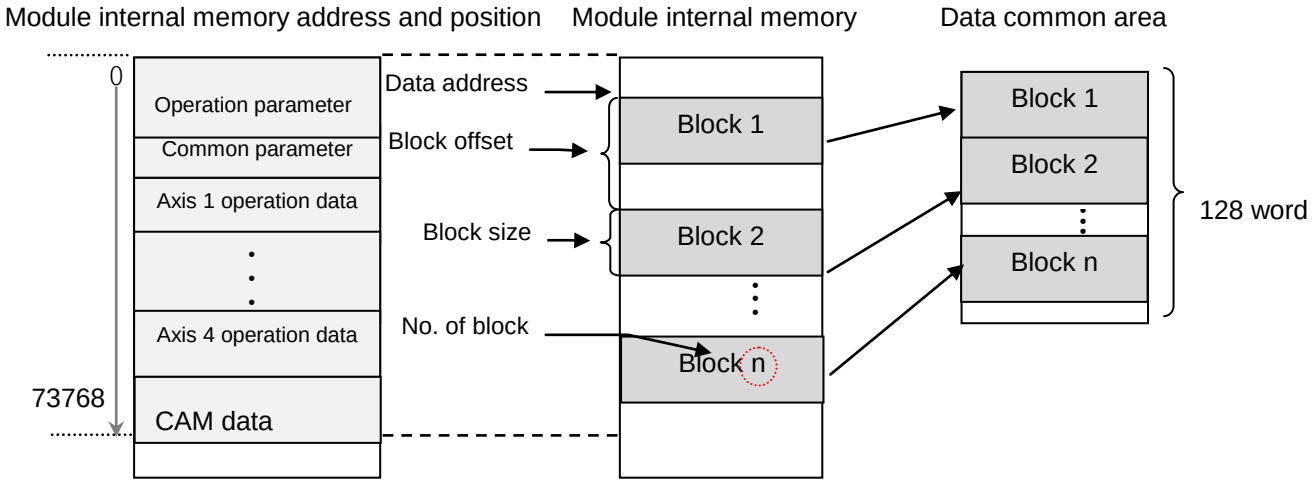
(c) Max. data size (Block size x No. of block) you can write with one command is 128 WORD.

(d) “Read Variable Data” command can’t be executed in operation.

(e) After executing “Write Variable Data” command, since the changed value is maintained while power is on, in order to keep the changed value, execute “Save parameter/Operation data” command

(f) Auxiliary data setting of “Write Variable Data” command

Item	Setting value	Description
Data device	-	Sets device where data to write to module is saved
Write address	0 ~ 73768	Sets head address of positioning module internal memory
Block offset	0 ~ 73768	Sets offset between blocks of Write data
Block size	1 ~ 128	Sets size of block
No. of block	1 ~ 128	Sets No. of Write block



(g) Restriction

In the following case, error occurs and can’t execute “Read Variable Data” command

■ Data range setting error (Error code: 711)

▪ Write data size (Block size x No. of block) is 0 or higher than 128 WORD

▪ Write data address [Write address + {Block offset x (No. of block -1)} + Block size] is higher than last address value (72793

■ Block overlap error (Error code: 713)

▪ In case module internal block to write is overlapped each other

(In case no. of block is higher than 2, block offset is smaller than block size)

■ Execution inhibition error in operation (Error code: 712)

▪ Any axis of positioning module is in operation

Appendix 1 Positioning Error Information & Solutions

Here describes the positioning error types and its solutions.

(1) Error Information of Basic Parameter

Error Code	Error Description	Solutions
101	Speed limit value of Basic Parameter exceeds the range	Speed limit value of Basic Parameter is 1 ~ 20,000,000 based on pulse unit.
104	Speed limit of basic parameter by degree is bigger than 180out of range, so circular interpolation can not be executed.	Operate with lower speed limit of Circular Interpolation

(2) Error Information of Expanded Parameter

Error Code	Error Description	Solutions
111	Extended Parameter software high/low limit range error	S/W high limit of Extended Parameter should be greater than or equal to S/W low limit of Extended Parameter.
112	M Code Mode value of Extended Parameter exceeds the range.	M Code output of Extended Parameter is 0:None, 1:With, 2:After. Select one among three.
113	S-Curve rate of Extended Parameter exceeds the range.	Change S-Curve rate of Extended Parameter to be more than 1 and less than 100.

(3) Error Information of Manual Operation Parameter

Error Code	Error Description	Solutions
121	Jog high speed value of Manual operation parameter exceeds the range.	Set Jog high speed of Manual operation parameter to be greater than or equal to bias speed of Basic Parameter and less than or equal to max. speed of Basic Parameter.
122	Jog low speed value of Manual operation parameter exceeds the range.	Set Jog low speed of Manual operation parameter to be more than 1 and less than Jog high speed of Manual operation parameter.
123	Inching speed value of Manual operation parameter exceeds the range.	Set Inching speed of Manual operation parameter to be greater than or equal to bias speed of Basic Parameter and less than or equal to max. speed of Basic parameter.

(4) Error Information of Common Parameter

Error Code	Error Description	Solutions
141	Encoder type value of Common parameter exceeds the range.	Set Encoder input signal of Common parameter to be between 0 and 5.
148	Encoder1 max/min value of common parameter Exceeds the range.	Set Encoder max value smaller than min value, also set encoder max/min value contains current position.

Error Code	Error Description	Solutions
149	Encoder2 max/min value of common parameter Exceeds the range.	Set Encoder max value smaller than min value, also set encoder max/min value contains current position.

(5) Error Information of Operating Data

Error Code	Error Description	Solutions
151	Not available to set operation speed value of Operation data as “0”.	Set operation speed to be greater than “0”.
152	Operation speed of Operation data exceeds max. speed value.	Set operation speed to be less than or equal to max. speed set in the Basic Parameter.
155	Exceeds End/Go on/Continuous operation setting range of Operation data.	Set one from operation pattern (0:End, 1:Go on, 2: Continuous) of operation data to operate
156	Even the operation pattern settled continuous, next command cannot support continuous operation.	Set for abstract positioning control or speed control. If it is for current step command then next step command should be a interpolation command.
157	Even the operation pattern settled continuous, next command cannot support axis of current command.	If operation pattern is continuous, them set both Operation data and next step operation data equally
158	Even the operation pattern set continuous, current command cannot support continuous current command.	Continuous operation only can be operated when it is shortening position control, linear interpolation, and circular interpolation. In other commands, set operation option to end or continuous.
159	Goal position of operation data exceeds the range.	For positioning control operating change goal position more than 2,147,483,648 and less than 2,147,483,647.

(6) Error Information of Data Writing

Error Code	Error Description	Solutions
171	Parameter writing command cannot be done because of start command execution while XG-PM is sending common parameter.	Once current operation is done, eliminate error with error-reset command, and then execute writing command again. Do not execute start operation while parameter sending.
172	Parameter writing command cannot be done because of start command execution while XG-PM is sending operating parameter.	Once current operation is done, eliminate error with error-reset command, then execute writing command again. Do not execute start operation while parameter sending.
173	Parameter writing command cannot be done because of start command execution while XG-PM is sending operating data.	Once current operation is done, eliminate error with error-reset command, then execute writing command again. Do not execute start operation while operating data sending.
174	Parameter writing command cannot be done because of start command execution while XG-PM is sending CAM data.	Once current operation is done, eliminate error with error-reset command, then execute writing command again. Do not execute start operation while CAM data sending.
175	Start command cannot be executed while writing sending-parameters or operating-data from XG-PM.	Execute again once writing of parameter or operating data are done.
176	Servo parameter writing command cannot be done because of start command execution while XG-PM is sending parameter data.	After current operation is done, remove error with Error reset and write servo parameter again. Don’t execute start command during servo parameter transmission

(7) Error Information of positioning command and Auxiliary Step control

Error Code	Error Description	Solutions
201	Not possible to carry out Homing command in the state of in operation.	Check if command axis is in operation when the Homing command is executed.
203	Not possible to carry out Homing command in the state of Servo Ready OFF.	Check if Driver Ready signal of command axis is OFF when Homing command is executed.
204	Home Return method (P3-25) of servo driver is set as “0: No operation”.	Set the Home Return method of servo driver parameter as the value other than “0: No operation” and execute Home Return.
205	Not possible to carry out Home Return, because servo driver doesn’t support Home return mode	Unable to carry out Home return in that servo driver
206	Not possible to complete reading home offset	Check the status of the servo driver and execute Home return command
207	Error occurs during home return	Check if Home return method is available for the servo driver and execute Home return again
211	Not possible to carry out Floating origin setting command in the state of in operation.	Check if command axis is in operation when Floating origin setting command is executed.
212	Not possible to carry out Floating origin setting command in the state of Servo OFF.	Carry out Floating origin setting command after making Servo ON status with Servo On command.
221	Not possible to carry out Direct Start command in the state of in operation.	Check if command axis is in operation when Direct Start command is executed.
223	Not possible to carry out Direct Start command in the state of M Code ON.	Execute Direct Start command after turning off the M code On signal with MOF command
224	Not possible to carry out Direct Start command at the absolute coordinate in the origin unsettled state.	Execute Direct Start command after making Home-decided status with Home Return or Floating Origin Setting command
225	Not possible to carry out Direct Start command in the state of Servo OFF.	Carry out Direct Start command after making Servo ON status with Servo On command
226	Shortest distance control can’t be executed in Incremental coordinate.	Set the coordinate as Absolute.
227	In Infinite Running Repeat mode, target position of shortest distance control is invalid	In Infinite Running Repeat mode, target position should be 0~ “Infinite Running Repeat position” of Extended parameter.
230	Not possible to carry out continuous operating out Indirect Start command in the state of feed control.	Execute indirect start with setting of feed control for operation control, continuous for operating pattern if it is set as continuous or end.
231	Not possible to carry out Indirect Start command in the state of in operation.	Check if command axis is in operation when Indirect Start command is executed.
233	Not possible to carry out Indirect Start command in the state of M Code ON.	Execute Indirect Start command after turning off the M code On signal with MOF command
234	Not possible to carry out Indirect Start command at the absolute coordinate in the origin unsettled state.	Execute Indirect Start command after making Home-decided status with Home Return or Floating Origin Setting command
235	Not possible to carry out Indirect Start command in the state of Servo OFF.	Carry out Indirect Start command after making Servo ON status with Servo On command
236	Not possible to carry out Continuous operation of Indirect Start at speed control.	When control method is “speed control” and operation pattern is “Continuous”, change the operation pattern as “End” or “Keep” and execute Indirect Start command.
237	Step no. of POINT start is limited up to 20.	Set the step no. for POINT start to be less than 20 and greater than 1
238	Not possible to carry out Continuous operation of Indirect Start at S-Curve acceleration / deceleration pattern.	Set the ACC/DEC pattern of extended parameter as “Trapezoid”

Error Code	Error Description	Solutions
239	When main-axis or sub-axis is “Enable” status, Continuous Operation of Indirect Start can’t be executed.	Set Infinite Running Repeat of sub-axis or main-axis as “0: Disable” or set the operation pattern as “END” or “KEEP”.
240	When main-axis or sub-axis is “Enable” status, Interpolation Operation of Indirect Start can’t be executed.	Set Infinite Running Repeat of sub-axis or main-axis as “0: Disable” or set the operation pattern as “END” or “KEEP”.
241	Not possible to carry out Linear interpolation Start in the state that main axis of linear interpolation is in operation.	Check if main axis is in operation when Linear interpolation command is executed.
242	Not possible to carry out Linear interpolation Start in the state that subordinate axis of linear interpolation is in operation.	Check if subordinate axis 1 is in operation when Linear interpolation command is executed.
247	Not possible to carry out Linear interpolation Start in the state that M Code signal of main axis of Linear interpolation is ON.	Turn off the M code On signal of main-axis with MOF command and execute the Linear Interpolation operation
248	Not possible to carry out Linear interpolation Start in the state that M Code signal of subordinate axis of Linear interpolation is ON.	Turn off the M code On signal of main-axis with MOF command and execute the Linear Interpolation operation
250	Not possible to carry out positioning operation of absolute coordinate in the state that main axis of Linear interpolation is origin unsettled.	Make the main-axis as home-decided status with Home Return command or Floating Origin setting command
251	Not possible to carry out positioning operation of absolute coordinate in the state that subordinate axis of Linear interpolation is origin unsettled.	Make the sub-axis as home-decided status with Home Return command or Floating Origin setting command
253	In case that main axis and subordinate axis is set wrong in Linear interpolation. (the case that the subordinate axis is not assigned, the case that only one axis is assigned, or the case that no axis is assigned)	Set the more than one axis among axes connected to the network except main-axis for sub-axis setting in main-axis operation data
254	Not possible to carry out the linear interpolation operation because the main axis of Linear interpolation is Servo Off status	Make the main axis as Servo On status with Servo On command.
255	Not possible to carry out the linear interpolation operation because the sub axis of Linear interpolation is Servo Off status	Make the sub axis as Servo On status with Servo On command.
261	Main axis speed of linear interpolation exceeds its speed limit.	Set low for main axis speed so that linear interpolation speed limit would not exceeds.
262	Not possible to insert the circular because the position of 2axis continuous linear interpolation circular insertion are longer than goal position.	Set low for position of 2 axis linear interpolation continuous operating circular insertion from expanded parameter, smaller than goal position.
263	Not possible to insert the circular because two lines of 2axis continuous linear interpolation circular insertion are at the same position.	Set again for goal position or set “0:Not insert circular” for 2 axis linear interpolation continuous operating circular insertion.
264	Not possible to insert the circular because the radius of 2axis continuous linear interpolation circular insertion are bigger than 2147483647.	Set again for goal position so those two lines would not be at the same location or set “0:Not insert circular” for 2 axis linear interpolation continuous operating circular insertion then execute linear interpolation.
265	Not possible to insert the circular because the radius of 2axis continuous linear interpolation circular insertion are rarely small or its speed limits are too high.	Make bigger for circular insert position and less for speed limit or set “0:Not insert circular” for 2 axis linear interpolation continuous operating circular insertion then execute linear interpolation.

Error Code	Error Description	Solutions
266	Not possible to insert the circular because the circular of 2axis continuous linear interpolation circular insertion are at the same position from where it is supposedly located.	Set again for goal position so those two lines would not be at the same location or set “0:Not insert circular” for 2 axis linear interpolation continuous operating circular insertion then execute linear interpolation.
270	Error of radius setting from radius circular interpolation.	Set radius setting from circular interpolation main axis operating data for 80% bigger than its half distance of beginning point to end point.
271	Not possible to carry circular interpolation start in the state that main axis of circular interpolation is in operation.	Check if main axis is in operation when circular interpolation command is executed.
272	Not possible to carry circular interpolation start in the state that subordinate axis of circular interpolation is in operation	Check if subordinate axis is in operation when circular interpolation command is executed.
275	Not possible to carry circular interpolation start in the state that M Code signal of main axis of circular interpolation is ON.	Turn off the M code On signal of the main-axis with MOF command
276	Not possible to carry circular interpolation start in the state that M Code signal of subordinate axis of circular interpolation is ON.	Turn off the M code On signal of the sub-axis with MOF command
277	Not possible to carry positioning operation of absolute coordinate in the state that main axis of circular interpolation is origin unsettled.	Make the main-axis as Home-decided status with Home Return command and Floating origin setting command and then execute the circular interpolation
278	Not possible to carry positioning operation of absolute coordinate in the state that subordinate axis of circular interpolation is origin unsettled	Make the sub-axis as Home-decided status with Home Return command and Floating origin setting command and then execute the circular interpolation
279	Incorrect setting of main axis from circular Interpolation. (Either, unset main axis, incorrect helical interpolation axis, exceeding number of current possible operating axis)	Execute circular interpolation after 1.Set one more operational axis from circular interpolation data except main axis 2. Set one more operate able axis from helical interpolation.
280	Not possible to carry out the Circular interpolation operation because the main axis of Circular interpolation is Servo Off status	Make the main axis as Servo On status with Servo On command.
281	Not possible to carry out the Circular interpolation operation because the sub axis of Circular interpolation is Servo Off status	Make the sub axis as Servo On status with Servo On command.
282	Not possible to carry out degree operation in circular interpolation.	Check if the unit of Basic Parameter of main axis of circular interpolation command is set as degree.
283	Not possible to carry out degree operation in circular interpolation.	Check if the unit of Basic Parameter of subordinate axis of circular interpolation command is set as degree.
284	Not possible to carry out the operation if start point =center point (middle point) or center point (middle point) =end point in circular interpolation.	Check if the center point or middle point is set as the same point as start point or end point in circular interpolation.
285	The start point and end point is Not possible to be same in the middle point mode (Radius mode) of circular interpolation.	Check if circular interpolation method of Common parameter is set as middle point (or Radius) and if the position of start point is not the same as end point.
286	Radius setting error in circular interpolation.	The radius of the circle to carry out circular interpolation operation is up to 2e31 pulse. Check if it is set in order to carry out the circular interpolation more than the size.

Error Code	Error Description	Solutions
287	Not possible to carry out the operation as linear profile comes out of circular interpolation.	Check if circular interpolation method of Common parameter is set as Middle point and the middle point is set to be aligned with start point and end point.
290	Since angular velocity is greater than 90°, correct circle cannot be drawn.	Set operation speed lower than 90° for circular Interpolation angular velocity.
291	Not possible to carry out Synchronous Start command in the state of in operation.	Check if the Error occurred axis is included in Synchronous Start command and if there is no axis in operation when the command is executed.
293	Not possible to carry out Synchronous Start command in the state of M Code ON.	Check if the Error occurred axis is included in Synchronous Start command and if M Code signal is ON when the command is executed. Available to make M Code OFF by MOF command
294	Not possible to carry out Synchronous Start command in case that there is no goal position.	Check if the Error occurred axis is included in Synchronous Start command, and if the goal position of operation data of the step to operate is not the same as the current position for absolute coordinate and is set as “0” for relative coordinate.
295	Not possible to carry out Synchronous Start command in the state that Servo Ready is OFF.	Check if the Error occurred axis is included in Synchronous Start command, and if Driver Ready signal is OFF when the command is executed.
296	In case that Synchronous Start command axis setting is wrong.	Check if only one axis of Synchronous Start command is assigned. The axis assignment address means 0 bit : X axis, 1 bit : Y axis, 2 bit : Z axis and each bit is set as “1” for axis assignment.
297	An error occurred from axis of synchronous start operating.	Execute synchronous start after eliminate an error element from error occurred axis.
301	Not possible to carry out Speed/Position control switching command not in the state of in operation.	Check if the axis is ‘stop’ state when speed/position control switching command is executed.
302	Not possible to carry out Speed/Position control switching command not in the state of speed control.	Check if the axis is ‘speed control’ state when speed/position control switching command is executed.
303	Not possible to carry out Speed/Position control switching command at subordinate axis of Synchronous Start operation.	Check if the axis is in operation by subordinate axis of Synchronous Start operation when speed/position control switching command is executed.
304	Not possible to carry out Speed/Position control switching command if there is no goal position.	Check if the operation has the goal position when speed /position control switching command is executed.
306	For Position-specified Speed/Position switching command, when Infinite Running Repeat is “Enable”, Speed/Position switching coordinate is “Absolute”, the value which makes the object go to the opposite direction can’t be set.	For position value of Position-specified speed/position switching command, when operation direction is forward, set the positive position value and when operation direction is reverse, set the negative position value.
311	Not possible to carry out Position/Speed control switching command not in the state of in operation.	Check if the axis is ‘stop’ state when position/speed control switching command is executed.
312	Not possible to carry out Position/Speed control switching command at subordinate axis of Synchronous Start operation.	Check if the axis is in operation by subordinate axis of Synchronous Start operation when position/speed control switching command is executed.
313	Not possible to carry out Position/Speed control switching command in the state of circular interpolation operation.	Check if the axis is in circular interpolation operation when position/speed control switching command is executed.

Error Code	Error Description	Solutions
314	Not possible to carry out Position/Speed control switching command in the state of Linear interpolation operation.	Check if the axis is in linear interpolation operation when position/speed control switching command is executed.
316	Not possible to carry out Position/Speed switching command in the state of decreasing section.	Execute Position/Speed switching command before the decreasing of axis, while in increasing section or regular section.
317	Not possible to carry out Position/Speed switching command when it is not either at the positioning control or inching operation	Execute Position/Speed switching command while the commanding axis is positioning control or inching operation
321	Dec. stop command can't ne executed when axis is not in operation.	Execute Dec. stop command when command axis is in operation
322	Not possible to carry out deceleration stop command in the state of Jog operation.	Dec. stop command can't stop JOG operation. For JOG operation stop, use the JOG STOP command.
324	Deceleration time setting from deceleration stop commands are out of range.	The range of deceleration time is between 0 and 2147483647. Execute deceleration command after resetting the value from its range.
331	Not possible to carry out Skip command not in the state of in operation.	Execute the Skip command when command axis is in operation.
332	Not possible to carry out Skip command for subordinate axis of Linear interpolation operation.	Give the Skip command to linear interpolation main-axis.
333	Not possible to carry out Skip command for subordinate axis of Synchronous Start operation.	Check if the axis is in operation by subordinate axis of Synchronous Start operation when Skip command is executed.
335	Not possible to carry out Skip command in the state of Jog operation.	Check if the axis is in Jog operation when Skip command is executed.
336	Not possible to carry out Skip command in the state of Direct Start operation.	Check if the axis is in Direct Start operation when Skip command is executed.
337	Not possible to carry out Skip command in the state of Inching operation.	Check if the axis is in Inching operation when Skip command is executed.
338	Not possible to carry out Skip command for subordinate axis of circular interpolation operation.	Check if the axis is in operation by subordinate axis of circular interpolation operation when Skip command is executed.
339	Skip operation command can't be executed during torque control.	Skip operation command doesn't work in the axis under torque control.
341	Not possible to carry out Synchronous Start by Position command in the state of in operation.	Check if the axis is in operation when Synchronous Start by Position command is executed.
343	Not possible to carry out Synchronous Start by Position command in the state of M Code ON.	Check if the M Code signal of the axis is ON when Synchronous Start by Position command is executed. Available to make M Code OFF by MOF command.
344	Not possible to carry out Synchronous Start by Position command at the absolute coordinate in the state of origin unsettled.	Not available to carry out absolute coordinate operation in the origin unsettled state. Check the coordinate of step to operate and the current origin determination state. Available to carry out absolute coordinate operation after origin determination by Homing command or floating origin setting command.
345	Not possible to carry out Synchronous Start by Position command in the state that Servo Ready is OFF.	Check if Driver Ready signal of the axis is OFF when Synchronous Start by Position command is executed.
346	Not possible to carry out Synchronous Start by Position command in the state that the origin of main axis is not settled.	Check if main axis is in the origin unsettled state when Synchronous Start command is executed.

Error Code	Error Description	Solutions
347	There is error in setting main axis/subordinate axis of Synchronous Start by Position command.	Set the main axis of Synchronous Start command with one among axes connected to the network other than command axis and encoders. For main axis setting, 1(1-axis)~8(8-axis), 9(Encoder1), 10(Encoder2) are available.
350	Not possible to carry out Synchronous Start when main-axis is in operation	Execute Synchronous Start when main-axis is not in operation.
351	Not possible to carry out Synchronous Start by Speed command in the state of in operation.	Check if the axis is in operation when Synchronous Start by Speed command is executed.
353	Not possible to carry out Synchronous Start by Speed command in the state of M Code ON.	Check if the M Code signal of the axis is ON when Synchronous Start by Speed command is executed. Available to make M Code OFF by XMOF command.
354	Not possible to carry out Synchronous Start by Speed command in the state that Servo Ready is OFF.	Check if Driver Ready signal of the axis is OFF when Synchronous Start by speed command is executed.
355	There is error in setting main axis/subordinate axis of Synchronous Start by Speed command.	Check if main axis of Synchronous Start by Speed command is set as the same as command axis. Main axis is set by writing 0(X axis),1(Y axis),2(Z axis) to the setting address.
356	There is error in setting main/sub axis settings.	Main axis ratio of Speed Synchronous command can't be 0. set the value of -32768 ~ 32767 except 0
357	The speed of Synchronous Start by Speed command cannot exceeds its speed limit.	Set low for main axis ratio/second axis ratio values so The value would not exceed its limitation.
361	Not possible to carry out Position Override command not in the state of in operation (Busy).	Check if the axis is 'stop' state when Position Override command is executed.
362	Not possible to carry out Position Override command not in the state of in dwell.	Check if the axis is in dwell when Position Override command is executed..
363	Not possible to carry out Position Override command not in the state of positioning operation.	Check if the axis is in operation by position control when Position Override command is executed.
364	Not possible to carry out Position Override command for the axis of Linear interpolation operation.	Check if the axis is in Linear interpolation operation when Position Override command is executed.
365	Not possible to carry out Position Override command for the axis of circular interpolation operation.	Check if the axis is in circular interpolation operation when Position Override command is executed.
366	Not possible to carry out Position Override command for the subordinate axis of Synchronous operation.	Check if the axis is in operation by subordinate axis of Synchronous Start operation when Position Override command is executed.
371	Not possible to carry out Speed Override command not in the state of in operation (Busy).	Check if the axis is 'stop' state when Speed Override is executed.
372	Exceeds the range of speed override value.	Speed value of Speed Override command should be less than or equal to max. speed set in Basic Parameter. Check the speed value.
373	Not possible to carry out Speed Override command for the subordinate axis of Linear interpolation operation.	Check if the axis is in operation by subordinate axis of Linear interpolation operation when Speed Override command is executed.

Error Code	Error Description	Solutions
374	Not possible to carry out Speed Override command for the axis of circular interpolation operation.	Check if the axis is in operation by subordinate axis of circular interpolation operation when Speed Override command is executed.
375	Not possible to carry out Speed Override command for the subordinate axis of Synchronous operation.	Check if the axis is in operation by subordinate axis of Synchronous Start operation when Speed Override command is executed.
377	Not possible to carry out Speed Override command in the deceleration section.	Check if the axis is in the state of deceleration stop when Speed Override command is executed.
378	Not possible to carry out Speed Override command in S-curve acceleration/deceleration pattern.	Check if the acceleration/deceleration pattern of Extended Parameter of command axis is set as S-Curve.
381	Not possible to carry out Random position speed override command not in the state of in operation.	Check if the axis is 'stop' state when Random position speed override command is executed.
382	Not possible to carry out Random position speed override command not in positioning operation.	Check if the axis is in speed control operation when Random position speed override command is executed.
383	Exceeds the speed override value range of Random position speed override command.	Speed value of Random position speed override command should be less than or equal to max. speed set in Basic Parameter. Check the speed value.
384	Not possible to carry out Random position speed override command for the subordinate axis of Linear interpolation operation.	Check if the axis is in operation by subordinate axis of Linear interpolation operation when Random position speed override command is executed.
385	Not possible to carry out Random position speed override command for the axis of circular interpolation operation.	Check if the axis is in circular interpolation operation when Speed Override command is executed.
386	Not possible to carry out Random position speed override command for the subordinate axis of Synchronous operation.	Check if the axis is in operation by subordinate axis of Synchronous Start operation when Speed Override command is executed.
389	Not possible to carry out Random position speed override command in S-Curve acceleration / deceleration pattern.	Check if the acceleration/deceleration pattern of Extended Parameter of command axis is set as S-Curve
390	Not possible to carry out Continuous operation command in S-Curve acceleration/deceleration pattern.	Check if the acceleration/deceleration pattern of Extended Parameter of command axis is set as S-Curve
391	Not possible to carry out Continuous operation command not in the state of in operation.	Check if the axis is 'stop' state when Continuous operation command is executed.
392	Not possible to carry out Continuous operation command not in the state of in dwell.	Check if the axis is in dwell when Continuous operation command is executed.
393	Not possible to carry out Continuous operation command not in the settled of positioning operation.	Check if the axis is in speed control operation when Continuous operation command is executed.
394	Speed data value of Continuous operation command exceeds the allowable range.	Speed value of Continuous operation command should be less than or equal to max. speed set in Basic Parameter. Check the speed value.
395	Not possible to carry out Continuous operation command for the subordinate axis of Linear interpolation operation.	Check if the axis is in operation by subordinate axis of Linear interpolation operation when Continuous operation command is executed.
396	Not possible to carry out Continuous operation command for the axis of circular interpolation operation axis.	Check if the axis is in circular interpolation operation when Continuous operation command is executed.
397	Not possible to carry out Continuous operation command for the subordinate axis of Synchronous operation.	Check if the axis is in operation by subordinate axis of Synchronous Start operation when Continuous operation command is executed.

Appendix 1 Positioning Error Information & Solutions

Error Code	Error Description	Solutions
399	Not possible to carry out Continuous operation command at the last step of Operation data.	Check if the axis is in operation of 400th step when Continuous operation command is executed.
400	Not possible to carry out Continuous operation command in the state of Direct Start operation.	Check if the axis is in operation by Direct Start command that Continuous operation command is executed.
401	Not possible to carry out Inching command in the state of in operation.	Check if the axis is in operation when Inching command is executed.
403	Not possible to carry out Inching command in the state that Drive Ready is OFF.	Check if Drive Ready signal of the axis is OFF when Inching command is executed.
411	Not possible to carry out Jog Start command in the state of in operation.	Check if the axis is in operation when Jog Start command is executed.
413	Not possible to carry out Jog Start command in the state that Servo Ready is OFF.	Check if Driver Ready signal of the axis is OFF when Jog Start command is executed.
431	Not possible to carry out Return to the Position before Manual Operation in the state of in operation.	Check if the axis is in operation when Return to the position before manual operation command is executed .
434	Not possible to carry out Return to the Position before Manual Operation in the state that Drive Ready is OFF.	Check if Driver Ready signal of the axis is ON when Return to the position before manual operation command is executed.
441	Not possible to carry out Start step no. Change/Repeat Operation Start step no. assignment command in the state of in operation.	Check if the axis is in operation when Start step no. change /repeat command is executed.
442	Exceeds the step assignment range of Start step no. Change/Repeat Operation Start step no. assignment command.	Check if the setting step value of Start step no. change command or repeat operation start step no. assignment command is greater than or equal to 1 and less than or equal to 400.
451	Not possible to carry out Current Position Preset command in the state of in operation.	Check if the axis is in operation when Current position preset command is executed.
452	Not possible to set the auxiliary position data value out of range of software high/low limit while Current Position Preset command is executed.	Check if the position value of current position preset command is within the range of soft high /low limit set in Extended Parameter.
461	Not possible to carry out Position Teaching command in the state of in operation.	Check if the axis is in operation when Position teaching command is executed.
462	Not possible to carry out Teaching Array command for the data over 16.	Check if the data no. of Teaching Array command is set in the range that is greater than or equal to 1 and less than or equal to 16.
463	Not possible to carry out Speed Teaching command in the state of in operation.	Check if the axis is in operation when Speed teaching command is executed.
465	Error from step number appointing which are about to execute teaching operation.	Make sure step for teaching operation is smaller than 400 or same as 400.
466	Teaching list error for multi teaching command.	Execute teaching command after set teaching data list as 0:position or 1:speed
467	Teaching method error for multi teaching command.	Execute teaching command after set teaching method as 0:position or 1:speed
471	Parameter teaching command cannot be Executed while its operating.	Check if the axis was operating when parameter teaching commands are executing
472	Operating data teaching command cannot be Executed while its operating.	Check if the axis was operating when operating Data teaching commands are executing
473	Set data cannot be teaching.	Execute teaching command after setting right value for parameter teaching data or operating data teaching list.

Error Code	Error Description	Solutions
474	Parameter/Operation data saving commands cannot be done while the axis is operating.	Check if the axis is operating when Parameter/ Operation data saving commands are operating. Execute Parameter/Operation command when any axis are not operating.
475	Error of value for teaching data is out of range.	Execute teaching command after setting value of parameter teaching or operating data teaching data among its set range.
476	Error of value for teaching method is out of range.	Execute teaching command after setting value of parameter teaching or operating data teaching data for 1(RAM teaching) or 2(ROM teaching).
477	There may be damage to parameter/operation data because power turns off when saving parameter/operation data.	Write parameter/operation data with “Write Project” command in the XG-PM.
478	There may be damage to CAM data because power turns off when saving parameter/operation data.	Write CAM data with “Write Project” command in the XG-PM.
481	Internal emergency stop	Eliminate reason of emergency stop and execute XCLR command to delete the error.
491	Error of external emergency stop	Eliminate reason of emergency stop and execute XCLR command to delete the error.
492	Hard Upper Error	Be out of limited external upper signal range by using counter direct jog command. Then execute XCLR command to delete the error.
493	Hard Lower Error	Be out of limited external lower signal range by using direct jog command. Then execute XCLR command to delete the error.
501	Soft Upper Error	Be out of limited soft upper range by using counter direct jog command. Then execute XCLR command to delete the error.
502	Soft Lower Error	Be out of limited soft upper range by using direct jog command. Then execute XCLR command to delete the error.
511	Inappropriate command	Check the commands are appropriate. Look up the references for COMMANDS.
512	Step number of support data is out of range.	Commands set for bigger than 400. Set it Between 1 and 400.
521	Can’t execute the command because of servo driver error during operation	Remove the servo error factor and clear the servo error with Servo Error Reset command.
522	The command cannot be done when the signal of Drive Ready is OFF during the operation.	Execute again once Drive Ready is ON.
523	Not possible to carry out command because “Quick stop” function is activated during operation	Check if “Quick Stop” function is activated by EMG stop input and etc.
531	Error for Encoding number exceed from Encoder preset command.	Execute Encoder preset command after set “0” For encoder number.
532	Preset command cannot be done because of the axis which using encoder1 as a main axis	Execute Encoder preset when the encoder1 using axis is not operating
533	Preset command cannot be done because of the axis which using encoder2 as a main axis	Execute Encoder preset when the encoder2 using axis is not operating

Error Code	Error Description	Solutions
534	The position of Encoder preset exceeds from Max or Min value of encoder.1	Execute Encoder1 preset command after set the value of encoder position preset as bigger than Min value and smaller than Max value.
535	The position of Encoder2 preset exceeds from Max or Min value of encoder.	Execute Encoder2 preset command after set the value of encoder position preset as bigger than Min value and smaller than Max value.
541	Ellipse interpolation cannot be operated while main axis of circular interpolation is operating.	Execute the Ellipse interpolation command when main axis is not operating.
542	Ellipse interpolation cannot be operated while support axis of circular interpolation is operating.	Execute the circular interpolation command when subordinate axis is not operating
543	Ellipse interpolation start cannot be operated when M code from main axis circular interpolation is “ON.”	Execute Ellipse interpolation command after set M code from main axis Ellipse interpolation is “OFF” with MOF command.
544	Ellipse interpolation start cannot be operated when M code from subordinate axis circular interpolation is “ON.”	Execute Ellipse interpolation command after set M code from subordinate axis Ellipse interpolation is “OFF” with XMOF command.
545	Not possible to carry out absolute coordinate positioning operation in the state that the origin of main axis is not settled.	Execute Ellipse interpolation command after set main axis as a state of being origin with homing command or floating origin setting.
546	Not possible to carry out absolute coordinate positioning operation in the state that the origin of sub axis is not settled.	Execute Ellipse interpolation command after Set sub axis as a state of being origin with homing command or floating origin setting.
547	Incorrect setting for main and subordinate axis from Ellipse interpolation.(Unset for main/ subordinate axis Set as Helical interpolation Exceed number of possible current operating Axis.)	Execute Ellipse interpolation after set a axis From subordinate axis setting beside its main axis and unset Helical interpolation.
548	Ellipse interpolation cannot be operated with middle point setting and radius setting.	Ellipse interpolation only can operate in center point setting. Execute Ellipse interpolation after changing operating data Ellipse interpolation mode for center point setting.
549	Cannot be operated when Drive Ready of Ellipse interpolation main axis is “OFF.”	Execute Ellipse interpolation command after Drive Ready is “ON” of main axis.
550	Cannot be operated when Drive Ready of Ellipse interpolation subordinate axis is “OFF.”	Execute Ellipse interpolation command after Drive Ready is “ON” of subordinate axis.
551	Cannot be operated when unit of Ellipse interpolation main axis is “degree.”	Execute Ellipse interpolation command after Basic parameter unit is “degree” of main axis.
552	Cannot be operated when unit of Ellipse interpolation subordinate axis is “degree.”	Execute Ellipse interpolation command after basic parameter unit is “degree” of subordinate axis.
553	Cannot be operated when three parameters of Ellipse interpolation are same. (start point=main point=end point)	Execute Ellipse interpolation command after set those parameters differently. (start point, main point, end point)
554	Radius setting error from Ellipse interpolation.	The range of possible execution for Ellipse Interpolation is between 0 and 2147483647. Set radius of circle from its range, smaller than 2147483647pulse.
555	Exact circle cannot be draw because of degree of Ellipse interpolation is bigger than 90°	Set lower for operation speed so that degree of Ellipse interpolation is smaller than 90°
556	Continuous operation cannot be done for Ellipse interpolation.	Execute Ellipse interpolation after terminate operation step of circular interpolation.
557	Ellipse interpolation only can be operated when control setting is circular interpolation.	Execute Ellipse interpolation after change control setting for drive step of Ellipse interpolation to circular interpolation.

Error Code	Error Description	Solutions
558	Operation cannot be executed when beginning point and end point of ellipse interpolation are not same.	Execute Ellipse interpolation after set the goal Position of ellipse interpolation operating step Same as current position.
559	Operation cannot be executed when operating degree of ellipse interpolation is “0.”	Set the value of operating degree for ellipse interpolation, larger than “0.”(1~65535)
561	Position/Torque switching command can’t be executed when axis is not in operation	Execute Position/Torque switching command when command axis is not in operation.
562	Position/Torque switching command can’t be executed at the sub axis of synchronous operation	Position/Torque switching command doesn’t work at the sub axis of synchronous operation
563	Position/Torque switching command can’t be executed under circular (ellipse) interpolation operation.	Position/Torque switching command doesn’t work at the axis under circular (ellipse) interpolation operation.
564	Position/Torque switching command can’t be executed under linear interpolation operation.	Position/Torque switching command doesn’t work at the axis under linear interpolation operation.
565	Not possible to carry out torque control because servo driver doesn’t support torque control	Unable to carry out torque control in that servo driver
571	Operation cannot be executed because of error from sub-coordinate axis of main axis by current axis.	Check the error from subordinate axis of main axis by current axis whether it is occurred during the operation of current axis.
572	Operation cannot be executed because of error from sub coordinate axis of main axis by interpolated axis.	Check the error from subordinate axis of main axis by current axis whether it is occurred during the operation of interpolated axis.
582	In infinite running repeat mode, In case of shortest distance positioning control, target position is invalid.	In infinite running repeat mode, In case of shortest distance positioning control, target position should be 0~ “infinite running repeat position” of extended parameter.
591	Not possible to carry our “Servo parameter write” command while operating	Execute “Servo parameter write” when command axis is not operating.
592	Data such as servo parameter index, subindex are out of range.	Don’t let data setting value out of range
593	“Abort” arises during “servo parameter write” command	Check if parameter is writable or parameter number and setting data is within range. Sometimes you can’t write parameter according to servo driver status.
594	There is no response of the servo driver on “servo parameter write” command.	Check if servo driver is normal or not.
595	Unable to carry out “Servo parameter EEPROM save” command while servo is on.	Execute “Servo parameter EEPROM save” command after making the servo “off” status with “Servo off” command

Error Code	Error Description	Solutions
596	“Abort” arises during “servo parameter EEPROM write” command	Check the status of the servo driver. In particular status, “Servo parameter EEPROM save” command can’t be executed.
597	There is no response of the servo driver on “servo parameter EEPROM save” command.	Check if servo driver is normal or not.
598	The axis for “Servo parameter EEPROM save” is not connected now.	It can execute “Servo parameter EEPROM save” command only for currently connected axis.
599	Unable to carry out other commands during “Servo parameter write” or “Servo parameter EEPRO save”	Execute other commands after completing “Servo parameter write” or “Servo parameter EEPROM save”.
600	“Abort” arises during “servo parameter read” command	Check if parameter is readable or parameter number and setting data is within range. Sometimes you can’t read parameter according to servo driver status.
601	There is no response of the servo driver on “servo parameter read” command.	Check if servo driver is normal or not.
602	It is not possible to execute the “Servo parameter read/write” or “Servo parameter save” command in the state that servo parameter read command is executing.	Execute command when servo parameter read command is completed.
701	Not possible to carry out CAM command in the state of in operation.	Execute CAM command when main axis is not operating.
702	Not possible to carry out CAM command in the state of M Code ON	Execute CAM command after set M Code OFF from commanding axis with MOF.
703	Not possible to carry out CAM command in the state that servo is OFF.	Execute CAM command when Servo On signal is “ON.”
704	Error of setting main/subordinate axis from CAM command.	Set main axis for CAM command as other axis besides its command axis from connecting axis. Set parameters are 1axis through 8axis.
705	CAM command of main axis cannot be executed during the operation.	Execute CAM command when the main axis setting of CAM command is not operating.
706	Error of CAM block setting from CAM command.	Execute CAM command after set a CAM block from CAM command as bigger than 1 and smaller than 8.
707	Error for CAM data of appointed block from CAM command.	Execute CAM command after set right data for appointed block from CAM command.
708	The speed of subordinate axis from CAM command cannot exceed its speed limit.	Set lower speed for main axis so that speed of subordinate axis from CAM data which is calculated by subordinate position would not exceed its speed limit.

Error Code	Error Description	Solutions
709	For CAM command, in case main axis is encoder, main axis unit f CAM data should be pulse.	When you set the main axis of CAM data as encoder, set the unit of main axis of CAM block as pulse.
710	Movement position per control cycle is out of main axis range of CAM data because high speed of main axis of CAM command.	Operate with lower speed of main axis.
711	Data area setting value (block size and no. of block) of Variable Data Read/Write command is out of range.	Set the block size and no. of block for [block size X no. of block] to be 1~128.
712	Variable Data Write command can't be executed during operation.	Check whether any axis is under operation when executing the Variable Data Write command
713	Block area of Variable Data Write command is overlapped so Writing is unavailable.	In case the number of block is more than 2, set the block set to be larger than block size. (Or set the block size to be smaller than block offset)
721	Restart command can't be executed after operate the restart unavailable command, just like circular interpolation etc.	Check whether execute the restart unavailable command before execute restart command.
722	Restart command can't be executed during the operation.	Execute restart command when main axis is not operating.
741	Not possible to execute torque control command in the state of in operation except torque control in operation	Execute torque control command when main axis is not operating.
742	Not possible to carry out torque control command in the state of M Code ON	Execute torque control command after set M Code OFF from commanding axis with MOF.
743	Not possible to carry out torque control command in thestate that servo is OFF.	Execute torque control command when Servo On signal is "ON."
801	Command axis is the axis which is not connected to the current network.	Check whether the command axis is the axis connected to current network. Give the command to the axis connected to current network.

(8) Error information related with communication

Error Code	Error Description	Solutions
5001	There is no servo connected to the current network.	Check whether power of the servo connected to the network is on, or whether communication cable between the module and first servo driver connected to the network is installed normally.
5002	Servo Communication Initialization Error	Check whether communication cable is installed normally, or whether communication cable is exposed to the noise.
5003	Servo Communication Initialization Error	Check whether communication cable is installed normally, or whether communication cable is exposed to the noise.
5004	Servo Communication Initialization Error	Check whether communication cable is installed normally, or whether communication cable is exposed to the noise.
5005	Servo Communication Initialization Error	Check whether communication cable is installed normally, or whether communication cable is exposed to the noise.

Error Code	Error Description	Solutions
5006	Servo Communication Initialization Error	Check whether communication cable is installed normally, or whether communication cable is exposed to the noise.
5007	Servo Parameter Read Communication Error	Check whether communication cable is installed normally, or whether communication cable is exposed to the noise.
5008	Fixed Period Communication Error	Check whether servo power is off, or whether communication cable is installed normally, or whether communication cable is exposed to the noise.
5009	Communication Setting Error	Check whether servo power is off, or whether communication cable is installed normally, or whether communication cable is exposed to the noise.
5010	Servo Axis Number Setting Error	There are duplicated axis numbers among servo drivers connected to the current network. Set the axis number of the servo driver again.
5011	Single Servo Parameter Write Error	Check whether communication cable is installed normally, or whether communication cable is exposed to the noise.
5012	Single Servo Parameter Read Error	Check whether communication cable is installed normally, or whether communication cable is exposed to the noise.
5013	Servo Communication Initialization Error	Check whether communication cable is installed normally, or whether communication cable is exposed to the noise.
5014	Servo Communication Initialization Error	Check whether communication cable is installed normally, or whether communication cable is exposed to the noise.
5015	Servo Parameter Writ Communication Error	Check whether communication cable is installed normally, or whether communication cable is exposed to the noise.
5020	There is no setting information on the servo driver connected to current network.	After adding the servo driver to the current network and writing network parameter, execute “Connect to all servos” command.
5021	There is no setting data in the network parameter	After setting the network parameter and writing network parameter, execute “Connect to all servos” command.
5022	Servo driver information set in the network parameter is different with that in the actual connection.	Set the servo driver information set in the network parameter to be same
5023	Unable to switch operation mode of the servo driver to Position control mode	Check if servo driver is normal

Error Code	Error Description	Solutions
5024	Unable to switch operation mode of the servo driver to Home return mode	Check if servo driver is normal
5025	Unable to switch operation mode of the servo driver to Torque control mode	Check if servo driver is normal
5026	Unable to compete “Servo on” because it is impossible to change the servo driver to “Switched on" status	Check the status of the servo driver In particular status, “Servo on” command can’t be executed.
5027	Unable to compete “Servo on” because it is impossible to change the servo driver to “Operation enabled " status	Check the status of the servo driver In particular status, “Servo on” command can’t be executed.
5028	Unable to compete “Servo on” because “Quick stop” function is activated.	Check if “Quick stop” function is activated because of EMG stop and etc. In particular status, “Servo on” command can’t be executed.

Appendix 2 Module Internal Memory Address of “Read/Write Variable Data” command

Appendix 2.1 Parameter Memory Address

	1axis		2axis		3axis		4axis		5axis		6axis		7axis		8axis		Contents
	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	
Basic Parameter	0	0	68	44	136	88	204	CC	272	110	340	154	408	198	476	1DC	Speed limit (Low)
	1	1	69	45	137	89	205	CD	273	111	341	155	409	199	477	1DD	Speed limit (High)
	2	2	70	46	138	8A	206	CE	274	112	342	156	410	19A	478	1DE	Acc. time 1 (Low)
	3	3	71	47	139	8B	207	CF	275	113	343	157	411	19B	479	1DF	Acc. time 1 (High)
	4	4	72	48	140	8C	208	D0	276	114	344	158	412	19C	480	1E0	Acc. time 2 (Low)
	5	5	73	49	141	8D	209	D1	277	115	345	159	413	19D	481	1E1	Acc. time 2 (High)
	6	6	74	4A	142	8E	210	D2	278	116	346	15A	414	19E	482	1E2	Acc. time 3 (Low)
	7	7	75	4B	143	8F	211	D3	279	117	347	15B	415	19F	483	1E3	Acc. time 3 (High)
	8	8	76	4C	144	90	212	D4	280	118	348	15C	416	1A0	484	1E4	Acc. time 4 (Low)
	9	9	77	4D	145	91	213	D5	281	119	349	15D	417	1A1	485	1E5	Acc. time 4 (High)
	10	A	78	4E	146	92	214	D6	282	11A	350	15E	418	1A2	486	1E6	Dec. time 1 (Low)
	11	B	79	4F	147	93	215	D7	283	11B	351	15F	419	1A3	487	1E7	Dec. time 1 (High)
	12	C	80	50	148	94	216	D8	284	11C	352	160	420	1A4	488	1E8	Dec. time 2 (Low)
	13	D	81	51	149	95	217	D9	285	11D	353	161	421	1A5	489	1E9	Dec. time 2 (High)
	14	E	82	52	150	96	218	DA	286	11E	354	162	422	1A6	490	1EA	Dec. time 3 (Low)
	15	F	83	53	151	97	219	DB	287	11F	355	163	423	1A7	491	1EB	Dec. time 3 (High)
	16	10	84	54	152	98	220	DC	288	120	356	164	424	1A8	492	1EC	Dec. time 4 (Low)
	17	11	85	55	153	99	221	DD	289	121	357	165	425	1A9	493	1ED	Dec. time 4 (High)
	18	12	86	56	154	9A	222	DE	290	122	358	166	426	1AA	494	1EE	Dec. time for EMG stop (Low)
	19	13	87	57	155	9B	223	DF	291	123	359	167	427	1AB	495	1EF	Dec. time for EMG stop (High)
	20	14	88	58	156	9C	224	E0	292	124	360	168	428	1AC	496	1F0	Pulse per rotation (Low)
	21	15	89	59	157	9D	225	E1	293	125	361	169	429	1AD	497	1F1	Pulse per rotation (High)
	22	16	90	5A	158	9E	226	E2	294	126	362	16A	430	1AE	498	1F2	Distance per rotation (Low)
	23	17	91	5B	159	9F	227	E3	295	127	363	16B	431	1AF	499	1F3	Distance per rotation (High)
	24	18	92	5C	160	A0	228	E4	296	128	364	16C	432	1B0	500	1F4	CONTROL WORD
	25	19	93	5D	161	A1	229	E5	297	129	365	16D	433	1B1	501	1F5	-
Extended parameter	26	1A	94	5E	162	A2	230	E6	298	12A	366	16E	434	1B2	502	1F6	S/W upper limit (Low)
	27	1B	95	5F	163	A3	231	E7	299	12B	367	16F	435	1B3	503	1F7	S/W upper limit (High)
	28	1C	96	60	164	A4	232	E8	300	12C	368	170	436	1B4	504	1F8	S/W lower limit (Low)
	29	1D	97	61	165	A5	233	E9	301	12D	369	171	437	1B5	505	1F9	S/W lower limit (High)
	30	1E	98	62	166	A6	234	EA	302	12E	370	172	438	1B6	506	1FA	
	31	1F	99	63	167	A7	235	EB	303	12F	371	173	439	1B7	507	1FB	Position completion time
	32	20	100	64	168	A8	236	EC	304	130	372	174	440	1B8	508	1FC	S-curve ratio
	33	21	101	65	169	A9	237	ED	305	131	373	175	441	1B9	509	1FD	CONTROL WORD
	34	22	102	66	170	AA	238	EE	306	132	374	176	442	1BA	510	1FE	In-position width (Low)
	35	23	103	67	171	AB	239	EF	307	133	375	177	443	1BB	511	1FF	In-position width (High)
	36	24	104	68	172	AC	240	F0	308	134	376	178	444	1BC	512	200	Arc insertion position (Low)
	37	25	105	69	173	AD	241	F1	309	135	377	179	445	1BD	513	201	Arc insertion position (High)
	38	26	106	6A	174	AE	242	F2	310	136	378	17A	446	1BE	514	202	Infinite Running Repeat position (Low)
	39	27	107	6B	175	AF	243	F3	311	137	379	17B	447	1BF	515	203	Infinite Running Repeat position (High)

	1axis		2axis		3axis		4axis		5axis		6axis		7axis		8axis		Contents
	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	
Manual operation parameter	40	28	108	6C	176	B0	244	F4	312	138	380	17C	448	1C0	516	204	JOG high speed (Low)
	41	29	109	6D	177	B1	245	F5	313	139	381	17D	449	1C1	517	205	JOG high speed (High)
	42	2A	110	6E	178	B2	246	F6	314	13A	382	17E	450	1C2	518	206	JOG low speed (Low)
	43	2B	111	6F	179	B3	247	F7	315	13B	383	17F	451	1C3	519	207	JOG low speed (High)
	44	2C	112	70	180	B4	248	F8	316	13C	384	180	452	1C4	520	208	JOG acc. time (Low)
	45	2D	113	71	181	B5	249	F9	317	13D	385	181	453	1C5	521	209	JOG acc. time (High)
	46	2E	114	72	182	B6	250	FA	318	13E	386	182	454	1C6	522	20A	JOG dec. time (Low)
	47	2F	115	73	183	B7	251	FB	319	13F	387	183	455	1C7	523	20B	JOG dec. time (High)
	48	30	116	74	184	B8	252	FC	320	140	388	184	456	1C8	524	20C	Inching speed
	49	31	117	75	185	B9	253	FD	321	141	389	185	457	1C9	525	20D	-
-	50	32	118	76	186	BA	254	FE	322	142	390	186	458	1CA	526	20E	-
	51	33	119	77	187	BB	255	FF	323	143	391	187	459	1CB	527	20F	
	52	34	120	78	188	BC	256	100	324	144	392	188	460	1CC	528	210	
	53	35	121	79	189	BD	257	101	325	145	393	189	461	1CD	529	211	
	54	36	122	7A	190	BE	258	102	326	146	394	18A	462	1CE	530	212	
	55	37	123	7B	191	BF	259	103	327	147	395	18B	463	1CF	531	213	
	56	38	124	7C	192	C0	260	104	328	148	396	18C	464	1D0	532	214	
	57	39	125	7D	193	C1	261	105	329	149	397	18D	465	1D1	533	215	
	58	3A	126	7E	194	C2	262	106	330	14A	398	18E	466	1D2	534	216	
	59	3B	127	7F	195	C3	263	107	331	14B	399	18F	467	1D3	535	217	
	60	3C	128	80	196	C4	264	108	332	14C	400	190	468	1D4	536	218	
	61	3D	129	81	197	C5	265	109	333	14D	401	191	469	1D5	537	219	
	62	3E	130	82	198	C6	266	10A	334	14E	402	192	470	1D6	538	21A	
	63	3F	131	83	199	C7	267	10B	335	14F	403	193	471	1D7	539	21B	
	64	40	132	84	200	C8	268	10C	336	150	404	194	472	1D8	540	21C	
	65	41	133	85	201	C9	269	10D	337	151	405	195	473	1D9	541	21D	
-	66	42	134	86	202	CA	270	10E	338	152	406	196	474	1DA	542	21E	-
	67	43	135	87	203	CB	271	10F	339	153	407	197	475	1DB	543	21F	
Common parameter	-														544	220	CONTROL WORD
															545	221	-
															546	222	Encoder 1 max. value (Low)
															547	223	Encoder 1 max. value (High)
															548	224	Encoder 1 min. value (Low)
															549	225	Encoder 1 min. value (High)
															550	226	Encoder 2 max. value (Low)
															551	227	Encoder 2 max. value (High)
															552	228	Encoder 2 min. value (Low)
															553	229	Encoder 2 min. value (High)

(1) Basic parameter Control Word

Bit position	Contents
- (bit 0 ~ 1)	-
Unit (bit 2 ~ 3)	0: pulse
	1: mm
	2: inch
	3: degree
Unit multiplier (bit 4 ~ 5)	0: x1
	1: x10
	2: x100
	3: x1000
Speed command unit (bit 6)	0: Unit/Time
	1:rpm
Encoder selection * (bit 7)	0: incremental encoder
	1: absolute encoder

*: only for XGF-PN8B

(2) Extended parameter Control Word

Bit position	Contents
- (bit 0)	-
Acc./Dec. pattern (bit 1)	0: Trapezoid,, 1: S-curve
M code mode (bit 2 ~ 3)	0: None, 1: With, 2: After
Interpolation speed selection (bit 4)	0: main-axis speed, 1: synthetic speed
Soft limit detect (bit 5)	0: Don’t detect, 1: Detect
External command selection (bit 6)	0: External speed/position control switching, 1: External stop command
External command (bit 7)	0: Disable, 1: Enable
Position complete condition (bit 10 ~ 11)	0: Dwell time, 1: In-position, 2: Dwell time AND In-position, 3: Dwell time OR In-position
Infinite running repeat (bit 12)	0: Disable, 1: Enable
Int. continuous opr. type (bit 13)	0: Pass target pos, 1: Pass near pos
Arc insertion (bit 14)	0: Don’t insert, 1: Insert arc cont.
Pos-specified speed override coordinate (bit 15)	0: ABS, 1: INC

(3) Common parameter Control Word

Bit position	Contents
Encoder1 pulse input (bit 0 ~ 2)	0: CW/CCW (x1)
	1: PULSE/DIR (x1)
	2: PULSE/DIR (x2)
	3: PHASE A/B (x1)
	4: PHASE A/B (x2)
	5: PHASE A/B (x3)
Encoder1 Z phase clear(bit 3)	0: Disable, 1: Enable
Encoder2 pulse input (bit 4 ~ 6)	0: CW/CCW (x1)
	1: PULSE/DIR (x1)
	2: PULSE/DIR (x2)
	3: PHASE A/B (x1)
	4: PHASE A/B (x2)
	5: PHASE A/B (x3)
Encoder2 Z phase clear (bit 7)	0: Disable, 1: Enable
Speed override mode (bit 8)	0: Specify %, 1: Specify speed

Appendix 2.2 1-axis operation data memory address

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
1	554	555	556	557	558	559	560	561	562	563	564	565
2	566	567	568	569	570	571	572	573	574	575	576	577
3	578	579	580	581	582	583	584	585	586	587	588	589
4	590	591	592	593	594	595	596	597	598	599	600	601
5	602	603	604	605	606	607	608	609	610	611	612	613
6	614	615	616	617	618	619	620	621	622	623	624	625
7	626	627	628	629	630	631	632	633	634	635	636	637
8	638	639	640	641	642	643	644	645	646	647	648	649
9	650	651	652	653	654	655	656	657	658	659	660	661
10	662	663	664	665	666	667	668	669	670	671	672	673
11	674	675	676	677	678	679	680	681	682	683	684	685
12	686	687	688	689	690	691	692	693	694	695	696	697
13	698	699	700	701	702	703	704	705	706	707	708	709
14	710	711	712	713	714	715	716	717	718	719	720	721
15	722	723	724	725	726	727	728	729	730	731	732	733
16	734	735	736	737	738	739	740	741	742	743	744	745
17	746	747	748	749	750	751	752	753	754	755	756	757
18	758	759	760	761	762	763	764	765	766	767	768	769
19	770	771	772	773	774	775	776	777	778	779	780	781
20	782	783	784	785	786	787	788	789	790	791	792	793
21	794	795	796	797	798	799	800	801	802	803	804	805
22	806	807	808	809	810	811	812	813	814	815	816	817
23	818	819	820	821	822	823	824	825	826	827	828	829
24	830	831	832	833	834	835	836	837	838	839	840	841
25	842	843	844	845	846	847	848	849	850	851	852	853
26	854	855	856	857	858	859	860	861	862	863	864	865
27	866	867	868	869	870	871	872	873	874	875	876	877
28	878	879	880	881	882	883	884	885	886	887	888	889
29	890	891	892	893	894	895	896	897	898	899	900	901
30	902	903	904	905	906	907	908	909	910	911	912	913
31	914	915	916	917	918	919	920	921	922	923	924	925
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33	938	939	940	941	942	943	944	945	946	947	948	949
34	950	951	952	953	954	955	956	957	958	959	960	961
35	962	963	964	965	966	967	968	969	970	971	972	973
36	974	975	976	977	978	979	980	981	982	983	984	985
37	986	987	988	989	990	991	992	993	994	995	996	997
38	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009
39	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
40	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033
41	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045
42	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057
43	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069
44	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081
45	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093
46	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105
47	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117
48	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129
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54	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201
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234	3350	3351	3352	3353	3354	3355	3356	3357	3358	3359	3360	3361
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240	3422	3423	3424	3425	3426	3427	3428	3429	3430	3431	3432	3433
241	3434	3435	3436	3437	3438	3439	3440	3441	3442	3443	3444	3445
242	3446	3447	3448	3449	3450	3451	3452	3453	3454	3455	3456	3457
243	3458	3459	3460	3461	3462	3463	3464	3465	3466	3467	3468	3469
244	3470	3471	3472	3473	3474	3475	3476	3477	3478	3479	3480	3481
245	3482	3483	3484	3485	3486	3487	3488	3489	3490	3491	3492	3493
246	3494	3495	3496	3497	3498	3499	3500	3501	3502	3503	3504	3505
247	3506	3507	3508	3509	3510	3511	3512	3513	3514	3515	3516	3517
248	3518	3519	3520	3521	3522	3523	3524	3525	3526	3527	3528	3529
249	3530	3531	3532	3533	3534	3535	3536	3537	3538	3539	3540	3541

250	3542	3543	3544	3545	3546	3547	3548	3549	3550	3551	3552	3553
251	3554	3555	3556	3557	3558	3559	3560	3561	3562	3563	3564	3565
252	3566	3567	3568	3569	3570	3571	3572	3573	3574	3575	3576	3577
253	3578	3579	3580	3581	3582	3583	3584	3585	3586	3587	3588	3589
254	3590	3591	3592	3593	3594	3595	3596	3597	3598	3599	3600	3601
255	3602	3603	3604	3605	3606	3607	3608	3609	3610	3611	3612	3613
256	3614	3615	3616	3617	3618	3619	3620	3621	3622	3623	3624	3625
257	3626	3627	3628	3629	3630	3631	3632	3633	3634	3635	3636	3637
258	3638	3639	3640	3641	3642	3643	3644	3645	3646	3647	3648	3649
259	3650	3651	3652	3653	3654	3655	3656	3657	3658	3659	3660	3661
260	3662	3663	3664	3665	3666	3667	3668	3669	3670	3671	3672	3673
261	3674	3675	3676	3677	3678	3679	3680	3681	3682	3683	3684	3685
262	3686	3687	3688	3689	3690	3691	3692	3693	3694	3695	3696	3697
263	3698	3699	3700	3701	3702	3703	3704	3705	3706	3707	3708	3709
264	3710	3711	3712	3713	3714	3715	3716	3717	3718	3719	3720	3721
265	3722	3723	3724	3725	3726	3727	3728	3729	3730	3731	3732	3733
266	3734	3735	3736	3737	3738	3739	3740	3741	3742	3743	3744	3745
267	3746	3747	3748	3749	3750	3751	3752	3753	3754	3755	3756	3757
268	3758	3759	3760	3761	3762	3763	3764	3765	3766	3767	3768	3769
269	3770	3771	3772	3773	3774	3775	3776	3777	3778	3779	3780	3781
270	3782	3783	3784	3785	3786	3787	3788	3789	3790	3791	3792	3793
271	3794	3795	3796	3797	3798	3799	3800	3801	3802	3803	3804	3805
272	3806	3807	3808	3809	3810	3811	3812	3813	3814	3815	3816	3817
273	3818	3819	3820	3821	3822	3823	3824	3825	3826	3827	3828	3829
274	3830	3831	3832	3833	3834	3835	3836	3837	3838	3839	3840	3841
275	3842	3843	3844	3845	3846	3847	3848	3849	3850	3851	3852	3853
276	3854	3855	3856	3857	3858	3859	3860	3861	3862	3863	3864	3865
277	3866	3867	3868	3869	3870	3871	3872	3873	3874	3875	3876	3877
278	3878	3879	3880	3881	3882	3883	3884	3885	3886	3887	3888	3889
279	3890	3891	3892	3893	3894	3895	3896	3897	3898	3899	3900	3901
280	3902	3903	3904	3905	3906	3907	3908	3909	3910	3911	3912	3913
281	3914	3915	3916	3917	3918	3919	3920	3921	3922	3923	3924	3925
282	3926	3927	3928	3929	3930	3931	3932	3933	3934	3935	3936	3937
283	3938	3939	3940	3941	3942	3943	3944	3945	3946	3947	3948	3949
284	3950	3951	3952	3953	3954	3955	3956	3957	3958	3959	3960	3961
285	3962	3963	3964	3965	3966	3967	3968	3969	3970	3971	3972	3973
286	3974	3975	3976	3977	3978	3979	3980	3981	3982	3983	3984	3985
287	3986	3987	3988	3989	3990	3991	3992	3993	3994	3995	3996	3997
288	3998	3999	4000	4001	4002	4003	4004	4005	4006	4007	4008	4009
289	4010	4011	4012	4013	4014	4015	4016	4017	4018	4019	4020	4021
290	4022	4023	4024	4025	4026	4027	4028	4029	4030	4031	4032	4033
291	4034	4035	4036	4037	4038	4039	4040	4041	4042	4043	4044	4045
292	4046	4047	4048	4049	4050	4051	4052	4053	4054	4055	4056	4057

293	4058	4059	4060	4061	4062	4063	4064	4065	4066	4067	4068	4069
294	4070	4071	4072	4073	4074	4075	4076	4077	4078	4079	4080	4081
295	4082	4083	4084	4085	4086	4087	4088	4089	4090	4091	4092	4093
296	4094	4095	4096	4097	4098	4099	4100	4101	4102	4103	4104	4105
297	4106	4107	4108	4109	4110	4111	4112	4113	4114	4115	4116	4117
298	4118	4119	4120	4121	4122	4123	4124	4125	4126	4127	4128	4129
299	4130	4131	4132	4133	4134	4135	4136	4137	4138	4139	4140	4141
300	4142	4143	4144	4145	4146	4147	4148	4149	4150	4151	4152	4153
301	4154	4155	4156	4157	4158	4159	4160	4161	4162	4163	4164	4165
302	4166	4167	4168	4169	4170	4171	4172	4173	4174	4175	4176	4177
303	4178	4179	4180	4181	4182	4183	4184	4185	4186	4187	4188	4189
304	4190	4191	4192	4193	4194	4195	4196	4197	4198	4199	4200	4201
305	4202	4203	4204	4205	4206	4207	4208	4209	4210	4211	4212	4213
306	4214	4215	4216	4217	4218	4219	4220	4221	4222	4223	4224	4225
307	4226	4227	4228	4229	4230	4231	4232	4233	4234	4235	4236	4237
308	4238	4239	4240	4241	4242	4243	4244	4245	4246	4247	4248	4249
309	4250	4251	4252	4253	4254	4255	4256	4257	4258	4259	4260	4261
310	4262	4263	4264	4265	4266	4267	4268	4269	4270	4271	4272	4273
311	4274	4275	4276	4277	4278	4279	4280	4281	4282	4283	4284	4285
312	4286	4287	4288	4289	4290	4291	4292	4293	4294	4295	4296	4297
313	4298	4299	4300	4301	4302	4303	4304	4305	4306	4307	4308	4309
314	4310	4311	4312	4313	4314	4315	4316	4317	4318	4319	4320	4321
315	4322	4323	4324	4325	4326	4327	4328	4329	4330	4331	4332	4333
316	4334	4335	4336	4337	4338	4339	4340	4341	4342	4343	4344	4345
317	4346	4347	4348	4349	4350	4351	4352	4353	4354	4355	4356	4357
318	4358	4359	4360	4361	4362	4363	4364	4365	4366	4367	4368	4369
319	4370	4371	4372	4373	4374	4375	4376	4377	4378	4379	4380	4381
320	4382	4383	4384	4385	4386	4387	4388	4389	4390	4391	4392	4393
321	4394	4395	4396	4397	4398	4399	4400	4401	4402	4403	4404	4405
322	4406	4407	4408	4409	4410	4411	4412	4413	4414	4415	4416	4417
323	4418	4419	4420	4421	4422	4423	4424	4425	4426	4427	4428	4429
324	4430	4431	4432	4433	4434	4435	4436	4437	4438	4439	4440	4441
325	4442	4443	4444	4445	4446	4447	4448	4449	4450	4451	4452	4453
326	4454	4455	4456	4457	4458	4459	4460	4461	4462	4463	4464	4465
327	4466	4467	4468	4469	4470	4471	4472	4473	4474	4475	4476	4477
328	4478	4479	4480	4481	4482	4483	4484	4485	4486	4487	4488	4489
329	4490	4491	4492	4493	4494	4495	4496	4497	4498	4499	4500	4501
330	4502	4503	4504	4505	4506	4507	4508	4509	4510	4511	4512	4513
331	4514	4515	4516	4517	4518	4519	4520	4521	4522	4523	4524	4525
332	4526	4527	4528	4529	4530	4531	4532	4533	4534	4535	4536	4537
333	4538	4539	4540	4541	4542	4543	4544	4545	4546	4547	4548	4549
334	4550	4551	4552	4553	4554	4555	4556	4557	4558	4559	4560	4561

335	4562	4563	4564	4565	4566	4567	4568	4569	4570	4571	4572	4573
336	4574	4575	4576	4577	4578	4579	4580	4581	4582	4583	4584	4585
337	4586	4587	4588	4589	4590	4591	4592	4593	4594	4595	4596	4597
338	4598	4599	4600	4601	4602	4603	4604	4605	4606	4607	4608	4609
339	4610	4611	4612	4613	4614	4615	4616	4617	4618	4619	4620	4621
340	4622	4623	4624	4625	4626	4627	4628	4629	4630	4631	4632	4633
341	4634	4635	4636	4637	4638	4639	4640	4641	4642	4643	4644	4645
342	4646	4647	4648	4649	4650	4651	4652	4653	4654	4655	4656	4657
343	4658	4659	4660	4661	4662	4663	4664	4665	4666	4667	4668	4669
344	4670	4671	4672	4673	4674	4675	4676	4677	4678	4679	4680	4681
345	4682	4683	4684	4685	4686	4687	4688	4689	4690	4691	4692	4693
346	4694	4695	4696	4697	4698	4699	4700	4701	4702	4703	4704	4705
347	4706	4707	4708	4709	4710	4711	4712	4713	4714	4715	4716	4717
348	4718	4719	4720	4721	4722	4723	4724	4725	4726	4727	4728	4729
349	4730	4731	4732	4733	4734	4735	4736	4737	4738	4739	4740	4741
350	4742	4743	4744	4745	4746	4747	4748	4749	4750	4751	4752	4753
351	4754	4755	4756	4757	4758	4759	4760	4761	4762	4763	4764	4765
352	4766	4767	4768	4769	4770	4771	4772	4773	4774	4775	4776	4777
353	4778	4779	4780	4781	4782	4783	4784	4785	4786	4787	4788	4789
354	4790	4791	4792	4793	4794	4795	4796	4797	4798	4799	4800	4801
355	4802	4803	4804	4805	4806	4807	4808	4809	4810	4811	4812	4813
356	4814	4815	4816	4817	4818	4819	4820	4821	4822	4823	4824	4825
357	4826	4827	4828	4829	4830	4831	4832	4833	4834	4835	4836	4837
358	4838	4839	4840	4841	4842	4843	4844	4845	4846	4847	4848	4849
359	4850	4851	4852	4853	4854	4855	4856	4857	4858	4859	4860	4861
360	4862	4863	4864	4865	4866	4867	4868	4869	4870	4871	4872	4873
361	4874	4875	4876	4877	4878	4879	4880	4881	4882	4883	4884	4885
362	4886	4887	4888	4889	4890	4891	4892	4893	4894	4895	4896	4897
363	4898	4899	4900	4901	4902	4903	4904	4905	4906	4907	4908	4909
364	4910	4911	4912	4913	4914	4915	4916	4917	4918	4919	4920	4921
365	4922	4923	4924	4925	4926	4927	4928	4929	4930	4931	4932	4933
366	4934	4935	4936	4937	4938	4939	4940	4941	4942	4943	4944	4945
367	4946	4947	4948	4949	4950	4951	4952	4953	4954	4955	4956	4957
368	4958	4959	4960	4961	4962	4963	4964	4965	4966	4967	4968	4969
369	4970	4971	4972	4973	4974	4975	4976	4977	4978	4979	4980	4981
370	4982	4983	4984	4985	4986	4987	4988	4989	4990	4991	4992	4993
371	4994	4995	4996	4997	4998	4999	5000	5001	5002	5003	5004	5005
372	5006	5007	5008	5009	5010	5011	5012	5013	5014	5015	5016	5017
373	5018	5019	5020	5021	5022	5023	5024	5025	5026	5027	5028	5029
374	5030	5031	5032	5033	5034	5035	5036	5037	5038	5039	5040	5041
375	5042	5043	5044	5045	5046	5047	5048	5049	5050	5051	5052	5053
376	5054	5055	5056	5057	5058	5059	5060	5061	5062	5063	5064	5065
377	5066	5067	5068	5069	5070	5071	5072	5073	5074	5075	5076	5077

378	5078	5079	5080	5081	5082	5083	5084	5085	5086	5087	5088	5089
379	5090	5091	5092	5093	5094	5095	5096	5097	5098	5099	5100	5101
380	5102	5103	5104	5105	5106	5107	5108	5109	5110	5111	5112	5113
381	5114	5115	5116	5117	5118	5119	5120	5121	5122	5123	5124	5125
382	5126	5127	5128	5129	5130	5131	5132	5133	5134	5135	5136	5137
383	5138	5139	5140	5141	5142	5143	5144	5145	5146	5147	5148	5149
384	5150	5151	5152	5153	5154	5155	5156	5157	5158	5159	5160	5161
385	5162	5163	5164	5165	5166	5167	5168	5169	5170	5171	5172	5173
386	5174	5175	5176	5177	5178	5179	5180	5181	5182	5183	5184	5185
387	5186	5187	5188	5189	5190	5191	5192	5193	5194	5195	5196	5197
388	5198	5199	5200	5201	5202	5203	5204	5205	5206	5207	5208	5209
389	5210	5211	5212	5213	5214	5215	5216	5217	5218	5219	5220	5221
390	5222	5223	5224	5225	5226	5227	5228	5229	5230	5231	5232	5233
391	5234	5235	5236	5237	5238	5239	5240	5241	5242	5243	5244	5245
392	5246	5247	5248	5249	5250	5251	5252	5253	5254	5255	5256	5257
393	5258	5259	5260	5261	5262	5263	5264	5265	5266	5267	5268	5269
394	5270	5271	5272	5273	5274	5275	5276	5277	5278	5279	5280	5281
395	5282	5283	5284	5285	5286	5287	5288	5289	5290	5291	5292	5293
396	5294	5295	5296	5297	5298	5299	5300	5301	5302	5303	5304	5305
397	5306	5307	5308	5309	5310	5311	5312	5313	5314	5315	5316	5317
398	5318	5319	5320	5321	5322	5323	5324	5325	5326	5327	5328	5329
399	5330	5331	5332	5333	5334	5335	5336	5337	5338	5339	5340	5341
400	5342	5343	5344	5345	5346	5347	5348	5349	5350	5351	5352	5353

Appendix 2.3 2-axis operation data memory address

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
1	5354	5355	5356	5357	5358	5359	5360	5361	5362	5363	5364	5365
2	5366	5367	5368	5369	5370	5371	5372	5373	5374	5375	5376	5377
3	5378	5379	5380	5381	5382	5383	5384	5385	5386	5387	5388	5389
4	5390	5391	5392	5393	5394	5395	5396	5397	5398	5399	5400	5401
5	5402	5403	5404	5405	5406	5407	5408	5409	5410	5411	5412	5413
6	5414	5415	5416	5417	5418	5419	5420	5421	5422	5423	5424	5425
7	5426	5427	5428	5429	5430	5431	5432	5433	5434	5435	5436	5437
8	5438	5439	5440	5441	5442	5443	5444	5445	5446	5447	5448	5449
9	5450	5451	5452	5453	5454	5455	5456	5457	5458	5459	5460	5461
10	5462	5463	5464	5465	5466	5467	5468	5469	5470	5471	5472	5473
11	5474	5475	5476	5477	5478	5479	5480	5481	5482	5483	5484	5485
12	5486	5487	5488	5489	5490	5491	5492	5493	5494	5495	5496	5497
13	5498	5499	5500	5501	5502	5503	5504	5505	5506	5507	5508	5509
14	5510	5511	5512	5513	5514	5515	5516	5517	5518	5519	5520	5521
15	5522	5523	5524	5525	5526	5527	5528	5529	5530	5531	5532	5533
16	5534	5535	5536	5537	5538	5539	5540	5541	5542	5543	5544	5545
17	5546	5547	5548	5549	5550	5551	5552	5553	5554	5555	5556	5557
18	5558	5559	5560	5561	5562	5563	5564	5565	5566	5567	5568	5569
19	5570	5571	5572	5573	5574	5575	5576	5577	5578	5579	5580	5581
20	5582	5583	5584	5585	5586	5587	5588	5589	5590	5591	5592	5593
21	5594	5595	5596	5597	5598	5599	5600	5601	5602	5603	5604	5605
22	5606	5607	5608	5609	5610	5611	5612	5613	5614	5615	5616	5617
23	5618	5619	5620	5621	5622	5623	5624	5625	5626	5627	5628	5629
24	5630	5631	5632	5633	5634	5635	5636	5637	5638	5639	5640	5641
25	5642	5643	5644	5645	5646	5647	5648	5649	5650	5651	5652	5653
26	5654	5655	5656	5657	5658	5659	5660	5661	5662	5663	5664	5665
27	5666	5667	5668	5669	5670	5671	5672	5673	5674	5675	5676	5677
28	5678	5679	5680	5681	5682	5683	5684	5685	5686	5687	5688	5689
29	5690	5691	5692	5693	5694	5695	5696	5697	5698	5699	5700	5701
30	5702	5703	5704	5705	5706	5707	5708	5709	5710	5711	5712	5713
31	5714	5715	5716	5717	5718	5719	5720	5721	5722	5723	5724	5725
32	5726	5727	5728	5729	5730	5731	5732	5733	5734	5735	5736	5737
33	5738	5739	5740	5741	5742	5743	5744	5745	5746	5747	5748	5749
34	5750	5751	5752	5753	5754	5755	5756	5757	5758	5759	5760	5761
35	5762	5763	5764	5765	5766	5767	5768	5769	5770	5771	5772	5773
36	5774	5775	5776	5777	5778	5779	5780	5781	5782	5783	5784	5785
37	5786	5787	5788	5789	5790	5791	5792	5793	5794	5795	5796	5797
38	5798	5799	5800	5801	5802	5803	5804	5805	5806	5807	5808	5809
39	5810	5811	5812	5813	5814	5815	5816	5817	5818	5819	5820	5821

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
40	5822	5823	5824	5825	5826	5827	5828	5829	5830	5831	5832	5833
41	5834	5835	5836	5837	5838	5839	5840	5841	5842	5843	5844	5845
42	5846	5847	5848	5849	5850	5851	5852	5853	5854	5855	5856	5857
43	5858	5859	5860	5861	5862	5863	5864	5865	5866	5867	5868	5869
44	5870	5871	5872	5873	5874	5875	5876	5877	5878	5879	5880	5881
45	5882	5883	5884	5885	5886	5887	5888	5889	5890	5891	5892	5893
46	5894	5895	5896	5897	5898	5899	5900	5901	5902	5903	5904	5905
47	5906	5907	5908	5909	5910	5911	5912	5913	5914	5915	5916	5917
48	5918	5919	5920	5921	5922	5923	5924	5925	5926	5927	5928	5929
49	5930	5931	5932	5933	5934	5935	5936	5937	5938	5939	5940	5941
50	5942	5943	5944	5945	5946	5947	5948	5949	5950	5951	5952	5953
51	5954	5955	5956	5957	5958	5959	5960	5961	5962	5963	5964	5965
52	5966	5967	5968	5969	5970	5971	5972	5973	5974	5975	5976	5977
53	5978	5979	5980	5981	5982	5983	5984	5985	5986	5987	5988	5989
54	5990	5991	5992	5993	5994	5995	5996	5997	5998	5999	6000	6001
55	6002	6003	6004	6005	6006	6007	6008	6009	6010	6011	6012	6013
56	6014	6015	6016	6017	6018	6019	6020	6021	6022	6023	6024	6025
57	6026	6027	6028	6029	6030	6031	6032	6033	6034	6035	6036	6037
58	6038	6039	6040	6041	6042	6043	6044	6045	6046	6047	6048	6049
59	6050	6051	6052	6053	6054	6055	6056	6057	6058	6059	6060	6061
60	6062	6063	6064	6065	6066	6067	6068	6069	6070	6071	6072	6073
61	6074	6075	6076	6077	6078	6079	6080	6081	6082	6083	6084	6085
62	6086	6087	6088	6089	6090	6091	6092	6093	6094	6095	6096	6097
63	6098	6099	6100	6101	6102	6103	6104	6105	6106	6107	6108	6109
64	6110	6111	6112	6113	6114	6115	6116	6117	6118	6119	6120	6121
65	6122	6123	6124	6125	6126	6127	6128	6129	6130	6131	6132	6133
66	6134	6135	6136	6137	6138	6139	6140	6141	6142	6143	6144	6145
67	6146	6147	6148	6149	6150	6151	6152	6153	6154	6155	6156	6157
68	6158	6159	6160	6161	6162	6163	6164	6165	6166	6167	6168	6169
69	6170	6171	6172	6173	6174	6175	6176	6177	6178	6179	6180	6181
70	6182	6183	6184	6185	6186	6187	6188	6189	6190	6191	6192	6193
71	6194	6195	6196	6197	6198	6199	6200	6201	6202	6203	6204	6205
72	6206	6207	6208	6209	6210	6211	6212	6213	6214	6215	6216	6217
73	6218	6219	6220	6221	6222	6223	6224	6225	6226	6227	6228	6229
74	6230	6231	6232	6233	6234	6235	6236	6237	6238	6239	6240	6241
75	6242	6243	6244	6245	6246	6247	6248	6249	6250	6251	6252	6253
76	6254	6255	6256	6257	6258	6259	6260	6261	6262	6263	6264	6265
77	6266	6267	6268	6269	6270	6271	6272	6273	6274	6275	6276	6277
78	6278	6279	6280	6281	6282	6283	6284	6285	6286	6287	6288	6289
79	6290	6291	6292	6293	6294	6295	6296	6297	6298	6299	6300	6301

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
80	6302	6303	6304	6305	6306	6307	6308	6309	6310	6311	6312	6313
81	6314	6315	6316	6317	6318	6319	6320	6321	6322	6323	6324	6325
82	6326	6327	6328	6329	6330	6331	6332	6333	6334	6335	6336	6337
83	6338	6339	6340	6341	6342	6343	6344	6345	6346	6347	6348	6349
84	6350	6351	6352	6353	6354	6355	6356	6357	6358	6359	6360	6361
85	6362	6363	6364	6365	6366	6367	6368	6369	6370	6371	6372	6373
86	6374	6375	6376	6377	6378	6379	6380	6381	6382	6383	6384	6385
87	6386	6387	6388	6389	6390	6391	6392	6393	6394	6395	6396	6397
88	6398	6399	6400	6401	6402	6403	6404	6405	6406	6407	6408	6409
89	6410	6411	6412	6413	6414	6415	6416	6417	6418	6419	6420	6421
90	6422	6423	6424	6425	6426	6427	6428	6429	6430	6431	6432	6433
91	6434	6435	6436	6437	6438	6439	6440	6441	6442	6443	6444	6445
92	6446	6447	6448	6449	6450	6451	6452	6453	6454	6455	6456	6457
93	6458	6459	6460	6461	6462	6463	6464	6465	6466	6467	6468	6469
94	6470	6471	6472	6473	6474	6475	6476	6477	6478	6479	6480	6481
95	6482	6483	6484	6485	6486	6487	6488	6489	6490	6491	6492	6493
96	6494	6495	6496	6497	6498	6499	6500	6501	6502	6503	6504	6505
97	6506	6507	6508	6509	6510	6511	6512	6513	6514	6515	6516	6517
98	6518	6519	6520	6521	6522	6523	6524	6525	6526	6527	6528	6529
99	6530	6531	6532	6533	6534	6535	6536	6537	6538	6539	6540	6541
100	6542	6543	6544	6545	6546	6547	6548	6549	6550	6551	6552	6553
101	6554	6555	6556	6557	6558	6559	6560	6561	6562	6563	6564	6565
102	6566	6567	6568	6569	6570	6571	6572	6573	6574	6575	6576	6577
103	6578	6579	6580	6581	6582	6583	6584	6585	6586	6587	6588	6589
104	6590	6591	6592	6593	6594	6595	6596	6597	6598	6599	6600	6601
105	6602	6603	6604	6605	6606	6607	6608	6609	6610	6611	6612	6613
106	6614	6615	6616	6617	6618	6619	6620	6621	6622	6623	6624	6625
107	6626	6627	6628	6629	6630	6631	6632	6633	6634	6635	6636	6637
108	6638	6639	6640	6641	6642	6643	6644	6645	6646	6647	6648	6649
109	6650	6651	6652	6653	6654	6655	6656	6657	6658	6659	6660	6661
110	6662	6663	6664	6665	6666	6667	6668	6669	6670	6671	6672	6673
111	6674	6675	6676	6677	6678	6679	6680	6681	6682	6683	6684	6685
112	6686	6687	6688	6689	6690	6691	6692	6693	6694	6695	6696	6697
113	6698	6699	6700	6701	6702	6703	6704	6705	6706	6707	6708	6709
114	6710	6711	6712	6713	6714	6715	6716	6717	6718	6719	6720	6721
115	6722	6723	6724	6725	6726	6727	6728	6729	6730	6731	6732	6733
116	6734	6735	6736	6737	6738	6739	6740	6741	6742	6743	6744	6745
117	6746	6747	6748	6749	6750	6751	6752	6753	6754	6755	6756	6757
118	6758	6759	6760	6761	6762	6763	6764	6765	6766	6767	6768	6769
119	6770	6771	6772	6773	6774	6775	6776	6777	6778	6779	6780	6781

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
120	6782	6783	6784	6785	6786	6787	6788	6789	6790	6791	6792	6793
121	6794	6795	6796	6797	6798	6799	6800	6801	6802	6803	6804	6805
122	6806	6807	6808	6809	6810	6811	6812	6813	6814	6815	6816	6817
123	6818	6819	6820	6821	6822	6823	6824	6825	6826	6827	6828	6829
124	6830	6831	6832	6833	6834	6835	6836	6837	6838	6839	6840	6841
125	6842	6843	6844	6845	6846	6847	6848	6849	6850	6851	6852	6853
126	6854	6855	6856	6857	6858	6859	6860	6861	6862	6863	6864	6865
127	6866	6867	6868	6869	6870	6871	6872	6873	6874	6875	6876	6877
128	6878	6879	6880	6881	6882	6883	6884	6885	6886	6887	6888	6889
129	6890	6891	6892	6893	6894	6895	6896	6897	6898	6899	6900	6901
130	6902	6903	6904	6905	6906	6907	6908	6909	6910	6911	6912	6913
131	6914	6915	6916	6917	6918	6919	6920	6921	6922	6923	6924	6925
132	6926	6927	6928	6929	6930	6931	6932	6933	6934	6935	6936	6937
133	6938	6939	6940	6941	6942	6943	6944	6945	6946	6947	6948	6949
134	6950	6951	6952	6953	6954	6955	6956	6957	6958	6959	6960	6961
135	6962	6963	6964	6965	6966	6967	6968	6969	6970	6971	6972	6973
136	6974	6975	6976	6977	6978	6979	6980	6981	6982	6983	6984	6985
137	6986	6987	6988	6989	6990	6991	6992	6993	6994	6995	6996	6997
138	6998	6999	7000	7001	7002	7003	7004	7005	7006	7007	7008	7009
139	7010	7011	7012	7013	7014	7015	7016	7017	7018	7019	7020	7021
140	7022	7023	7024	7025	7026	7027	7028	7029	7030	7031	7032	7033
141	7034	7035	7036	7037	7038	7039	7040	7041	7042	7043	7044	7045
142	7046	7047	7048	7049	7050	7051	7052	7053	7054	7055	7056	7057
143	7058	7059	7060	7061	7062	7063	7064	7065	7066	7067	7068	7069
144	7070	7071	7072	7073	7074	7075	7076	7077	7078	7079	7080	7081
145	7082	7083	7084	7085	7086	7087	7088	7089	7090	7091	7092	7093
146	7094	7095	7096	7097	7098	7099	7100	7101	7102	7103	7104	7105
147	7106	7107	7108	7109	7110	7111	7112	7113	7114	7115	7116	7117
148	7118	7119	7120	7121	7122	7123	7124	7125	7126	7127	7128	7129
149	7130	7131	7132	7133	7134	7135	7136	7137	7138	7139	7140	7141
150	7142	7143	7144	7145	7146	7147	7148	7149	7150	7151	7152	7153
151	7154	7155	7156	7157	7158	7159	7160	7161	7162	7163	7164	7165
152	7166	7167	7168	7169	7170	7171	7172	7173	7174	7175	7176	7177
153	7178	7179	7180	7181	7182	7183	7184	7185	7186	7187	7188	7189
154	7190	7191	7192	7193	7194	7195	7196	7197	7198	7199	7200	7201
155	7202	7203	7204	7205	7206	7207	7208	7209	7210	7211	7212	7213
156	7214	7215	7216	7217	7218	7219	7220	7221	7222	7223	7224	7225
157	7226	7227	7228	7229	7230	7231	7232	7233	7234	7235	7236	7237
158	7238	7239	7240	7241	7242	7243	7244	7245	7246	7247	7248	7249

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
159	7250	7251	7252	7253	7254	7255	7256	7257	7258	7259	7260	7261
160	7262	7263	7264	7265	7266	7267	7268	7269	7270	7271	7272	7273
161	7274	7275	7276	7277	7278	7279	7280	7281	7282	7283	7284	7285
162	7286	7287	7288	7289	7290	7291	7292	7293	7294	7295	7296	7297
163	7298	7299	7300	7301	7302	7303	7304	7305	7306	7307	7308	7309
164	7310	7311	7312	7313	7314	7315	7316	7317	7318	7319	7320	7321
165	7322	7323	7324	7325	7326	7327	7328	7329	7330	7331	7332	7333
166	7334	7335	7336	7337	7338	7339	7340	7341	7342	7343	7344	7345
167	7346	7347	7348	7349	7350	7351	7352	7353	7354	7355	7356	7357
168	7358	7359	7360	7361	7362	7363	7364	7365	7366	7367	7368	7369
169	7370	7371	7372	7373	7374	7375	7376	7377	7378	7379	7380	7381
170	7382	7383	7384	7385	7386	7387	7388	7389	7390	7391	7392	7393
171	7394	7395	7396	7397	7398	7399	7400	7401	7402	7403	7404	7405
172	7406	7407	7408	7409	7410	7411	7412	7413	7414	7415	7416	7417
173	7418	7419	7420	7421	7422	7423	7424	7425	7426	7427	7428	7429
174	7430	7431	7432	7433	7434	7435	7436	7437	7438	7439	7440	7441
175	7442	7443	7444	7445	7446	7447	7448	7449	7450	7451	7452	7453
176	7454	7455	7456	7457	7458	7459	7460	7461	7462	7463	7464	7465
177	7466	7467	7468	7469	7470	7471	7472	7473	7474	7475	7476	7477
178	7478	7479	7480	7481	7482	7483	7484	7485	7486	7487	7488	7489
179	7490	7491	7492	7493	7494	7495	7496	7497	7498	7499	7500	7501
180	7502	7503	7504	7505	7506	7507	7508	7509	7510	7511	7512	7513
181	7514	7515	7516	7517	7518	7519	7520	7521	7522	7523	7524	7525
182	7526	7527	7528	7529	7530	7531	7532	7533	7534	7535	7536	7537
183	7538	7539	7540	7541	7542	7543	7544	7545	7546	7547	7548	7549
184	7550	7551	7552	7553	7554	7555	7556	7557	7558	7559	7560	7561
185	7562	7563	7564	7565	7566	7567	7568	7569	7570	7571	7572	7573
186	7574	7575	7576	7577	7578	7579	7580	7581	7582	7583	7584	7585
187	7586	7587	7588	7589	7590	7591	7592	7593	7594	7595	7596	7597
188	7598	7599	7600	7601	7602	7603	7604	7605	7606	7607	7608	7609
189	7610	7611	7612	7613	7614	7615	7616	7617	7618	7619	7620	7621
190	7622	7623	7624	7625	7626	7627	7628	7629	7630	7631	7632	7633
191	7634	7635	7636	7637	7638	7639	7640	7641	7642	7643	7644	7645
192	7646	7647	7648	7649	7650	7651	7652	7653	7654	7655	7656	7657
193	7658	7659	7660	7661	7662	7663	7664	7665	7666	7667	7668	7669
194	7670	7671	7672	7673	7674	7675	7676	7677	7678	7679	7680	7681
195	7682	7683	7684	7685	7686	7687	7688	7689	7690	7691	7692	7693
196	7694	7695	7696	7697	7698	7699	7700	7701	7702	7703	7704	7705
197	7706	7707	7708	7709	7710	7711	7712	7713	7714	7715	7716	7717
198	7718	7719	7720	7721	7722	7723	7724	7725	7726	7727	7728	7729

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
199	7730	7731	7732	7733	7734	7735	7736	7737	7738	7739	7740	7741
200	7742	7743	7744	7745	7746	7747	7748	7749	7750	7751	7752	7753
201	7754	7755	7756	7757	7758	7759	7760	7761	7762	7763	7764	7765
202	7766	7767	7768	7769	7770	7771	7772	7773	7774	7775	7776	7777
203	7778	7779	7780	7781	7782	7783	7784	7785	7786	7787	7788	7789
204	7790	7791	7792	7793	7794	7795	7796	7797	7798	7799	7800	7801
205	7802	7803	7804	7805	7806	7807	7808	7809	7810	7811	7812	7813
206	7814	7815	7816	7817	7818	7819	7820	7821	7822	7823	7824	7825
207	7826	7827	7828	7829	7830	7831	7832	7833	7834	7835	7836	7837
208	7838	7839	7840	7841	7842	7843	7844	7845	7846	7847	7848	7849
209	7850	7851	7852	7853	7854	7855	7856	7857	7858	7859	7860	7861
210	7862	7863	7864	7865	7866	7867	7868	7869	7870	7871	7872	7873
211	7874	7875	7876	7877	7878	7879	7880	7881	7882	7883	7884	7885
212	7886	7887	7888	7889	7890	7891	7892	7893	7894	7895	7896	7897
213	7898	7899	7900	7901	7902	7903	7904	7905	7906	7907	7908	7909
214	7910	7911	7912	7913	7914	7915	7916	7917	7918	7919	7920	7921
215	7922	7923	7924	7925	7926	7927	7928	7929	7930	7931	7932	7933
216	7934	7935	7936	7937	7938	7939	7940	7941	7942	7943	7944	7945
217	7946	7947	7948	7949	7950	7951	7952	7953	7954	7955	7956	7957
218	7958	7959	7960	7961	7962	7963	7964	7965	7966	7967	7968	7969
219	7970	7971	7972	7973	7974	7975	7976	7977	7978	7979	7980	7981
220	7982	7983	7984	7985	7986	7987	7988	7989	7990	7991	7992	7993
221	7994	7995	7996	7997	7998	7999	8000	8001	8002	8003	8004	8005
222	8006	8007	8008	8009	8010	8011	8012	8013	8014	8015	8016	8017
223	8018	8019	8020	8021	8022	8023	8024	8025	8026	8027	8028	8029
224	8030	8031	8032	8033	8034	8035	8036	8037	8038	8039	8040	8041
225	8042	8043	8044	8045	8046	8047	8048	8049	8050	8051	8052	8053
226	8054	8055	8056	8057	8058	8059	8060	8061	8062	8063	8064	8065
227	8066	8067	8068	8069	8070	8071	8072	8073	8074	8075	8076	8077
228	8078	8079	8080	8081	8082	8083	8084	8085	8086	8087	8088	8089
229	8090	8091	8092	8093	8094	8095	8096	8097	8098	8099	8100	8101
230	8102	8103	8104	8105	8106	8107	8108	8109	8110	8111	8112	8113
231	8114	8115	8116	8117	8118	8119	8120	8121	8122	8123	8124	8125
232	8126	8127	8128	8129	8130	8131	8132	8133	8134	8135	8136	8137
233	8138	8139	8140	8141	8142	8143	8144	8145	8146	8147	8148	8149
234	8150	8151	8152	8153	8154	8155	8156	8157	8158	8159	8160	8161
235	8162	8163	8164	8165	8166	8167	8168	8169	8170	8171	8172	8173
236	8174	8175	8176	8177	8178	8179	8180	8181	8182	8183	8184	8185
237	8186	8187	8188	8189	8190	8191	8192	8193	8194	8195	8196	8197

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
238	8198	8199	8200	8201	8202	8203	8204	8205	8206	8207	8208	8209
239	8210	8211	8212	8213	8214	8215	8216	8217	8218	8219	8220	8221
240	8222	8223	8224	8225	8226	8227	8228	8229	8230	8231	8232	8233
241	8234	8235	8236	8237	8238	8239	8240	8241	8242	8243	8244	8245
242	8246	8247	8248	8249	8250	8251	8252	8253	8254	8255	8256	8257
243	8258	8259	8260	8261	8262	8263	8264	8265	8266	8267	8268	8269
244	8270	8271	8272	8273	8274	8275	8276	8277	8278	8279	8280	8281
245	8282	8283	8284	8285	8286	8287	8288	8289	8290	8291	8292	8293
246	8294	8295	8296	8297	8298	8299	8300	8301	8302	8303	8304	8305
247	8306	8307	8308	8309	8310	8311	8312	8313	8314	8315	8316	8317
248	8318	8319	8320	8321	8322	8323	8324	8325	8326	8327	8328	8329
249	8330	8331	8332	8333	8334	8335	8336	8337	8338	8339	8340	8341
250	8342	8343	8344	8345	8346	8347	8348	8349	8350	8351	8352	8353
251	8354	8355	8356	8357	8358	8359	8360	8361	8362	8363	8364	8365
252	8366	8367	8368	8369	8370	8371	8372	8373	8374	8375	8376	8377
253	8378	8379	8380	8381	8382	8383	8384	8385	8386	8387	8388	8389
254	8390	8391	8392	8393	8394	8395	8396	8397	8398	8399	8400	8401
255	8402	8403	8404	8405	8406	8407	8408	8409	8410	8411	8412	8413
256	8414	8415	8416	8417	8418	8419	8420	8421	8422	8423	8424	8425
257	8426	8427	8428	8429	8430	8431	8432	8433	8434	8435	8436	8437
258	8438	8439	8440	8441	8442	8443	8444	8445	8446	8447	8448	8449
259	8450	8451	8452	8453	8454	8455	8456	8457	8458	8459	8460	8461
260	8462	8463	8464	8465	8466	8467	8468	8469	8470	8471	8472	8473
261	8474	8475	8476	8477	8478	8479	8480	8481	8482	8483	8484	8485
262	8486	8487	8488	8489	8490	8491	8492	8493	8494	8495	8496	8497
263	8498	8499	8500	8501	8502	8503	8504	8505	8506	8507	8508	8509
264	8510	8511	8512	8513	8514	8515	8516	8517	8518	8519	8520	8521
265	8522	8523	8524	8525	8526	8527	8528	8529	8530	8531	8532	8533
266	8534	8535	8536	8537	8538	8539	8540	8541	8542	8543	8544	8545
267	8546	8547	8548	8549	8550	8551	8552	8553	8554	8555	8556	8557
268	8558	8559	8560	8561	8562	8563	8564	8565	8566	8567	8568	8569
269	8570	8571	8572	8573	8574	8575	8576	8577	8578	8579	8580	8581
270	8582	8583	8584	8585	8586	8587	8588	8589	8590	8591	8592	8593
271	8594	8595	8596	8597	8598	8599	8600	8601	8602	8603	8604	8605
272	8606	8607	8608	8609	8610	8611	8612	8613	8614	8615	8616	8617
273	8618	8619	8620	8621	8622	8623	8624	8625	8626	8627	8628	8629
274	8630	8631	8632	8633	8634	8635	8636	8637	8638	8639	8640	8641
275	8642	8643	8644	8645	8646	8647	8648	8649	8650	8651	8652	8653
276	8654	8655	8656	8657	8658	8659	8660	8661	8662	8663	8664	8665
277	8666	8667	8668	8669	8670	8671	8672	8673	8674	8675	8676	8677

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
278	8678	8679	8680	8681	8682	8683	8684	8685	8686	8687	8688	8689
279	8690	8691	8692	8693	8694	8695	8696	8697	8698	8699	8700	8701
280	8702	8703	8704	8705	8706	8707	8708	8709	8710	8711	8712	8713
281	8714	8715	8716	8717	8718	8719	8720	8721	8722	8723	8724	8725
282	8726	8727	8728	8729	8730	8731	8732	8733	8734	8735	8736	8737
283	8738	8739	8740	8741	8742	8743	8744	8745	8746	8747	8748	8749
284	8750	8751	8752	8753	8754	8755	8756	8757	8758	8759	8760	8761
285	8762	8763	8764	8765	8766	8767	8768	8769	8770	8771	8772	8773
286	8774	8775	8776	8777	8778	8779	8780	8781	8782	8783	8784	8785
287	8786	8787	8788	8789	8790	8791	8792	8793	8794	8795	8796	8797
288	8798	8799	8800	8801	8802	8803	8804	8805	8806	8807	8808	8809
289	8810	8811	8812	8813	8814	8815	8816	8817	8818	8819	8820	8821
290	8822	8823	8824	8825	8826	8827	8828	8829	8830	8831	8832	8833
291	8834	8835	8836	8837	8838	8839	8840	8841	8842	8843	8844	8845
292	8846	8847	8848	8849	8850	8851	8852	8853	8854	8855	8856	8857
293	8858	8859	8860	8861	8862	8863	8864	8865	8866	8867	8868	8869
294	8870	8871	8872	8873	8874	8875	8876	8877	8878	8879	8880	8881
295	8882	8883	8884	8885	8886	8887	8888	8889	8890	8891	8892	8893
296	8894	8895	8896	8897	8898	8899	8900	8901	8902	8903	8904	8905
297	8906	8907	8908	8909	8910	8911	8912	8913	8914	8915	8916	8917
298	8918	8919	8920	8921	8922	8923	8924	8925	8926	8927	8928	8929
299	8930	8931	8932	8933	8934	8935	8936	8937	8938	8939	8940	8941
300	8942	8943	8944	8945	8946	8947	8948	8949	8950	8951	8952	8953
301	8954	8955	8956	8957	8958	8959	8960	8961	8962	8963	8964	8965
302	8966	8967	8968	8969	8970	8971	8972	8973	8974	8975	8976	8977
303	8978	8979	8980	8981	8982	8983	8984	8985	8986	8987	8988	8989
304	8990	8991	8992	8993	8994	8995	8996	8997	8998	8999	9000	9001
305	9002	9003	9004	9005	9006	9007	9008	9009	9010	9011	9012	9013
306	9014	9015	9016	9017	9018	9019	9020	9021	9022	9023	9024	9025
307	9026	9027	9028	9029	9030	9031	9032	9033	9034	9035	9036	9037
308	9038	9039	9040	9041	9042	9043	9044	9045	9046	9047	9048	9049
309	9050	9051	9052	9053	9054	9055	9056	9057	9058	9059	9060	9061
310	9062	9063	9064	9065	9066	9067	9068	9069	9070	9071	9072	9073
311	9074	9075	9076	9077	9078	9079	9080	9081	9082	9083	9084	9085
312	9086	9087	9088	9089	9090	9091	9092	9093	9094	9095	9096	9097
313	9098	9099	9100	9101	9102	9103	9104	9105	9106	9107	9108	9109
314	9110	9111	9112	9113	9114	9115	9116	9117	9118	9119	9120	9121
315	9122	9123	9124	9125	9126	9127	9128	9129	9130	9131	9132	9133
316	9134	9135	9136	9137	9138	9139	9140	9141	9142	9143	9144	9145

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
317	9146	9147	9148	9149	9150	9151	9152	9153	9154	9155	9156	9157
318	9158	9159	9160	9161	9162	9163	9164	9165	9166	9167	9168	9169
319	9170	9171	9172	9173	9174	9175	9176	9177	9178	9179	9180	9181
320	9182	9183	9184	9185	9186	9187	9188	9189	9190	9191	9192	9193
321	9194	9195	9196	9197	9198	9199	9200	9201	9202	9203	9204	9205
322	9206	9207	9208	9209	9210	9211	9212	9213	9214	9215	9216	9217
323	9218	9219	9220	9221	9222	9223	9224	9225	9226	9227	9228	9229
324	9230	9231	9232	9233	9234	9235	9236	9237	9238	9239	9240	9241
325	9242	9243	9244	9245	9246	9247	9248	9249	9250	9251	9252	9253
326	9254	9255	9256	9257	9258	9259	9260	9261	9262	9263	9264	9265
327	9266	9267	9268	9269	9270	9271	9272	9273	9274	9275	9276	9277
328	9278	9279	9280	9281	9282	9283	9284	9285	9286	9287	9288	9289
329	9290	9291	9292	9293	9294	9295	9296	9297	9298	9299	9300	9301
330	9302	9303	9304	9305	9306	9307	9308	9309	9310	9311	9312	9313
331	9314	9315	9316	9317	9318	9319	9320	9321	9322	9323	9324	9325
332	9326	9327	9328	9329	9330	9331	9332	9333	9334	9335	9336	9337
333	9338	9339	9340	9341	9342	9343	9344	9345	9346	9347	9348	9349
334	9350	9351	9352	9353	9354	9355	9356	9357	9358	9359	9360	9361
335	9362	9363	9364	9365	9366	9367	9368	9369	9370	9371	9372	9373
336	9374	9375	9376	9377	9378	9379	9380	9381	9382	9383	9384	9385
337	9386	9387	9388	9389	9390	9391	9392	9393	9394	9395	9396	9397
338	9398	9399	9400	9401	9402	9403	9404	9405	9406	9407	9408	9409
339	9410	9411	9412	9413	9414	9415	9416	9417	9418	9419	9420	9421
340	9422	9423	9424	9425	9426	9427	9428	9429	9430	9431	9432	9433
341	9434	9435	9436	9437	9438	9439	9440	9441	9442	9443	9444	9445
342	9446	9447	9448	9449	9450	9451	9452	9453	9454	9455	9456	9457
343	9458	9459	9460	9461	9462	9463	9464	9465	9466	9467	9468	9469
344	9470	9471	9472	9473	9474	9475	9476	9477	9478	9479	9480	9481
345	9482	9483	9484	9485	9486	9487	9488	9489	9490	9491	9492	9493
346	9494	9495	9496	9497	9498	9499	9500	9501	9502	9503	9504	9505
347	9506	9507	9508	9509	9510	9511	9512	9513	9514	9515	9516	9517
348	9518	9519	9520	9521	9522	9523	9524	9525	9526	9527	9528	9529
349	9530	9531	9532	9533	9534	9535	9536	9537	9538	9539	9540	9541
350	9542	9543	9544	9545	9546	9547	9548	9549	9550	9551	9552	9553
351	9554	9555	9556	9557	9558	9559	9560	9561	9562	9563	9564	9565
352	9566	9567	9568	9569	9570	9571	9572	9573	9574	9575	9576	9577
353	9578	9579	9580	9581	9582	9583	9584	9585	9586	9587	9588	9589
354	9590	9591	9592	9593	9594	9595	9596	9597	9598	9599	9600	9601
355	9602	9603	9604	9605	9606	9607	9608	9609	9610	9611	9612	9613
356	9614	9615	9616	9617	9618	9619	9620	9621	9622	9623	9624	9625

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
357	9626	9627	9628	9629	9630	9631	9632	9633	9634	9635	9636	9637
358	9638	9639	9640	9641	9642	9643	9644	9645	9646	9647	9648	9649
359	9650	9651	9652	9653	9654	9655	9656	9657	9658	9659	9660	9661
360	9662	9663	9664	9665	9666	9667	9668	9669	9670	9671	9672	9673
361	9674	9675	9676	9677	9678	9679	9680	9681	9682	9683	9684	9685
362	9686	9687	9688	9689	9690	9691	9692	9693	9694	9695	9696	9697
363	9698	9699	9700	9701	9702	9703	9704	9705	9706	9707	9708	9709
364	9710	9711	9712	9713	9714	9715	9716	9717	9718	9719	9720	9721
365	9722	9723	9724	9725	9726	9727	9728	9729	9730	9731	9732	9733
366	9734	9735	9736	9737	9738	9739	9740	9741	9742	9743	9744	9745
367	9746	9747	9748	9749	9750	9751	9752	9753	9754	9755	9756	9757
368	9758	9759	9760	9761	9762	9763	9764	9765	9766	9767	9768	9769
369	9770	9771	9772	9773	9774	9775	9776	9777	9778	9779	9780	9781
370	9782	9783	9784	9785	9786	9787	9788	9789	9790	9791	9792	9793
371	9794	9795	9796	9797	9798	9799	9800	9801	9802	9803	9804	9805
372	9806	9807	9808	9809	9810	9811	9812	9813	9814	9815	9816	9817
373	9818	9819	9820	9821	9822	9823	9824	9825	9826	9827	9828	9829
374	9830	9831	9832	9833	9834	9835	9836	9837	9838	9839	9840	9841
375	9842	9843	9844	9845	9846	9847	9848	9849	9850	9851	9852	9853
376	9854	9855	9856	9857	9858	9859	9860	9861	9862	9863	9864	9865
377	9866	9867	9868	9869	9870	9871	9872	9873	9874	9875	9876	9877
378	9878	9879	9880	9881	9882	9883	9884	9885	9886	9887	9888	9889
379	9890	9891	9892	9893	9894	9895	9896	9897	9898	9899	9900	9901
380	9902	9903	9904	9905	9906	9907	9908	9909	9910	9911	9912	9913
381	9914	9915	9916	9917	9918	9919	9920	9921	9922	9923	9924	9925
382	9926	9927	9928	9929	9930	9931	9932	9933	9934	9935	9936	9937
383	9938	9939	9940	9941	9942	9943	9944	9945	9946	9947	9948	9949
384	9950	9951	9952	9953	9954	9955	9956	9957	9958	9959	9960	9961
385	9962	9963	9964	9965	9966	9967	9968	9969	9970	9971	9972	9973
386	9974	9975	9976	9977	9978	9979	9980	9981	9982	9983	9984	9985
387	9986	9987	9988	9989	9990	9991	9992	9993	9994	9995	9996	9997
388	9998	9999	10000	10001	10002	10003	10004	10005	10006	10007	10008	10009
389	10010	10011	10012	10013	10014	10015	10016	10017	10018	10019	10020	10021
390	10022	10023	10024	10025	10026	10027	10028	10029	10030	10031	10032	10033
391	10034	10035	10036	10037	10038	10039	10040	10041	10042	10043	10044	10045
392	10046	10047	10048	10049	10050	10051	10052	10053	10054	10055	10056	10057
393	10058	10059	10060	10061	10062	10063	10064	10065	10066	10067	10068	10069
394	10070	10071	10072	10073	10074	10075	10076	10077	10078	10079	10080	10081
395	10082	10083	10084	10085	10086	10087	10088	10089	10090	10091	10092	10093

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
396	10094	10095	10096	10097	10098	10099	10100	10101	10102	10103	10104	10105
397	10106	10107	10108	10109	10110	10111	10112	10113	10114	10115	10116	10117
398	10118	10119	10120	10121	10122	10123	10124	10125	10126	10127	10128	10129
399	10130	10131	10132	10133	10134	10135	10136	10137	10138	10139	10140	10141
400	10142	10143	10144	10145	10146	10147	10148	10149	10150	10151	10152	10153

Appendix 2.4 3-axis operation data memory address

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
1	10154	10155	10156	10157	10158	10159	10160	10161	10162	10163	10164	10165
2	10166	10167	10168	10169	10170	10171	10172	10173	10174	10175	10176	10177
3	10178	10179	10180	10181	10182	10183	10184	10185	10186	10187	10188	10189
4	10190	10191	10192	10193	10194	10195	10196	10197	10198	10199	10200	10201
5	10202	10203	10204	10205	10206	10207	10208	10209	10210	10211	10212	10213
6	10214	10215	10216	10217	10218	10219	10220	10221	10222	10223	10224	10225
7	10226	10227	10228	10229	10230	10231	10232	10233	10234	10235	10236	10237
8	10238	10239	10240	10241	10242	10243	10244	10245	10246	10247	10248	10249
9	10250	10251	10252	10253	10254	10255	10256	10257	10258	10259	10260	10261
10	10262	10263	10264	10265	10266	10267	10268	10269	10270	10271	10272	10273
11	10274	10275	10276	10277	10278	10279	10280	10281	10282	10283	10284	10285
12	10286	10287	10288	10289	10290	10291	10292	10293	10294	10295	10296	10297
13	10298	10299	10300	10301	10302	10303	10304	10305	10306	10307	10308	10309
14	10310	10311	10312	10313	10314	10315	10316	10317	10318	10319	10320	10321
15	10322	10323	10324	10325	10326	10327	10328	10329	10330	10331	10332	10333
16	10334	10335	10336	10337	10338	10339	10340	10341	10342	10343	10344	10345
17	10346	10347	10348	10349	10350	10351	10352	10353	10354	10355	10356	10357
18	10358	10359	10360	10361	10362	10363	10364	10365	10366	10367	10368	10369
19	10370	10371	10372	10373	10374	10375	10376	10377	10378	10379	10380	10381
20	10382	10383	10384	10385	10386	10387	10388	10389	10390	10391	10392	10393
21	10394	10395	10396	10397	10398	10399	10400	10401	10402	10403	10404	10405
22	10406	10407	10408	10409	10410	10411	10412	10413	10414	10415	10416	10417
23	10418	10419	10420	10421	10422	10423	10424	10425	10426	10427	10428	10429
24	10430	10431	10432	10433	10434	10435	10436	10437	10438	10439	10440	10441
25	10442	10443	10444	10445	10446	10447	10448	10449	10450	10451	10452	10453
26	10454	10455	10456	10457	10458	10459	10460	10461	10462	10463	10464	10465
27	10466	10467	10468	10469	10470	10471	10472	10473	10474	10475	10476	10477
28	10478	10479	10480	10481	10482	10483	10484	10485	10486	10487	10488	10489
29	10490	10491	10492	10493	10494	10495	10496	10497	10498	10499	10500	10501
30	10502	10503	10504	10505	10506	10507	10508	10509	10510	10511	10512	10513
31	10514	10515	10516	10517	10518	10519	10520	10521	10522	10523	10524	10525
32	10526	10527	10528	10529	10530	10531	10532	10533	10534	10535	10536	10537
33	10538	10539	10540	10541	10542	10543	10544	10545	10546	10547	10548	10549
34	10550	10551	10552	10553	10554	10555	10556	10557	10558	10559	10560	10561
35	10562	10563	10564	10565	10566	10567	10568	10569	10570	10571	10572	10573
36	10574	10575	10576	10577	10578	10579	10580	10581	10582	10583	10584	10585
37	10586	10587	10588	10589	10590	10591	10592	10593	10594	10595	10596	10597
38	10598	10599	10600	10601	10602	10603	10604	10605	10606	10607	10608	10609

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
39	10610	10611	10612	10613	10614	10615	10616	10617	10618	10619	10620	10621
40	10622	10623	10624	10625	10626	10627	10628	10629	10630	10631	10632	10633
41	10634	10635	10636	10637	10638	10639	10640	10641	10642	10643	10644	10645
42	10646	10647	10648	10649	10650	10651	10652	10653	10654	10655	10656	10657
43	10658	10659	10660	10661	10662	10663	10664	10665	10666	10667	10668	10669
44	10670	10671	10672	10673	10674	10675	10676	10677	10678	10679	10680	10681
45	10682	10683	10684	10685	10686	10687	10688	10689	10690	10691	10692	10693
46	10694	10695	10696	10697	10698	10699	10700	10701	10702	10703	10704	10705
47	10706	10707	10708	10709	10710	10711	10712	10713	10714	10715	10716	10717
48	10718	10719	10720	10721	10722	10723	10724	10725	10726	10727	10728	10729
49	10730	10731	10732	10733	10734	10735	10736	10737	10738	10739	10740	10741
50	10742	10743	10744	10745	10746	10747	10748	10749	10750	10751	10752	10753
51	10754	10755	10756	10757	10758	10759	10760	10761	10762	10763	10764	10765
52	10766	10767	10768	10769	10770	10771	10772	10773	10774	10775	10776	10777
53	10778	10779	10780	10781	10782	10783	10784	10785	10786	10787	10788	10789
54	10790	10791	10792	10793	10794	10795	10796	10797	10798	10799	10800	10801
55	10802	10803	10804	10805	10806	10807	10808	10809	10810	10811	10812	10813
56	10814	10815	10816	10817	10818	10819	10820	10821	10822	10823	10824	10825
57	10826	10827	10828	10829	10830	10831	10832	10833	10834	10835	10836	10837
58	10838	10839	10840	10841	10842	10843	10844	10845	10846	10847	10848	10849
59	10850	10851	10852	10853	10854	10855	10856	10857	10858	10859	10860	10861
60	10862	10863	10864	10865	10866	10867	10868	10869	10870	10871	10872	10873
61	10874	10875	10876	10877	10878	10879	10880	10881	10882	10883	10884	10885
62	10886	10887	10888	10889	10890	10891	10892	10893	10894	10895	10896	10897
63	10898	10899	10900	10901	10902	10903	10904	10905	10906	10907	10908	10909
64	10910	10911	10912	10913	10914	10915	10916	10917	10918	10919	10920	10921
65	10922	10923	10924	10925	10926	10927	10928	10929	10930	10931	10932	10933
66	10934	10935	10936	10937	10938	10939	10940	10941	10942	10943	10944	10945
67	10946	10947	10948	10949	10950	10951	10952	10953	10954	10955	10956	10957
68	10958	10959	10960	10961	10962	10963	10964	10965	10966	10967	10968	10969
69	10970	10971	10972	10973	10974	10975	10976	10977	10978	10979	10980	10981
70	10982	10983	10984	10985	10986	10987	10988	10989	10990	10991	10992	10993
71	10994	10995	10996	10997	10998	10999	11000	11001	11002	11003	11004	11005
72	11006	11007	11008	11009	11010	11011	11012	11013	11014	11015	11016	11017
73	11018	11019	11020	11021	11022	11023	11024	11025	11026	11027	11028	11029
74	11030	11031	11032	11033	11034	11035	11036	11037	11038	11039	11040	11041
75	11042	11043	11044	11045	11046	11047	11048	11049	11050	11051	11052	11053
76	11054	11055	11056	11057	11058	11059	11060	11061	11062	11063	11064	11065
77	11066	11067	11068	11069	11070	11071	11072	11073	11074	11075	11076	11077
78	11078	11079	11080	11081	11082	11083	11084	11085	11086	11087	11088	11089

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
79	11090	11091	11092	11093	11094	11095	11096	11097	11098	11099	11100	11101
80	11102	11103	11104	11105	11106	11107	11108	11109	11110	11111	11112	11113
81	11114	11115	11116	11117	11118	11119	11120	11121	11122	11123	11124	11125
82	11126	11127	11128	11129	11130	11131	11132	11133	11134	11135	11136	11137
83	11138	11139	11140	11141	11142	11143	11144	11145	11146	11147	11148	11149
84	11150	11151	11152	11153	11154	11155	11156	11157	11158	11159	11160	11161
85	11162	11163	11164	11165	11166	11167	11168	11169	11170	11171	11172	11173
86	11174	11175	11176	11177	11178	11179	11180	11181	11182	11183	11184	11185
87	11186	11187	11188	11189	11190	11191	11192	11193	11194	11195	11196	11197
88	11198	11199	11200	11201	11202	11203	11204	11205	11206	11207	11208	11209
89	11210	11211	11212	11213	11214	11215	11216	11217	11218	11219	11220	11221
90	11222	11223	11224	11225	11226	11227	11228	11229	11230	11231	11232	11233
91	11234	11235	11236	11237	11238	11239	11240	11241	11242	11243	11244	11245
92	11246	11247	11248	11249	11250	11251	11252	11253	11254	11255	11256	11257
93	11258	11259	11260	11261	11262	11263	11264	11265	11266	11267	11268	11269
94	11270	11271	11272	11273	11274	11275	11276	11277	11278	11279	11280	11281
95	11282	11283	11284	11285	11286	11287	11288	11289	11290	11291	11292	11293
96	11294	11295	11296	11297	11298	11299	11300	11301	11302	11303	11304	11305
97	11306	11307	11308	11309	11310	11311	11312	11313	11314	11315	11316	11317
98	11318	11319	11320	11321	11322	11323	11324	11325	11326	11327	11328	11329
99	11330	11331	11332	11333	11334	11335	11336	11337	11338	11339	11340	11341
100	11342	11343	11344	11345	11346	11347	11348	11349	11350	11351	11352	11353
101	11354	11355	11356	11357	11358	11359	11360	11361	11362	11363	11364	11365
102	11366	11367	11368	11369	11370	11371	11372	11373	11374	11375	11376	11377
103	11378	11379	11380	11381	11382	11383	11384	11385	11386	11387	11388	11389
104	11390	11391	11392	11393	11394	11395	11396	11397	11398	11399	11400	11401
105	11402	11403	11404	11405	11406	11407	11408	11409	11410	11411	11412	11413
106	11414	11415	11416	11417	11418	11419	11420	11421	11422	11423	11424	11425
107	11426	11427	11428	11429	11430	11431	11432	11433	11434	11435	11436	11437
108	11438	11439	11440	11441	11442	11443	11444	11445	11446	11447	11448	11449
109	11450	11451	11452	11453	11454	11455	11456	11457	11458	11459	11460	11461
110	11462	11463	11464	11465	11466	11467	11468	11469	11470	11471	11472	11473
111	11474	11475	11476	11477	11478	11479	11480	11481	11482	11483	11484	11485
112	11486	11487	11488	11489	11490	11491	11492	11493	11494	11495	11496	11497
113	11498	11499	11500	11501	11502	11503	11504	11505	11506	11507	11508	11509
114	11510	11511	11512	11513	11514	11515	11516	11517	11518	11519	11520	11521
115	11522	11523	11524	11525	11526	11527	11528	11529	11530	11531	11532	11533
116	11534	11535	11536	11537	11538	11539	11540	11541	11542	11543	11544	11545
117	11546	11547	11548	11549	11550	11551	11552	11553	11554	11555	11556	11557

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
118	11558	11559	11560	11561	11562	11563	11564	11565	11566	11567	11568	11569
119	11570	11571	11572	11573	11574	11575	11576	11577	11578	11579	11580	11581
120	11582	11583	11584	11585	11586	11587	11588	11589	11590	11591	11592	11593
121	11594	11595	11596	11597	11598	11599	11600	11601	11602	11603	11604	11605
122	11606	11607	11608	11609	11610	11611	11612	11613	11614	11615	11616	11617
123	11618	11619	11620	11621	11622	11623	11624	11625	11626	11627	11628	11629
124	11630	11631	11632	11633	11634	11635	11636	11637	11638	11639	11640	11641
125	11642	11643	11644	11645	11646	11647	11648	11649	11650	11651	11652	11653
126	11654	11655	11656	11657	11658	11659	11660	11661	11662	11663	11664	11665
127	11666	11667	11668	11669	11670	11671	11672	11673	11674	11675	11676	11677
128	11678	11679	11680	11681	11682	11683	11684	11685	11686	11687	11688	11689
129	11690	11691	11692	11693	11694	11695	11696	11697	11698	11699	11700	11701
130	11702	11703	11704	11705	11706	11707	11708	11709	11710	11711	11712	11713
131	11714	11715	11716	11717	11718	11719	11720	11721	11722	11723	11724	11725
132	11726	11727	11728	11729	11730	11731	11732	11733	11734	11735	11736	11737
133	11738	11739	11740	11741	11742	11743	11744	11745	11746	11747	11748	11749
134	11750	11751	11752	11753	11754	11755	11756	11757	11758	11759	11760	11761
135	11762	11763	11764	11765	11766	11767	11768	11769	11770	11771	11772	11773
136	11774	11775	11776	11777	11778	11779	11780	11781	11782	11783	11784	11785
137	11786	11787	11788	11789	11790	11791	11792	11793	11794	11795	11796	11797
138	11798	11799	11800	11801	11802	11803	11804	11805	11806	11807	11808	11809
139	11810	11811	11812	11813	11814	11815	11816	11817	11818	11819	11820	11821
140	11822	11823	11824	11825	11826	11827	11828	11829	11830	11831	11832	11833
141	11834	11835	11836	11837	11838	11839	11840	11841	11842	11843	11844	11845
142	11846	11847	11848	11849	11850	11851	11852	11853	11854	11855	11856	11857
143	11858	11859	11860	11861	11862	11863	11864	11865	11866	11867	11868	11869
144	11870	11871	11872	11873	11874	11875	11876	11877	11878	11879	11880	11881
145	11882	11883	11884	11885	11886	11887	11888	11889	11890	11891	11892	11893
146	11894	11895	11896	11897	11898	11899	11900	11901	11902	11903	11904	11905
147	11906	11907	11908	11909	11910	11911	11912	11913	11914	11915	11916	11917
148	11918	11919	11920	11921	11922	11923	11924	11925	11926	11927	11928	11929
149	11930	11931	11932	11933	11934	11935	11936	11937	11938	11939	11940	11941
150	11942	11943	11944	11945	11946	11947	11948	11949	11950	11951	11952	11953
151	11954	11955	11956	11957	11958	11959	11960	11961	11962	11963	11964	11965
152	11966	11967	11968	11969	11970	11971	11972	11973	11974	11975	11976	11977
153	11978	11979	11980	11981	11982	11983	11984	11985	11986	11987	11988	11989
154	11990	11991	11992	11993	11994	11995	11996	11997	11998	11999	12000	12001
155	12002	12003	12004	12005	12006	12007	12008	12009	12010	12011	12012	12013
156	12014	12015	12016	12017	12018	12019	12020	12021	12022	12023	12024	12025
157	12026	12027	12028	12029	12030	12031	12032	12033	12034	12035	12036	12037

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
158	12038	12039	12040	12041	12042	12043	12044	12045	12046	12047	12048	12049
159	12050	12051	12052	12053	12054	12055	12056	12057	12058	12059	12060	12061
160	12062	12063	12064	12065	12066	12067	12068	12069	12070	12071	12072	12073
161	12074	12075	12076	12077	12078	12079	12080	12081	12082	12083	12084	12085
162	12086	12087	12088	12089	12090	12091	12092	12093	12094	12095	12096	12097
163	12098	12099	12100	12101	12102	12103	12104	12105	12106	12107	12108	12109
164	12110	12111	12112	12113	12114	12115	12116	12117	12118	12119	12120	12121
165	12122	12123	12124	12125	12126	12127	12128	12129	12130	12131	12132	12133
166	12134	12135	12136	12137	12138	12139	12140	12141	12142	12143	12144	12145
167	12146	12147	12148	12149	12150	12151	12152	12153	12154	12155	12156	12157
168	12158	12159	12160	12161	12162	12163	12164	12165	12166	12167	12168	12169
169	12170	12171	12172	12173	12174	12175	12176	12177	12178	12179	12180	12181
170	12182	12183	12184	12185	12186	12187	12188	12189	12190	12191	12192	12193
171	12194	12195	12196	12197	12198	12199	12200	12201	12202	12203	12204	12205
172	12206	12207	12208	12209	12210	12211	12212	12213	12214	12215	12216	12217
173	12218	12219	12220	12221	12222	12223	12224	12225	12226	12227	12228	12229
174	12230	12231	12232	12233	12234	12235	12236	12237	12238	12239	12240	12241
175	12242	12243	12244	12245	12246	12247	12248	12249	12250	12251	12252	12253
176	12254	12255	12256	12257	12258	12259	12260	12261	12262	12263	12264	12265
177	12266	12267	12268	12269	12270	12271	12272	12273	12274	12275	12276	12277
178	12278	12279	12280	12281	12282	12283	12284	12285	12286	12287	12288	12289
179	12290	12291	12292	12293	12294	12295	12296	12297	12298	12299	12300	12301
180	12302	12303	12304	12305	12306	12307	12308	12309	12310	12311	12312	12313
181	12314	12315	12316	12317	12318	12319	12320	12321	12322	12323	12324	12325
182	12326	12327	12328	12329	12330	12331	12332	12333	12334	12335	12336	12337
183	12338	12339	12340	12341	12342	12343	12344	12345	12346	12347	12348	12349
184	12350	12351	12352	12353	12354	12355	12356	12357	12358	12359	12360	12361
185	12362	12363	12364	12365	12366	12367	12368	12369	12370	12371	12372	12373
186	12374	12375	12376	12377	12378	12379	12380	12381	12382	12383	12384	12385
187	12386	12387	12388	12389	12390	12391	12392	12393	12394	12395	12396	12397
188	12398	12399	12400	12401	12402	12403	12404	12405	12406	12407	12408	12409
189	12410	12411	12412	12413	12414	12415	12416	12417	12418	12419	12420	12421
190	12422	12423	12424	12425	12426	12427	12428	12429	12430	12431	12432	12433
191	12434	12435	12436	12437	12438	12439	12440	12441	12442	12443	12444	12445
192	12446	12447	12448	12449	12450	12451	12452	12453	12454	12455	12456	12457
193	12458	12459	12460	12461	12462	12463	12464	12465	12466	12467	12468	12469
194	12470	12471	12472	12473	12474	12475	12476	12477	12478	12479	12480	12481
195	12482	12483	12484	12485	12486	12487	12488	12489	12490	12491	12492	12493
196	12494	12495	12496	12497	12498	12499	12500	12501	12502	12503	12504	12505

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
197	12506	12507	12508	12509	12510	12511	12512	12513	12514	12515	12516	12517
198	12518	12519	12520	12521	12522	12523	12524	12525	12526	12527	12528	12529
199	12530	12531	12532	12533	12534	12535	12536	12537	12538	12539	12540	12541
200	12542	12543	12544	12545	12546	12547	12548	12549	12550	12551	12552	12553
201	12554	12555	12556	12557	12558	12559	12560	12561	12562	12563	12564	12565
202	12566	12567	12568	12569	12570	12571	12572	12573	12574	12575	12576	12577
203	12578	12579	12580	12581	12582	12583	12584	12585	12586	12587	12588	12589
204	12590	12591	12592	12593	12594	12595	12596	12597	12598	12599	12600	12601
205	12602	12603	12604	12605	12606	12607	12608	12609	12610	12611	12612	12613
206	12614	12615	12616	12617	12618	12619	12620	12621	12622	12623	12624	12625
207	12626	12627	12628	12629	12630	12631	12632	12633	12634	12635	12636	12637
208	12638	12639	12640	12641	12642	12643	12644	12645	12646	12647	12648	12649
209	12650	12651	12652	12653	12654	12655	12656	12657	12658	12659	12660	12661
210	12662	12663	12664	12665	12666	12667	12668	12669	12670	12671	12672	12673
211	12674	12675	12676	12677	12678	12679	12680	12681	12682	12683	12684	12685
212	12686	12687	12688	12689	12690	12691	12692	12693	12694	12695	12696	12697
213	12698	12699	12700	12701	12702	12703	12704	12705	12706	12707	12708	12709
214	12710	12711	12712	12713	12714	12715	12716	12717	12718	12719	12720	12721
215	12722	12723	12724	12725	12726	12727	12728	12729	12730	12731	12732	12733
216	12734	12735	12736	12737	12738	12739	12740	12741	12742	12743	12744	12745
217	12746	12747	12748	12749	12750	12751	12752	12753	12754	12755	12756	12757
218	12758	12759	12760	12761	12762	12763	12764	12765	12766	12767	12768	12769
219	12770	12771	12772	12773	12774	12775	12776	12777	12778	12779	12780	12781
220	12782	12783	12784	12785	12786	12787	12788	12789	12790	12791	12792	12793
221	12794	12795	12796	12797	12798	12799	12800	12801	12802	12803	12804	12805
222	12806	12807	12808	12809	12810	12811	12812	12813	12814	12815	12816	12817
223	12818	12819	12820	12821	12822	12823	12824	12825	12826	12827	12828	12829
224	12830	12831	12832	12833	12834	12835	12836	12837	12838	12839	12840	12841
225	12842	12843	12844	12845	12846	12847	12848	12849	12850	12851	12852	12853
226	12854	12855	12856	12857	12858	12859	12860	12861	12862	12863	12864	12865
227	12866	12867	12868	12869	12870	12871	12872	12873	12874	12875	12876	12877
228	12878	12879	12880	12881	12882	12883	12884	12885	12886	12887	12888	12889
229	12890	12891	12892	12893	12894	12895	12896	12897	12898	12899	12900	12901
230	12902	12903	12904	12905	12906	12907	12908	12909	12910	12911	12912	12913
231	12914	12915	12916	12917	12918	12919	12920	12921	12922	12923	12924	12925
232	12926	12927	12928	12929	12930	12931	12932	12933	12934	12935	12936	12937
233	12938	12939	12940	12941	12942	12943	12944	12945	12946	12947	12948	12949
234	12950	12951	12952	12953	12954	12955	12956	12957	12958	12959	12960	12961
235	12962	12963	12964	12965	12966	12967	12968	12969	12970	12971	12972	12973
236	12974	12975	12976	12977	12978	12979	12980	12981	12982	12983	12984	12985

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
237	12986	12987	12988	12989	12990	12991	12992	12993	12994	12995	12996	12997
238	12998	12999	13000	13001	13002	13003	13004	13005	13006	13007	13008	13009
239	13010	13011	13012	13013	13014	13015	13016	13017	13018	13019	13020	13021
240	13022	13023	13024	13025	13026	13027	13028	13029	13030	13031	13032	13033
241	13034	13035	13036	13037	13038	13039	13040	13041	13042	13043	13044	13045
242	13046	13047	13048	13049	13050	13051	13052	13053	13054	13055	13056	13057
243	13058	13059	13060	13061	13062	13063	13064	13065	13066	13067	13068	13069
244	13070	13071	13072	13073	13074	13075	13076	13077	13078	13079	13080	13081
245	13082	13083	13084	13085	13086	13087	13088	13089	13090	13091	13092	13093
246	13094	13095	13096	13097	13098	13099	13100	13101	13102	13103	13104	13105
247	13106	13107	13108	13109	13110	13111	13112	13113	13114	13115	13116	13117
248	13118	13119	13120	13121	13122	13123	13124	13125	13126	13127	13128	13129
249	13130	13131	13132	13133	13134	13135	13136	13137	13138	13139	13140	13141
250	13142	13143	13144	13145	13146	13147	13148	13149	13150	13151	13152	13153
251	13154	13155	13156	13157	13158	13159	13160	13161	13162	13163	13164	13165
252	13166	13167	13168	13169	13170	13171	13172	13173	13174	13175	13176	13177
253	13178	13179	13180	13181	13182	13183	13184	13185	13186	13187	13188	13189
254	13190	13191	13192	13193	13194	13195	13196	13197	13198	13199	13200	13201
255	13202	13203	13204	13205	13206	13207	13208	13209	13210	13211	13212	13213
256	13214	13215	13216	13217	13218	13219	13220	13221	13222	13223	13224	13225
257	13226	13227	13228	13229	13230	13231	13232	13233	13234	13235	13236	13237
258	13238	13239	13240	13241	13242	13243	13244	13245	13246	13247	13248	13249
259	13250	13251	13252	13253	13254	13255	13256	13257	13258	13259	13260	13261
260	13262	13263	13264	13265	13266	13267	13268	13269	13270	13271	13272	13273
261	13274	13275	13276	13277	13278	13279	13280	13281	13282	13283	13284	13285
262	13286	13287	13288	13289	13290	13291	13292	13293	13294	13295	13296	13297
263	13298	13299	13300	13301	13302	13303	13304	13305	13306	13307	13308	13309
264	13310	13311	13312	13313	13314	13315	13316	13317	13318	13319	13320	13321
265	13322	13323	13324	13325	13326	13327	13328	13329	13330	13331	13332	13333
266	13334	13335	13336	13337	13338	13339	13340	13341	13342	13343	13344	13345
267	13346	13347	13348	13349	13350	13351	13352	13353	13354	13355	13356	13357
268	13358	13359	13360	13361	13362	13363	13364	13365	13366	13367	13368	13369
269	13370	13371	13372	13373	13374	13375	13376	13377	13378	13379	13380	13381
270	13382	13383	13384	13385	13386	13387	13388	13389	13390	13391	13392	13393
271	13394	13395	13396	13397	13398	13399	13400	13401	13402	13403	13404	13405
272	13406	13407	13408	13409	13410	13411	13412	13413	13414	13415	13416	13417
273	13418	13419	13420	13421	13422	13423	13424	13425	13426	13427	13428	13429
274	13430	13431	13432	13433	13434	13435	13436	13437	13438	13439	13440	13441
275	13442	13443	13444	13445	13446	13447	13448	13449	13450	13451	13452	13453

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
276	13454	13455	13456	13457	13458	13459	13460	13461	13462	13463	13464	13465
277	13466	13467	13468	13469	13470	13471	13472	13473	13474	13475	13476	13477
278	13478	13479	13480	13481	13482	13483	13484	13485	13486	13487	13488	13489
279	13490	13491	13492	13493	13494	13495	13496	13497	13498	13499	13500	13501
280	13502	13503	13504	13505	13506	13507	13508	13509	13510	13511	13512	13513
281	13514	13515	13516	13517	13518	13519	13520	13521	13522	13523	13524	13525
282	13526	13527	13528	13529	13530	13531	13532	13533	13534	13535	13536	13537
283	13538	13539	13540	13541	13542	13543	13544	13545	13546	13547	13548	13549
284	13550	13551	13552	13553	13554	13555	13556	13557	13558	13559	13560	13561
285	13562	13563	13564	13565	13566	13567	13568	13569	13570	13571	13572	13573
286	13574	13575	13576	13577	13578	13579	13580	13581	13582	13583	13584	13585
287	13586	13587	13588	13589	13590	13591	13592	13593	13594	13595	13596	13597
288	13598	13599	13600	13601	13602	13603	13604	13605	13606	13607	13608	13609
289	13610	13611	13612	13613	13614	13615	13616	13617	13618	13619	13620	13621
290	13622	13623	13624	13625	13626	13627	13628	13629	13630	13631	13632	13633
291	13634	13635	13636	13637	13638	13639	13640	13641	13642	13643	13644	13645
292	13646	13647	13648	13649	13650	13651	13652	13653	13654	13655	13656	13657
293	13658	13659	13660	13661	13662	13663	13664	13665	13666	13667	13668	13669
294	13670	13671	13672	13673	13674	13675	13676	13677	13678	13679	13680	13681
295	13682	13683	13684	13685	13686	13687	13688	13689	13690	13691	13692	13693
296	13694	13695	13696	13697	13698	13699	13700	13701	13702	13703	13704	13705
297	13706	13707	13708	13709	13710	13711	13712	13713	13714	13715	13716	13717
298	13718	13719	13720	13721	13722	13723	13724	13725	13726	13727	13728	13729
299	13730	13731	13732	13733	13734	13735	13736	13737	13738	13739	13740	13741
300	13742	13743	13744	13745	13746	13747	13748	13749	13750	13751	13752	13753
301	13754	13755	13756	13757	13758	13759	13760	13761	13762	13763	13764	13765
302	13766	13767	13768	13769	13770	13771	13772	13773	13774	13775	13776	13777
303	13778	13779	13780	13781	13782	13783	13784	13785	13786	13787	13788	13789
304	13790	13791	13792	13793	13794	13795	13796	13797	13798	13799	13800	13801
305	13802	13803	13804	13805	13806	13807	13808	13809	13810	13811	13812	13813
306	13814	13815	13816	13817	13818	13819	13820	13821	13822	13823	13824	13825
307	13826	13827	13828	13829	13830	13831	13832	13833	13834	13835	13836	13837
308	13838	13839	13840	13841	13842	13843	13844	13845	13846	13847	13848	13849
309	13850	13851	13852	13853	13854	13855	13856	13857	13858	13859	13860	13861
310	13862	13863	13864	13865	13866	13867	13868	13869	13870	13871	13872	13873
311	13874	13875	13876	13877	13878	13879	13880	13881	13882	13883	13884	13885
312	13886	13887	13888	13889	13890	13891	13892	13893	13894	13895	13896	13897
313	13898	13899	13900	13901	13902	13903	13904	13905	13906	13907	13908	13909
314	13910	13911	13912	13913	13914	13915	13916	13917	13918	13919	13920	13921
315	13922	13923	13924	13925	13926	13927	13928	13929	13930	13931	13932	13933

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
316	13934	13935	13936	13937	13938	13939	13940	13941	13942	13943	13944	13945
317	13946	13947	13948	13949	13950	13951	13952	13953	13954	13955	13956	13957
318	13958	13959	13960	13961	13962	13963	13964	13965	13966	13967	13968	13969
319	13970	13971	13972	13973	13974	13975	13976	13977	13978	13979	13980	13981
320	13982	13983	13984	13985	13986	13987	13988	13989	13990	13991	13992	13993
321	13994	13995	13996	13997	13998	13999	14000	14001	14002	14003	14004	14005
322	14006	14007	14008	14009	14010	14011	14012	14013	14014	14015	14016	14017
323	14018	14019	14020	14021	14022	14023	14024	14025	14026	14027	14028	14029
324	14030	14031	14032	14033	14034	14035	14036	14037	14038	14039	14040	14041
325	14042	14043	14044	14045	14046	14047	14048	14049	14050	14051	14052	14053
326	14054	14055	14056	14057	14058	14059	14060	14061	14062	14063	14064	14065
327	14066	14067	14068	14069	14070	14071	14072	14073	14074	14075	14076	14077
328	14078	14079	14080	14081	14082	14083	14084	14085	14086	14087	14088	14089
329	14090	14091	14092	14093	14094	14095	14096	14097	14098	14099	14100	14101
330	14102	14103	14104	14105	14106	14107	14108	14109	14110	14111	14112	14113
331	14114	14115	14116	14117	14118	14119	14120	14121	14122	14123	14124	14125
332	14126	14127	14128	14129	14130	14131	14132	14133	14134	14135	14136	14137
333	14138	14139	14140	14141	14142	14143	14144	14145	14146	14147	14148	14149
334	14150	14151	14152	14153	14154	14155	14156	14157	14158	14159	14160	14161
335	14162	14163	14164	14165	14166	14167	14168	14169	14170	14171	14172	14173
336	14174	14175	14176	14177	14178	14179	14180	14181	14182	14183	14184	14185
337	14186	14187	14188	14189	14190	14191	14192	14193	14194	14195	14196	14197
338	14198	14199	14200	14201	14202	14203	14204	14205	14206	14207	14208	14209
339	14210	14211	14212	14213	14214	14215	14216	14217	14218	14219	14220	14221
340	14222	14223	14224	14225	14226	14227	14228	14229	14230	14231	14232	14233
341	14234	14235	14236	14237	14238	14239	14240	14241	14242	14243	14244	14245
342	14246	14247	14248	14249	14250	14251	14252	14253	14254	14255	14256	14257
343	14258	14259	14260	14261	14262	14263	14264	14265	14266	14267	14268	14269
344	14270	14271	14272	14273	14274	14275	14276	14277	14278	14279	14280	14281
345	14282	14283	14284	14285	14286	14287	14288	14289	14290	14291	14292	14293
346	14294	14295	14296	14297	14298	14299	14300	14301	14302	14303	14304	14305
347	14306	14307	14308	14309	14310	14311	14312	14313	14314	14315	14316	14317
348	14318	14319	14320	14321	14322	14323	14324	14325	14326	14327	14328	14329
349	14330	14331	14332	14333	14334	14335	14336	14337	14338	14339	14340	14341
350	14342	14343	14344	14345	14346	14347	14348	14349	14350	14351	14352	14353
351	14354	14355	14356	14357	14358	14359	14360	14361	14362	14363	14364	14365
352	14366	14367	14368	14369	14370	14371	14372	14373	14374	14375	14376	14377
353	14378	14379	14380	14381	14382	14383	14384	14385	14386	14387	14388	14389
354	14390	14391	14392	14393	14394	14395	14396	14397	14398	14399	14400	14401

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
355	14402	14403	14404	14405	14406	14407	14408	14409	14410	14411	14412	14413
356	14414	14415	14416	14417	14418	14419	14420	14421	14422	14423	14424	14425
357	14426	14427	14428	14429	14430	14431	14432	14433	14434	14435	14436	14437
358	14438	14439	14440	14441	14442	14443	14444	14445	14446	14447	14448	14449
359	14450	14451	14452	14453	14454	14455	14456	14457	14458	14459	14460	14461
360	14462	14463	14464	14465	14466	14467	14468	14469	14470	14471	14472	14473
361	14474	14475	14476	14477	14478	14479	14480	14481	14482	14483	14484	14485
362	14486	14487	14488	14489	14490	14491	14492	14493	14494	14495	14496	14497
363	14498	14499	14500	14501	14502	14503	14504	14505	14506	14507	14508	14509
364	14510	14511	14512	14513	14514	14515	14516	14517	14518	14519	14520	14521
365	14522	14523	14524	14525	14526	14527	14528	14529	14530	14531	14532	14533
366	14534	14535	14536	14537	14538	14539	14540	14541	14542	14543	14544	14545
367	14546	14547	14548	14549	14550	14551	14552	14553	14554	14555	14556	14557
368	14558	14559	14560	14561	14562	14563	14564	14565	14566	14567	14568	14569
369	14570	14571	14572	14573	14574	14575	14576	14577	14578	14579	14580	14581
370	14582	14583	14584	14585	14586	14587	14588	14589	14590	14591	14592	14593
371	14594	14595	14596	14597	14598	14599	14600	14601	14602	14603	14604	14605
372	14606	14607	14608	14609	14610	14611	14612	14613	14614	14615	14616	14617
373	14618	14619	14620	14621	14622	14623	14624	14625	14626	14627	14628	14629
374	14630	14631	14632	14633	14634	14635	14636	14637	14638	14639	14640	14641
375	14642	14643	14644	14645	14646	14647	14648	14649	14650	14651	14652	14653
376	14654	14655	14656	14657	14658	14659	14660	14661	14662	14663	14664	14665
377	14666	14667	14668	14669	14670	14671	14672	14673	14674	14675	14676	14677
378	14678	14679	14680	14681	14682	14683	14684	14685	14686	14687	14688	14689
379	14690	14691	14692	14693	14694	14695	14696	14697	14698	14699	14700	14701
380	14702	14703	14704	14705	14706	14707	14708	14709	14710	14711	14712	14713
381	14714	14715	14716	14717	14718	14719	14720	14721	14722	14723	14724	14725
382	14726	14727	14728	14729	14730	14731	14732	14733	14734	14735	14736	14737
383	14738	14739	14740	14741	14742	14743	14744	14745	14746	14747	14748	14749
384	14750	14751	14752	14753	14754	14755	14756	14757	14758	14759	14760	14761
385	14762	14763	14764	14765	14766	14767	14768	14769	14770	14771	14772	14773
386	14774	14775	14776	14777	14778	14779	14780	14781	14782	14783	14784	14785
387	14786	14787	14788	14789	14790	14791	14792	14793	14794	14795	14796	14797
388	14798	14799	14800	14801	14802	14803	14804	14805	14806	14807	14808	14809
389	14810	14811	14812	14813	14814	14815	14816	14817	14818	14819	14820	14821
390	14822	14823	14824	14825	14826	14827	14828	14829	14830	14831	14832	14833
391	14834	14835	14836	14837	14838	14839	14840	14841	14842	14843	14844	14845
392	14846	14847	14848	14849	14850	14851	14852	14853	14854	14855	14856	14857
393	14858	14859	14860	14861	14862	14863	14864	14865	14866	14867	14868	14869
394	14870	14871	14872	14873	14874	14875	14876	14877	14878	14879	14880	14881

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
395	14882	14883	14884	14885	14886	14887	14888	14889	14890	14891	14892	14893
396	14894	14895	14896	14897	14898	14899	14900	14901	14902	14903	14904	14905
397	14906	14907	14908	14909	14910	14911	14912	14913	14914	14915	14916	14917
398	14918	14919	14920	14921	14922	14923	14924	14925	14926	14927	14928	14929
399	14930	14931	14932	14933	14934	14935	14936	14937	14938	14939	14940	14941
400	14942	14943	14944	14945	14946	14947	14948	14949	14950	14951	14952	14953

Appendix 2.5 4-axis operation data memory address

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
1	14954	14955	14956	14957	14958	14959	14960	14961	14962	14963	14964	14965
2	14966	14967	14968	14969	14970	14971	14972	14973	14974	14975	14976	14977
3	14978	14979	14980	14981	14982	14983	14984	14985	14986	14987	14988	14989
4	14990	14991	14992	14993	14994	14995	14996	14997	14998	14999	15000	15001
5	15002	15003	15004	15005	15006	15007	15008	15009	15010	15011	15012	15013
6	15014	15015	15016	15017	15018	15019	15020	15021	15022	15023	15024	15025
7	15026	15027	15028	15029	15030	15031	15032	15033	15034	15035	15036	15037
8	15038	15039	15040	15041	15042	15043	15044	15045	15046	15047	15048	15049
9	15050	15051	15052	15053	15054	15055	15056	15057	15058	15059	15060	15061
10	15062	15063	15064	15065	15066	15067	15068	15069	15070	15071	15072	15073
11	15074	15075	15076	15077	15078	15079	15080	15081	15082	15083	15084	15085
12	15086	15087	15088	15089	15090	15091	15092	15093	15094	15095	15096	15097
13	15098	15099	15100	15101	15102	15103	15104	15105	15106	15107	15108	15109
14	15110	15111	15112	15113	15114	15115	15116	15117	15118	15119	15120	15121
15	15122	15123	15124	15125	15126	15127	15128	15129	15130	15131	15132	15133
16	15134	15135	15136	15137	15138	15139	15140	15141	15142	15143	15144	15145
17	15146	15147	15148	15149	15150	15151	15152	15153	15154	15155	15156	15157
18	15158	15159	15160	15161	15162	15163	15164	15165	15166	15167	15168	15169
19	15170	15171	15172	15173	15174	15175	15176	15177	15178	15179	15180	15181
20	15182	15183	15184	15185	15186	15187	15188	15189	15190	15191	15192	15193
21	15194	15195	15196	15197	15198	15199	15200	15201	15202	15203	15204	15205
22	15206	15207	15208	15209	15210	15211	15212	15213	15214	15215	15216	15217
23	15218	15219	15220	15221	15222	15223	15224	15225	15226	15227	15228	15229
24	15230	15231	15232	15233	15234	15235	15236	15237	15238	15239	15240	15241
25	15242	15243	15244	15245	15246	15247	15248	15249	15250	15251	15252	15253
26	15254	15255	15256	15257	15258	15259	15260	15261	15262	15263	15264	15265
27	15266	15267	15268	15269	15270	15271	15272	15273	15274	15275	15276	15277
28	15278	15279	15280	15281	15282	15283	15284	15285	15286	15287	15288	15289
29	15290	15291	15292	15293	15294	15295	15296	15297	15298	15299	15300	15301
30	15302	15303	15304	15305	15306	15307	15308	15309	15310	15311	15312	15313
31	15314	15315	15316	15317	15318	15319	15320	15321	15322	15323	15324	15325
32	15326	15327	15328	15329	15330	15331	15332	15333	15334	15335	15336	15337
33	15338	15339	15340	15341	15342	15343	15344	15345	15346	15347	15348	15349
34	15350	15351	15352	15353	15354	15355	15356	15357	15358	15359	15360	15361
35	15362	15363	15364	15365	15366	15367	15368	15369	15370	15371	15372	15373
36	15374	15375	15376	15377	15378	15379	15380	15381	15382	15383	15384	15385
37	15386	15387	15388	15389	15390	15391	15392	15393	15394	15395	15396	15397
38	15398	15399	15400	15401	15402	15403	15404	15405	15406	15407	15408	15409
39	15410	15411	15412	15413	15414	15415	15416	15417	15418	15419	15420	15421

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
40	15422	15423	15424	15425	15426	15427	15428	15429	15430	15431	15432	15433
41	15434	15435	15436	15437	15438	15439	15440	15441	15442	15443	15444	15445
42	15446	15447	15448	15449	15450	15451	15452	15453	15454	15455	15456	15457
43	15458	15459	15460	15461	15462	15463	15464	15465	15466	15467	15468	15469
44	15470	15471	15472	15473	15474	15475	15476	15477	15478	15479	15480	15481
45	15482	15483	15484	15485	15486	15487	15488	15489	15490	15491	15492	15493
46	15494	15495	15496	15497	15498	15499	15500	15501	15502	15503	15504	15505
47	15506	15507	15508	15509	15510	15511	15512	15513	15514	15515	15516	15517
48	15518	15519	15520	15521	15522	15523	15524	15525	15526	15527	15528	15529
49	15530	15531	15532	15533	15534	15535	15536	15537	15538	15539	15540	15541
50	15542	15543	15544	15545	15546	15547	15548	15549	15550	15551	15552	15553
51	15554	15555	15556	15557	15558	15559	15560	15561	15562	15563	15564	15565
52	15566	15567	15568	15569	15570	15571	15572	15573	15574	15575	15576	15577
53	15578	15579	15580	15581	15582	15583	15584	15585	15586	15587	15588	15589
54	15590	15591	15592	15593	15594	15595	15596	15597	15598	15599	15600	15601
55	15602	15603	15604	15605	15606	15607	15608	15609	15610	15611	15612	15613
56	15614	15615	15616	15617	15618	15619	15620	15621	15622	15623	15624	15625
57	15626	15627	15628	15629	15630	15631	15632	15633	15634	15635	15636	15637
58	15638	15639	15640	15641	15642	15643	15644	15645	15646	15647	15648	15649
59	15650	15651	15652	15653	15654	15655	15656	15657	15658	15659	15660	15661
60	15662	15663	15664	15665	15666	15667	15668	15669	15670	15671	15672	15673
61	15674	15675	15676	15677	15678	15679	15680	15681	15682	15683	15684	15685
62	15686	15687	15688	15689	15690	15691	15692	15693	15694	15695	15696	15697
63	15698	15699	15700	15701	15702	15703	15704	15705	15706	15707	15708	15709
64	15710	15711	15712	15713	15714	15715	15716	15717	15718	15719	15720	15721
65	15722	15723	15724	15725	15726	15727	15728	15729	15730	15731	15732	15733
66	15734	15735	15736	15737	15738	15739	15740	15741	15742	15743	15744	15745
67	15746	15747	15748	15749	15750	15751	15752	15753	15754	15755	15756	15757
68	15758	15759	15760	15761	15762	15763	15764	15765	15766	15767	15768	15769
69	15770	15771	15772	15773	15774	15775	15776	15777	15778	15779	15780	15781
70	15782	15783	15784	15785	15786	15787	15788	15789	15790	15791	15792	15793
71	15794	15795	15796	15797	15798	15799	15800	15801	15802	15803	15804	15805
72	15806	15807	15808	15809	15810	15811	15812	15813	15814	15815	15816	15817
73	15818	15819	15820	15821	15822	15823	15824	15825	15826	15827	15828	15829
74	15830	15831	15832	15833	15834	15835	15836	15837	15838	15839	15840	15841
75	15842	15843	15844	15845	15846	15847	15848	15849	15850	15851	15852	15853
76	15854	15855	15856	15857	15858	15859	15860	15861	15862	15863	15864	15865
77	15866	15867	15868	15869	15870	15871	15872	15873	15874	15875	15876	15877
78	15878	15879	15880	15881	15882	15883	15884	15885	15886	15887	15888	15889

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
79	15890	15891	15892	15893	15894	15895	15896	15897	15898	15899	15900	15901
80	15902	15903	15904	15905	15906	15907	15908	15909	15910	15911	15912	15913
81	15914	15915	15916	15917	15918	15919	15920	15921	15922	15923	15924	15925
82	15926	15927	15928	15929	15930	15931	15932	15933	15934	15935	15936	15937
83	15938	15939	15940	15941	15942	15943	15944	15945	15946	15947	15948	15949
84	15950	15951	15952	15953	15954	15955	15956	15957	15958	15959	15960	15961
85	15962	15963	15964	15965	15966	15967	15968	15969	15970	15971	15972	15973
86	15974	15975	15976	15977	15978	15979	15980	15981	15982	15983	15984	15985
87	15986	15987	15988	15989	15990	15991	15992	15993	15994	15995	15996	15997
88	15998	15999	16000	16001	16002	16003	16004	16005	16006	16007	16008	16009
89	16010	16011	16012	16013	16014	16015	16016	16017	16018	16019	16020	16021
90	16022	16023	16024	16025	16026	16027	16028	16029	16030	16031	16032	16033
91	16034	16035	16036	16037	16038	16039	16040	16041	16042	16043	16044	16045
92	16046	16047	16048	16049	16050	16051	16052	16053	16054	16055	16056	16057
93	16058	16059	16060	16061	16062	16063	16064	16065	16066	16067	16068	16069
94	16070	16071	16072	16073	16074	16075	16076	16077	16078	16079	16080	16081
95	16082	16083	16084	16085	16086	16087	16088	16089	16090	16091	16092	16093
96	16094	16095	16096	16097	16098	16099	16100	16101	16102	16103	16104	16105
97	16106	16107	16108	16109	16110	16111	16112	16113	16114	16115	16116	16117
98	16118	16119	16120	16121	16122	16123	16124	16125	16126	16127	16128	16129
99	16130	16131	16132	16133	16134	16135	16136	16137	16138	16139	16140	16141
100	16142	16143	16144	16145	16146	16147	16148	16149	16150	16151	16152	16153
101	16154	16155	16156	16157	16158	16159	16160	16161	16162	16163	16164	16165
102	16166	16167	16168	16169	16170	16171	16172	16173	16174	16175	16176	16177
103	16178	16179	16180	16181	16182	16183	16184	16185	16186	16187	16188	16189
104	16190	16191	16192	16193	16194	16195	16196	16197	16198	16199	16200	16201
105	16202	16203	16204	16205	16206	16207	16208	16209	16210	16211	16212	16213
106	16214	16215	16216	16217	16218	16219	16220	16221	16222	16223	16224	16225
107	16226	16227	16228	16229	16230	16231	16232	16233	16234	16235	16236	16237
108	16238	16239	16240	16241	16242	16243	16244	16245	16246	16247	16248	16249
109	16250	16251	16252	16253	16254	16255	16256	16257	16258	16259	16260	16261
110	16262	16263	16264	16265	16266	16267	16268	16269	16270	16271	16272	16273
111	16274	16275	16276	16277	16278	16279	16280	16281	16282	16283	16284	16285
112	16286	16287	16288	16289	16290	16291	16292	16293	16294	16295	16296	16297
113	16298	16299	16300	16301	16302	16303	16304	16305	16306	16307	16308	16309
114	16310	16311	16312	16313	16314	16315	16316	16317	16318	16319	16320	16321
115	16322	16323	16324	16325	16326	16327	16328	16329	16330	16331	16332	16333
116	16334	16335	16336	16337	16338	16339	16340	16341	16342	16343	16344	16345
117	16346	16347	16348	16349	16350	16351	16352	16353	16354	16355	16356	16357
118	16358	16359	16360	16361	16362	16363	16364	16365	16366	16367	16368	16369

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
119	16370	16371	16372	16373	16374	16375	16376	16377	16378	16379	16380	16381
120	16382	16383	16384	16385	16386	16387	16388	16389	16390	16391	16392	16393
121	16394	16395	16396	16397	16398	16399	16400	16401	16402	16403	16404	16405
122	16406	16407	16408	16409	16410	16411	16412	16413	16414	16415	16416	16417
123	16418	16419	16420	16421	16422	16423	16424	16425	16426	16427	16428	16429
124	16430	16431	16432	16433	16434	16435	16436	16437	16438	16439	16440	16441
125	16442	16443	16444	16445	16446	16447	16448	16449	16450	16451	16452	16453
126	16454	16455	16456	16457	16458	16459	16460	16461	16462	16463	16464	16465
127	16466	16467	16468	16469	16470	16471	16472	16473	16474	16475	16476	16477
128	16478	16479	16480	16481	16482	16483	16484	16485	16486	16487	16488	16489
129	16490	16491	16492	16493	16494	16495	16496	16497	16498	16499	16500	16501
130	16502	16503	16504	16505	16506	16507	16508	16509	16510	16511	16512	16513
131	16514	16515	16516	16517	16518	16519	16520	16521	16522	16523	16524	16525
132	16526	16527	16528	16529	16530	16531	16532	16533	16534	16535	16536	16537
133	16538	16539	16540	16541	16542	16543	16544	16545	16546	16547	16548	16549
134	16550	16551	16552	16553	16554	16555	16556	16557	16558	16559	16560	16561
135	16562	16563	16564	16565	16566	16567	16568	16569	16570	16571	16572	16573
136	16574	16575	16576	16577	16578	16579	16580	16581	16582	16583	16584	16585
137	16586	16587	16588	16589	16590	16591	16592	16593	16594	16595	16596	16597
138	16598	16599	16600	16601	16602	16603	16604	16605	16606	16607	16608	16609
139	16610	16611	16612	16613	16614	16615	16616	16617	16618	16619	16620	16621
140	16622	16623	16624	16625	16626	16627	16628	16629	16630	16631	16632	16633
141	16634	16635	16636	16637	16638	16639	16640	16641	16642	16643	16644	16645
142	16646	16647	16648	16649	16650	16651	16652	16653	16654	16655	16656	16657
143	16658	16659	16660	16661	16662	16663	16664	16665	16666	16667	16668	16669
144	16670	16671	16672	16673	16674	16675	16676	16677	16678	16679	16680	16681
145	16682	16683	16684	16685	16686	16687	16688	16689	16690	16691	16692	16693
146	16694	16695	16696	16697	16698	16699	16700	16701	16702	16703	16704	16705
147	16706	16707	16708	16709	16710	16711	16712	16713	16714	16715	16716	16717
148	16718	16719	16720	16721	16722	16723	16724	16725	16726	16727	16728	16729
149	16730	16731	16732	16733	16734	16735	16736	16737	16738	16739	16740	16741
150	16742	16743	16744	16745	16746	16747	16748	16749	16750	16751	16752	16753
151	16754	16755	16756	16757	16758	16759	16760	16761	16762	16763	16764	16765
152	16766	16767	16768	16769	16770	16771	16772	16773	16774	16775	16776	16777
153	16778	16779	16780	16781	16782	16783	16784	16785	16786	16787	16788	16789
154	16790	16791	16792	16793	16794	16795	16796	16797	16798	16799	16800	16801
155	16802	16803	16804	16805	16806	16807	16808	16809	16810	16811	16812	16813
156	16814	16815	16816	16817	16818	16819	16820	16821	16822	16823	16824	16825
157	16826	16827	16828	16829	16830	16831	16832	16833	16834	16835	16836	16837

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
158	16838	16839	16840	16841	16842	16843	16844	16845	16846	16847	16848	16849
159	16850	16851	16852	16853	16854	16855	16856	16857	16858	16859	16860	16861
160	16862	16863	16864	16865	16866	16867	16868	16869	16870	16871	16872	16873
161	16874	16875	16876	16877	16878	16879	16880	16881	16882	16883	16884	16885
162	16886	16887	16888	16889	16890	16891	16892	16893	16894	16895	16896	16897
163	16898	16899	16900	16901	16902	16903	16904	16905	16906	16907	16908	16909
164	16910	16911	16912	16913	16914	16915	16916	16917	16918	16919	16920	16921
165	16922	16923	16924	16925	16926	16927	16928	16929	16930	16931	16932	16933
166	16934	16935	16936	16937	16938	16939	16940	16941	16942	16943	16944	16945
167	16946	16947	16948	16949	16950	16951	16952	16953	16954	16955	16956	16957
168	16958	16959	16960	16961	16962	16963	16964	16965	16966	16967	16968	16969
169	16970	16971	16972	16973	16974	16975	16976	16977	16978	16979	16980	16981
170	16982	16983	16984	16985	16986	16987	16988	16989	16990	16991	16992	16993
171	16994	16995	16996	16997	16998	16999	17000	17001	17002	17003	17004	17005
172	17006	17007	17008	17009	17010	17011	17012	17013	17014	17015	17016	17017
173	17018	17019	17020	17021	17022	17023	17024	17025	17026	17027	17028	17029
174	17030	17031	17032	17033	17034	17035	17036	17037	17038	17039	17040	17041
175	17042	17043	17044	17045	17046	17047	17048	17049	17050	17051	17052	17053
176	17054	17055	17056	17057	17058	17059	17060	17061	17062	17063	17064	17065
177	17066	17067	17068	17069	17070	17071	17072	17073	17074	17075	17076	17077
178	17078	17079	17080	17081	17082	17083	17084	17085	17086	17087	17088	17089
179	17090	17091	17092	17093	17094	17095	17096	17097	17098	17099	17100	17101
180	17102	17103	17104	17105	17106	17107	17108	17109	17110	17111	17112	17113
181	17114	17115	17116	17117	17118	17119	17120	17121	17122	17123	17124	17125
182	17126	17127	17128	17129	17130	17131	17132	17133	17134	17135	17136	17137
183	17138	17139	17140	17141	17142	17143	17144	17145	17146	17147	17148	17149
184	17150	17151	17152	17153	17154	17155	17156	17157	17158	17159	17160	17161
185	17162	17163	17164	17165	17166	17167	17168	17169	17170	17171	17172	17173
186	17174	17175	17176	17177	17178	17179	17180	17181	17182	17183	17184	17185
187	17186	17187	17188	17189	17190	17191	17192	17193	17194	17195	17196	17197
188	17198	17199	17200	17201	17202	17203	17204	17205	17206	17207	17208	17209
189	17210	17211	17212	17213	17214	17215	17216	17217	17218	17219	17220	17221
190	17222	17223	17224	17225	17226	17227	17228	17229	17230	17231	17232	17233
191	17234	17235	17236	17237	17238	17239	17240	17241	17242	17243	17244	17245
192	17246	17247	17248	17249	17250	17251	17252	17253	17254	17255	17256	17257
193	17258	17259	17260	17261	17262	17263	17264	17265	17266	17267	17268	17269
194	17270	17271	17272	17273	17274	17275	17276	17277	17278	17279	17280	17281
195	17282	17283	17284	17285	17286	17287	17288	17289	17290	17291	17292	17293
196	17294	17295	17296	17297	17298	17299	17300	17301	17302	17303	17304	17305
197	17306	17307	17308	17309	17310	17311	17312	17313	17314	17315	17316	17317

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
198	17318	17319	17320	17321	17322	17323	17324	17325	17326	17327	17328	17329
199	17330	17331	17332	17333	17334	17335	17336	17337	17338	17339	17340	17341
200	17342	17343	17344	17345	17346	17347	17348	17349	17350	17351	17352	17353
201	17354	17355	17356	17357	17358	17359	17360	17361	17362	17363	17364	17365
202	17366	17367	17368	17369	17370	17371	17372	17373	17374	17375	17376	17377
203	17378	17379	17380	17381	17382	17383	17384	17385	17386	17387	17388	17389
204	17390	17391	17392	17393	17394	17395	17396	17397	17398	17399	17400	17401
205	17402	17403	17404	17405	17406	17407	17408	17409	17410	17411	17412	17413
206	17414	17415	17416	17417	17418	17419	17420	17421	17422	17423	17424	17425
207	17426	17427	17428	17429	17430	17431	17432	17433	17434	17435	17436	17437
208	17438	17439	17440	17441	17442	17443	17444	17445	17446	17447	17448	17449
209	17450	17451	17452	17453	17454	17455	17456	17457	17458	17459	17460	17461
210	17462	17463	17464	17465	17466	17467	17468	17469	17470	17471	17472	17473
211	17474	17475	17476	17477	17478	17479	17480	17481	17482	17483	17484	17485
212	17486	17487	17488	17489	17490	17491	17492	17493	17494	17495	17496	17497
213	17498	17499	17500	17501	17502	17503	17504	17505	17506	17507	17508	17509
214	17510	17511	17512	17513	17514	17515	17516	17517	17518	17519	17520	17521
215	17522	17523	17524	17525	17526	17527	17528	17529	17530	17531	17532	17533
216	17534	17535	17536	17537	17538	17539	17540	17541	17542	17543	17544	17545
217	17546	17547	17548	17549	17550	17551	17552	17553	17554	17555	17556	17557
218	17558	17559	17560	17561	17562	17563	17564	17565	17566	17567	17568	17569
219	17570	17571	17572	17573	17574	17575	17576	17577	17578	17579	17580	17581
220	17582	17583	17584	17585	17586	17587	17588	17589	17590	17591	17592	17593
221	17594	17595	17596	17597	17598	17599	17600	17601	17602	17603	17604	17605
222	17606	17607	17608	17609	17610	17611	17612	17613	17614	17615	17616	17617
223	17618	17619	17620	17621	17622	17623	17624	17625	17626	17627	17628	17629
224	17630	17631	17632	17633	17634	17635	17636	17637	17638	17639	17640	17641
225	17642	17643	17644	17645	17646	17647	17648	17649	17650	17651	17652	17653
226	17654	17655	17656	17657	17658	17659	17660	17661	17662	17663	17664	17665
227	17666	17667	17668	17669	17670	17671	17672	17673	17674	17675	17676	17677
228	17678	17679	17680	17681	17682	17683	17684	17685	17686	17687	17688	17689
229	17690	17691	17692	17693	17694	17695	17696	17697	17698	17699	17700	17701
230	17702	17703	17704	17705	17706	17707	17708	17709	17710	17711	17712	17713
231	17714	17715	17716	17717	17718	17719	17720	17721	17722	17723	17724	17725
232	17726	17727	17728	17729	17730	17731	17732	17733	17734	17735	17736	17737
233	17738	17739	17740	17741	17742	17743	17744	17745	17746	17747	17748	17749
234	17750	17751	17752	17753	17754	17755	17756	17757	17758	17759	17760	17761
235	17762	17763	17764	17765	17766	17767	17768	17769	17770	17771	17772	17773
236	17774	17775	17776	17777	17778	17779	17780	17781	17782	17783	17784	17785

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
237	17786	17787	17788	17789	17790	17791	17792	17793	17794	17795	17796	17797
238	17798	17799	17800	17801	17802	17803	17804	17805	17806	17807	17808	17809
239	17810	17811	17812	17813	17814	17815	17816	17817	17818	17819	17820	17821
240	17822	17823	17824	17825	17826	17827	17828	17829	17830	17831	17832	17833
241	17834	17835	17836	17837	17838	17839	17840	17841	17842	17843	17844	17845
242	17846	17847	17848	17849	17850	17851	17852	17853	17854	17855	17856	17857
243	17858	17859	17860	17861	17862	17863	17864	17865	17866	17867	17868	17869
244	17870	17871	17872	17873	17874	17875	17876	17877	17878	17879	17880	17881
245	17882	17883	17884	17885	17886	17887	17888	17889	17890	17891	17892	17893
246	17894	17895	17896	17897	17898	17899	17900	17901	17902	17903	17904	17905
247	17906	17907	17908	17909	17910	17911	17912	17913	17914	17915	17916	17917
248	17918	17919	17920	17921	17922	17923	17924	17925	17926	17927	17928	17929
249	17930	17931	17932	17933	17934	17935	17936	17937	17938	17939	17940	17941
250	17942	17943	17944	17945	17946	17947	17948	17949	17950	17951	17952	17953
251	17954	17955	17956	17957	17958	17959	17960	17961	17962	17963	17964	17965
252	17966	17967	17968	17969	17970	17971	17972	17973	17974	17975	17976	17977
253	17978	17979	17980	17981	17982	17983	17984	17985	17986	17987	17988	17989
254	17990	17991	17992	17993	17994	17995	17996	17997	17998	17999	18000	18001
255	18002	18003	18004	18005	18006	18007	18008	18009	18010	18011	18012	18013
256	18014	18015	18016	18017	18018	18019	18020	18021	18022	18023	18024	18025
257	18026	18027	18028	18029	18030	18031	18032	18033	18034	18035	18036	18037
258	18038	18039	18040	18041	18042	18043	18044	18045	18046	18047	18048	18049
259	18050	18051	18052	18053	18054	18055	18056	18057	18058	18059	18060	18061
260	18062	18063	18064	18065	18066	18067	18068	18069	18070	18071	18072	18073
261	18074	18075	18076	18077	18078	18079	18080	18081	18082	18083	18084	18085
262	18086	18087	18088	18089	18090	18091	18092	18093	18094	18095	18096	18097
263	18098	18099	18100	18101	18102	18103	18104	18105	18106	18107	18108	18109
264	18110	18111	18112	18113	18114	18115	18116	18117	18118	18119	18120	18121
265	18122	18123	18124	18125	18126	18127	18128	18129	18130	18131	18132	18133
266	18134	18135	18136	18137	18138	18139	18140	18141	18142	18143	18144	18145
267	18146	18147	18148	18149	18150	18151	18152	18153	18154	18155	18156	18157
268	18158	18159	18160	18161	18162	18163	18164	18165	18166	18167	18168	18169
269	18170	18171	18172	18173	18174	18175	18176	18177	18178	18179	18180	18181
270	18182	18183	18184	18185	18186	18187	18188	18189	18190	18191	18192	18193
271	18194	18195	18196	18197	18198	18199	18200	18201	18202	18203	18204	18205
272	18206	18207	18208	18209	18210	18211	18212	18213	18214	18215	18216	18217
273	18218	18219	18220	18221	18222	18223	18224	18225	18226	18227	18228	18229
274	18230	18231	18232	18233	18234	18235	18236	18237	18238	18239	18240	18241
275	18242	18243	18244	18245	18246	18247	18248	18249	18250	18251	18252	18253
276	18254	18255	18256	18257	18258	18259	18260	18261	18262	18263	18264	18265

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
277	18266	18267	18268	18269	18270	18271	18272	18273	18274	18275	18276	18277
278	18278	18279	18280	18281	18282	18283	18284	18285	18286	18287	18288	18289
279	18290	18291	18292	18293	18294	18295	18296	18297	18298	18299	18300	18301
280	18302	18303	18304	18305	18306	18307	18308	18309	18310	18311	18312	18313
281	18314	18315	18316	18317	18318	18319	18320	18321	18322	18323	18324	18325
282	18326	18327	18328	18329	18330	18331	18332	18333	18334	18335	18336	18337
283	18338	18339	18340	18341	18342	18343	18344	18345	18346	18347	18348	18349
284	18350	18351	18352	18353	18354	18355	18356	18357	18358	18359	18360	18361
285	18362	18363	18364	18365	18366	18367	18368	18369	18370	18371	18372	18373
286	18374	18375	18376	18377	18378	18379	18380	18381	18382	18383	18384	18385
287	18386	18387	18388	18389	18390	18391	18392	18393	18394	18395	18396	18397
288	18398	18399	18400	18401	18402	18403	18404	18405	18406	18407	18408	18409
289	18410	18411	18412	18413	18414	18415	18416	18417	18418	18419	18420	18421
290	18422	18423	18424	18425	18426	18427	18428	18429	18430	18431	18432	18433
291	18434	18435	18436	18437	18438	18439	18440	18441	18442	18443	18444	18445
292	18446	18447	18448	18449	18450	18451	18452	18453	18454	18455	18456	18457
293	18458	18459	18460	18461	18462	18463	18464	18465	18466	18467	18468	18469
294	18470	18471	18472	18473	18474	18475	18476	18477	18478	18479	18480	18481
295	18482	18483	18484	18485	18486	18487	18488	18489	18490	18491	18492	18493
296	18494	18495	18496	18497	18498	18499	18500	18501	18502	18503	18504	18505
297	18506	18507	18508	18509	18510	18511	18512	18513	18514	18515	18516	18517
298	18518	18519	18520	18521	18522	18523	18524	18525	18526	18527	18528	18529
299	18530	18531	18532	18533	18534	18535	18536	18537	18538	18539	18540	18541
300	18542	18543	18544	18545	18546	18547	18548	18549	18550	18551	18552	18553
301	18554	18555	18556	18557	18558	18559	18560	18561	18562	18563	18564	18565
302	18566	18567	18568	18569	18570	18571	18572	18573	18574	18575	18576	18577
303	18578	18579	18580	18581	18582	18583	18584	18585	18586	18587	18588	18589
304	18590	18591	18592	18593	18594	18595	18596	18597	18598	18599	18600	18601
305	18602	18603	18604	18605	18606	18607	18608	18609	18610	18611	18612	18613
306	18614	18615	18616	18617	18618	18619	18620	18621	18622	18623	18624	18625
307	18626	18627	18628	18629	18630	18631	18632	18633	18634	18635	18636	18637
308	18638	18639	18640	18641	18642	18643	18644	18645	18646	18647	18648	18649
309	18650	18651	18652	18653	18654	18655	18656	18657	18658	18659	18660	18661
310	18662	18663	18664	18665	18666	18667	18668	18669	18670	18671	18672	18673
311	18674	18675	18676	18677	18678	18679	18680	18681	18682	18683	18684	18685
312	18686	18687	18688	18689	18690	18691	18692	18693	18694	18695	18696	18697
313	18698	18699	18700	18701	18702	18703	18704	18705	18706	18707	18708	18709
314	18710	18711	18712	18713	18714	18715	18716	18717	18718	18719	18720	18721
315	18722	18723	18724	18725	18726	18727	18728	18729	18730	18731	18732	18733

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
316	18734	18735	18736	18737	18738	18739	18740	18741	18742	18743	18744	18745
317	18746	18747	18748	18749	18750	18751	18752	18753	18754	18755	18756	18757
318	18758	18759	18760	18761	18762	18763	18764	18765	18766	18767	18768	18769
319	18770	18771	18772	18773	18774	18775	18776	18777	18778	18779	18780	18781
320	18782	18783	18784	18785	18786	18787	18788	18789	18790	18791	18792	18793
321	18794	18795	18796	18797	18798	18799	18800	18801	18802	18803	18804	18805
322	18806	18807	18808	18809	18810	18811	18812	18813	18814	18815	18816	18817
323	18818	18819	18820	18821	18822	18823	18824	18825	18826	18827	18828	18829
324	18830	18831	18832	18833	18834	18835	18836	18837	18838	18839	18840	18841
325	18842	18843	18844	18845	18846	18847	18848	18849	18850	18851	18852	18853
326	18854	18855	18856	18857	18858	18859	18860	18861	18862	18863	18864	18865
327	18866	18867	18868	18869	18870	18871	18872	18873	18874	18875	18876	18877
328	18878	18879	18880	18881	18882	18883	18884	18885	18886	18887	18888	18889
329	18890	18891	18892	18893	18894	18895	18896	18897	18898	18899	18900	18901
330	18902	18903	18904	18905	18906	18907	18908	18909	18910	18911	18912	18913
331	18914	18915	18916	18917	18918	18919	18920	18921	18922	18923	18924	18925
332	18926	18927	18928	18929	18930	18931	18932	18933	18934	18935	18936	18937
333	18938	18939	18940	18941	18942	18943	18944	18945	18946	18947	18948	18949
334	18950	18951	18952	18953	18954	18955	18956	18957	18958	18959	18960	18961
335	18962	18963	18964	18965	18966	18967	18968	18969	18970	18971	18972	18973
336	18974	18975	18976	18977	18978	18979	18980	18981	18982	18983	18984	18985
337	18986	18987	18988	18989	18990	18991	18992	18993	18994	18995	18996	18997
338	18998	18999	19000	19001	19002	19003	19004	19005	19006	19007	19008	19009
339	19010	19011	19012	19013	19014	19015	19016	19017	19018	19019	19020	19021
340	19022	19023	19024	19025	19026	19027	19028	19029	19030	19031	19032	19033
341	19034	19035	19036	19037	19038	19039	19040	19041	19042	19043	19044	19045
342	19046	19047	19048	19049	19050	19051	19052	19053	19054	19055	19056	19057
343	19058	19059	19060	19061	19062	19063	19064	19065	19066	19067	19068	19069
344	19070	19071	19072	19073	19074	19075	19076	19077	19078	19079	19080	19081
345	19082	19083	19084	19085	19086	19087	19088	19089	19090	19091	19092	19093
346	19094	19095	19096	19097	19098	19099	19100	19101	19102	19103	19104	19105
347	19106	19107	19108	19109	19110	19111	19112	19113	19114	19115	19116	19117
348	19118	19119	19120	19121	19122	19123	19124	19125	19126	19127	19128	19129
349	19130	19131	19132	19133	19134	19135	19136	19137	19138	19139	19140	19141
350	19142	19143	19144	19145	19146	19147	19148	19149	19150	19151	19152	19153
351	19154	19155	19156	19157	19158	19159	19160	19161	19162	19163	19164	19165
352	19166	19167	19168	19169	19170	19171	19172	19173	19174	19175	19176	19177
353	19178	19179	19180	19181	19182	19183	19184	19185	19186	19187	19188	19189
354	19190	19191	19192	19193	19194	19195	19196	19197	19198	19199	19200	19201
355	19202	19203	19204	19205	19206	19207	19208	19209	19210	19211	19212	19213

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
356	19214	19215	19216	19217	19218	19219	19220	19221	19222	19223	19224	19225
357	19226	19227	19228	19229	19230	19231	19232	19233	19234	19235	19236	19237
358	19238	19239	19240	19241	19242	19243	19244	19245	19246	19247	19248	19249
359	19250	19251	19252	19253	19254	19255	19256	19257	19258	19259	19260	19261
360	19262	19263	19264	19265	19266	19267	19268	19269	19270	19271	19272	19273
361	19274	19275	19276	19277	19278	19279	19280	19281	19282	19283	19284	19285
362	19286	19287	19288	19289	19290	19291	19292	19293	19294	19295	19296	19297
363	19298	19299	19300	19301	19302	19303	19304	19305	19306	19307	19308	19309
364	19310	19311	19312	19313	19314	19315	19316	19317	19318	19319	19320	19321
365	19322	19323	19324	19325	19326	19327	19328	19329	19330	19331	19332	19333
366	19334	19335	19336	19337	19338	19339	19340	19341	19342	19343	19344	19345
367	19346	19347	19348	19349	19350	19351	19352	19353	19354	19355	19356	19357
368	19358	19359	19360	19361	19362	19363	19364	19365	19366	19367	19368	19369
369	19370	19371	19372	19373	19374	19375	19376	19377	19378	19379	19380	19381
370	19382	19383	19384	19385	19386	19387	19388	19389	19390	19391	19392	19393
371	19394	19395	19396	19397	19398	19399	19400	19401	19402	19403	19404	19405
372	19406	19407	19408	19409	19410	19411	19412	19413	19414	19415	19416	19417
373	19418	19419	19420	19421	19422	19423	19424	19425	19426	19427	19428	19429
374	19430	19431	19432	19433	19434	19435	19436	19437	19438	19439	19440	19441
375	19442	19443	19444	19445	19446	19447	19448	19449	19450	19451	19452	19453
376	19454	19455	19456	19457	19458	19459	19460	19461	19462	19463	19464	19465
377	19466	19467	19468	19469	19470	19471	19472	19473	19474	19475	19476	19477
378	19478	19479	19480	19481	19482	19483	19484	19485	19486	19487	19488	19489
379	19490	19491	19492	19493	19494	19495	19496	19497	19498	19499	19500	19501
380	19502	19503	19504	19505	19506	19507	19508	19509	19510	19511	19512	19513
381	19514	19515	19516	19517	19518	19519	19520	19521	19522	19523	19524	19525
382	19526	19527	19528	19529	19530	19531	19532	19533	19534	19535	19536	19537
383	19538	19539	19540	19541	19542	19543	19544	19545	19546	19547	19548	19549
384	19550	19551	19552	19553	19554	19555	19556	19557	19558	19559	19560	19561
385	19562	19563	19564	19565	19566	19567	19568	19569	19570	19571	19572	19573
386	19574	19575	19576	19577	19578	19579	19580	19581	19582	19583	19584	19585
387	19586	19587	19588	19589	19590	19591	19592	19593	19594	19595	19596	19597
388	19598	19599	19600	19601	19602	19603	19604	19605	19606	19607	19608	19609
389	19610	19611	19612	19613	19614	19615	19616	19617	19618	19619	19620	19621
390	19622	19623	19624	19625	19626	19627	19628	19629	19630	19631	19632	19633
391	19634	19635	19636	19637	19638	19639	19640	19641	19642	19643	19644	19645
392	19646	19647	19648	19649	19650	19651	19652	19653	19654	19655	19656	19657
393	19658	19659	19660	19661	19662	19663	19664	19665	19666	19667	19668	19669
394	19670	19671	19672	19673	19674	19675	19676	19677	19678	19679	19680	19681

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
395	19682	19683	19684	19685	19686	19687	19688	19689	19690	19691	19692	19693
396	19694	19695	19696	19697	19698	19699	19700	19701	19702	19703	19704	19705
397	19706	19707	19708	19709	19710	19711	19712	19713	19714	19715	19716	19717
398	19718	19719	19720	19721	19722	19723	19724	19725	19726	19727	19728	19729
399	19730	19731	19732	19733	19734	19735	19736	19737	19738	19739	19740	19741
400	19742	19743	19744	19745	19746	19747	19748	19749	19750	19751	19752	19753

Appendix 2.6 5-axis operation data memory address

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
1	19754	19755	19756	19757	19758	19759	19760	19761	19762	19763	19764	19765
2	19766	19767	19768	19769	19770	19771	19772	19773	19774	19775	19776	19777
3	19778	19779	19780	19781	19782	19783	19784	19785	19786	19787	19788	19789
4	19790	19791	19792	19793	19794	19795	19796	19797	19798	19799	19800	19801
5	19802	19803	19804	19805	19806	19807	19808	19809	19810	19811	19812	19813
6	19814	19815	19816	19817	19818	19819	19820	19821	19822	19823	19824	19825
7	19826	19827	19828	19829	19830	19831	19832	19833	19834	19835	19836	19837
8	19838	19839	19840	19841	19842	19843	19844	19845	19846	19847	19848	19849
9	19850	19851	19852	19853	19854	19855	19856	19857	19858	19859	19860	19861
10	19862	19863	19864	19865	19866	19867	19868	19869	19870	19871	19872	19873
11	19874	19875	19876	19877	19878	19879	19880	19881	19882	19883	19884	19885
12	19886	19887	19888	19889	19890	19891	19892	19893	19894	19895	19896	19897
13	19898	19899	19900	19901	19902	19903	19904	19905	19906	19907	19908	19909
14	19910	19911	19912	19913	19914	19915	19916	19917	19918	19919	19920	19921
15	19922	19923	19924	19925	19926	19927	19928	19929	19930	19931	19932	19933
16	19934	19935	19936	19937	19938	19939	19940	19941	19942	19943	19944	19945
17	19946	19947	19948	19949	19950	19951	19952	19953	19954	19955	19956	19957
18	19958	19959	19960	19961	19962	19963	19964	19965	19966	19967	19968	19969
19	19970	19971	19972	19973	19974	19975	19976	19977	19978	19979	19980	19981
20	19982	19983	19984	19985	19986	19987	19988	19989	19990	19991	19992	19993
21	19994	19995	19996	19997	19998	19999	20000	20001	20002	20003	20004	20005
22	20006	20007	20008	20009	20010	20011	20012	20013	20014	20015	20016	20017
23	20018	20019	20020	20021	20022	20023	20024	20025	20026	20027	20028	20029
24	20030	20031	20032	20033	20034	20035	20036	20037	20038	20039	20040	20041
25	20042	20043	20044	20045	20046	20047	20048	20049	20050	20051	20052	20053
26	20054	20055	20056	20057	20058	20059	20060	20061	20062	20063	20064	20065
27	20066	20067	20068	20069	20070	20071	20072	20073	20074	20075	20076	20077
28	20078	20079	20080	20081	20082	20083	20084	20085	20086	20087	20088	20089
29	20090	20091	20092	20093	20094	20095	20096	20097	20098	20099	20100	20101
30	20102	20103	20104	20105	20106	20107	20108	20109	20110	20111	20112	20113
31	20114	20115	20116	20117	20118	20119	20120	20121	20122	20123	20124	20125
32	20126	20127	20128	20129	20130	20131	20132	20133	20134	20135	20136	20137
33	20138	20139	20140	20141	20142	20143	20144	20145	20146	20147	20148	20149
34	20150	20151	20152	20153	20154	20155	20156	20157	20158	20159	20160	20161
35	20162	20163	20164	20165	20166	20167	20168	20169	20170	20171	20172	20173
36	20174	20175	20176	20177	20178	20179	20180	20181	20182	20183	20184	20185
37	20186	20187	20188	20189	20190	20191	20192	20193	20194	20195	20196	20197
38	20198	20199	20200	20201	20202	20203	20204	20205	20206	20207	20208	20209

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
39	20210	20211	20212	20213	20214	20215	20216	20217	20218	20219	20220	20221
40	20222	20223	20224	20225	20226	20227	20228	20229	20230	20231	20232	20233
41	20234	20235	20236	20237	20238	20239	20240	20241	20242	20243	20244	20245
42	20246	20247	20248	20249	20250	20251	20252	20253	20254	20255	20256	20257
43	20258	20259	20260	20261	20262	20263	20264	20265	20266	20267	20268	20269
44	20270	20271	20272	20273	20274	20275	20276	20277	20278	20279	20280	20281
45	20282	20283	20284	20285	20286	20287	20288	20289	20290	20291	20292	20293
46	20294	20295	20296	20297	20298	20299	20300	20301	20302	20303	20304	20305
47	20306	20307	20308	20309	20310	20311	20312	20313	20314	20315	20316	20317
48	20318	20319	20320	20321	20322	20323	20324	20325	20326	20327	20328	20329
49	20330	20331	20332	20333	20334	20335	20336	20337	20338	20339	20340	20341
50	20342	20343	20344	20345	20346	20347	20348	20349	20350	20351	20352	20353
51	20354	20355	20356	20357	20358	20359	20360	20361	20362	20363	20364	20365
52	20366	20367	20368	20369	20370	20371	20372	20373	20374	20375	20376	20377
53	20378	20379	20380	20381	20382	20383	20384	20385	20386	20387	20388	20389
54	20390	20391	20392	20393	20394	20395	20396	20397	20398	20399	20400	20401
55	20402	20403	20404	20405	20406	20407	20408	20409	20410	20411	20412	20413
56	20414	20415	20416	20417	20418	20419	20420	20421	20422	20423	20424	20425
57	20426	20427	20428	20429	20430	20431	20432	20433	20434	20435	20436	20437
58	20438	20439	20440	20441	20442	20443	20444	20445	20446	20447	20448	20449
59	20450	20451	20452	20453	20454	20455	20456	20457	20458	20459	20460	20461
60	20462	20463	20464	20465	20466	20467	20468	20469	20470	20471	20472	20473
61	20474	20475	20476	20477	20478	20479	20480	20481	20482	20483	20484	20485
62	20486	20487	20488	20489	20490	20491	20492	20493	20494	20495	20496	20497
63	20498	20499	20500	20501	20502	20503	20504	20505	20506	20507	20508	20509
64	20510	20511	20512	20513	20514	20515	20516	20517	20518	20519	20520	20521
65	20522	20523	20524	20525	20526	20527	20528	20529	20530	20531	20532	20533
66	20534	20535	20536	20537	20538	20539	20540	20541	20542	20543	20544	20545
67	20546	20547	20548	20549	20550	20551	20552	20553	20554	20555	20556	20557
68	20558	20559	20560	20561	20562	20563	20564	20565	20566	20567	20568	20569
69	20570	20571	20572	20573	20574	20575	20576	20577	20578	20579	20580	20581
70	20582	20583	20584	20585	20586	20587	20588	20589	20590	20591	20592	20593
71	20594	20595	20596	20597	20598	20599	20600	20601	20602	20603	20604	20605
72	20606	20607	20608	20609	20610	20611	20612	20613	20614	20615	20616	20617
73	20618	20619	20620	20621	20622	20623	20624	20625	20626	20627	20628	20629
74	20630	20631	20632	20633	20634	20635	20636	20637	20638	20639	20640	20641
75	20642	20643	20644	20645	20646	20647	20648	20649	20650	20651	20652	20653
76	20654	20655	20656	20657	20658	20659	20660	20661	20662	20663	20664	20665
77	20666	20667	20668	20669	20670	20671	20672	20673	20674	20675	20676	20677
78	20678	20679	20680	20681	20682	20683	20684	20685	20686	20687	20688	20689

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
79	20690	20691	20692	20693	20694	20695	20696	20697	20698	20699	20700	20701
80	20702	20703	20704	20705	20706	20707	20708	20709	20710	20711	20712	20713
81	20714	20715	20716	20717	20718	20719	20720	20721	20722	20723	20724	20725
82	20726	20727	20728	20729	20730	20731	20732	20733	20734	20735	20736	20737
83	20738	20739	20740	20741	20742	20743	20744	20745	20746	20747	20748	20749
84	20750	20751	20752	20753	20754	20755	20756	20757	20758	20759	20760	20761
85	20762	20763	20764	20765	20766	20767	20768	20769	20770	20771	20772	20773
86	20774	20775	20776	20777	20778	20779	20780	20781	20782	20783	20784	20785
87	20786	20787	20788	20789	20790	20791	20792	20793	20794	20795	20796	20797
88	20798	20799	20800	20801	20802	20803	20804	20805	20806	20807	20808	20809
89	20810	20811	20812	20813	20814	20815	20816	20817	20818	20819	20820	20821
90	20822	20823	20824	20825	20826	20827	20828	20829	20830	20831	20832	20833
91	20834	20835	20836	20837	20838	20839	20840	20841	20842	20843	20844	20845
92	20846	20847	20848	20849	20850	20851	20852	20853	20854	20855	20856	20857
93	20858	20859	20860	20861	20862	20863	20864	20865	20866	20867	20868	20869
94	20870	20871	20872	20873	20874	20875	20876	20877	20878	20879	20880	20881
95	20882	20883	20884	20885	20886	20887	20888	20889	20890	20891	20892	20893
96	20894	20895	20896	20897	20898	20899	20900	20901	20902	20903	20904	20905
97	20906	20907	20908	20909	20910	20911	20912	20913	20914	20915	20916	20917
98	20918	20919	20920	20921	20922	20923	20924	20925	20926	20927	20928	20929
99	20930	20931	20932	20933	20934	20935	20936	20937	20938	20939	20940	20941
100	20942	20943	20944	20945	20946	20947	20948	20949	20950	20951	20952	20953
101	20954	20955	20956	20957	20958	20959	20960	20961	20962	20963	20964	20965
102	20966	20967	20968	20969	20970	20971	20972	20973	20974	20975	20976	20977
103	20978	20979	20980	20981	20982	20983	20984	20985	20986	20987	20988	20989
104	20990	20991	20992	20993	20994	20995	20996	20997	20998	20999	21000	21001
105	21002	21003	21004	21005	21006	21007	21008	21009	21010	21011	21012	21013
106	21014	21015	21016	21017	21018	21019	21020	21021	21022	21023	21024	21025
107	21026	21027	21028	21029	21030	21031	21032	21033	21034	21035	21036	21037
108	21038	21039	21040	21041	21042	21043	21044	21045	21046	21047	21048	21049
109	21050	21051	21052	21053	21054	21055	21056	21057	21058	21059	21060	21061
110	21062	21063	21064	21065	21066	21067	21068	21069	21070	21071	21072	21073
111	21074	21075	21076	21077	21078	21079	21080	21081	21082	21083	21084	21085
112	21086	21087	21088	21089	21090	21091	21092	21093	21094	21095	21096	21097
113	21098	21099	21100	21101	21102	21103	21104	21105	21106	21107	21108	21109
114	21110	21111	21112	21113	21114	21115	21116	21117	21118	21119	21120	21121
115	21122	21123	21124	21125	21126	21127	21128	21129	21130	21131	21132	21133
116	21134	21135	21136	21137	21138	21139	21140	21141	21142	21143	21144	21145
117	21146	21147	21148	21149	21150	21151	21152	21153	21154	21155	21156	21157

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
118	21158	21159	21160	21161	21162	21163	21164	21165	21166	21167	21168	21169
119	21170	21171	21172	21173	21174	21175	21176	21177	21178	21179	21180	21181
120	21182	21183	21184	21185	21186	21187	21188	21189	21190	21191	21192	21193
121	21194	21195	21196	21197	21198	21199	21200	21201	21202	21203	21204	21205
122	21206	21207	21208	21209	21210	21211	21212	21213	21214	21215	21216	21217
123	21218	21219	21220	21221	21222	21223	21224	21225	21226	21227	21228	21229
124	21230	21231	21232	21233	21234	21235	21236	21237	21238	21239	21240	21241
125	21242	21243	21244	21245	21246	21247	21248	21249	21250	21251	21252	21253
126	21254	21255	21256	21257	21258	21259	21260	21261	21262	21263	21264	21265
127	21266	21267	21268	21269	21270	21271	21272	21273	21274	21275	21276	21277
128	21278	21279	21280	21281	21282	21283	21284	21285	21286	21287	21288	21289
129	21290	21291	21292	21293	21294	21295	21296	21297	21298	21299	21300	21301
130	21302	21303	21304	21305	21306	21307	21308	21309	21310	21311	21312	21313
131	21314	21315	21316	21317	21318	21319	21320	21321	21322	21323	21324	21325
132	21326	21327	21328	21329	21330	21331	21332	21333	21334	21335	21336	21337
133	21338	21339	21340	21341	21342	21343	21344	21345	21346	21347	21348	21349
134	21350	21351	21352	21353	21354	21355	21356	21357	21358	21359	21360	21361
135	21362	21363	21364	21365	21366	21367	21368	21369	21370	21371	21372	21373
136	21374	21375	21376	21377	21378	21379	21380	21381	21382	21383	21384	21385
137	21386	21387	21388	21389	21390	21391	21392	21393	21394	21395	21396	21397
138	21398	21399	21400	21401	21402	21403	21404	21405	21406	21407	21408	21409
139	21410	21411	21412	21413	21414	21415	21416	21417	21418	21419	21420	21421
140	21422	21423	21424	21425	21426	21427	21428	21429	21430	21431	21432	21433
141	21434	21435	21436	21437	21438	21439	21440	21441	21442	21443	21444	21445
142	21446	21447	21448	21449	21450	21451	21452	21453	21454	21455	21456	21457
143	21458	21459	21460	21461	21462	21463	21464	21465	21466	21467	21468	21469
144	21470	21471	21472	21473	21474	21475	21476	21477	21478	21479	21480	21481
145	21482	21483	21484	21485	21486	21487	21488	21489	21490	21491	21492	21493
146	21494	21495	21496	21497	21498	21499	21500	21501	21502	21503	21504	21505
147	21506	21507	21508	21509	21510	21511	21512	21513	21514	21515	21516	21517
148	21518	21519	21520	21521	21522	21523	21524	21525	21526	21527	21528	21529
149	21530	21531	21532	21533	21534	21535	21536	21537	21538	21539	21540	21541
150	21542	21543	21544	21545	21546	21547	21548	21549	21550	21551	21552	21553
151	21554	21555	21556	21557	21558	21559	21560	21561	21562	21563	21564	21565
152	21566	21567	21568	21569	21570	21571	21572	21573	21574	21575	21576	21577
153	21578	21579	21580	21581	21582	21583	21584	21585	21586	21587	21588	21589
154	21590	21591	21592	21593	21594	21595	21596	21597	21598	21599	21600	21601
155	21602	21603	21604	21605	21606	21607	21608	21609	21610	21611	21612	21613
156	21614	21615	21616	21617	21618	21619	21620	21621	21622	21623	21624	21625
157	21626	21627	21628	21629	21630	21631	21632	21633	21634	21635	21636	21637

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
158	21638	21639	21640	21641	21642	21643	21644	21645	21646	21647	21648	21649
159	21650	21651	21652	21653	21654	21655	21656	21657	21658	21659	21660	21661
160	21662	21663	21664	21665	21666	21667	21668	21669	21670	21671	21672	21673
161	21674	21675	21676	21677	21678	21679	21680	21681	21682	21683	21684	21685
162	21686	21687	21688	21689	21690	21691	21692	21693	21694	21695	21696	21697
163	21698	21699	21700	21701	21702	21703	21704	21705	21706	21707	21708	21709
164	21710	21711	21712	21713	21714	21715	21716	21717	21718	21719	21720	21721
165	21722	21723	21724	21725	21726	21727	21728	21729	21730	21731	21732	21733
166	21734	21735	21736	21737	21738	21739	21740	21741	21742	21743	21744	21745
167	21746	21747	21748	21749	21750	21751	21752	21753	21754	21755	21756	21757
168	21758	21759	21760	21761	21762	21763	21764	21765	21766	21767	21768	21769
169	21770	21771	21772	21773	21774	21775	21776	21777	21778	21779	21780	21781
170	21782	21783	21784	21785	21786	21787	21788	21789	21790	21791	21792	21793
171	21794	21795	21796	21797	21798	21799	21800	21801	21802	21803	21804	21805
172	21806	21807	21808	21809	21810	21811	21812	21813	21814	21815	21816	21817
173	21818	21819	21820	21821	21822	21823	21824	21825	21826	21827	21828	21829
174	21830	21831	21832	21833	21834	21835	21836	21837	21838	21839	21840	21841
175	21842	21843	21844	21845	21846	21847	21848	21849	21850	21851	21852	21853
176	21854	21855	21856	21857	21858	21859	21860	21861	21862	21863	21864	21865
177	21866	21867	21868	21869	21870	21871	21872	21873	21874	21875	21876	21877
178	21878	21879	21880	21881	21882	21883	21884	21885	21886	21887	21888	21889
179	21890	21891	21892	21893	21894	21895	21896	21897	21898	21899	21900	21901
180	21902	21903	21904	21905	21906	21907	21908	21909	21910	21911	21912	21913
181	21914	21915	21916	21917	21918	21919	21920	21921	21922	21923	21924	21925
182	21926	21927	21928	21929	21930	21931	21932	21933	21934	21935	21936	21937
183	21938	21939	21940	21941	21942	21943	21944	21945	21946	21947	21948	21949
184	21950	21951	21952	21953	21954	21955	21956	21957	21958	21959	21960	21961
185	21962	21963	21964	21965	21966	21967	21968	21969	21970	21971	21972	21973
186	21974	21975	21976	21977	21978	21979	21980	21981	21982	21983	21984	21985
187	21986	21987	21988	21989	21990	21991	21992	21993	21994	21995	21996	21997
188	21998	21999	22000	22001	22002	22003	22004	22005	22006	22007	22008	22009
189	22010	22011	22012	22013	22014	22015	22016	22017	22018	22019	22020	22021
190	22022	22023	22024	22025	22026	22027	22028	22029	22030	22031	22032	22033
191	22034	22035	22036	22037	22038	22039	22040	22041	22042	22043	22044	22045
192	22046	22047	22048	22049	22050	22051	22052	22053	22054	22055	22056	22057
193	22058	22059	22060	22061	22062	22063	22064	22065	22066	22067	22068	22069
194	22070	22071	22072	22073	22074	22075	22076	22077	22078	22079	22080	22081
195	22082	22083	22084	22085	22086	22087	22088	22089	22090	22091	22092	22093
196	22094	22095	22096	22097	22098	22099	22100	22101	22102	22103	22104	22105

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
197	22106	22107	22108	22109	22110	22111	22112	22113	22114	22115	22116	22117
198	22118	22119	22120	22121	22122	22123	22124	22125	22126	22127	22128	22129
199	22130	22131	22132	22133	22134	22135	22136	22137	22138	22139	22140	22141
200	22142	22143	22144	22145	22146	22147	22148	22149	22150	22151	22152	22153
201	22154	22155	22156	22157	22158	22159	22160	22161	22162	22163	22164	22165
202	22166	22167	22168	22169	22170	22171	22172	22173	22174	22175	22176	22177
203	22178	22179	22180	22181	22182	22183	22184	22185	22186	22187	22188	22189
204	22190	22191	22192	22193	22194	22195	22196	22197	22198	22199	22200	22201
205	22202	22203	22204	22205	22206	22207	22208	22209	22210	22211	22212	22213
206	22214	22215	22216	22217	22218	22219	22220	22221	22222	22223	22224	22225
207	22226	22227	22228	22229	22230	22231	22232	22233	22234	22235	22236	22237
208	22238	22239	22240	22241	22242	22243	22244	22245	22246	22247	22248	22249
209	22250	22251	22252	22253	22254	22255	22256	22257	22258	22259	22260	22261
210	22262	22263	22264	22265	22266	22267	22268	22269	22270	22271	22272	22273
211	22274	22275	22276	22277	22278	22279	22280	22281	22282	22283	22284	22285
212	22286	22287	22288	22289	22290	22291	22292	22293	22294	22295	22296	22297
213	22298	22299	22300	22301	22302	22303	22304	22305	22306	22307	22308	22309
214	22310	22311	22312	22313	22314	22315	22316	22317	22318	22319	22320	22321
215	22322	22323	22324	22325	22326	22327	22328	22329	22330	22331	22332	22333
216	22334	22335	22336	22337	22338	22339	22340	22341	22342	22343	22344	22345
217	22346	22347	22348	22349	22350	22351	22352	22353	22354	22355	22356	22357
218	22358	22359	22360	22361	22362	22363	22364	22365	22366	22367	22368	22369
219	22370	22371	22372	22373	22374	22375	22376	22377	22378	22379	22380	22381
220	22382	22383	22384	22385	22386	22387	22388	22389	22390	22391	22392	22393
221	22394	22395	22396	22397	22398	22399	22400	22401	22402	22403	22404	22405
222	22406	22407	22408	22409	22410	22411	22412	22413	22414	22415	22416	22417
223	22418	22419	22420	22421	22422	22423	22424	22425	22426	22427	22428	22429
224	22430	22431	22432	22433	22434	22435	22436	22437	22438	22439	22440	22441
225	22442	22443	22444	22445	22446	22447	22448	22449	22450	22451	22452	22453
226	22454	22455	22456	22457	22458	22459	22460	22461	22462	22463	22464	22465
227	22466	22467	22468	22469	22470	22471	22472	22473	22474	22475	22476	22477
228	22478	22479	22480	22481	22482	22483	22484	22485	22486	22487	22488	22489
229	22490	22491	22492	22493	22494	22495	22496	22497	22498	22499	22500	22501
230	22502	22503	22504	22505	22506	22507	22508	22509	22510	22511	22512	22513
231	22514	22515	22516	22517	22518	22519	22520	22521	22522	22523	22524	22525
232	22526	22527	22528	22529	22530	22531	22532	22533	22534	22535	22536	22537
233	22538	22539	22540	22541	22542	22543	22544	22545	22546	22547	22548	22549
234	22550	22551	22552	22553	22554	22555	22556	22557	22558	22559	22560	22561
235	22562	22563	22564	22565	22566	22567	22568	22569	22570	22571	22572	22573
236	22574	22575	22576	22577	22578	22579	22580	22581	22582	22583	22584	22585

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
237	22586	22587	22588	22589	22590	22591	22592	22593	22594	22595	22596	22597
238	22598	22599	22600	22601	22602	22603	22604	22605	22606	22607	22608	22609
239	22610	22611	22612	22613	22614	22615	22616	22617	22618	22619	22620	22621
240	22622	22623	22624	22625	22626	22627	22628	22629	22630	22631	22632	22633
241	22634	22635	22636	22637	22638	22639	22640	22641	22642	22643	22644	22645
242	22646	22647	22648	22649	22650	22651	22652	22653	22654	22655	22656	22657
243	22658	22659	22660	22661	22662	22663	22664	22665	22666	22667	22668	22669
244	22670	22671	22672	22673	22674	22675	22676	22677	22678	22679	22680	22681
245	22682	22683	22684	22685	22686	22687	22688	22689	22690	22691	22692	22693
246	22694	22695	22696	22697	22698	22699	22700	22701	22702	22703	22704	22705
247	22706	22707	22708	22709	22710	22711	22712	22713	22714	22715	22716	22717
248	22718	22719	22720	22721	22722	22723	22724	22725	22726	22727	22728	22729
249	22730	22731	22732	22733	22734	22735	22736	22737	22738	22739	22740	22741
250	22742	22743	22744	22745	22746	22747	22748	22749	22750	22751	22752	22753
251	22754	22755	22756	22757	22758	22759	22760	22761	22762	22763	22764	22765
252	22766	22767	22768	22769	22770	22771	22772	22773	22774	22775	22776	22777
253	22778	22779	22780	22781	22782	22783	22784	22785	22786	22787	22788	22789
254	22790	22791	22792	22793	22794	22795	22796	22797	22798	22799	22800	22801
255	22802	22803	22804	22805	22806	22807	22808	22809	22810	22811	22812	22813
256	22814	22815	22816	22817	22818	22819	22820	22821	22822	22823	22824	22825
257	22826	22827	22828	22829	22830	22831	22832	22833	22834	22835	22836	22837
258	22838	22839	22840	22841	22842	22843	22844	22845	22846	22847	22848	22849
259	22850	22851	22852	22853	22854	22855	22856	22857	22858	22859	22860	22861
260	22862	22863	22864	22865	22866	22867	22868	22869	22870	22871	22872	22873
261	22874	22875	22876	22877	22878	22879	22880	22881	22882	22883	22884	22885
262	22886	22887	22888	22889	22890	22891	22892	22893	22894	22895	22896	22897
263	22898	22899	22900	22901	22902	22903	22904	22905	22906	22907	22908	22909
264	22910	22911	22912	22913	22914	22915	22916	22917	22918	22919	22920	22921
265	22922	22923	22924	22925	22926	22927	22928	22929	22930	22931	22932	22933
266	22934	22935	22936	22937	22938	22939	22940	22941	22942	22943	22944	22945
267	22946	22947	22948	22949	22950	22951	22952	22953	22954	22955	22956	22957
268	22958	22959	22960	22961	22962	22963	22964	22965	22966	22967	22968	22969
269	22970	22971	22972	22973	22974	22975	22976	22977	22978	22979	22980	22981
270	22982	22983	22984	22985	22986	22987	22988	22989	22990	22991	22992	22993
271	22994	22995	22996	22997	22998	22999	23000	23001	23002	23003	23004	23005
272	23006	23007	23008	23009	23010	23011	23012	23013	23014	23015	23016	23017
273	23018	23019	23020	23021	23022	23023	23024	23025	23026	23027	23028	23029
274	23030	23031	23032	23033	23034	23035	23036	23037	23038	23039	23040	23041
275	23042	23043	23044	23045	23046	23047	23048	23049	23050	23051	23052	23053

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
276	23054	23055	23056	23057	23058	23059	23060	23061	23062	23063	23064	23065
277	23066	23067	23068	23069	23070	23071	23072	23073	23074	23075	23076	23077
278	23078	23079	23080	23081	23082	23083	23084	23085	23086	23087	23088	23089
279	23090	23091	23092	23093	23094	23095	23096	23097	23098	23099	23100	23101
280	23102	23103	23104	23105	23106	23107	23108	23109	23110	23111	23112	23113
281	23114	23115	23116	23117	23118	23119	23120	23121	23122	23123	23124	23125
282	23126	23127	23128	23129	23130	23131	23132	23133	23134	23135	23136	23137
283	23138	23139	23140	23141	23142	23143	23144	23145	23146	23147	23148	23149
284	23150	23151	23152	23153	23154	23155	23156	23157	23158	23159	23160	23161
285	23162	23163	23164	23165	23166	23167	23168	23169	23170	23171	23172	23173
286	23174	23175	23176	23177	23178	23179	23180	23181	23182	23183	23184	23185
287	23186	23187	23188	23189	23190	23191	23192	23193	23194	23195	23196	23197
288	23198	23199	23200	23201	23202	23203	23204	23205	23206	23207	23208	23209
289	23210	23211	23212	23213	23214	23215	23216	23217	23218	23219	23220	23221
290	23222	23223	23224	23225	23226	23227	23228	23229	23230	23231	23232	23233
291	23234	23235	23236	23237	23238	23239	23240	23241	23242	23243	23244	23245
292	23246	23247	23248	23249	23250	23251	23252	23253	23254	23255	23256	23257
293	23258	23259	23260	23261	23262	23263	23264	23265	23266	23267	23268	23269
294	23270	23271	23272	23273	23274	23275	23276	23277	23278	23279	23280	23281
295	23282	23283	23284	23285	23286	23287	23288	23289	23290	23291	23292	23293
296	23294	23295	23296	23297	23298	23299	23300	23301	23302	23303	23304	23305
297	23306	23307	23308	23309	23310	23311	23312	23313	23314	23315	23316	23317
298	23318	23319	23320	23321	23322	23323	23324	23325	23326	23327	23328	23329
299	23330	23331	23332	23333	23334	23335	23336	23337	23338	23339	23340	23341
300	23342	23343	23344	23345	23346	23347	23348	23349	23350	23351	23352	23353
301	23354	23355	23356	23357	23358	23359	23360	23361	23362	23363	23364	23365
302	23366	23367	23368	23369	23370	23371	23372	23373	23374	23375	23376	23377
303	23378	23379	23380	23381	23382	23383	23384	23385	23386	23387	23388	23389
304	23390	23391	23392	23393	23394	23395	23396	23397	23398	23399	23400	23401
305	23402	23403	23404	23405	23406	23407	23408	23409	23410	23411	23412	23413
306	23414	23415	23416	23417	23418	23419	23420	23421	23422	23423	23424	23425
307	23426	23427	23428	23429	23430	23431	23432	23433	23434	23435	23436	23437
308	23438	23439	23440	23441	23442	23443	23444	23445	23446	23447	23448	23449
309	23450	23451	23452	23453	23454	23455	23456	23457	23458	23459	23460	23461
310	23462	23463	23464	23465	23466	23467	23468	23469	23470	23471	23472	23473
311	23474	23475	23476	23477	23478	23479	23480	23481	23482	23483	23484	23485
312	23486	23487	23488	23489	23490	23491	23492	23493	23494	23495	23496	23497
313	23498	23499	23500	23501	23502	23503	23504	23505	23506	23507	23508	23509
314	23510	23511	23512	23513	23514	23515	23516	23517	23518	23519	23520	23521
315	23522	23523	23524	23525	23526	23527	23528	23529	23530	23531	23532	23533

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
316	23534	23535	23536	23537	23538	23539	23540	23541	23542	23543	23544	23545
317	23546	23547	23548	23549	23550	23551	23552	23553	23554	23555	23556	23557
318	23558	23559	23560	23561	23562	23563	23564	23565	23566	23567	23568	23569
319	23570	23571	23572	23573	23574	23575	23576	23577	23578	23579	23580	23581
320	23582	23583	23584	23585	23586	23587	23588	23589	23590	23591	23592	23593
321	23594	23595	23596	23597	23598	23599	23600	23601	23602	23603	23604	23605
322	23606	23607	23608	23609	23610	23611	23612	23613	23614	23615	23616	23617
323	23618	23619	23620	23621	23622	23623	23624	23625	23626	23627	23628	23629
324	23630	23631	23632	23633	23634	23635	23636	23637	23638	23639	23640	23641
325	23642	23643	23644	23645	23646	23647	23648	23649	23650	23651	23652	23653
326	23654	23655	23656	23657	23658	23659	23660	23661	23662	23663	23664	23665
327	23666	23667	23668	23669	23670	23671	23672	23673	23674	23675	23676	23677
328	23678	23679	23680	23681	23682	23683	23684	23685	23686	23687	23688	23689
329	23690	23691	23692	23693	23694	23695	23696	23697	23698	23699	23700	23701
330	23702	23703	23704	23705	23706	23707	23708	23709	23710	23711	23712	23713
331	23714	23715	23716	23717	23718	23719	23720	23721	23722	23723	23724	23725
332	23726	23727	23728	23729	23730	23731	23732	23733	23734	23735	23736	23737
333	23738	23739	23740	23741	23742	23743	23744	23745	23746	23747	23748	23749
334	23750	23751	23752	23753	23754	23755	23756	23757	23758	23759	23760	23761
335	23762	23763	23764	23765	23766	23767	23768	23769	23770	23771	23772	23773
336	23774	23775	23776	23777	23778	23779	23780	23781	23782	23783	23784	23785
337	23786	23787	23788	23789	23790	23791	23792	23793	23794	23795	23796	23797
338	23798	23799	23800	23801	23802	23803	23804	23805	23806	23807	23808	23809
339	23810	23811	23812	23813	23814	23815	23816	23817	23818	23819	23820	23821
340	23822	23823	23824	23825	23826	23827	23828	23829	23830	23831	23832	23833
341	23834	23835	23836	23837	23838	23839	23840	23841	23842	23843	23844	23845
342	23846	23847	23848	23849	23850	23851	23852	23853	23854	23855	23856	23857
343	23858	23859	23860	23861	23862	23863	23864	23865	23866	23867	23868	23869
344	23870	23871	23872	23873	23874	23875	23876	23877	23878	23879	23880	23881
345	23882	23883	23884	23885	23886	23887	23888	23889	23890	23891	23892	23893
346	23894	23895	23896	23897	23898	23899	23900	23901	23902	23903	23904	23905
347	23906	23907	23908	23909	23910	23911	23912	23913	23914	23915	23916	23917
348	23918	23919	23920	23921	23922	23923	23924	23925	23926	23927	23928	23929
349	23930	23931	23932	23933	23934	23935	23936	23937	23938	23939	23940	23941
350	23942	23943	23944	23945	23946	23947	23948	23949	23950	23951	23952	23953
351	23954	23955	23956	23957	23958	23959	23960	23961	23962	23963	23964	23965
352	23966	23967	23968	23969	23970	23971	23972	23973	23974	23975	23976	23977
353	23978	23979	23980	23981	23982	23983	23984	23985	23986	23987	23988	23989
354	23990	23991	23992	23993	23994	23995	23996	23997	23998	23999	24000	24001

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
355	24002	24003	24004	24005	24006	24007	24008	24009	24010	24011	24012	24013
356	24014	24015	24016	24017	24018	24019	24020	24021	24022	24023	24024	24025
357	24026	24027	24028	24029	24030	24031	24032	24033	24034	24035	24036	24037
358	24038	24039	24040	24041	24042	24043	24044	24045	24046	24047	24048	24049
359	24050	24051	24052	24053	24054	24055	24056	24057	24058	24059	24060	24061
360	24062	24063	24064	24065	24066	24067	24068	24069	24070	24071	24072	24073
361	24074	24075	24076	24077	24078	24079	24080	24081	24082	24083	24084	24085
362	24086	24087	24088	24089	24090	24091	24092	24093	24094	24095	24096	24097
363	24098	24099	24100	24101	24102	24103	24104	24105	24106	24107	24108	24109
364	24110	24111	24112	24113	24114	24115	24116	24117	24118	24119	24120	24121
365	24122	24123	24124	24125	24126	24127	24128	24129	24130	24131	24132	24133
366	24134	24135	24136	24137	24138	24139	24140	24141	24142	24143	24144	24145
367	24146	24147	24148	24149	24150	24151	24152	24153	24154	24155	24156	24157
368	24158	24159	24160	24161	24162	24163	24164	24165	24166	24167	24168	24169
369	24170	24171	24172	24173	24174	24175	24176	24177	24178	24179	24180	24181
370	24182	24183	24184	24185	24186	24187	24188	24189	24190	24191	24192	24193
371	24194	24195	24196	24197	24198	24199	24200	24201	24202	24203	24204	24205
372	24206	24207	24208	24209	24210	24211	24212	24213	24214	24215	24216	24217
373	24218	24219	24220	24221	24222	24223	24224	24225	24226	24227	24228	24229
374	24230	24231	24232	24233	24234	24235	24236	24237	24238	24239	24240	24241
375	24242	24243	24244	24245	24246	24247	24248	24249	24250	24251	24252	24253
376	24254	24255	24256	24257	24258	24259	24260	24261	24262	24263	24264	24265
377	24266	24267	24268	24269	24270	24271	24272	24273	24274	24275	24276	24277
378	24278	24279	24280	24281	24282	24283	24284	24285	24286	24287	24288	24289
379	24290	24291	24292	24293	24294	24295	24296	24297	24298	24299	24300	24301
380	24302	24303	24304	24305	24306	24307	24308	24309	24310	24311	24312	24313
381	24314	24315	24316	24317	24318	24319	24320	24321	24322	24323	24324	24325
382	24326	24327	24328	24329	24330	24331	24332	24333	24334	24335	24336	24337
383	24338	24339	24340	24341	24342	24343	24344	24345	24346	24347	24348	24349
384	24350	24351	24352	24353	24354	24355	24356	24357	24358	24359	24360	24361
385	24362	24363	24364	24365	24366	24367	24368	24369	24370	24371	24372	24373
386	24374	24375	24376	24377	24378	24379	24380	24381	24382	24383	24384	24385
387	24386	24387	24388	24389	24390	24391	24392	24393	24394	24395	24396	24397
388	24398	24399	24400	24401	24402	24403	24404	24405	24406	24407	24408	24409
389	24410	24411	24412	24413	24414	24415	24416	24417	24418	24419	24420	24421
390	24422	24423	24424	24425	24426	24427	24428	24429	24430	24431	24432	24433
391	24434	24435	24436	24437	24438	24439	24440	24441	24442	24443	24444	24445
392	24446	24447	24448	24449	24450	24451	24452	24453	24454	24455	24456	24457
393	24458	24459	24460	24461	24462	24463	24464	24465	24466	24467	24468	24469
394	24470	24471	24472	24473	24474	24475	24476	24477	24478	24479	24480	24481

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
395	24482	24483	24484	24485	24486	24487	24488	24489	24490	24491	24492	24493
396	24494	24495	24496	24497	24498	24499	24500	24501	24502	24503	24504	24505
397	24506	24507	24508	24509	24510	24511	24512	24513	24514	24515	24516	24517
398	24518	24519	24520	24521	24522	24523	24524	24525	24526	24527	24528	24529
399	24530	24531	24532	24533	24534	24535	24536	24537	24538	24539	24540	24541
400	24542	24543	24544	24545	24546	24547	24548	24549	24550	24551	24552	24553

Appendix 2.7 6-axis operation data memory address

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
1	24554	24555	24556	24557	24558	24559	24560	24561	24562	24563	24564	24565
2	24566	24567	24568	24569	24570	24571	24572	24573	24574	24575	24576	24577
3	24578	24579	24580	24581	24582	24583	24584	24585	24586	24587	24588	24589
4	24590	24591	24592	24593	24594	24595	24596	24597	24598	24599	24600	24601
5	24602	24603	24604	24605	24606	24607	24608	24609	24610	24611	24612	24613
6	24614	24615	24616	24617	24618	24619	24620	24621	24622	24623	24624	24625
7	24626	24627	24628	24629	24630	24631	24632	24633	24634	24635	24636	24637
8	24638	24639	24640	24641	24642	24643	24644	24645	24646	24647	24648	24649
9	24650	24651	24652	24653	24654	24655	24656	24657	24658	24659	24660	24661
10	24662	24663	24664	24665	24666	24667	24668	24669	24670	24671	24672	24673
11	24674	24675	24676	24677	24678	24679	24680	24681	24682	24683	24684	24685
12	24686	24687	24688	24689	24690	24691	24692	24693	24694	24695	24696	24697
13	24698	24699	24700	24701	24702	24703	24704	24705	24706	24707	24708	24709
14	24710	24711	24712	24713	24714	24715	24716	24717	24718	24719	24720	24721
15	24722	24723	24724	24725	24726	24727	24728	24729	24730	24731	24732	24733
16	24734	24735	24736	24737	24738	24739	24740	24741	24742	24743	24744	24745
17	24746	24747	24748	24749	24750	24751	24752	24753	24754	24755	24756	24757
18	24758	24759	24760	24761	24762	24763	24764	24765	24766	24767	24768	24769
19	24770	24771	24772	24773	24774	24775	24776	24777	24778	24779	24780	24781
20	24782	24783	24784	24785	24786	24787	24788	24789	24790	24791	24792	24793
21	24794	24795	24796	24797	24798	24799	24800	24801	24802	24803	24804	24805
22	24806	24807	24808	24809	24810	24811	24812	24813	24814	24815	24816	24817
23	24818	24819	24820	24821	24822	24823	24824	24825	24826	24827	24828	24829
24	24830	24831	24832	24833	24834	24835	24836	24837	24838	24839	24840	24841
25	24842	24843	24844	24845	24846	24847	24848	24849	24850	24851	24852	24853
26	24854	24855	24856	24857	24858	24859	24860	24861	24862	24863	24864	24865
27	24866	24867	24868	24869	24870	24871	24872	24873	24874	24875	24876	24877
28	24878	24879	24880	24881	24882	24883	24884	24885	24886	24887	24888	24889
29	24890	24891	24892	24893	24894	24895	24896	24897	24898	24899	24900	24901
30	24902	24903	24904	24905	24906	24907	24908	24909	24910	24911	24912	24913
31	24914	24915	24916	24917	24918	24919	24920	24921	24922	24923	24924	24925
32	24926	24927	24928	24929	24930	24931	24932	24933	24934	24935	24936	24937
33	24938	24939	24940	24941	24942	24943	24944	24945	24946	24947	24948	24949
34	24950	24951	24952	24953	24954	24955	24956	24957	24958	24959	24960	24961
35	24962	24963	24964	24965	24966	24967	24968	24969	24970	24971	24972	24973
36	24974	24975	24976	24977	24978	24979	24980	24981	24982	24983	24984	24985
37	24986	24987	24988	24989	24990	24991	24992	24993	24994	24995	24996	24997
38	24998	24999	25000	25001	25002	25003	25004	25005	25006	25007	25008	25009
39	25010	25011	25012	25013	25014	25015	25016	25017	25018	25019	25020	25021

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
40	25022	25023	25024	25025	25026	25027	25028	25029	25030	25031	25032	25033
41	25034	25035	25036	25037	25038	25039	25040	25041	25042	25043	25044	25045
42	25046	25047	25048	25049	25050	25051	25052	25053	25054	25055	25056	25057
43	25058	25059	25060	25061	25062	25063	25064	25065	25066	25067	25068	25069
44	25070	25071	25072	25073	25074	25075	25076	25077	25078	25079	25080	25081
45	25082	25083	25084	25085	25086	25087	25088	25089	25090	25091	25092	25093
46	25094	25095	25096	25097	25098	25099	25100	25101	25102	25103	25104	25105
47	25106	25107	25108	25109	25110	25111	25112	25113	25114	25115	25116	25117
48	25118	25119	25120	25121	25122	25123	25124	25125	25126	25127	25128	25129
49	25130	25131	25132	25133	25134	25135	25136	25137	25138	25139	25140	25141
50	25142	25143	25144	25145	25146	25147	25148	25149	25150	25151	25152	25153
51	25154	25155	25156	25157	25158	25159	25160	25161	25162	25163	25164	25165
52	25166	25167	25168	25169	25170	25171	25172	25173	25174	25175	25176	25177
53	25178	25179	25180	25181	25182	25183	25184	25185	25186	25187	25188	25189
54	25190	25191	25192	25193	25194	25195	25196	25197	25198	25199	25200	25201
55	25202	25203	25204	25205	25206	25207	25208	25209	25210	25211	25212	25213
56	25214	25215	25216	25217	25218	25219	25220	25221	25222	25223	25224	25225
57	25226	25227	25228	25229	25230	25231	25232	25233	25234	25235	25236	25237
58	25238	25239	25240	25241	25242	25243	25244	25245	25246	25247	25248	25249
59	25250	25251	25252	25253	25254	25255	25256	25257	25258	25259	25260	25261
60	25262	25263	25264	25265	25266	25267	25268	25269	25270	25271	25272	25273
61	25274	25275	25276	25277	25278	25279	25280	25281	25282	25283	25284	25285
62	25286	25287	25288	25289	25290	25291	25292	25293	25294	25295	25296	25297
63	25298	25299	25300	25301	25302	25303	25304	25305	25306	25307	25308	25309
64	25310	25311	25312	25313	25314	25315	25316	25317	25318	25319	25320	25321
65	25322	25323	25324	25325	25326	25327	25328	25329	25330	25331	25332	25333
66	25334	25335	25336	25337	25338	25339	25340	25341	25342	25343	25344	25345
67	25346	25347	25348	25349	25350	25351	25352	25353	25354	25355	25356	25357
68	25358	25359	25360	25361	25362	25363	25364	25365	25366	25367	25368	25369
69	25370	25371	25372	25373	25374	25375	25376	25377	25378	25379	25380	25381
70	25382	25383	25384	25385	25386	25387	25388	25389	25390	25391	25392	25393
71	25394	25395	25396	25397	25398	25399	25400	25401	25402	25403	25404	25405
72	25406	25407	25408	25409	25410	25411	25412	25413	25414	25415	25416	25417
73	25418	25419	25420	25421	25422	25423	25424	25425	25426	25427	25428	25429
74	25430	25431	25432	25433	25434	25435	25436	25437	25438	25439	25440	25441
75	25442	25443	25444	25445	25446	25447	25448	25449	25450	25451	25452	25453
76	25454	25455	25456	25457	25458	25459	25460	25461	25462	25463	25464	25465
77	25466	25467	25468	25469	25470	25471	25472	25473	25474	25475	25476	25477
78	25478	25479	25480	25481	25482	25483	25484	25485	25486	25487	25488	25489

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
79	25490	25491	25492	25493	25494	25495	25496	25497	25498	25499	25500	25501
80	25502	25503	25504	25505	25506	25507	25508	25509	25510	25511	25512	25513
81	25514	25515	25516	25517	25518	25519	25520	25521	25522	25523	25524	25525
82	25526	25527	25528	25529	25530	25531	25532	25533	25534	25535	25536	25537
83	25538	25539	25540	25541	25542	25543	25544	25545	25546	25547	25548	25549
84	25550	25551	25552	25553	25554	25555	25556	25557	25558	25559	25560	25561
85	25562	25563	25564	25565	25566	25567	25568	25569	25570	25571	25572	25573
86	25574	25575	25576	25577	25578	25579	25580	25581	25582	25583	25584	25585
87	25586	25587	25588	25589	25590	25591	25592	25593	25594	25595	25596	25597
88	25598	25599	25600	25601	25602	25603	25604	25605	25606	25607	25608	25609
89	25610	25611	25612	25613	25614	25615	25616	25617	25618	25619	25620	25621
90	25622	25623	25624	25625	25626	25627	25628	25629	25630	25631	25632	25633
91	25634	25635	25636	25637	25638	25639	25640	25641	25642	25643	25644	25645
92	25646	25647	25648	25649	25650	25651	25652	25653	25654	25655	25656	25657
93	25658	25659	25660	25661	25662	25663	25664	25665	25666	25667	25668	25669
94	25670	25671	25672	25673	25674	25675	25676	25677	25678	25679	25680	25681
95	25682	25683	25684	25685	25686	25687	25688	25689	25690	25691	25692	25693
96	25694	25695	25696	25697	25698	25699	25700	25701	25702	25703	25704	25705
97	25706	25707	25708	25709	25710	25711	25712	25713	25714	25715	25716	25717
98	25718	25719	25720	25721	25722	25723	25724	25725	25726	25727	25728	25729
99	25730	25731	25732	25733	25734	25735	25736	25737	25738	25739	25740	25741
100	25742	25743	25744	25745	25746	25747	25748	25749	25750	25751	25752	25753
101	25754	25755	25756	25757	25758	25759	25760	25761	25762	25763	25764	25765
102	25766	25767	25768	25769	25770	25771	25772	25773	25774	25775	25776	25777
103	25778	25779	25780	25781	25782	25783	25784	25785	25786	25787	25788	25789
104	25790	25791	25792	25793	25794	25795	25796	25797	25798	25799	25800	25801
105	25802	25803	25804	25805	25806	25807	25808	25809	25810	25811	25812	25813
106	25814	25815	25816	25817	25818	25819	25820	25821	25822	25823	25824	25825
107	25826	25827	25828	25829	25830	25831	25832	25833	25834	25835	25836	25837
108	25838	25839	25840	25841	25842	25843	25844	25845	25846	25847	25848	25849
109	25850	25851	25852	25853	25854	25855	25856	25857	25858	25859	25860	25861
110	25862	25863	25864	25865	25866	25867	25868	25869	25870	25871	25872	25873
111	25874	25875	25876	25877	25878	25879	25880	25881	25882	25883	25884	25885
112	25886	25887	25888	25889	25890	25891	25892	25893	25894	25895	25896	25897
113	25898	25899	25900	25901	25902	25903	25904	25905	25906	25907	25908	25909
114	25910	25911	25912	25913	25914	25915	25916	25917	25918	25919	25920	25921
115	25922	25923	25924	25925	25926	25927	25928	25929	25930	25931	25932	25933
116	25934	25935	25936	25937	25938	25939	25940	25941	25942	25943	25944	25945
117	25946	25947	25948	25949	25950	25951	25952	25953	25954	25955	25956	25957
118	25958	25959	25960	25961	25962	25963	25964	25965	25966	25967	25968	25969

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
119	25970	25971	25972	25973	25974	25975	25976	25977	25978	25979	25980	25981
120	25982	25983	25984	25985	25986	25987	25988	25989	25990	25991	25992	25993
121	25994	25995	25996	25997	25998	25999	26000	26001	26002	26003	26004	26005
122	26006	26007	26008	26009	26010	26011	26012	26013	26014	26015	26016	26017
123	26018	26019	26020	26021	26022	26023	26024	26025	26026	26027	26028	26029
124	26030	26031	26032	26033	26034	26035	26036	26037	26038	26039	26040	26041
125	26042	26043	26044	26045	26046	26047	26048	26049	26050	26051	26052	26053
126	26054	26055	26056	26057	26058	26059	26060	26061	26062	26063	26064	26065
127	26066	26067	26068	26069	26070	26071	26072	26073	26074	26075	26076	26077
128	26078	26079	26080	26081	26082	26083	26084	26085	26086	26087	26088	26089
129	26090	26091	26092	26093	26094	26095	26096	26097	26098	26099	26100	26101
130	26102	26103	26104	26105	26106	26107	26108	26109	26110	26111	26112	26113
131	26114	26115	26116	26117	26118	26119	26120	26121	26122	26123	26124	26125
132	26126	26127	26128	26129	26130	26131	26132	26133	26134	26135	26136	26137
133	26138	26139	26140	26141	26142	26143	26144	26145	26146	26147	26148	26149
134	26150	26151	26152	26153	26154	26155	26156	26157	26158	26159	26160	26161
135	26162	26163	26164	26165	26166	26167	26168	26169	26170	26171	26172	26173
136	26174	26175	26176	26177	26178	26179	26180	26181	26182	26183	26184	26185
137	26186	26187	26188	26189	26190	26191	26192	26193	26194	26195	26196	26197
138	26198	26199	26200	26201	26202	26203	26204	26205	26206	26207	26208	26209
139	26210	26211	26212	26213	26214	26215	26216	26217	26218	26219	26220	26221
140	26222	26223	26224	26225	26226	26227	26228	26229	26230	26231	26232	26233
141	26234	26235	26236	26237	26238	26239	26240	26241	26242	26243	26244	26245
142	26246	26247	26248	26249	26250	26251	26252	26253	26254	26255	26256	26257
143	26258	26259	26260	26261	26262	26263	26264	26265	26266	26267	26268	26269
144	26270	26271	26272	26273	26274	26275	26276	26277	26278	26279	26280	26281
145	26282	26283	26284	26285	26286	26287	26288	26289	26290	26291	26292	26293
146	26294	26295	26296	26297	26298	26299	26300	26301	26302	26303	26304	26305
147	26306	26307	26308	26309	26310	26311	26312	26313	26314	26315	26316	26317
148	26318	26319	26320	26321	26322	26323	26324	26325	26326	26327	26328	26329
149	26330	26331	26332	26333	26334	26335	26336	26337	26338	26339	26340	26341
150	26342	26343	26344	26345	26346	26347	26348	26349	26350	26351	26352	26353
151	26354	26355	26356	26357	26358	26359	26360	26361	26362	26363	26364	26365
152	26366	26367	26368	26369	26370	26371	26372	26373	26374	26375	26376	26377
153	26378	26379	26380	26381	26382	26383	26384	26385	26386	26387	26388	26389
154	26390	26391	26392	26393	26394	26395	26396	26397	26398	26399	26400	26401
155	26402	26403	26404	26405	26406	26407	26408	26409	26410	26411	26412	26413
156	26414	26415	26416	26417	26418	26419	26420	26421	26422	26423	26424	26425
157	26426	26427	26428	26429	26430	26431	26432	26433	26434	26435	26436	26437

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
158	26438	26439	26440	26441	26442	26443	26444	26445	26446	26447	26448	26449
159	26450	26451	26452	26453	26454	26455	26456	26457	26458	26459	26460	26461
160	26462	26463	26464	26465	26466	26467	26468	26469	26470	26471	26472	26473
161	26474	26475	26476	26477	26478	26479	26480	26481	26482	26483	26484	26485
162	26486	26487	26488	26489	26490	26491	26492	26493	26494	26495	26496	26497
163	26498	26499	26500	26501	26502	26503	26504	26505	26506	26507	26508	26509
164	26510	26511	26512	26513	26514	26515	26516	26517	26518	26519	26520	26521
165	26522	26523	26524	26525	26526	26527	26528	26529	26530	26531	26532	26533
166	26534	26535	26536	26537	26538	26539	26540	26541	26542	26543	26544	26545
167	26546	26547	26548	26549	26550	26551	26552	26553	26554	26555	26556	26557
168	26558	26559	26560	26561	26562	26563	26564	26565	26566	26567	26568	26569
169	26570	26571	26572	26573	26574	26575	26576	26577	26578	26579	26580	26581
170	26582	26583	26584	26585	26586	26587	26588	26589	26590	26591	26592	26593
171	26594	26595	26596	26597	26598	26599	26600	26601	26602	26603	26604	26605
172	26606	26607	26608	26609	26610	26611	26612	26613	26614	26615	26616	26617
173	26618	26619	26620	26621	26622	26623	26624	26625	26626	26627	26628	26629
174	26630	26631	26632	26633	26634	26635	26636	26637	26638	26639	26640	26641
175	26642	26643	26644	26645	26646	26647	26648	26649	26650	26651	26652	26653
176	26654	26655	26656	26657	26658	26659	26660	26661	26662	26663	26664	26665
177	26666	26667	26668	26669	26670	26671	26672	26673	26674	26675	26676	26677
178	26678	26679	26680	26681	26682	26683	26684	26685	26686	26687	26688	26689
179	26690	26691	26692	26693	26694	26695	26696	26697	26698	26699	26700	26701
180	26702	26703	26704	26705	26706	26707	26708	26709	26710	26711	26712	26713
181	26714	26715	26716	26717	26718	26719	26720	26721	26722	26723	26724	26725
182	26726	26727	26728	26729	26730	26731	26732	26733	26734	26735	26736	26737
183	26738	26739	26740	26741	26742	26743	26744	26745	26746	26747	26748	26749
184	26750	26751	26752	26753	26754	26755	26756	26757	26758	26759	26760	26761
185	26762	26763	26764	26765	26766	26767	26768	26769	26770	26771	26772	26773
186	26774	26775	26776	26777	26778	26779	26780	26781	26782	26783	26784	26785
187	26786	26787	26788	26789	26790	26791	26792	26793	26794	26795	26796	26797
188	26798	26799	26800	26801	26802	26803	26804	26805	26806	26807	26808	26809
189	26810	26811	26812	26813	26814	26815	26816	26817	26818	26819	26820	26821
190	26822	26823	26824	26825	26826	26827	26828	26829	26830	26831	26832	26833
191	26834	26835	26836	26837	26838	26839	26840	26841	26842	26843	26844	26845
192	26846	26847	26848	26849	26850	26851	26852	26853	26854	26855	26856	26857
193	26858	26859	26860	26861	26862	26863	26864	26865	26866	26867	26868	26869
194	26870	26871	26872	26873	26874	26875	26876	26877	26878	26879	26880	26881
195	26882	26883	26884	26885	26886	26887	26888	26889	26890	26891	26892	26893
196	26894	26895	26896	26897	26898	26899	26900	26901	26902	26903	26904	26905
197	26906	26907	26908	26909	26910	26911	26912	26913	26914	26915	26916	26917

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
198	26918	26919	26920	26921	26922	26923	26924	26925	26926	26927	26928	26929
199	26930	26931	26932	26933	26934	26935	26936	26937	26938	26939	26940	26941
200	26942	26943	26944	26945	26946	26947	26948	26949	26950	26951	26952	26953
201	26954	26955	26956	26957	26958	26959	26960	26961	26962	26963	26964	26965
202	26966	26967	26968	26969	26970	26971	26972	26973	26974	26975	26976	26977
203	26978	26979	26980	26981	26982	26983	26984	26985	26986	26987	26988	26989
204	26990	26991	26992	26993	26994	26995	26996	26997	26998	26999	27000	27001
205	27002	27003	27004	27005	27006	27007	27008	27009	27010	27011	27012	27013
206	27014	27015	27016	27017	27018	27019	27020	27021	27022	27023	27024	27025
207	27026	27027	27028	27029	27030	27031	27032	27033	27034	27035	27036	27037
208	27038	27039	27040	27041	27042	27043	27044	27045	27046	27047	27048	27049
209	27050	27051	27052	27053	27054	27055	27056	27057	27058	27059	27060	27061
210	27062	27063	27064	27065	27066	27067	27068	27069	27070	27071	27072	27073
211	27074	27075	27076	27077	27078	27079	27080	27081	27082	27083	27084	27085
212	27086	27087	27088	27089	27090	27091	27092	27093	27094	27095	27096	27097
213	27098	27099	27100	27101	27102	27103	27104	27105	27106	27107	27108	27109
214	27110	27111	27112	27113	27114	27115	27116	27117	27118	27119	27120	27121
215	27122	27123	27124	27125	27126	27127	27128	27129	27130	27131	27132	27133
216	27134	27135	27136	27137	27138	27139	27140	27141	27142	27143	27144	27145
217	27146	27147	27148	27149	27150	27151	27152	27153	27154	27155	27156	27157
218	27158	27159	27160	27161	27162	27163	27164	27165	27166	27167	27168	27169
219	27170	27171	27172	27173	27174	27175	27176	27177	27178	27179	27180	27181
220	27182	27183	27184	27185	27186	27187	27188	27189	27190	27191	27192	27193
221	27194	27195	27196	27197	27198	27199	27200	27201	27202	27203	27204	27205
222	27206	27207	27208	27209	27210	27211	27212	27213	27214	27215	27216	27217
223	27218	27219	27220	27221	27222	27223	27224	27225	27226	27227	27228	27229
224	27230	27231	27232	27233	27234	27235	27236	27237	27238	27239	27240	27241
225	27242	27243	27244	27245	27246	27247	27248	27249	27250	27251	27252	27253
226	27254	27255	27256	27257	27258	27259	27260	27261	27262	27263	27264	27265
227	27266	27267	27268	27269	27270	27271	27272	27273	27274	27275	27276	27277
228	27278	27279	27280	27281	27282	27283	27284	27285	27286	27287	27288	27289
229	27290	27291	27292	27293	27294	27295	27296	27297	27298	27299	27300	27301
230	27302	27303	27304	27305	27306	27307	27308	27309	27310	27311	27312	27313
231	27314	27315	27316	27317	27318	27319	27320	27321	27322	27323	27324	27325
232	27326	27327	27328	27329	27330	27331	27332	27333	27334	27335	27336	27337
233	27338	27339	27340	27341	27342	27343	27344	27345	27346	27347	27348	27349
234	27350	27351	27352	27353	27354	27355	27356	27357	27358	27359	27360	27361
235	27362	27363	27364	27365	27366	27367	27368	27369	27370	27371	27372	27373
236	27374	27375	27376	27377	27378	27379	27380	27381	27382	27383	27384	27385

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
237	27386	27387	27388	27389	27390	27391	27392	27393	27394	27395	27396	27397
238	27398	27399	27400	27401	27402	27403	27404	27405	27406	27407	27408	27409
239	27410	27411	27412	27413	27414	27415	27416	27417	27418	27419	27420	27421
240	27422	27423	27424	27425	27426	27427	27428	27429	27430	27431	27432	27433
241	27434	27435	27436	27437	27438	27439	27440	27441	27442	27443	27444	27445
242	27446	27447	27448	27449	27450	27451	27452	27453	27454	27455	27456	27457
243	27458	27459	27460	27461	27462	27463	27464	27465	27466	27467	27468	27469
244	27470	27471	27472	27473	27474	27475	27476	27477	27478	27479	27480	27481
245	27482	27483	27484	27485	27486	27487	27488	27489	27490	27491	27492	27493
246	27494	27495	27496	27497	27498	27499	27500	27501	27502	27503	27504	27505
247	27506	27507	27508	27509	27510	27511	27512	27513	27514	27515	27516	27517
248	27518	27519	27520	27521	27522	27523	27524	27525	27526	27527	27528	27529
249	27530	27531	27532	27533	27534	27535	27536	27537	27538	27539	27540	27541
250	27542	27543	27544	27545	27546	27547	27548	27549	27550	27551	27552	27553
251	27554	27555	27556	27557	27558	27559	27560	27561	27562	27563	27564	27565
252	27566	27567	27568	27569	27570	27571	27572	27573	27574	27575	27576	27577
253	27578	27579	27580	27581	27582	27583	27584	27585	27586	27587	27588	27589
254	27590	27591	27592	27593	27594	27595	27596	27597	27598	27599	27600	27601
255	27602	27603	27604	27605	27606	27607	27608	27609	27610	27611	27612	27613
256	27614	27615	27616	27617	27618	27619	27620	27621	27622	27623	27624	27625
257	27626	27627	27628	27629	27630	27631	27632	27633	27634	27635	27636	27637
258	27638	27639	27640	27641	27642	27643	27644	27645	27646	27647	27648	27649
259	27650	27651	27652	27653	27654	27655	27656	27657	27658	27659	27660	27661
260	27662	27663	27664	27665	27666	27667	27668	27669	27670	27671	27672	27673
261	27674	27675	27676	27677	27678	27679	27680	27681	27682	27683	27684	27685
262	27686	27687	27688	27689	27690	27691	27692	27693	27694	27695	27696	27697
263	27698	27699	27700	27701	27702	27703	27704	27705	27706	27707	27708	27709
264	27710	27711	27712	27713	27714	27715	27716	27717	27718	27719	27720	27721
265	27722	27723	27724	27725	27726	27727	27728	27729	27730	27731	27732	27733
266	27734	27735	27736	27737	27738	27739	27740	27741	27742	27743	27744	27745
267	27746	27747	27748	27749	27750	27751	27752	27753	27754	27755	27756	27757
268	27758	27759	27760	27761	27762	27763	27764	27765	27766	27767	27768	27769
269	27770	27771	27772	27773	27774	27775	27776	27777	27778	27779	27780	27781
270	27782	27783	27784	27785	27786	27787	27788	27789	27790	27791	27792	27793
271	27794	27795	27796	27797	27798	27799	27800	27801	27802	27803	27804	27805
272	27806	27807	27808	27809	27810	27811	27812	27813	27814	27815	27816	27817
273	27818	27819	27820	27821	27822	27823	27824	27825	27826	27827	27828	27829
274	27830	27831	27832	27833	27834	27835	27836	27837	27838	27839	27840	27841
275	27842	27843	27844	27845	27846	27847	27848	27849	27850	27851	27852	27853
276	27854	27855	27856	27857	27858	27859	27860	27861	27862	27863	27864	27865

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
277	27866	27867	27868	27869	27870	27871	27872	27873	27874	27875	27876	27877
278	27878	27879	27880	27881	27882	27883	27884	27885	27886	27887	27888	27889
279	27890	27891	27892	27893	27894	27895	27896	27897	27898	27899	27900	27901
280	27902	27903	27904	27905	27906	27907	27908	27909	27910	27911	27912	27913
281	27914	27915	27916	27917	27918	27919	27920	27921	27922	27923	27924	27925
282	27926	27927	27928	27929	27930	27931	27932	27933	27934	27935	27936	27937
283	27938	27939	27940	27941	27942	27943	27944	27945	27946	27947	27948	27949
284	27950	27951	27952	27953	27954	27955	27956	27957	27958	27959	27960	27961
285	27962	27963	27964	27965	27966	27967	27968	27969	27970	27971	27972	27973
286	27974	27975	27976	27977	27978	27979	27980	27981	27982	27983	27984	27985
287	27986	27987	27988	27989	27990	27991	27992	27993	27994	27995	27996	27997
288	27998	27999	28000	28001	28002	28003	28004	28005	28006	28007	28008	28009
289	28010	28011	28012	28013	28014	28015	28016	28017	28018	28019	28020	28021
290	28022	28023	28024	28025	28026	28027	28028	28029	28030	28031	28032	28033
291	28034	28035	28036	28037	28038	28039	28040	28041	28042	28043	28044	28045
292	28046	28047	28048	28049	28050	28051	28052	28053	28054	28055	28056	28057
293	28058	28059	28060	28061	28062	28063	28064	28065	28066	28067	28068	28069
294	28070	28071	28072	28073	28074	28075	28076	28077	28078	28079	28080	28081
295	28082	28083	28084	28085	28086	28087	28088	28089	28090	28091	28092	28093
296	28094	28095	28096	28097	28098	28099	28100	28101	28102	28103	28104	28105
297	28106	28107	28108	28109	28110	28111	28112	28113	28114	28115	28116	28117
298	28118	28119	28120	28121	28122	28123	28124	28125	28126	28127	28128	28129
299	28130	28131	28132	28133	28134	28135	28136	28137	28138	28139	28140	28141
300	28142	28143	28144	28145	28146	28147	28148	28149	28150	28151	28152	28153
301	28154	28155	28156	28157	28158	28159	28160	28161	28162	28163	28164	28165
302	28166	28167	28168	28169	28170	28171	28172	28173	28174	28175	28176	28177
303	28178	28179	28180	28181	28182	28183	28184	28185	28186	28187	28188	28189
304	28190	28191	28192	28193	28194	28195	28196	28197	28198	28199	28200	28201
305	28202	28203	28204	28205	28206	28207	28208	28209	28210	28211	28212	28213
306	28214	28215	28216	28217	28218	28219	28220	28221	28222	28223	28224	28225
307	28226	28227	28228	28229	28230	28231	28232	28233	28234	28235	28236	28237
308	28238	28239	28240	28241	28242	28243	28244	28245	28246	28247	28248	28249
309	28250	28251	28252	28253	28254	28255	28256	28257	28258	28259	28260	28261
310	28262	28263	28264	28265	28266	28267	28268	28269	28270	28271	28272	28273
311	28274	28275	28276	28277	28278	28279	28280	28281	28282	28283	28284	28285
312	28286	28287	28288	28289	28290	28291	28292	28293	28294	28295	28296	28297
313	28298	28299	28300	28301	28302	28303	28304	28305	28306	28307	28308	28309
314	28310	28311	28312	28313	28314	28315	28316	28317	28318	28319	28320	28321
315	28322	28323	28324	28325	28326	28327	28328	28329	28330	28331	28332	28333

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
316	28334	28335	28336	28337	28338	28339	28340	28341	28342	28343	28344	28345
317	28346	28347	28348	28349	28350	28351	28352	28353	28354	28355	28356	28357
318	28358	28359	28360	28361	28362	28363	28364	28365	28366	28367	28368	28369
319	28370	28371	28372	28373	28374	28375	28376	28377	28378	28379	28380	28381
320	28382	28383	28384	28385	28386	28387	28388	28389	28390	28391	28392	28393
321	28394	28395	28396	28397	28398	28399	28400	28401	28402	28403	28404	28405
322	28406	28407	28408	28409	28410	28411	28412	28413	28414	28415	28416	28417
323	28418	28419	28420	28421	28422	28423	28424	28425	28426	28427	28428	28429
324	28430	28431	28432	28433	28434	28435	28436	28437	28438	28439	28440	28441
325	28442	28443	28444	28445	28446	28447	28448	28449	28450	28451	28452	28453
326	28454	28455	28456	28457	28458	28459	28460	28461	28462	28463	28464	28465
327	28466	28467	28468	28469	28470	28471	28472	28473	28474	28475	28476	28477
328	28478	28479	28480	28481	28482	28483	28484	28485	28486	28487	28488	28489
329	28490	28491	28492	28493	28494	28495	28496	28497	28498	28499	28500	28501
330	28502	28503	28504	28505	28506	28507	28508	28509	28510	28511	28512	28513
331	28514	28515	28516	28517	28518	28519	28520	28521	28522	28523	28524	28525
332	28526	28527	28528	28529	28530	28531	28532	28533	28534	28535	28536	28537
333	28538	28539	28540	28541	28542	28543	28544	28545	28546	28547	28548	28549
334	28550	28551	28552	28553	28554	28555	28556	28557	28558	28559	28560	28561
335	28562	28563	28564	28565	28566	28567	28568	28569	28570	28571	28572	28573
336	28574	28575	28576	28577	28578	28579	28580	28581	28582	28583	28584	28585
337	28586	28587	28588	28589	28590	28591	28592	28593	28594	28595	28596	28597
338	28598	28599	28600	28601	28602	28603	28604	28605	28606	28607	28608	28609
339	28610	28611	28612	28613	28614	28615	28616	28617	28618	28619	28620	28621
340	28622	28623	28624	28625	28626	28627	28628	28629	28630	28631	28632	28633
341	28634	28635	28636	28637	28638	28639	28640	28641	28642	28643	28644	28645
342	28646	28647	28648	28649	28650	28651	28652	28653	28654	28655	28656	28657
343	28658	28659	28660	28661	28662	28663	28664	28665	28666	28667	28668	28669
344	28670	28671	28672	28673	28674	28675	28676	28677	28678	28679	28680	28681
345	28682	28683	28684	28685	28686	28687	28688	28689	28690	28691	28692	28693
346	28694	28695	28696	28697	28698	28699	28700	28701	28702	28703	28704	28705
347	28706	28707	28708	28709	28710	28711	28712	28713	28714	28715	28716	28717
348	28718	28719	28720	28721	28722	28723	28724	28725	28726	28727	28728	28729
349	28730	28731	28732	28733	28734	28735	28736	28737	28738	28739	28740	28741
350	28742	28743	28744	28745	28746	28747	28748	28749	28750	28751	28752	28753
351	28754	28755	28756	28757	28758	28759	28760	28761	28762	28763	28764	28765
352	28766	28767	28768	28769	28770	28771	28772	28773	28774	28775	28776	28777
353	28778	28779	28780	28781	28782	28783	28784	28785	28786	28787	28788	28789
354	28790	28791	28792	28793	28794	28795	28796	28797	28798	28799	28800	28801
355	28802	28803	28804	28805	28806	28807	28808	28809	28810	28811	28812	28813

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
356	28814	28815	28816	28817	28818	28819	28820	28821	28822	28823	28824	28825
357	28826	28827	28828	28829	28830	28831	28832	28833	28834	28835	28836	28837
358	28838	28839	28840	28841	28842	28843	28844	28845	28846	28847	28848	28849
359	28850	28851	28852	28853	28854	28855	28856	28857	28858	28859	28860	28861
360	28862	28863	28864	28865	28866	28867	28868	28869	28870	28871	28872	28873
361	28874	28875	28876	28877	28878	28879	28880	28881	28882	28883	28884	28885
362	28886	28887	28888	28889	28890	28891	28892	28893	28894	28895	28896	28897
363	28898	28899	28900	28901	28902	28903	28904	28905	28906	28907	28908	28909
364	28910	28911	28912	28913	28914	28915	28916	28917	28918	28919	28920	28921
365	28922	28923	28924	28925	28926	28927	28928	28929	28930	28931	28932	28933
366	28934	28935	28936	28937	28938	28939	28940	28941	28942	28943	28944	28945
367	28946	28947	28948	28949	28950	28951	28952	28953	28954	28955	28956	28957
368	28958	28959	28960	28961	28962	28963	28964	28965	28966	28967	28968	28969
369	28970	28971	28972	28973	28974	28975	28976	28977	28978	28979	28980	28981
370	28982	28983	28984	28985	28986	28987	28988	28989	28990	28991	28992	28993
371	28994	28995	28996	28997	28998	28999	29000	29001	29002	29003	29004	29005
372	29006	29007	29008	29009	29010	29011	29012	29013	29014	29015	29016	29017
373	29018	29019	29020	29021	29022	29023	29024	29025	29026	29027	29028	29029
374	29030	29031	29032	29033	29034	29035	29036	29037	29038	29039	29040	29041
375	29042	29043	29044	29045	29046	29047	29048	29049	29050	29051	29052	29053
376	29054	29055	29056	29057	29058	29059	29060	29061	29062	29063	29064	29065
377	29066	29067	29068	29069	29070	29071	29072	29073	29074	29075	29076	29077
378	29078	29079	29080	29081	29082	29083	29084	29085	29086	29087	29088	29089
379	29090	29091	29092	29093	29094	29095	29096	29097	29098	29099	29100	29101
380	29102	29103	29104	29105	29106	29107	29108	29109	29110	29111	29112	29113
381	29114	29115	29116	29117	29118	29119	29120	29121	29122	29123	29124	29125
382	29126	29127	29128	29129	29130	29131	29132	29133	29134	29135	29136	29137
383	29138	29139	29140	29141	29142	29143	29144	29145	29146	29147	29148	29149
384	29150	29151	29152	29153	29154	29155	29156	29157	29158	29159	29160	29161
385	29162	29163	29164	29165	29166	29167	29168	29169	29170	29171	29172	29173
386	29174	29175	29176	29177	29178	29179	29180	29181	29182	29183	29184	29185
387	29186	29187	29188	29189	29190	29191	29192	29193	29194	29195	29196	29197
388	29198	29199	29200	29201	29202	29203	29204	29205	29206	29207	29208	29209
389	29210	29211	29212	29213	29214	29215	29216	29217	29218	29219	29220	29221
390	29222	29223	29224	29225	29226	29227	29228	29229	29230	29231	29232	29233
391	29234	29235	29236	29237	29238	29239	29240	29241	29242	29243	29244	29245
392	29246	29247	29248	29249	29250	29251	29252	29253	29254	29255	29256	29257
393	29258	29259	29260	29261	29262	29263	29264	29265	29266	29267	29268	29269
394	29270	29271	29272	29273	29274	29275	29276	29277	29278	29279	29280	29281

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
395	29282	29283	29284	29285	29286	29287	29288	29289	29290	29291	29292	29293
396	29294	29295	29296	29297	29298	29299	29300	29301	29302	29303	29304	29305
397	29306	29307	29308	29309	29310	29311	29312	29313	29314	29315	29316	29317
398	29318	29319	29320	29321	29322	29323	29324	29325	29326	29327	29328	29329
399	29330	29331	29332	29333	29334	29335	29336	29337	29338	29339	29340	29341
400	29342	29343	29344	29345	29346	29347	29348	29349	29350	29351	29352	29353

Appendix 2.8 7-axis operation data memory address

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
1	29354	29355	29356	29357	29358	29359	29360	29361	29362	29363	29364	29365
2	29366	29367	29368	29369	29370	29371	29372	29373	29374	29375	29376	29377
3	29378	29379	29380	29381	29382	29383	29384	29385	29386	29387	29388	29389
4	29390	29391	29392	29393	29394	29395	29396	29397	29398	29399	29400	29401
5	29402	29403	29404	29405	29406	29407	29408	29409	29410	29411	29412	29413
6	29414	29415	29416	29417	29418	29419	29420	29421	29422	29423	29424	29425
7	29426	29427	29428	29429	29430	29431	29432	29433	29434	29435	29436	29437
8	29438	29439	29440	29441	29442	29443	29444	29445	29446	29447	29448	29449
9	29450	29451	29452	29453	29454	29455	29456	29457	29458	29459	29460	29461
10	29462	29463	29464	29465	29466	29467	29468	29469	29470	29471	29472	29473
11	29474	29475	29476	29477	29478	29479	29480	29481	29482	29483	29484	29485
12	29486	29487	29488	29489	29490	29491	29492	29493	29494	29495	29496	29497
13	29498	29499	29500	29501	29502	29503	29504	29505	29506	29507	29508	29509
14	29510	29511	29512	29513	29514	29515	29516	29517	29518	29519	29520	29521
15	29522	29523	29524	29525	29526	29527	29528	29529	29530	29531	29532	29533
16	29534	29535	29536	29537	29538	29539	29540	29541	29542	29543	29544	29545
17	29546	29547	29548	29549	29550	29551	29552	29553	29554	29555	29556	29557
18	29558	29559	29560	29561	29562	29563	29564	29565	29566	29567	29568	29569
19	29570	29571	29572	29573	29574	29575	29576	29577	29578	29579	29580	29581
20	29582	29583	29584	29585	29586	29587	29588	29589	29590	29591	29592	29593
21	29594	29595	29596	29597	29598	29599	29600	29601	29602	29603	29604	29605
22	29606	29607	29608	29609	29610	29611	29612	29613	29614	29615	29616	29617
23	29618	29619	29620	29621	29622	29623	29624	29625	29626	29627	29628	29629
24	29630	29631	29632	29633	29634	29635	29636	29637	29638	29639	29640	29641
25	29642	29643	29644	29645	29646	29647	29648	29649	29650	29651	29652	29653
26	29654	29655	29656	29657	29658	29659	29660	29661	29662	29663	29664	29665
27	29666	29667	29668	29669	29670	29671	29672	29673	29674	29675	29676	29677
28	29678	29679	29680	29681	29682	29683	29684	29685	29686	29687	29688	29689
29	29690	29691	29692	29693	29694	29695	29696	29697	29698	29699	29700	29701
30	29702	29703	29704	29705	29706	29707	29708	29709	29710	29711	29712	29713
31	29714	29715	29716	29717	29718	29719	29720	29721	29722	29723	29724	29725
32	29726	29727	29728	29729	29730	29731	29732	29733	29734	29735	29736	29737
33	29738	29739	29740	29741	29742	29743	29744	29745	29746	29747	29748	29749
34	29750	29751	29752	29753	29754	29755	29756	29757	29758	29759	29760	29761
35	29762	29763	29764	29765	29766	29767	29768	29769	29770	29771	29772	29773
36	29774	29775	29776	29777	29778	29779	29780	29781	29782	29783	29784	29785
37	29786	29787	29788	29789	29790	29791	29792	29793	29794	29795	29796	29797
38	29798	29799	29800	29801	29802	29803	29804	29805	29806	29807	29808	29809

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
39	29810	29811	29812	29813	29814	29815	29816	29817	29818	29819	29820	29821
40	29822	29823	29824	29825	29826	29827	29828	29829	29830	29831	29832	29833
41	29834	29835	29836	29837	29838	29839	29840	29841	29842	29843	29844	29845
42	29846	29847	29848	29849	29850	29851	29852	29853	29854	29855	29856	29857
43	29858	29859	29860	29861	29862	29863	29864	29865	29866	29867	29868	29869
44	29870	29871	29872	29873	29874	29875	29876	29877	29878	29879	29880	29881
45	29882	29883	29884	29885	29886	29887	29888	29889	29890	29891	29892	29893
46	29894	29895	29896	29897	29898	29899	29900	29901	29902	29903	29904	29905
47	29906	29907	29908	29909	29910	29911	29912	29913	29914	29915	29916	29917
48	29918	29919	29920	29921	29922	29923	29924	29925	29926	29927	29928	29929
49	29930	29931	29932	29933	29934	29935	29936	29937	29938	29939	29940	29941
50	29942	29943	29944	29945	29946	29947	29948	29949	29950	29951	29952	29953
51	29954	29955	29956	29957	29958	29959	29960	29961	29962	29963	29964	29965
52	29966	29967	29968	29969	29970	29971	29972	29973	29974	29975	29976	29977
53	29978	29979	29980	29981	29982	29983	29984	29985	29986	29987	29988	29989
54	29990	29991	29992	29993	29994	29995	29996	29997	29998	29999	30000	30001
55	30002	30003	30004	30005	30006	30007	30008	30009	30010	30011	30012	30013
56	30014	30015	30016	30017	30018	30019	30020	30021	30022	30023	30024	30025
57	30026	30027	30028	30029	30030	30031	30032	30033	30034	30035	30036	30037
58	30038	30039	30040	30041	30042	30043	30044	30045	30046	30047	30048	30049
59	30050	30051	30052	30053	30054	30055	30056	30057	30058	30059	30060	30061
60	30062	30063	30064	30065	30066	30067	30068	30069	30070	30071	30072	30073
61	30074	30075	30076	30077	30078	30079	30080	30081	30082	30083	30084	30085
62	30086	30087	30088	30089	30090	30091	30092	30093	30094	30095	30096	30097
63	30098	30099	30100	30101	30102	30103	30104	30105	30106	30107	30108	30109
64	30110	30111	30112	30113	30114	30115	30116	30117	30118	30119	30120	30121
65	30122	30123	30124	30125	30126	30127	30128	30129	30130	30131	30132	30133
66	30134	30135	30136	30137	30138	30139	30140	30141	30142	30143	30144	30145
67	30146	30147	30148	30149	30150	30151	30152	30153	30154	30155	30156	30157
68	30158	30159	30160	30161	30162	30163	30164	30165	30166	30167	30168	30169
69	30170	30171	30172	30173	30174	30175	30176	30177	30178	30179	30180	30181
70	30182	30183	30184	30185	30186	30187	30188	30189	30190	30191	30192	30193
71	30194	30195	30196	30197	30198	30199	30200	30201	30202	30203	30204	30205
72	30206	30207	30208	30209	30210	30211	30212	30213	30214	30215	30216	30217
73	30218	30219	30220	30221	30222	30223	30224	30225	30226	30227	30228	30229
74	30230	30231	30232	30233	30234	30235	30236	30237	30238	30239	30240	30241
75	30242	30243	30244	30245	30246	30247	30248	30249	30250	30251	30252	30253
76	30254	30255	30256	30257	30258	30259	30260	30261	30262	30263	30264	30265
77	30266	30267	30268	30269	30270	30271	30272	30273	30274	30275	30276	30277
78	30278	30279	30280	30281	30282	30283	30284	30285	30286	30287	30288	30289

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
79	30290	30291	30292	30293	30294	30295	30296	30297	30298	30299	30300	30301
80	30302	30303	30304	30305	30306	30307	30308	30309	30310	30311	30312	30313
81	30314	30315	30316	30317	30318	30319	30320	30321	30322	30323	30324	30325
82	30326	30327	30328	30329	30330	30331	30332	30333	30334	30335	30336	30337
83	30338	30339	30340	30341	30342	30343	30344	30345	30346	30347	30348	30349
84	30350	30351	30352	30353	30354	30355	30356	30357	30358	30359	30360	30361
85	30362	30363	30364	30365	30366	30367	30368	30369	30370	30371	30372	30373
86	30374	30375	30376	30377	30378	30379	30380	30381	30382	30383	30384	30385
87	30386	30387	30388	30389	30390	30391	30392	30393	30394	30395	30396	30397
88	30398	30399	30400	30401	30402	30403	30404	30405	30406	30407	30408	30409
89	30410	30411	30412	30413	30414	30415	30416	30417	30418	30419	30420	30421
90	30422	30423	30424	30425	30426	30427	30428	30429	30430	30431	30432	30433
91	30434	30435	30436	30437	30438	30439	30440	30441	30442	30443	30444	30445
92	30446	30447	30448	30449	30450	30451	30452	30453	30454	30455	30456	30457
93	30458	30459	30460	30461	30462	30463	30464	30465	30466	30467	30468	30469
94	30470	30471	30472	30473	30474	30475	30476	30477	30478	30479	30480	30481
95	30482	30483	30484	30485	30486	30487	30488	30489	30490	30491	30492	30493
96	30494	30495	30496	30497	30498	30499	30500	30501	30502	30503	30504	30505
97	30506	30507	30508	30509	30510	30511	30512	30513	30514	30515	30516	30517
98	30518	30519	30520	30521	30522	30523	30524	30525	30526	30527	30528	30529
99	30530	30531	30532	30533	30534	30535	30536	30537	30538	30539	30540	30541
100	30542	30543	30544	30545	30546	30547	30548	30549	30550	30551	30552	30553
101	30554	30555	30556	30557	30558	30559	30560	30561	30562	30563	30564	30565
102	30566	30567	30568	30569	30570	30571	30572	30573	30574	30575	30576	30577
103	30578	30579	30580	30581	30582	30583	30584	30585	30586	30587	30588	30589
104	30590	30591	30592	30593	30594	30595	30596	30597	30598	30599	30600	30601
105	30602	30603	30604	30605	30606	30607	30608	30609	30610	30611	30612	30613
106	30614	30615	30616	30617	30618	30619	30620	30621	30622	30623	30624	30625
107	30626	30627	30628	30629	30630	30631	30632	30633	30634	30635	30636	30637
108	30638	30639	30640	30641	30642	30643	30644	30645	30646	30647	30648	30649
109	30650	30651	30652	30653	30654	30655	30656	30657	30658	30659	30660	30661
110	30662	30663	30664	30665	30666	30667	30668	30669	30670	30671	30672	30673
111	30674	30675	30676	30677	30678	30679	30680	30681	30682	30683	30684	30685
112	30686	30687	30688	30689	30690	30691	30692	30693	30694	30695	30696	30697
113	30698	30699	30700	30701	30702	30703	30704	30705	30706	30707	30708	30709
114	30710	30711	30712	30713	30714	30715	30716	30717	30718	30719	30720	30721
115	30722	30723	30724	30725	30726	30727	30728	30729	30730	30731	30732	30733
116	30734	30735	30736	30737	30738	30739	30740	30741	30742	30743	30744	30745
117	30746	30747	30748	30749	30750	30751	30752	30753	30754	30755	30756	30757

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
118	30758	30759	30760	30761	30762	30763	30764	30765	30766	30767	30768	30769
119	30770	30771	30772	30773	30774	30775	30776	30777	30778	30779	30780	30781
120	30782	30783	30784	30785	30786	30787	30788	30789	30790	30791	30792	30793
121	30794	30795	30796	30797	30798	30799	30800	30801	30802	30803	30804	30805
122	30806	30807	30808	30809	30810	30811	30812	30813	30814	30815	30816	30817
123	30818	30819	30820	30821	30822	30823	30824	30825	30826	30827	30828	30829
124	30830	30831	30832	30833	30834	30835	30836	30837	30838	30839	30840	30841
125	30842	30843	30844	30845	30846	30847	30848	30849	30850	30851	30852	30853
126	30854	30855	30856	30857	30858	30859	30860	30861	30862	30863	30864	30865
127	30866	30867	30868	30869	30870	30871	30872	30873	30874	30875	30876	30877
128	30878	30879	30880	30881	30882	30883	30884	30885	30886	30887	30888	30889
129	30890	30891	30892	30893	30894	30895	30896	30897	30898	30899	30900	30901
130	30902	30903	30904	30905	30906	30907	30908	30909	30910	30911	30912	30913
131	30914	30915	30916	30917	30918	30919	30920	30921	30922	30923	30924	30925
132	30926	30927	30928	30929	30930	30931	30932	30933	30934	30935	30936	30937
133	30938	30939	30940	30941	30942	30943	30944	30945	30946	30947	30948	30949
134	30950	30951	30952	30953	30954	30955	30956	30957	30958	30959	30960	30961
135	30962	30963	30964	30965	30966	30967	30968	30969	30970	30971	30972	30973
136	30974	30975	30976	30977	30978	30979	30980	30981	30982	30983	30984	30985
137	30986	30987	30988	30989	30990	30991	30992	30993	30994	30995	30996	30997
138	30998	30999	31000	31001	31002	31003	31004	31005	31006	31007	31008	31009
139	31010	31011	31012	31013	31014	31015	31016	31017	31018	31019	31020	31021
140	31022	31023	31024	31025	31026	31027	31028	31029	31030	31031	31032	31033
141	31034	31035	31036	31037	31038	31039	31040	31041	31042	31043	31044	31045
142	31046	31047	31048	31049	31050	31051	31052	31053	31054	31055	31056	31057
143	31058	31059	31060	31061	31062	31063	31064	31065	31066	31067	31068	31069
144	31070	31071	31072	31073	31074	31075	31076	31077	31078	31079	31080	31081
145	31082	31083	31084	31085	31086	31087	31088	31089	31090	31091	31092	31093
146	31094	31095	31096	31097	31098	31099	31100	31101	31102	31103	31104	31105
147	31106	31107	31108	31109	31110	31111	31112	31113	31114	31115	31116	31117
148	31118	31119	31120	31121	31122	31123	31124	31125	31126	31127	31128	31129
149	31130	31131	31132	31133	31134	31135	31136	31137	31138	31139	31140	31141
150	31142	31143	31144	31145	31146	31147	31148	31149	31150	31151	31152	31153
151	31154	31155	31156	31157	31158	31159	31160	31161	31162	31163	31164	31165
152	31166	31167	31168	31169	31170	31171	31172	31173	31174	31175	31176	31177
153	31178	31179	31180	31181	31182	31183	31184	31185	31186	31187	31188	31189
154	31190	31191	31192	31193	31194	31195	31196	31197	31198	31199	31200	31201
155	31202	31203	31204	31205	31206	31207	31208	31209	31210	31211	31212	31213
156	31214	31215	31216	31217	31218	31219	31220	31221	31222	31223	31224	31225
157	31226	31227	31228	31229	31230	31231	31232	31233	31234	31235	31236	31237

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
158	31238	31239	31240	31241	31242	31243	31244	31245	31246	31247	31248	31249
159	31250	31251	31252	31253	31254	31255	31256	31257	31258	31259	31260	31261
160	31262	31263	31264	31265	31266	31267	31268	31269	31270	31271	31272	31273
161	31274	31275	31276	31277	31278	31279	31280	31281	31282	31283	31284	31285
162	31286	31287	31288	31289	31290	31291	31292	31293	31294	31295	31296	31297
163	31298	31299	31300	31301	31302	31303	31304	31305	31306	31307	31308	31309
164	31310	31311	31312	31313	31314	31315	31316	31317	31318	31319	31320	31321
165	31322	31323	31324	31325	31326	31327	31328	31329	31330	31331	31332	31333
166	31334	31335	31336	31337	31338	31339	31340	31341	31342	31343	31344	31345
167	31346	31347	31348	31349	31350	31351	31352	31353	31354	31355	31356	31357
168	31358	31359	31360	31361	31362	31363	31364	31365	31366	31367	31368	31369
169	31370	31371	31372	31373	31374	31375	31376	31377	31378	31379	31380	31381
170	31382	31383	31384	31385	31386	31387	31388	31389	31390	31391	31392	31393
171	31394	31395	31396	31397	31398	31399	31400	31401	31402	31403	31404	31405
172	31406	31407	31408	31409	31410	31411	31412	31413	31414	31415	31416	31417
173	31418	31419	31420	31421	31422	31423	31424	31425	31426	31427	31428	31429
174	31430	31431	31432	31433	31434	31435	31436	31437	31438	31439	31440	31441
175	31442	31443	31444	31445	31446	31447	31448	31449	31450	31451	31452	31453
176	31454	31455	31456	31457	31458	31459	31460	31461	31462	31463	31464	31465
177	31466	31467	31468	31469	31470	31471	31472	31473	31474	31475	31476	31477
178	31478	31479	31480	31481	31482	31483	31484	31485	31486	31487	31488	31489
179	31490	31491	31492	31493	31494	31495	31496	31497	31498	31499	31500	31501
180	31502	31503	31504	31505	31506	31507	31508	31509	31510	31511	31512	31513
181	31514	31515	31516	31517	31518	31519	31520	31521	31522	31523	31524	31525
182	31526	31527	31528	31529	31530	31531	31532	31533	31534	31535	31536	31537
183	31538	31539	31540	31541	31542	31543	31544	31545	31546	31547	31548	31549
184	31550	31551	31552	31553	31554	31555	31556	31557	31558	31559	31560	31561
185	31562	31563	31564	31565	31566	31567	31568	31569	31570	31571	31572	31573
186	31574	31575	31576	31577	31578	31579	31580	31581	31582	31583	31584	31585
187	31586	31587	31588	31589	31590	31591	31592	31593	31594	31595	31596	31597
188	31598	31599	31600	31601	31602	31603	31604	31605	31606	31607	31608	31609
189	31610	31611	31612	31613	31614	31615	31616	31617	31618	31619	31620	31621
190	31622	31623	31624	31625	31626	31627	31628	31629	31630	31631	31632	31633
191	31634	31635	31636	31637	31638	31639	31640	31641	31642	31643	31644	31645
192	31646	31647	31648	31649	31650	31651	31652	31653	31654	31655	31656	31657
193	31658	31659	31660	31661	31662	31663	31664	31665	31666	31667	31668	31669
194	31670	31671	31672	31673	31674	31675	31676	31677	31678	31679	31680	31681
195	31682	31683	31684	31685	31686	31687	31688	31689	31690	31691	31692	31693
196	31694	31695	31696	31697	31698	31699	31700	31701	31702	31703	31704	31705

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
197	31706	31707	31708	31709	31710	31711	31712	31713	31714	31715	31716	31717
198	31718	31719	31720	31721	31722	31723	31724	31725	31726	31727	31728	31729
199	31730	31731	31732	31733	31734	31735	31736	31737	31738	31739	31740	31741
200	31742	31743	31744	31745	31746	31747	31748	31749	31750	31751	31752	31753
201	31754	31755	31756	31757	31758	31759	31760	31761	31762	31763	31764	31765
202	31766	31767	31768	31769	31770	31771	31772	31773	31774	31775	31776	31777
203	31778	31779	31780	31781	31782	31783	31784	31785	31786	31787	31788	31789
204	31790	31791	31792	31793	31794	31795	31796	31797	31798	31799	31800	31801
205	31802	31803	31804	31805	31806	31807	31808	31809	31810	31811	31812	31813
206	31814	31815	31816	31817	31818	31819	31820	31821	31822	31823	31824	31825
207	31826	31827	31828	31829	31830	31831	31832	31833	31834	31835	31836	31837
208	31838	31839	31840	31841	31842	31843	31844	31845	31846	31847	31848	31849
209	31850	31851	31852	31853	31854	31855	31856	31857	31858	31859	31860	31861
210	31862	31863	31864	31865	31866	31867	31868	31869	31870	31871	31872	31873
211	31874	31875	31876	31877	31878	31879	31880	31881	31882	31883	31884	31885
212	31886	31887	31888	31889	31890	31891	31892	31893	31894	31895	31896	31897
213	31898	31899	31900	31901	31902	31903	31904	31905	31906	31907	31908	31909
214	31910	31911	31912	31913	31914	31915	31916	31917	31918	31919	31920	31921
215	31922	31923	31924	31925	31926	31927	31928	31929	31930	31931	31932	31933
216	31934	31935	31936	31937	31938	31939	31940	31941	31942	31943	31944	31945
217	31946	31947	31948	31949	31950	31951	31952	31953	31954	31955	31956	31957
218	31958	31959	31960	31961	31962	31963	31964	31965	31966	31967	31968	31969
219	31970	31971	31972	31973	31974	31975	31976	31977	31978	31979	31980	31981
220	31982	31983	31984	31985	31986	31987	31988	31989	31990	31991	31992	31993
221	31994	31995	31996	31997	31998	31999	32000	32001	32002	32003	32004	32005
222	32006	32007	32008	32009	32010	32011	32012	32013	32014	32015	32016	32017
223	32018	32019	32020	32021	32022	32023	32024	32025	32026	32027	32028	32029
224	32030	32031	32032	32033	32034	32035	32036	32037	32038	32039	32040	32041
225	32042	32043	32044	32045	32046	32047	32048	32049	32050	32051	32052	32053
226	32054	32055	32056	32057	32058	32059	32060	32061	32062	32063	32064	32065
227	32066	32067	32068	32069	32070	32071	32072	32073	32074	32075	32076	32077
228	32078	32079	32080	32081	32082	32083	32084	32085	32086	32087	32088	32089
229	32090	32091	32092	32093	32094	32095	32096	32097	32098	32099	32100	32101
230	32102	32103	32104	32105	32106	32107	32108	32109	32110	32111	32112	32113
231	32114	32115	32116	32117	32118	32119	32120	32121	32122	32123	32124	32125
232	32126	32127	32128	32129	32130	32131	32132	32133	32134	32135	32136	32137
233	32138	32139	32140	32141	32142	32143	32144	32145	32146	32147	32148	32149
234	32150	32151	32152	32153	32154	32155	32156	32157	32158	32159	32160	32161
235	32162	32163	32164	32165	32166	32167	32168	32169	32170	32171	32172	32173
236	32174	32175	32176	32177	32178	32179	32180	32181	32182	32183	32184	32185

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
237	32186	32187	32188	32189	32190	32191	32192	32193	32194	32195	32196	32197
238	32198	32199	32200	32201	32202	32203	32204	32205	32206	32207	32208	32209
239	32210	32211	32212	32213	32214	32215	32216	32217	32218	32219	32220	32221
240	32222	32223	32224	32225	32226	32227	32228	32229	32230	32231	32232	32233
241	32234	32235	32236	32237	32238	32239	32240	32241	32242	32243	32244	32245
242	32246	32247	32248	32249	32250	32251	32252	32253	32254	32255	32256	32257
243	32258	32259	32260	32261	32262	32263	32264	32265	32266	32267	32268	32269
244	32270	32271	32272	32273	32274	32275	32276	32277	32278	32279	32280	32281
245	32282	32283	32284	32285	32286	32287	32288	32289	32290	32291	32292	32293
246	32294	32295	32296	32297	32298	32299	32300	32301	32302	32303	32304	32305
247	32306	32307	32308	32309	32310	32311	32312	32313	32314	32315	32316	32317
248	32318	32319	32320	32321	32322	32323	32324	32325	32326	32327	32328	32329
249	32330	32331	32332	32333	32334	32335	32336	32337	32338	32339	32340	32341
250	32342	32343	32344	32345	32346	32347	32348	32349	32350	32351	32352	32353
251	32354	32355	32356	32357	32358	32359	32360	32361	32362	32363	32364	32365
252	32366	32367	32368	32369	32370	32371	32372	32373	32374	32375	32376	32377
253	32378	32379	32380	32381	32382	32383	32384	32385	32386	32387	32388	32389
254	32390	32391	32392	32393	32394	32395	32396	32397	32398	32399	32400	32401
255	32402	32403	32404	32405	32406	32407	32408	32409	32410	32411	32412	32413
256	32414	32415	32416	32417	32418	32419	32420	32421	32422	32423	32424	32425
257	32426	32427	32428	32429	32430	32431	32432	32433	32434	32435	32436	32437
258	32438	32439	32440	32441	32442	32443	32444	32445	32446	32447	32448	32449
259	32450	32451	32452	32453	32454	32455	32456	32457	32458	32459	32460	32461
260	32462	32463	32464	32465	32466	32467	32468	32469	32470	32471	32472	32473
261	32474	32475	32476	32477	32478	32479	32480	32481	32482	32483	32484	32485
262	32486	32487	32488	32489	32490	32491	32492	32493	32494	32495	32496	32497
263	32498	32499	32500	32501	32502	32503	32504	32505	32506	32507	32508	32509
264	32510	32511	32512	32513	32514	32515	32516	32517	32518	32519	32520	32521
265	32522	32523	32524	32525	32526	32527	32528	32529	32530	32531	32532	32533
266	32534	32535	32536	32537	32538	32539	32540	32541	32542	32543	32544	32545
267	32546	32547	32548	32549	32550	32551	32552	32553	32554	32555	32556	32557
268	32558	32559	32560	32561	32562	32563	32564	32565	32566	32567	32568	32569
269	32570	32571	32572	32573	32574	32575	32576	32577	32578	32579	32580	32581
270	32582	32583	32584	32585	32586	32587	32588	32589	32590	32591	32592	32593
271	32594	32595	32596	32597	32598	32599	32600	32601	32602	32603	32604	32605
272	32606	32607	32608	32609	32610	32611	32612	32613	32614	32615	32616	32617
273	32618	32619	32620	32621	32622	32623	32624	32625	32626	32627	32628	32629
274	32630	32631	32632	32633	32634	32635	32636	32637	32638	32639	32640	32641
275	32642	32643	32644	32645	32646	32647	32648	32649	32650	32651	32652	32653

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
276	32654	32655	32656	32657	32658	32659	32660	32661	32662	32663	32664	32665
277	32666	32667	32668	32669	32670	32671	32672	32673	32674	32675	32676	32677
278	32678	32679	32680	32681	32682	32683	32684	32685	32686	32687	32688	32689
279	32690	32691	32692	32693	32694	32695	32696	32697	32698	32699	32700	32701
280	32702	32703	32704	32705	32706	32707	32708	32709	32710	32711	32712	32713
281	32714	32715	32716	32717	32718	32719	32720	32721	32722	32723	32724	32725
282	32726	32727	32728	32729	32730	32731	32732	32733	32734	32735	32736	32737
283	32738	32739	32740	32741	32742	32743	32744	32745	32746	32747	32748	32749
284	32750	32751	32752	32753	32754	32755	32756	32757	32758	32759	32760	32761
285	32762	32763	32764	32765	32766	32767	32768	32769	32770	32771	32772	32773
286	32774	32775	32776	32777	32778	32779	32780	32781	32782	32783	32784	32785
287	32786	32787	32788	32789	32790	32791	32792	32793	32794	32795	32796	32797
288	32798	32799	32800	32801	32802	32803	32804	32805	32806	32807	32808	32809
289	32810	32811	32812	32813	32814	32815	32816	32817	32818	32819	32820	32821
290	32822	32823	32824	32825	32826	32827	32828	32829	32830	32831	32832	32833
291	32834	32835	32836	32837	32838	32839	32840	32841	32842	32843	32844	32845
292	32846	32847	32848	32849	32850	32851	32852	32853	32854	32855	32856	32857
293	32858	32859	32860	32861	32862	32863	32864	32865	32866	32867	32868	32869
294	32870	32871	32872	32873	32874	32875	32876	32877	32878	32879	32880	32881
295	32882	32883	32884	32885	32886	32887	32888	32889	32890	32891	32892	32893
296	32894	32895	32896	32897	32898	32899	32900	32901	32902	32903	32904	32905
297	32906	32907	32908	32909	32910	32911	32912	32913	32914	32915	32916	32917
298	32918	32919	32920	32921	32922	32923	32924	32925	32926	32927	32928	32929
299	32930	32931	32932	32933	32934	32935	32936	32937	32938	32939	32940	32941
300	32942	32943	32944	32945	32946	32947	32948	32949	32950	32951	32952	32953
301	32954	32955	32956	32957	32958	32959	32960	32961	32962	32963	32964	32965
302	32966	32967	32968	32969	32970	32971	32972	32973	32974	32975	32976	32977
303	32978	32979	32980	32981	32982	32983	32984	32985	32986	32987	32988	32989
304	32990	32991	32992	32993	32994	32995	32996	32997	32998	32999	33000	33001
305	33002	33003	33004	33005	33006	33007	33008	33009	33010	33011	33012	33013
306	33014	33015	33016	33017	33018	33019	33020	33021	33022	33023	33024	33025
307	33026	33027	33028	33029	33030	33031	33032	33033	33034	33035	33036	33037
308	33038	33039	33040	33041	33042	33043	33044	33045	33046	33047	33048	33049
309	33050	33051	33052	33053	33054	33055	33056	33057	33058	33059	33060	33061
310	33062	33063	33064	33065	33066	33067	33068	33069	33070	33071	33072	33073
311	33074	33075	33076	33077	33078	33079	33080	33081	33082	33083	33084	33085
312	33086	33087	33088	33089	33090	33091	33092	33093	33094	33095	33096	33097
313	33098	33099	33100	33101	33102	33103	33104	33105	33106	33107	33108	33109
314	33110	33111	33112	33113	33114	33115	33116	33117	33118	33119	33120	33121
315	33122	33123	33124	33125	33126	33127	33128	33129	33130	33131	33132	33133

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
316	33134	33135	33136	33137	33138	33139	33140	33141	33142	33143	33144	33145
317	33146	33147	33148	33149	33150	33151	33152	33153	33154	33155	33156	33157
318	33158	33159	33160	33161	33162	33163	33164	33165	33166	33167	33168	33169
319	33170	33171	33172	33173	33174	33175	33176	33177	33178	33179	33180	33181
320	33182	33183	33184	33185	33186	33187	33188	33189	33190	33191	33192	33193
321	33194	33195	33196	33197	33198	33199	33200	33201	33202	33203	33204	33205
322	33206	33207	33208	33209	33210	33211	33212	33213	33214	33215	33216	33217
323	33218	33219	33220	33221	33222	33223	33224	33225	33226	33227	33228	33229
324	33230	33231	33232	33233	33234	33235	33236	33237	33238	33239	33240	33241
325	33242	33243	33244	33245	33246	33247	33248	33249	33250	33251	33252	33253
326	33254	33255	33256	33257	33258	33259	33260	33261	33262	33263	33264	33265
327	33266	33267	33268	33269	33270	33271	33272	33273	33274	33275	33276	33277
328	33278	33279	33280	33281	33282	33283	33284	33285	33286	33287	33288	33289
329	33290	33291	33292	33293	33294	33295	33296	33297	33298	33299	33300	33301
330	33302	33303	33304	33305	33306	33307	33308	33309	33310	33311	33312	33313
331	33314	33315	33316	33317	33318	33319	33320	33321	33322	33323	33324	33325
332	33326	33327	33328	33329	33330	33331	33332	33333	33334	33335	33336	33337
333	33338	33339	33340	33341	33342	33343	33344	33345	33346	33347	33348	33349
334	33350	33351	33352	33353	33354	33355	33356	33357	33358	33359	33360	33361
335	33362	33363	33364	33365	33366	33367	33368	33369	33370	33371	33372	33373
336	33374	33375	33376	33377	33378	33379	33380	33381	33382	33383	33384	33385
337	33386	33387	33388	33389	33390	33391	33392	33393	33394	33395	33396	33397
338	33398	33399	33400	33401	33402	33403	33404	33405	33406	33407	33408	33409
339	33410	33411	33412	33413	33414	33415	33416	33417	33418	33419	33420	33421
340	33422	33423	33424	33425	33426	33427	33428	33429	33430	33431	33432	33433
341	33434	33435	33436	33437	33438	33439	33440	33441	33442	33443	33444	33445
342	33446	33447	33448	33449	33450	33451	33452	33453	33454	33455	33456	33457
343	33458	33459	33460	33461	33462	33463	33464	33465	33466	33467	33468	33469
344	33470	33471	33472	33473	33474	33475	33476	33477	33478	33479	33480	33481
345	33482	33483	33484	33485	33486	33487	33488	33489	33490	33491	33492	33493
346	33494	33495	33496	33497	33498	33499	33500	33501	33502	33503	33504	33505
347	33506	33507	33508	33509	33510	33511	33512	33513	33514	33515	33516	33517
348	33518	33519	33520	33521	33522	33523	33524	33525	33526	33527	33528	33529
349	33530	33531	33532	33533	33534	33535	33536	33537	33538	33539	33540	33541
350	33542	33543	33544	33545	33546	33547	33548	33549	33550	33551	33552	33553
351	33554	33555	33556	33557	33558	33559	33560	33561	33562	33563	33564	33565
352	33566	33567	33568	33569	33570	33571	33572	33573	33574	33575	33576	33577
353	33578	33579	33580	33581	33582	33583	33584	33585	33586	33587	33588	33589
354	33590	33591	33592	33593	33594	33595	33596	33597	33598	33599	33600	33601

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
355	33602	33603	33604	33605	33606	33607	33608	33609	33610	33611	33612	33613
356	33614	33615	33616	33617	33618	33619	33620	33621	33622	33623	33624	33625
357	33626	33627	33628	33629	33630	33631	33632	33633	33634	33635	33636	33637
358	33638	33639	33640	33641	33642	33643	33644	33645	33646	33647	33648	33649
359	33650	33651	33652	33653	33654	33655	33656	33657	33658	33659	33660	33661
360	33662	33663	33664	33665	33666	33667	33668	33669	33670	33671	33672	33673
361	33674	33675	33676	33677	33678	33679	33680	33681	33682	33683	33684	33685
362	33686	33687	33688	33689	33690	33691	33692	33693	33694	33695	33696	33697
363	33698	33699	33700	33701	33702	33703	33704	33705	33706	33707	33708	33709
364	33710	33711	33712	33713	33714	33715	33716	33717	33718	33719	33720	33721
365	33722	33723	33724	33725	33726	33727	33728	33729	33730	33731	33732	33733
366	33734	33735	33736	33737	33738	33739	33740	33741	33742	33743	33744	33745
367	33746	33747	33748	33749	33750	33751	33752	33753	33754	33755	33756	33757
368	33758	33759	33760	33761	33762	33763	33764	33765	33766	33767	33768	33769
369	33770	33771	33772	33773	33774	33775	33776	33777	33778	33779	33780	33781
370	33782	33783	33784	33785	33786	33787	33788	33789	33790	33791	33792	33793
371	33794	33795	33796	33797	33798	33799	33800	33801	33802	33803	33804	33805
372	33806	33807	33808	33809	33810	33811	33812	33813	33814	33815	33816	33817
373	33818	33819	33820	33821	33822	33823	33824	33825	33826	33827	33828	33829
374	33830	33831	33832	33833	33834	33835	33836	33837	33838	33839	33840	33841
375	33842	33843	33844	33845	33846	33847	33848	33849	33850	33851	33852	33853
376	33854	33855	33856	33857	33858	33859	33860	33861	33862	33863	33864	33865
377	33866	33867	33868	33869	33870	33871	33872	33873	33874	33875	33876	33877
378	33878	33879	33880	33881	33882	33883	33884	33885	33886	33887	33888	33889
379	33890	33891	33892	33893	33894	33895	33896	33897	33898	33899	33900	33901
380	33902	33903	33904	33905	33906	33907	33908	33909	33910	33911	33912	33913
381	33914	33915	33916	33917	33918	33919	33920	33921	33922	33923	33924	33925
382	33926	33927	33928	33929	33930	33931	33932	33933	33934	33935	33936	33937
383	33938	33939	33940	33941	33942	33943	33944	33945	33946	33947	33948	33949
384	33950	33951	33952	33953	33954	33955	33956	33957	33958	33959	33960	33961
385	33962	33963	33964	33965	33966	33967	33968	33969	33970	33971	33972	33973
386	33974	33975	33976	33977	33978	33979	33980	33981	33982	33983	33984	33985
387	33986	33987	33988	33989	33990	33991	33992	33993	33994	33995	33996	33997
388	33998	33999	34000	34001	34002	34003	34004	34005	34006	34007	34008	34009
389	34010	34011	34012	34013	34014	34015	34016	34017	34018	34019	34020	34021
390	34022	34023	34024	34025	34026	34027	34028	34029	34030	34031	34032	34033
391	34034	34035	34036	34037	34038	34039	34040	34041	34042	34043	34044	34045
392	34046	34047	34048	34049	34050	34051	34052	34053	34054	34055	34056	34057
393	34058	34059	34060	34061	34062	34063	34064	34065	34066	34067	34068	34069
394	34070	34071	34072	34073	34074	34075	34076	34077	34078	34079	34080	34081

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
395	34082	34083	34084	34085	34086	34087	34088	34089	34090	34091	34092	34093
396	34094	34095	34096	34097	34098	34099	34100	34101	34102	34103	34104	34105
397	34106	34107	34108	34109	34110	34111	34112	34113	34114	34115	34116	34117
398	34118	34119	34120	34121	34122	34123	34124	34125	34126	34127	34128	34129
399	34130	34131	34132	34133	34134	34135	34136	34137	34138	34139	34140	34141
400	34142	34143	34144	34145	34146	34147	34148	34149	34150	34151	34152	34153

Appendix 2.9 8-axis operation data memory address

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
1	34154	34155	34156	34157	34158	34159	34160	34161	34162	34163	34164	34165
2	34166	34167	34168	34169	34170	34171	34172	34173	34174	34175	34176	34177
3	34178	34179	34180	34181	34182	34183	34184	34185	34186	34187	34188	34189
4	34190	34191	34192	34193	34194	34195	34196	34197	34198	34199	34200	34201
5	34202	34203	34204	34205	34206	34207	34208	34209	34210	34211	34212	34213
6	34214	34215	34216	34217	34218	34219	34220	34221	34222	34223	34224	34225
7	34226	34227	34228	34229	34230	34231	34232	34233	34234	34235	34236	34237
8	34238	34239	34240	34241	34242	34243	34244	34245	34246	34247	34248	34249
9	34250	34251	34252	34253	34254	34255	34256	34257	34258	34259	34260	34261
10	34262	34263	34264	34265	34266	34267	34268	34269	34270	34271	34272	34273
11	34274	34275	34276	34277	34278	34279	34280	34281	34282	34283	34284	34285
12	34286	34287	34288	34289	34290	34291	34292	34293	34294	34295	34296	34297
13	34298	34299	34300	34301	34302	34303	34304	34305	34306	34307	34308	34309
14	34310	34311	34312	34313	34314	34315	34316	34317	34318	34319	34320	34321
15	34322	34323	34324	34325	34326	34327	34328	34329	34330	34331	34332	34333
16	34334	34335	34336	34337	34338	34339	34340	34341	34342	34343	34344	34345
17	34346	34347	34348	34349	34350	34351	34352	34353	34354	34355	34356	34357
18	34358	34359	34360	34361	34362	34363	34364	34365	34366	34367	34368	34369
19	34370	34371	34372	34373	34374	34375	34376	34377	34378	34379	34380	34381
20	34382	34383	34384	34385	34386	34387	34388	34389	34390	34391	34392	34393
21	34394	34395	34396	34397	34398	34399	34400	34401	34402	34403	34404	34405
22	34406	34407	34408	34409	34410	34411	34412	34413	34414	34415	34416	34417
23	34418	34419	34420	34421	34422	34423	34424	34425	34426	34427	34428	34429
24	34430	34431	34432	34433	34434	34435	34436	34437	34438	34439	34440	34441
25	34442	34443	34444	34445	34446	34447	34448	34449	34450	34451	34452	34453
26	34454	34455	34456	34457	34458	34459	34460	34461	34462	34463	34464	34465
27	34466	34467	34468	34469	34470	34471	34472	34473	34474	34475	34476	34477
28	34478	34479	34480	34481	34482	34483	34484	34485	34486	34487	34488	34489
29	34490	34491	34492	34493	34494	34495	34496	34497	34498	34499	34500	34501
30	34502	34503	34504	34505	34506	34507	34508	34509	34510	34511	34512	34513
31	34514	34515	34516	34517	34518	34519	34520	34521	34522	34523	34524	34525
32	34526	34527	34528	34529	34530	34531	34532	34533	34534	34535	34536	34537
33	34538	34539	34540	34541	34542	34543	34544	34545	34546	34547	34548	34549
34	34550	34551	34552	34553	34554	34555	34556	34557	34558	34559	34560	34561
35	34562	34563	34564	34565	34566	34567	34568	34569	34570	34571	34572	34573
36	34574	34575	34576	34577	34578	34579	34580	34581	34582	34583	34584	34585
37	34586	34587	34588	34589	34590	34591	34592	34593	34594	34595	34596	34597
38	34598	34599	34600	34601	34602	34603	34604	34605	34606	34607	34608	34609
39	34610	34611	34612	34613	34614	34615	34616	34617	34618	34619	34620	34621

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
40	34622	34623	34624	34625	34626	34627	34628	34629	34630	34631	34632	34633
41	34634	34635	34636	34637	34638	34639	34640	34641	34642	34643	34644	34645
42	34646	34647	34648	34649	34650	34651	34652	34653	34654	34655	34656	34657
43	34658	34659	34660	34661	34662	34663	34664	34665	34666	34667	34668	34669
44	34670	34671	34672	34673	34674	34675	34676	34677	34678	34679	34680	34681
45	34682	34683	34684	34685	34686	34687	34688	34689	34690	34691	34692	34693
46	34694	34695	34696	34697	34698	34699	34700	34701	34702	34703	34704	34705
47	34706	34707	34708	34709	34710	34711	34712	34713	34714	34715	34716	34717
48	34718	34719	34720	34721	34722	34723	34724	34725	34726	34727	34728	34729
49	34730	34731	34732	34733	34734	34735	34736	34737	34738	34739	34740	34741
50	34742	34743	34744	34745	34746	34747	34748	34749	34750	34751	34752	34753
51	34754	34755	34756	34757	34758	34759	34760	34761	34762	34763	34764	34765
52	34766	34767	34768	34769	34770	34771	34772	34773	34774	34775	34776	34777
53	34778	34779	34780	34781	34782	34783	34784	34785	34786	34787	34788	34789
54	34790	34791	34792	34793	34794	34795	34796	34797	34798	34799	34800	34801
55	34802	34803	34804	34805	34806	34807	34808	34809	34810	34811	34812	34813
56	34814	34815	34816	34817	34818	34819	34820	34821	34822	34823	34824	34825
57	34826	34827	34828	34829	34830	34831	34832	34833	34834	34835	34836	34837
58	34838	34839	34840	34841	34842	34843	34844	34845	34846	34847	34848	34849
59	34850	34851	34852	34853	34854	34855	34856	34857	34858	34859	34860	34861
60	34862	34863	34864	34865	34866	34867	34868	34869	34870	34871	34872	34873
61	34874	34875	34876	34877	34878	34879	34880	34881	34882	34883	34884	34885
62	34886	34887	34888	34889	34890	34891	34892	34893	34894	34895	34896	34897
63	34898	34899	34900	34901	34902	34903	34904	34905	34906	34907	34908	34909
64	34910	34911	34912	34913	34914	34915	34916	34917	34918	34919	34920	34921
65	34922	34923	34924	34925	34926	34927	34928	34929	34930	34931	34932	34933
66	34934	34935	34936	34937	34938	34939	34940	34941	34942	34943	34944	34945
67	34946	34947	34948	34949	34950	34951	34952	34953	34954	34955	34956	34957
68	34958	34959	34960	34961	34962	34963	34964	34965	34966	34967	34968	34969
69	34970	34971	34972	34973	34974	34975	34976	34977	34978	34979	34980	34981
70	34982	34983	34984	34985	34986	34987	34988	34989	34990	34991	34992	34993
71	34994	34995	34996	34997	34998	34999	35000	35001	35002	35003	35004	35005
72	35006	35007	35008	35009	35010	35011	35012	35013	35014	35015	35016	35017
73	35018	35019	35020	35021	35022	35023	35024	35025	35026	35027	35028	35029
74	35030	35031	35032	35033	35034	35035	35036	35037	35038	35039	35040	35041
75	35042	35043	35044	35045	35046	35047	35048	35049	35050	35051	35052	35053
76	35054	35055	35056	35057	35058	35059	35060	35061	35062	35063	35064	35065
77	35066	35067	35068	35069	35070	35071	35072	35073	35074	35075	35076	35077
78	35078	35079	35080	35081	35082	35083	35084	35085	35086	35087	35088	35089

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
79	35090	35091	35092	35093	35094	35095	35096	35097	35098	35099	35100	35101
80	35102	35103	35104	35105	35106	35107	35108	35109	35110	35111	35112	35113
81	35114	35115	35116	35117	35118	35119	35120	35121	35122	35123	35124	35125
82	35126	35127	35128	35129	35130	35131	35132	35133	35134	35135	35136	35137
83	35138	35139	35140	35141	35142	35143	35144	35145	35146	35147	35148	35149
84	35150	35151	35152	35153	35154	35155	35156	35157	35158	35159	35160	35161
85	35162	35163	35164	35165	35166	35167	35168	35169	35170	35171	35172	35173
86	35174	35175	35176	35177	35178	35179	35180	35181	35182	35183	35184	35185
87	35186	35187	35188	35189	35190	35191	35192	35193	35194	35195	35196	35197
88	35198	35199	35200	35201	35202	35203	35204	35205	35206	35207	35208	35209
89	35210	35211	35212	35213	35214	35215	35216	35217	35218	35219	35220	35221
90	35222	35223	35224	35225	35226	35227	35228	35229	35230	35231	35232	35233
91	35234	35235	35236	35237	35238	35239	35240	35241	35242	35243	35244	35245
92	35246	35247	35248	35249	35250	35251	35252	35253	35254	35255	35256	35257
93	35258	35259	35260	35261	35262	35263	35264	35265	35266	35267	35268	35269
94	35270	35271	35272	35273	35274	35275	35276	35277	35278	35279	35280	35281
95	35282	35283	35284	35285	35286	35287	35288	35289	35290	35291	35292	35293
96	35294	35295	35296	35297	35298	35299	35300	35301	35302	35303	35304	35305
97	35306	35307	35308	35309	35310	35311	35312	35313	35314	35315	35316	35317
98	35318	35319	35320	35321	35322	35323	35324	35325	35326	35327	35328	35329
99	35330	35331	35332	35333	35334	35335	35336	35337	35338	35339	35340	35341
100	35342	35343	35344	35345	35346	35347	35348	35349	35350	35351	35352	35353
101	35354	35355	35356	35357	35358	35359	35360	35361	35362	35363	35364	35365
102	35366	35367	35368	35369	35370	35371	35372	35373	35374	35375	35376	35377
103	35378	35379	35380	35381	35382	35383	35384	35385	35386	35387	35388	35389
104	35390	35391	35392	35393	35394	35395	35396	35397	35398	35399	35400	35401
105	35402	35403	35404	35405	35406	35407	35408	35409	35410	35411	35412	35413
106	35414	35415	35416	35417	35418	35419	35420	35421	35422	35423	35424	35425
107	35426	35427	35428	35429	35430	35431	35432	35433	35434	35435	35436	35437
108	35438	35439	35440	35441	35442	35443	35444	35445	35446	35447	35448	35449
109	35450	35451	35452	35453	35454	35455	35456	35457	35458	35459	35460	35461
110	35462	35463	35464	35465	35466	35467	35468	35469	35470	35471	35472	35473
111	35474	35475	35476	35477	35478	35479	35480	35481	35482	35483	35484	35485
112	35486	35487	35488	35489	35490	35491	35492	35493	35494	35495	35496	35497
113	35498	35499	35500	35501	35502	35503	35504	35505	35506	35507	35508	35509
114	35510	35511	35512	35513	35514	35515	35516	35517	35518	35519	35520	35521
115	35522	35523	35524	35525	35526	35527	35528	35529	35530	35531	35532	35533
116	35534	35535	35536	35537	35538	35539	35540	35541	35542	35543	35544	35545
117	35546	35547	35548	35549	35550	35551	35552	35553	35554	35555	35556	35557
118	35558	35559	35560	35561	35562	35563	35564	35565	35566	35567	35568	35569

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
119	35570	35571	35572	35573	35574	35575	35576	35577	35578	35579	35580	35581
120	35582	35583	35584	35585	35586	35587	35588	35589	35590	35591	35592	35593
121	35594	35595	35596	35597	35598	35599	35600	35601	35602	35603	35604	35605
122	35606	35607	35608	35609	35610	35611	35612	35613	35614	35615	35616	35617
123	35618	35619	35620	35621	35622	35623	35624	35625	35626	35627	35628	35629
124	35630	35631	35632	35633	35634	35635	35636	35637	35638	35639	35640	35641
125	35642	35643	35644	35645	35646	35647	35648	35649	35650	35651	35652	35653
126	35654	35655	35656	35657	35658	35659	35660	35661	35662	35663	35664	35665
127	35666	35667	35668	35669	35670	35671	35672	35673	35674	35675	35676	35677
128	35678	35679	35680	35681	35682	35683	35684	35685	35686	35687	35688	35689
129	35690	35691	35692	35693	35694	35695	35696	35697	35698	35699	35700	35701
130	35702	35703	35704	35705	35706	35707	35708	35709	35710	35711	35712	35713
131	35714	35715	35716	35717	35718	35719	35720	35721	35722	35723	35724	35725
132	35726	35727	35728	35729	35730	35731	35732	35733	35734	35735	35736	35737
133	35738	35739	35740	35741	35742	35743	35744	35745	35746	35747	35748	35749
134	35750	35751	35752	35753	35754	35755	35756	35757	35758	35759	35760	35761
135	35762	35763	35764	35765	35766	35767	35768	35769	35770	35771	35772	35773
136	35774	35775	35776	35777	35778	35779	35780	35781	35782	35783	35784	35785
137	35786	35787	35788	35789	35790	35791	35792	35793	35794	35795	35796	35797
138	35798	35799	35800	35801	35802	35803	35804	35805	35806	35807	35808	35809
139	35810	35811	35812	35813	35814	35815	35816	35817	35818	35819	35820	35821
140	35822	35823	35824	35825	35826	35827	35828	35829	35830	35831	35832	35833
141	35834	35835	35836	35837	35838	35839	35840	35841	35842	35843	35844	35845
142	35846	35847	35848	35849	35850	35851	35852	35853	35854	35855	35856	35857
143	35858	35859	35860	35861	35862	35863	35864	35865	35866	35867	35868	35869
144	35870	35871	35872	35873	35874	35875	35876	35877	35878	35879	35880	35881
145	35882	35883	35884	35885	35886	35887	35888	35889	35890	35891	35892	35893
146	35894	35895	35896	35897	35898	35899	35900	35901	35902	35903	35904	35905
147	35906	35907	35908	35909	35910	35911	35912	35913	35914	35915	35916	35917
148	35918	35919	35920	35921	35922	35923	35924	35925	35926	35927	35928	35929
149	35930	35931	35932	35933	35934	35935	35936	35937	35938	35939	35940	35941
150	35942	35943	35944	35945	35946	35947	35948	35949	35950	35951	35952	35953
151	35954	35955	35956	35957	35958	35959	35960	35961	35962	35963	35964	35965
152	35966	35967	35968	35969	35970	35971	35972	35973	35974	35975	35976	35977
153	35978	35979	35980	35981	35982	35983	35984	35985	35986	35987	35988	35989
154	35990	35991	35992	35993	35994	35995	35996	35997	35998	35999	36000	36001
155	36002	36003	36004	36005	36006	36007	36008	36009	36010	36011	36012	36013
156	36014	36015	36016	36017	36018	36019	36020	36021	36022	36023	36024	36025
157	36026	36027	36028	36029	36030	36031	36032	36033	36034	36035	36036	36037

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
158	36038	36039	36040	36041	36042	36043	36044	36045	36046	36047	36048	36049
159	36050	36051	36052	36053	36054	36055	36056	36057	36058	36059	36060	36061
160	36062	36063	36064	36065	36066	36067	36068	36069	36070	36071	36072	36073
161	36074	36075	36076	36077	36078	36079	36080	36081	36082	36083	36084	36085
162	36086	36087	36088	36089	36090	36091	36092	36093	36094	36095	36096	36097
163	36098	36099	36100	36101	36102	36103	36104	36105	36106	36107	36108	36109
164	36110	36111	36112	36113	36114	36115	36116	36117	36118	36119	36120	36121
165	36122	36123	36124	36125	36126	36127	36128	36129	36130	36131	36132	36133
166	36134	36135	36136	36137	36138	36139	36140	36141	36142	36143	36144	36145
167	36146	36147	36148	36149	36150	36151	36152	36153	36154	36155	36156	36157
168	36158	36159	36160	36161	36162	36163	36164	36165	36166	36167	36168	36169
169	36170	36171	36172	36173	36174	36175	36176	36177	36178	36179	36180	36181
170	36182	36183	36184	36185	36186	36187	36188	36189	36190	36191	36192	36193
171	36194	36195	36196	36197	36198	36199	36200	36201	36202	36203	36204	36205
172	36206	36207	36208	36209	36210	36211	36212	36213	36214	36215	36216	36217
173	36218	36219	36220	36221	36222	36223	36224	36225	36226	36227	36228	36229
174	36230	36231	36232	36233	36234	36235	36236	36237	36238	36239	36240	36241
175	36242	36243	36244	36245	36246	36247	36248	36249	36250	36251	36252	36253
176	36254	36255	36256	36257	36258	36259	36260	36261	36262	36263	36264	36265
177	36266	36267	36268	36269	36270	36271	36272	36273	36274	36275	36276	36277
178	36278	36279	36280	36281	36282	36283	36284	36285	36286	36287	36288	36289
179	36290	36291	36292	36293	36294	36295	36296	36297	36298	36299	36300	36301
180	36302	36303	36304	36305	36306	36307	36308	36309	36310	36311	36312	36313
181	36314	36315	36316	36317	36318	36319	36320	36321	36322	36323	36324	36325
182	36326	36327	36328	36329	36330	36331	36332	36333	36334	36335	36336	36337
183	36338	36339	36340	36341	36342	36343	36344	36345	36346	36347	36348	36349
184	36350	36351	36352	36353	36354	36355	36356	36357	36358	36359	36360	36361
185	36362	36363	36364	36365	36366	36367	36368	36369	36370	36371	36372	36373
186	36374	36375	36376	36377	36378	36379	36380	36381	36382	36383	36384	36385
187	36386	36387	36388	36389	36390	36391	36392	36393	36394	36395	36396	36397
188	36398	36399	36400	36401	36402	36403	36404	36405	36406	36407	36408	36409
189	36410	36411	36412	36413	36414	36415	36416	36417	36418	36419	36420	36421
190	36422	36423	36424	36425	36426	36427	36428	36429	36430	36431	36432	36433
191	36434	36435	36436	36437	36438	36439	36440	36441	36442	36443	36444	36445
192	36446	36447	36448	36449	36450	36451	36452	36453	36454	36455	36456	36457
193	36458	36459	36460	36461	36462	36463	36464	36465	36466	36467	36468	36469
194	36470	36471	36472	36473	36474	36475	36476	36477	36478	36479	36480	36481
195	36482	36483	36484	36485	36486	36487	36488	36489	36490	36491	36492	36493
196	36494	36495	36496	36497	36498	36499	36500	36501	36502	36503	36504	36505
197	36506	36507	36508	36509	36510	36511	36512	36513	36514	36515	36516	36517

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
198	36518	36519	36520	36521	36522	36523	36524	36525	36526	36527	36528	36529
199	36530	36531	36532	36533	36534	36535	36536	36537	36538	36539	36540	36541
200	36542	36543	36544	36545	36546	36547	36548	36549	36550	36551	36552	36553
201	36554	36555	36556	36557	36558	36559	36560	36561	36562	36563	36564	36565
202	36566	36567	36568	36569	36570	36571	36572	36573	36574	36575	36576	36577
203	36578	36579	36580	36581	36582	36583	36584	36585	36586	36587	36588	36589
204	36590	36591	36592	36593	36594	36595	36596	36597	36598	36599	36600	36601
205	36602	36603	36604	36605	36606	36607	36608	36609	36610	36611	36612	36613
206	36614	36615	36616	36617	36618	36619	36620	36621	36622	36623	36624	36625
207	36626	36627	36628	36629	36630	36631	36632	36633	36634	36635	36636	36637
208	36638	36639	36640	36641	36642	36643	36644	36645	36646	36647	36648	36649
209	36650	36651	36652	36653	36654	36655	36656	36657	36658	36659	36660	36661
210	36662	36663	36664	36665	36666	36667	36668	36669	36670	36671	36672	36673
211	36674	36675	36676	36677	36678	36679	36680	36681	36682	36683	36684	36685
212	36686	36687	36688	36689	36690	36691	36692	36693	36694	36695	36696	36697
213	36698	36699	36700	36701	36702	36703	36704	36705	36706	36707	36708	36709
214	36710	36711	36712	36713	36714	36715	36716	36717	36718	36719	36720	36721
215	36722	36723	36724	36725	36726	36727	36728	36729	36730	36731	36732	36733
216	36734	36735	36736	36737	36738	36739	36740	36741	36742	36743	36744	36745
217	36746	36747	36748	36749	36750	36751	36752	36753	36754	36755	36756	36757
218	36758	36759	36760	36761	36762	36763	36764	36765	36766	36767	36768	36769
219	36770	36771	36772	36773	36774	36775	36776	36777	36778	36779	36780	36781
220	36782	36783	36784	36785	36786	36787	36788	36789	36790	36791	36792	36793
221	36794	36795	36796	36797	36798	36799	36800	36801	36802	36803	36804	36805
222	36806	36807	36808	36809	36810	36811	36812	36813	36814	36815	36816	36817
223	36818	36819	36820	36821	36822	36823	36824	36825	36826	36827	36828	36829
224	36830	36831	36832	36833	36834	36835	36836	36837	36838	36839	36840	36841
225	36842	36843	36844	36845	36846	36847	36848	36849	36850	36851	36852	36853
226	36854	36855	36856	36857	36858	36859	36860	36861	36862	36863	36864	36865
227	36866	36867	36868	36869	36870	36871	36872	36873	36874	36875	36876	36877
228	36878	36879	36880	36881	36882	36883	36884	36885	36886	36887	36888	36889
229	36890	36891	36892	36893	36894	36895	36896	36897	36898	36899	36900	36901
230	36902	36903	36904	36905	36906	36907	36908	36909	36910	36911	36912	36913
231	36914	36915	36916	36917	36918	36919	36920	36921	36922	36923	36924	36925
232	36926	36927	36928	36929	36930	36931	36932	36933	36934	36935	36936	36937
233	36938	36939	36940	36941	36942	36943	36944	36945	36946	36947	36948	36949
234	36950	36951	36952	36953	36954	36955	36956	36957	36958	36959	36960	36961
235	36962	36963	36964	36965	36966	36967	36968	36969	36970	36971	36972	36973
236	36974	36975	36976	36977	36978	36979	36980	36981	36982	36983	36984	36985

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
237	36986	36987	36988	36989	36990	36991	36992	36993	36994	36995	36996	36997
238	36998	36999	37000	37001	37002	37003	37004	37005	37006	37007	37008	37009
239	37010	37011	37012	37013	37014	37015	37016	37017	37018	37019	37020	37021
240	37022	37023	37024	37025	37026	37027	37028	37029	37030	37031	37032	37033
241	37034	37035	37036	37037	37038	37039	37040	37041	37042	37043	37044	37045
242	37046	37047	37048	37049	37050	37051	37052	37053	37054	37055	37056	37057
243	37058	37059	37060	37061	37062	37063	37064	37065	37066	37067	37068	37069
244	37070	37071	37072	37073	37074	37075	37076	37077	37078	37079	37080	37081
245	37082	37083	37084	37085	37086	37087	37088	37089	37090	37091	37092	37093
246	37094	37095	37096	37097	37098	37099	37100	37101	37102	37103	37104	37105
247	37106	37107	37108	37109	37110	37111	37112	37113	37114	37115	37116	37117
248	37118	37119	37120	37121	37122	37123	37124	37125	37126	37127	37128	37129
249	37130	37131	37132	37133	37134	37135	37136	37137	37138	37139	37140	37141
250	37142	37143	37144	37145	37146	37147	37148	37149	37150	37151	37152	37153
251	37154	37155	37156	37157	37158	37159	37160	37161	37162	37163	37164	37165
252	37166	37167	37168	37169	37170	37171	37172	37173	37174	37175	37176	37177
253	37178	37179	37180	37181	37182	37183	37184	37185	37186	37187	37188	37189
254	37190	37191	37192	37193	37194	37195	37196	37197	37198	37199	37200	37201
255	37202	37203	37204	37205	37206	37207	37208	37209	37210	37211	37212	37213
256	37214	37215	37216	37217	37218	37219	37220	37221	37222	37223	37224	37225
257	37226	37227	37228	37229	37230	37231	37232	37233	37234	37235	37236	37237
258	37238	37239	37240	37241	37242	37243	37244	37245	37246	37247	37248	37249
259	37250	37251	37252	37253	37254	37255	37256	37257	37258	37259	37260	37261
260	37262	37263	37264	37265	37266	37267	37268	37269	37270	37271	37272	37273
261	37274	37275	37276	37277	37278	37279	37280	37281	37282	37283	37284	37285
262	37286	37287	37288	37289	37290	37291	37292	37293	37294	37295	37296	37297
263	37298	37299	37300	37301	37302	37303	37304	37305	37306	37307	37308	37309
264	37310	37311	37312	37313	37314	37315	37316	37317	37318	37319	37320	37321
265	37322	37323	37324	37325	37326	37327	37328	37329	37330	37331	37332	37333
266	37334	37335	37336	37337	37338	37339	37340	37341	37342	37343	37344	37345
267	37346	37347	37348	37349	37350	37351	37352	37353	37354	37355	37356	37357
268	37358	37359	37360	37361	37362	37363	37364	37365	37366	37367	37368	37369
269	37370	37371	37372	37373	37374	37375	37376	37377	37378	37379	37380	37381
270	37382	37383	37384	37385	37386	37387	37388	37389	37390	37391	37392	37393
271	37394	37395	37396	37397	37398	37399	37400	37401	37402	37403	37404	37405
272	37406	37407	37408	37409	37410	37411	37412	37413	37414	37415	37416	37417
273	37418	37419	37420	37421	37422	37423	37424	37425	37426	37427	37428	37429
274	37430	37431	37432	37433	37434	37435	37436	37437	37438	37439	37440	37441
275	37442	37443	37444	37445	37446	37447	37448	37449	37450	37451	37452	37453
276	37454	37455	37456	37457	37458	37459	37460	37461	37462	37463	37464	37465

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
277	37466	37467	37468	37469	37470	37471	37472	37473	37474	37475	37476	37477
278	37478	37479	37480	37481	37482	37483	37484	37485	37486	37487	37488	37489
279	37490	37491	37492	37493	37494	37495	37496	37497	37498	37499	37500	37501
280	37502	37503	37504	37505	37506	37507	37508	37509	37510	37511	37512	37513
281	37514	37515	37516	37517	37518	37519	37520	37521	37522	37523	37524	37525
282	37526	37527	37528	37529	37530	37531	37532	37533	37534	37535	37536	37537
283	37538	37539	37540	37541	37542	37543	37544	37545	37546	37547	37548	37549
284	37550	37551	37552	37553	37554	37555	37556	37557	37558	37559	37560	37561
285	37562	37563	37564	37565	37566	37567	37568	37569	37570	37571	37572	37573
286	37574	37575	37576	37577	37578	37579	37580	37581	37582	37583	37584	37585
287	37586	37587	37588	37589	37590	37591	37592	37593	37594	37595	37596	37597
288	37598	37599	37600	37601	37602	37603	37604	37605	37606	37607	37608	37609
289	37610	37611	37612	37613	37614	37615	37616	37617	37618	37619	37620	37621
290	37622	37623	37624	37625	37626	37627	37628	37629	37630	37631	37632	37633
291	37634	37635	37636	37637	37638	37639	37640	37641	37642	37643	37644	37645
292	37646	37647	37648	37649	37650	37651	37652	37653	37654	37655	37656	37657
293	37658	37659	37660	37661	37662	37663	37664	37665	37666	37667	37668	37669
294	37670	37671	37672	37673	37674	37675	37676	37677	37678	37679	37680	37681
295	37682	37683	37684	37685	37686	37687	37688	37689	37690	37691	37692	37693
296	37694	37695	37696	37697	37698	37699	37700	37701	37702	37703	37704	37705
297	37706	37707	37708	37709	37710	37711	37712	37713	37714	37715	37716	37717
298	37718	37719	37720	37721	37722	37723	37724	37725	37726	37727	37728	37729
299	37730	37731	37732	37733	37734	37735	37736	37737	37738	37739	37740	37741
300	37742	37743	37744	37745	37746	37747	37748	37749	37750	37751	37752	37753
301	37754	37755	37756	37757	37758	37759	37760	37761	37762	37763	37764	37765
302	37766	37767	37768	37769	37770	37771	37772	37773	37774	37775	37776	37777
303	37778	37779	37780	37781	37782	37783	37784	37785	37786	37787	37788	37789
304	37790	37791	37792	37793	37794	37795	37796	37797	37798	37799	37800	37801
305	37802	37803	37804	37805	37806	37807	37808	37809	37810	37811	37812	37813
306	37814	37815	37816	37817	37818	37819	37820	37821	37822	37823	37824	37825
307	37826	37827	37828	37829	37830	37831	37832	37833	37834	37835	37836	37837
308	37838	37839	37840	37841	37842	37843	37844	37845	37846	37847	37848	37849
309	37850	37851	37852	37853	37854	37855	37856	37857	37858	37859	37860	37861
310	37862	37863	37864	37865	37866	37867	37868	37869	37870	37871	37872	37873
311	37874	37875	37876	37877	37878	37879	37880	37881	37882	37883	37884	37885
312	37886	37887	37888	37889	37890	37891	37892	37893	37894	37895	37896	37897
313	37898	37899	37900	37901	37902	37903	37904	37905	37906	37907	37908	37909
314	37910	37911	37912	37913	37914	37915	37916	37917	37918	37919	37920	37921
315	37922	37923	37924	37925	37926	37927	37928	37929	37930	37931	37932	37933

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
316	37934	37935	37936	37937	37938	37939	37940	37941	37942	37943	37944	37945
317	37946	37947	37948	37949	37950	37951	37952	37953	37954	37955	37956	37957
318	37958	37959	37960	37961	37962	37963	37964	37965	37966	37967	37968	37969
319	37970	37971	37972	37973	37974	37975	37976	37977	37978	37979	37980	37981
320	37982	37983	37984	37985	37986	37987	37988	37989	37990	37991	37992	37993
321	37994	37995	37996	37997	37998	37999	38000	38001	38002	38003	38004	38005
322	38006	38007	38008	38009	38010	38011	38012	38013	38014	38015	38016	38017
323	38018	38019	38020	38021	38022	38023	38024	38025	38026	38027	38028	38029
324	38030	38031	38032	38033	38034	38035	38036	38037	38038	38039	38040	38041
325	38042	38043	38044	38045	38046	38047	38048	38049	38050	38051	38052	38053
326	38054	38055	38056	38057	38058	38059	38060	38061	38062	38063	38064	38065
327	38066	38067	38068	38069	38070	38071	38072	38073	38074	38075	38076	38077
328	38078	38079	38080	38081	38082	38083	38084	38085	38086	38087	38088	38089
329	38090	38091	38092	38093	38094	38095	38096	38097	38098	38099	38100	38101
330	38102	38103	38104	38105	38106	38107	38108	38109	38110	38111	38112	38113
331	38114	38115	38116	38117	38118	38119	38120	38121	38122	38123	38124	38125
332	38126	38127	38128	38129	38130	38131	38132	38133	38134	38135	38136	38137
333	38138	38139	38140	38141	38142	38143	38144	38145	38146	38147	38148	38149
334	38150	38151	38152	38153	38154	38155	38156	38157	38158	38159	38160	38161
335	38162	38163	38164	38165	38166	38167	38168	38169	38170	38171	38172	38173
336	38174	38175	38176	38177	38178	38179	38180	38181	38182	38183	38184	38185
337	38186	38187	38188	38189	38190	38191	38192	38193	38194	38195	38196	38197
338	38198	38199	38200	38201	38202	38203	38204	38205	38206	38207	38208	38209
339	38210	38211	38212	38213	38214	38215	38216	38217	38218	38219	38220	38221
340	38222	38223	38224	38225	38226	38227	38228	38229	38230	38231	38232	38233
341	38234	38235	38236	38237	38238	38239	38240	38241	38242	38243	38244	38245
342	38246	38247	38248	38249	38250	38251	38252	38253	38254	38255	38256	38257
343	38258	38259	38260	38261	38262	38263	38264	38265	38266	38267	38268	38269
344	38270	38271	38272	38273	38274	38275	38276	38277	38278	38279	38280	38281
345	38282	38283	38284	38285	38286	38287	38288	38289	38290	38291	38292	38293
346	38294	38295	38296	38297	38298	38299	38300	38301	38302	38303	38304	38305
347	38306	38307	38308	38309	38310	38311	38312	38313	38314	38315	38316	38317
348	38318	38319	38320	38321	38322	38323	38324	38325	38326	38327	38328	38329
349	38330	38331	38332	38333	38334	38335	38336	38337	38338	38339	38340	38341
350	38342	38343	38344	38345	38346	38347	38348	38349	38350	38351	38352	38353
351	38354	38355	38356	38357	38358	38359	38360	38361	38362	38363	38364	38365
352	38366	38367	38368	38369	38370	38371	38372	38373	38374	38375	38376	38377
353	38378	38379	38380	38381	38382	38383	38384	38385	38386	38387	38388	38389
354	38390	38391	38392	38393	38394	38395	38396	38397	38398	38399	38400	38401
355	38402	38403	38404	38405	38406	38407	38408	38409	38410	38411	38412	38413

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
356	38414	38415	38416	38417	38418	38419	38420	38421	38422	38423	38424	38425
357	38426	38427	38428	38429	38430	38431	38432	38433	38434	38435	38436	38437
358	38438	38439	38440	38441	38442	38443	38444	38445	38446	38447	38448	38449
359	38450	38451	38452	38453	38454	38455	38456	38457	38458	38459	38460	38461
360	38462	38463	38464	38465	38466	38467	38468	38469	38470	38471	38472	38473
361	38474	38475	38476	38477	38478	38479	38480	38481	38482	38483	38484	38485
362	38486	38487	38488	38489	38490	38491	38492	38493	38494	38495	38496	38497
363	38498	38499	38500	38501	38502	38503	38504	38505	38506	38507	38508	38509
364	38510	38511	38512	38513	38514	38515	38516	38517	38518	38519	38520	38521
365	38522	38523	38524	38525	38526	38527	38528	38529	38530	38531	38532	38533
366	38534	38535	38536	38537	38538	38539	38540	38541	38542	38543	38544	38545
367	38546	38547	38548	38549	38550	38551	38552	38553	38554	38555	38556	38557
368	38558	38559	38560	38561	38562	38563	38564	38565	38566	38567	38568	38569
369	38570	38571	38572	38573	38574	38575	38576	38577	38578	38579	38580	38581
370	38582	38583	38584	38585	38586	38587	38588	38589	38590	38591	38592	38593
371	38594	38595	38596	38597	38598	38599	38600	38601	38602	38603	38604	38605
372	38606	38607	38608	38609	38610	38611	38612	38613	38614	38615	38616	38617
373	38618	38619	38620	38621	38622	38623	38624	38625	38626	38627	38628	38629
374	38630	38631	38632	38633	38634	38635	38636	38637	38638	38639	38640	38641
375	38642	38643	38644	38645	38646	38647	38648	38649	38650	38651	38652	38653
376	38654	38655	38656	38657	38658	38659	38660	38661	38662	38663	38664	38665
377	38666	38667	38668	38669	38670	38671	38672	38673	38674	38675	38676	38677
378	38678	38679	38680	38681	38682	38683	38684	38685	38686	38687	38688	38689
379	38690	38691	38692	38693	38694	38695	38696	38697	38698	38699	38700	38701
380	38702	38703	38704	38705	38706	38707	38708	38709	38710	38711	38712	38713
381	38714	38715	38716	38717	38718	38719	38720	38721	38722	38723	38724	38725
382	38726	38727	38728	38729	38730	38731	38732	38733	38734	38735	38736	38737
383	38738	38739	38740	38741	38742	38743	38744	38745	38746	38747	38748	38749
384	38750	38751	38752	38753	38754	38755	38756	38757	38758	38759	38760	38761
385	38762	38763	38764	38765	38766	38767	38768	38769	38770	38771	38772	38773
386	38774	38775	38776	38777	38778	38779	38780	38781	38782	38783	38784	38785
387	38786	38787	38788	38789	38790	38791	38792	38793	38794	38795	38796	38797
388	38798	38799	38800	38801	38802	38803	38804	38805	38806	38807	38808	38809
389	38810	38811	38812	38813	38814	38815	38816	38817	38818	38819	38820	38821
390	38822	38823	38824	38825	38826	38827	38828	38829	38830	38831	38832	38833
391	38834	38835	38836	38837	38838	38839	38840	38841	38842	38843	38844	38845
392	38846	38847	38848	38849	38850	38851	38852	38853	38854	38855	38856	38857
393	38858	38859	38860	38861	38862	38863	38864	38865	38866	38867	38868	38869
394	38870	38871	38872	38873	38874	38875	38876	38877	38878	38879	38880	38881

Step	Target position		Cir. int. auxiliary point		Operation speed		Dwell time	M code	Sub. Axis setting	Helical int.	Circular int. turns	Control word
	Low	High	Low	High	Low	High						
395	38882	38883	38884	38885	38886	38887	38888	38889	38890	38891	38892	38893
396	38894	38895	38896	38897	38898	38899	38900	38901	38902	38903	38904	38905
397	38906	38907	38908	38909	38910	38911	38912	38913	38914	38915	38916	38917
398	38918	38919	38920	38921	38922	38923	38924	38925	38926	38927	38928	38929
399	38930	38931	38932	38933	38934	38935	38936	38937	38938	38939	38940	38941
400	38942	38943	38944	38945	38946	38947	38948	38949	38950	38951	38952	38953

(1) Control word

Bit position	Contents
Coordinate (bit 0)	0: ABS, 1: INC
Control method (bit 1~3)	0: single axis position control, 1: single axis speed control, 2: single axis FEED control, 3: Linear interpolation, 4: Circular interpolation
Operation method (bit 4)	0: Single, 1: Repeat
Operation pattern (bit 5~6)	0: End, 1: Keep, 2: Continuous
Arc size (bit 7)	0: Arc<180, 1: Arc>=180
Acc. No. (bit 8~9)	0 ~ 3
Dec. No. (bit 10~11)	0 ~ 3
Circular interpolation mode (bit 12~13)	0: Middle point, 1: Center point, 2: Radius
Circular interpolation direction (bit 14)	0: CW, 1: CCW

Appendix 2.10 CAM data memory address

Item		Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
Main axis travel distance per rotation		38954	43184	47414	51644	55874	60104	64334	68564
Main axis pulse per rotation		38956	43186	47416	51646	55876	60106	64336	68566
Sub axis travel distance per rotation		38958	43188	47418	51648	55878	60108	64338	68568
Sub axis pulse per rotation		38960	43190	47420	51650	55880	60110	64340	68570
CAM profile data count (WORD)		38962	43192	47422	51652	55882	60112	64342	68572
Parameter and control mode (WORD) Bit 0~1 : main axis unit Bit 2~3 : sub axis unit Bit 8 : control method (0:Repeat,1:Increse)		38963	43193	47423	51653	55883	60113	64343	68573
CAM block data 1	Main axis end pos.	38964	43194	47424	51654	55884	60114	64344	68574
	Sub axis end pos.	38966	43196	47426	51656	55886	60116	64346	68576
	CAM Curve	38968	43198	47428	51658	55888	60118	64348	68578
CAM block data 2	Main axis end pos.	38970	43200	47430	51660	55890	60120	64350	68580
	Sub axis end pos.	38972	43202	47432	51662	55892	60122	64352	68582
	CAM Curve	38974	43204	47434	51664	55894	60124	64354	68584
CAM block data 3	Main axis end pos.	38976	43206	47436	51666	55896	60126	64356	68586
	Sub axis end pos.	38978	43208	47438	51668	55898	60128	64358	68588
	CAM Curve	38980	43210	47440	51670	55900	60130	64360	68590
CAM block data 4	Main axis end pos.	38982	43212	47442	51672	55902	60132	64362	68592
	Sub axis end pos.	38984	43214	47444	51674	55904	60134	64364	68594
	CAM Curve	38986	43216	47446	51676	55906	60136	64366	68596
CAM block data 5	Main axis end pos.	38988	43218	47448	51678	55908	60138	64368	68598
	Sub axis end pos.	38990	43220	47450	51680	55910	60140	64370	68600
	CAM Curve	38992	43222	47452	51682	55912	60142	64372	68602
CAM block data 6	Main axis end pos.	38994	43224	47454	51684	55914	60144	64374	68604
	Sub axis end pos.	38996	43226	47456	51686	55916	60146	64376	68606
	CAM Curve	38998	43228	47458	51688	55918	60148	64378	68608
CAM block data 7	Main axis end pos.	39000	43230	47460	51690	55920	60150	64380	68610
	Sub axis end pos.	39002	43232	47462	51692	55922	60152	64382	68612

Item		Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
	CAM Curve	39004	43234	47464	51694	55924	60154	64384	68614
CAM block data 8	Main axis end pos.	39006	43236	47466	51696	55926	60156	64386	68616
	Sub axis end pos.	39008	43238	47468	51698	55928	60158	64388	68618
	CAM Curve	39010	43240	47470	51700	55930	60160	64390	68620
CAM block data 9	Main axis end pos.	39012	43242	47472	51702	55932	60162	64392	68622
	Sub axis end pos.	39014	43244	47474	51704	55934	60164	64394	68624
	CAM Curve	39016	43246	47476	51706	55936	60166	64396	68626
CAM block data 10	Main axis end pos.	39018	43248	47478	51708	55938	60168	64398	68628
	Sub axis end pos.	39020	43250	47480	51710	55940	60170	64400	68630
	CAM Curve	39022	43252	47482	51712	55942	60172	64402	68632
CAM block data 11	Main axis end pos.	39024	43254	47484	51714	55944	60174	64404	68634
	Sub axis end pos.	39026	43256	47486	51716	55946	60176	64406	68636
	CAM Curve	39028	43258	47488	51718	55948	60178	64408	68638
CAM block data 12	Main axis end pos.	39030	43260	47490	51720	55950	60180	64410	68640
	Sub axis end pos.	39032	43262	47492	51722	55952	60182	64412	68642
	CAM Curve	39034	43264	47494	51724	55954	60184	64414	68644
CAM block data 13	Main axis end pos.	39036	43266	47496	51726	55956	60186	64416	68646
	Sub axis end pos.	39038	43268	47498	51728	55958	60188	64418	68648
	CAM Curve	39040	43270	47500	51730	55960	60190	64420	68650
CAM block data 14	Main axis end pos.	39042	43272	47502	51732	55962	60192	64422	68652
	Sub axis end pos.	39044	43274	47504	51734	55964	60194	64424	68654
	CAM Curve	39046	43276	47506	51736	55966	60196	64426	68656
CAM block data 15	Main axis end pos.	39048	43278	47508	51738	55968	60198	64428	68658
	Sub axis end pos.	39050	43280	47510	51740	55970	60200	64430	68660
	CAM Curve	39052	43282	47512	51742	55972	60202	64432	68662
CAM block data 16	Main axis end pos.	39054	43284	47514	51744	55974	60204	64434	68664
	Sub axis end pos.	39056	43286	47516	51746	55976	60206	64436	68666
	CAM Curve	39058	43288	47518	51748	55978	60208	64438	68668

Item		Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM block data 17	Main axis end pos.	39060	43290	47520	51750	55980	60210	64440	68670
	Sub axis end pos.	39062	43292	47522	51752	55982	60212	64442	68672
	CAM Curve	39064	43294	47524	51754	55984	60214	64444	68674
CAM block data 18	Main axis end pos.	39066	43296	47526	51756	55986	60216	64446	68676
	Sub axis end pos.	39068	43298	47528	51758	55988	60218	64448	68678
	CAM Curve	39070	43300	47530	51760	55990	60220	64450	68680
CAM block data 19	Main axis end pos.	39072	43302	47532	51762	55992	60222	64452	68682
	Sub axis end pos.	39074	43304	47534	51764	55994	60224	64454	68684
	CAM Curve	39076	43306	47536	51766	55996	60226	64456	68686
CAM block data 20	Main axis end pos.	39078	43308	47538	51768	55998	60228	64458	68688
	Sub axis end pos.	39080	43310	47540	51770	56000	60230	64460	68690
	CAM Curve	39082	43312	47542	51772	56002	60232	64462	68692
Point unit		39084	43314	47544	51774	56004	60234	64464	68694
Main axis end position		39086	43316	47546	51776	56006	60236	64466	68696
CAM Data[0] (REAL)		39088	43318	47548	51778	56008	60238	64468	68698
CAM Data[1] (REAL)		39090	43320	47550	51780	56010	60240	64470	68700
CAM Data[2] (REAL)		39092	43322	47552	51782	56012	60242	64472	68702
CAM Data[3] (REAL)		39094	43324	47554	51784	56014	60244	64474	68704
CAM Data[4] (REAL)		39096	43326	47556	51786	56016	60246	64476	68706
CAM Data[5] (REAL)		39098	43328	47558	51788	56018	60248	64478	68708
CAM Data[6] (REAL)		39100	43330	47560	51790	56020	60250	64480	68710
CAM Data[7] (REAL)		39102	43332	47562	51792	56022	60252	64482	68712
CAM Data[8] (REAL)		39104	43334	47564	51794	56024	60254	64484	68714
CAM Data[9] (REAL)		39106	43336	47566	51796	56026	60256	64486	68716
CAM Data[10] (REAL)		39108	43338	47568	51798	56028	60258	64488	68718
CAM Data[11] (REAL)		39110	43340	47570	51800	56030	60260	64490	68720
CAM Data[12] (REAL)		39112	43342	47572	51802	56032	60262	64492	68722
CAM Data[13] (REAL)		39114	43344	47574	51804	56034	60264	64494	68724
CAM Data[14] (REAL)		39116	43346	47576	51806	56036	60266	64496	68726
CAM Data[15] (REAL)		39118	43348	47578	51808	56038	60268	64498	68728
CAM Data[16] (REAL)		39120	43350	47580	51810	56040	60270	64500	68730
CAM Data[17] (REAL)		39122	43352	47582	51812	56042	60272	64502	68732
CAM Data[18] (REAL)		39124	43354	47584	51814	56044	60274	64504	68734
CAM Data[19] (REAL)		39126	43356	47586	51816	56046	60276	64506	68736
CAM Data[20] (REAL)		39128	43358	47588	51818	56048	60278	64508	68738

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[21] (REAL)	39130	43360	47590	51820	56050	60280	64510	68740
CAM Data[22] (REAL)	39132	43362	47592	51822	56052	60282	64512	68742
CAM Data[23] (REAL)	39134	43364	47594	51824	56054	60284	64514	68744
CAM Data[24] (REAL)	39136	43366	47596	51826	56056	60286	64516	68746
CAM Data[25] (REAL)	39138	43368	47598	51828	56058	60288	64518	68748
CAM Data[26] (REAL)	39140	43370	47600	51830	56060	60290	64520	68750
CAM Data[27] (REAL)	39142	43372	47602	51832	56062	60292	64522	68752
CAM Data[28] (REAL)	39144	43374	47604	51834	56064	60294	64524	68754
CAM Data[29] (REAL)	39146	43376	47606	51836	56066	60296	64526	68756
CAM Data[30] (REAL)	39148	43378	47608	51838	56068	60298	64528	68758
CAM Data[31] (REAL)	39150	43380	47610	51840	56070	60300	64530	68760
CAM Data[32] (REAL)	39152	43382	47612	51842	56072	60302	64532	68762
CAM Data[33] (REAL)	39154	43384	47614	51844	56074	60304	64534	68764
CAM Data[34] (REAL)	39156	43386	47616	51846	56076	60306	64536	68766
CAM Data[35] (REAL)	39158	43388	47618	51848	56078	60308	64538	68768
CAM Data[36] (REAL)	39160	43390	47620	51850	56080	60310	64540	68770
CAM Data[37] (REAL)	39162	43392	47622	51852	56082	60312	64542	68772
CAM Data[38] (REAL)	39164	43394	47624	51854	56084	60314	64544	68774
CAM Data[39] (REAL)	39166	43396	47626	51856	56086	60316	64546	68776
CAM Data[40] (REAL)	39168	43398	47628	51858	56088	60318	64548	68778
CAM Data[41] (REAL)	39170	43400	47630	51860	56090	60320	64550	68780
CAM Data[42] (REAL)	39172	43402	47632	51862	56092	60322	64552	68782
CAM Data[43] (REAL)	39174	43404	47634	51864	56094	60324	64554	68784
CAM Data[44] (REAL)	39176	43406	47636	51866	56096	60326	64556	68786
CAM Data[45] (REAL)	39178	43408	47638	51868	56098	60328	64558	68788
CAM Data[46] (REAL)	39180	43410	47640	51870	56100	60330	64560	68790
CAM Data[47] (REAL)	39182	43412	47642	51872	56102	60332	64562	68792
CAM Data[48] (REAL)	39184	43414	47644	51874	56104	60334	64564	68794
CAM Data[49] (REAL)	39186	43416	47646	51876	56106	60336	64566	68796
CAM Data[50] (REAL)	39188	43418	47648	51878	56108	60338	64568	68798
CAM Data[51] (REAL)	39190	43420	47650	51880	56110	60340	64570	68800
CAM Data[52] (REAL)	39192	43422	47652	51882	56112	60342	64572	68802
CAM Data[53] (REAL)	39194	43424	47654	51884	56114	60344	64574	68804
CAM Data[54] (REAL)	39196	43426	47656	51886	56116	60346	64576	68806
CAM Data[55] (REAL)	39198	43428	47658	51888	56118	60348	64578	68808
CAM Data[56] (REAL)	39200	43430	47660	51890	56120	60350	64580	68810
CAM Data[57] (REAL)	39202	43432	47662	51892	56122	60352	64582	68812
CAM Data[58] (REAL)	39204	43434	47664	51894	56124	60354	64584	68814
CAM Data[59] (REAL)	39206	43436	47666	51896	56126	60356	64586	68816
CAM Data[60] (REAL)	39208	43438	47668	51898	56128	60358	64588	68818
CAM Data[61] (REAL)	39210	43440	47670	51900	56130	60360	64590	68820
CAM Data[62] (REAL)	39212	43442	47672	51902	56132	60362	64592	68822

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[63] (REAL)	39214	43444	47674	51904	56134	60364	64594	68824
CAM Data[64] (REAL)	39216	43446	47676	51906	56136	60366	64596	68826
CAM Data[65] (REAL)	39218	43448	47678	51908	56138	60368	64598	68828
CAM Data[66] (REAL)	39220	43450	47680	51910	56140	60370	64600	68830
CAM Data[67] (REAL)	39222	43452	47682	51912	56142	60372	64602	68832
CAM Data[68] (REAL)	39224	43454	47684	51914	56144	60374	64604	68834
CAM Data[69] (REAL)	39226	43456	47686	51916	56146	60376	64606	68836
CAM Data[70] (REAL)	39228	43458	47688	51918	56148	60378	64608	68838
CAM Data[71] (REAL)	39230	43460	47690	51920	56150	60380	64610	68840
CAM Data[72] (REAL)	39232	43462	47692	51922	56152	60382	64612	68842
CAM Data[73] (REAL)	39234	43464	47694	51924	56154	60384	64614	68844
CAM Data[74] (REAL)	39236	43466	47696	51926	56156	60386	64616	68846
CAM Data[75] (REAL)	39238	43468	47698	51928	56158	60388	64618	68848
CAM Data[76] (REAL)	39240	43470	47700	51930	56160	60390	64620	68850
CAM Data[77] (REAL)	39242	43472	47702	51932	56162	60392	64622	68852
CAM Data[78] (REAL)	39244	43474	47704	51934	56164	60394	64624	68854
CAM Data[79] (REAL)	39246	43476	47706	51936	56166	60396	64626	68856
CAM Data[80] (REAL)	39248	43478	47708	51938	56168	60398	64628	68858
CAM Data[81] (REAL)	39250	43480	47710	51940	56170	60400	64630	68860
CAM Data[82] (REAL)	39252	43482	47712	51942	56172	60402	64632	68862
CAM Data[83] (REAL)	39254	43484	47714	51944	56174	60404	64634	68864
CAM Data[84] (REAL)	39256	43486	47716	51946	56176	60406	64636	68866
CAM Data[85] (REAL)	39258	43488	47718	51948	56178	60408	64638	68868
CAM Data[86] (REAL)	39260	43490	47720	51950	56180	60410	64640	68870
CAM Data[87] (REAL)	39262	43492	47722	51952	56182	60412	64642	68872
CAM Data[88] (REAL)	39264	43494	47724	51954	56184	60414	64644	68874
CAM Data[89] (REAL)	39266	43496	47726	51956	56186	60416	64646	68876
CAM Data[90] (REAL)	39268	43498	47728	51958	56188	60418	64648	68878
CAM Data[91] (REAL)	39270	43500	47730	51960	56190	60420	64650	68880
CAM Data[92] (REAL)	39272	43502	47732	51962	56192	60422	64652	68882
CAM Data[93] (REAL)	39274	43504	47734	51964	56194	60424	64654	68884
CAM Data[94] (REAL)	39276	43506	47736	51966	56196	60426	64656	68886
CAM Data[95] (REAL)	39278	43508	47738	51968	56198	60428	64658	68888
CAM Data[96] (REAL)	39280	43510	47740	51970	56200	60430	64660	68890
CAM Data[97] (REAL)	39282	43512	47742	51972	56202	60432	64662	68892
CAM Data[98] (REAL)	39284	43514	47744	51974	56204	60434	64664	68894
CAM Data[99] (REAL)	39286	43516	47746	51976	56206	60436	64666	68896
CAM Data[100] (REAL)	39288	43518	47748	51978	56208	60438	64668	68898
CAM Data[101] (REAL)	39290	43520	47750	51980	56210	60440	64670	68900
CAM Data[102] (REAL)	39292	43522	47752	51982	56212	60442	64672	68902
CAM Data[103] (REAL)	39294	43524	47754	51984	56214	60444	64674	68904

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[104] (REAL)	39296	43526	47756	51986	56216	60446	64676	68906
CAM Data[105] (REAL)	39298	43528	47758	51988	56218	60448	64678	68908
CAM Data[106] (REAL)	39300	43530	47760	51990	56220	60450	64680	68910
CAM Data[107] (REAL)	39302	43532	47762	51992	56222	60452	64682	68912
CAM Data[108] (REAL)	39304	43534	47764	51994	56224	60454	64684	68914
CAM Data[109] (REAL)	39306	43536	47766	51996	56226	60456	64686	68916
CAM Data[110] (REAL)	39308	43538	47768	51998	56228	60458	64688	68918
CAM Data[111] (REAL)	39310	43540	47770	52000	56230	60460	64690	68920
CAM Data[112] (REAL)	39312	43542	47772	52002	56232	60462	64692	68922
CAM Data[113] (REAL)	39314	43544	47774	52004	56234	60464	64694	68924
CAM Data[114] (REAL)	39316	43546	47776	52006	56236	60466	64696	68926
CAM Data[115] (REAL)	39318	43548	47778	52008	56238	60468	64698	68928
CAM Data[116] (REAL)	39320	43550	47780	52010	56240	60470	64700	68930
CAM Data[117] (REAL)	39322	43552	47782	52012	56242	60472	64702	68932
CAM Data[118] (REAL)	39324	43554	47784	52014	56244	60474	64704	68934
CAM Data[119] (REAL)	39326	43556	47786	52016	56246	60476	64706	68936
CAM Data[120] (REAL)	39328	43558	47788	52018	56248	60478	64708	68938
CAM Data[121] (REAL)	39330	43560	47790	52020	56250	60480	64710	68940
CAM Data[122] (REAL)	39332	43562	47792	52022	56252	60482	64712	68942
CAM Data[123] (REAL)	39334	43564	47794	52024	56254	60484	64714	68944
CAM Data[124] (REAL)	39336	43566	47796	52026	56256	60486	64716	68946
CAM Data[125] (REAL)	39338	43568	47798	52028	56258	60488	64718	68948
CAM Data[126] (REAL)	39340	43570	47800	52030	56260	60490	64720	68950
CAM Data[127] (REAL)	39342	43572	47802	52032	56262	60492	64722	68952
CAM Data[128] (REAL)	39344	43574	47804	52034	56264	60494	64724	68954
CAM Data[129] (REAL)	39346	43576	47806	52036	56266	60496	64726	68956
CAM Data[130] (REAL)	39348	43578	47808	52038	56268	60498	64728	68958
CAM Data[131] (REAL)	39350	43580	47810	52040	56270	60500	64730	68960
CAM Data[132] (REAL)	39352	43582	47812	52042	56272	60502	64732	68962
CAM Data[133] (REAL)	39354	43584	47814	52044	56274	60504	64734	68964
CAM Data[134] (REAL)	39356	43586	47816	52046	56276	60506	64736	68966
CAM Data[135] (REAL)	39358	43588	47818	52048	56278	60508	64738	68968
CAM Data[136] (REAL)	39360	43590	47820	52050	56280	60510	64740	68970
CAM Data[137] (REAL)	39362	43592	47822	52052	56282	60512	64742	68972
CAM Data[138] (REAL)	39364	43594	47824	52054	56284	60514	64744	68974
CAM Data[139] (REAL)	39366	43596	47826	52056	56286	60516	64746	68976
CAM Data[140] (REAL)	39368	43598	47828	52058	56288	60518	64748	68978
CAM Data[141] (REAL)	39370	43600	47830	52060	56290	60520	64750	68980
CAM Data[142] (REAL)	39372	43602	47832	52062	56292	60522	64752	68982
CAM Data[143] (REAL)	39374	43604	47834	52064	56294	60524	64754	68984
CAM Data[144] (REAL)	39376	43606	47836	52066	56296	60526	64756	68986
CAM Data[145] (REAL)	39378	43608	47838	52068	56298	60528	64758	68988

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[146] (REAL)	39380	43610	47840	52070	56300	60530	64760	68990
CAM Data[147] (REAL)	39382	43612	47842	52072	56302	60532	64762	68992
CAM Data[148] (REAL)	39384	43614	47844	52074	56304	60534	64764	68994
CAM Data[149] (REAL)	39386	43616	47846	52076	56306	60536	64766	68996
CAM Data[150] (REAL)	39388	43618	47848	52078	56308	60538	64768	68998
CAM Data[151] (REAL)	39390	43620	47850	52080	56310	60540	64770	69000
CAM Data[152] (REAL)	39392	43622	47852	52082	56312	60542	64772	69002
CAM Data[153] (REAL)	39394	43624	47854	52084	56314	60544	64774	69004
CAM Data[154] (REAL)	39396	43626	47856	52086	56316	60546	64776	69006
CAM Data[155] (REAL)	39398	43628	47858	52088	56318	60548	64778	69008
CAM Data[156] (REAL)	39400	43630	47860	52090	56320	60550	64780	69010
CAM Data[157] (REAL)	39402	43632	47862	52092	56322	60552	64782	69012
CAM Data[158] (REAL)	39404	43634	47864	52094	56324	60554	64784	69014
CAM Data[159] (REAL)	39406	43636	47866	52096	56326	60556	64786	69016
CAM Data[160] (REAL)	39408	43638	47868	52098	56328	60558	64788	69018
CAM Data[161] (REAL)	39410	43640	47870	52100	56330	60560	64790	69020
CAM Data[162] (REAL)	39412	43642	47872	52102	56332	60562	64792	69022
CAM Data[163] (REAL)	39414	43644	47874	52104	56334	60564	64794	69024
CAM Data[164] (REAL)	39416	43646	47876	52106	56336	60566	64796	69026
CAM Data[165] (REAL)	39418	43648	47878	52108	56338	60568	64798	69028
CAM Data[166] (REAL)	39420	43650	47880	52110	56340	60570	64800	69030
CAM Data[167] (REAL)	39422	43652	47882	52112	56342	60572	64802	69032
CAM Data[168] (REAL)	39424	43654	47884	52114	56344	60574	64804	69034
CAM Data[169] (REAL)	39426	43656	47886	52116	56346	60576	64806	69036
CAM Data[170] (REAL)	39428	43658	47888	52118	56348	60578	64808	69038
CAM Data[171] (REAL)	39430	43660	47890	52120	56350	60580	64810	69040
CAM Data[172] (REAL)	39432	43662	47892	52122	56352	60582	64812	69042
CAM Data[173] (REAL)	39434	43664	47894	52124	56354	60584	64814	69044
CAM Data[174] (REAL)	39436	43666	47896	52126	56356	60586	64816	69046
CAM Data[175] (REAL)	39438	43668	47898	52128	56358	60588	64818	69048
CAM Data[176] (REAL)	39440	43670	47900	52130	56360	60590	64820	69050
CAM Data[177] (REAL)	39442	43672	47902	52132	56362	60592	64822	69052
CAM Data[178] (REAL)	39444	43674	47904	52134	56364	60594	64824	69054
CAM Data[179] (REAL)	39446	43676	47906	52136	56366	60596	64826	69056
CAM Data[180] (REAL)	39448	43678	47908	52138	56368	60598	64828	69058
CAM Data[181] (REAL)	39450	43680	47910	52140	56370	60600	64830	69060
CAM Data[182] (REAL)	39452	43682	47912	52142	56372	60602	64832	69062
CAM Data[183] (REAL)	39454	43684	47914	52144	56374	60604	64834	69064
CAM Data[184] (REAL)	39456	43686	47916	52146	56376	60606	64836	69066
CAM Data[185] (REAL)	39458	43688	47918	52148	56378	60608	64838	69068
CAM Data[186] (REAL)	39460	43690	47920	52150	56380	60610	64840	69070

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[187] (REAL)	39462	43692	47922	52152	56382	60612	64842	69072
CAM Data[188] (REAL)	39464	43694	47924	52154	56384	60614	64844	69074
CAM Data[189] (REAL)	39466	43696	47926	52156	56386	60616	64846	69076
CAM Data[190] (REAL)	39468	43698	47928	52158	56388	60618	64848	69078
CAM Data[191] (REAL)	39470	43700	47930	52160	56390	60620	64850	69080
CAM Data[192] (REAL)	39472	43702	47932	52162	56392	60622	64852	69082
CAM Data[193] (REAL)	39474	43704	47934	52164	56394	60624	64854	69084
CAM Data[194] (REAL)	39476	43706	47936	52166	56396	60626	64856	69086
CAM Data[195] (REAL)	39478	43708	47938	52168	56398	60628	64858	69088
CAM Data[196] (REAL)	39480	43710	47940	52170	56400	60630	64860	69090
CAM Data[197] (REAL)	39482	43712	47942	52172	56402	60632	64862	69092
CAM Data[198] (REAL)	39484	43714	47944	52174	56404	60634	64864	69094
CAM Data[199] (REAL)	39486	43716	47946	52176	56406	60636	64866	69096
CAM Data[200] (REAL)	39488	43718	47948	52178	56408	60638	64868	69098
CAM Data[201] (REAL)	39490	43720	47950	52180	56410	60640	64870	69100
CAM Data[202] (REAL)	39492	43722	47952	52182	56412	60642	64872	69102
CAM Data[203] (REAL)	39494	43724	47954	52184	56414	60644	64874	69104
CAM Data[204] (REAL)	39496	43726	47956	52186	56416	60646	64876	69106
CAM Data[205] (REAL)	39498	43728	47958	52188	56418	60648	64878	69108
CAM Data[206] (REAL)	39500	43730	47960	52190	56420	60650	64880	69110
CAM Data[207] (REAL)	39502	43732	47962	52192	56422	60652	64882	69112
CAM Data[208] (REAL)	39504	43734	47964	52194	56424	60654	64884	69114
CAM Data[209] (REAL)	39506	43736	47966	52196	56426	60656	64886	69116
CAM Data[210] (REAL)	39508	43738	47968	52198	56428	60658	64888	69118
CAM Data[211] (REAL)	39510	43740	47970	52200	56430	60660	64890	69120
CAM Data[212] (REAL)	39512	43742	47972	52202	56432	60662	64892	69122
CAM Data[213] (REAL)	39514	43744	47974	52204	56434	60664	64894	69124
CAM Data[214] (REAL)	39516	43746	47976	52206	56436	60666	64896	69126
CAM Data[215] (REAL)	39518	43748	47978	52208	56438	60668	64898	69128
CAM Data[216] (REAL)	39520	43750	47980	52210	56440	60670	64900	69130
CAM Data[217] (REAL)	39522	43752	47982	52212	56442	60672	64902	69132
CAM Data[218] (REAL)	39524	43754	47984	52214	56444	60674	64904	69134
CAM Data[219] (REAL)	39526	43756	47986	52216	56446	60676	64906	69136
CAM Data[220] (REAL)	39528	43758	47988	52218	56448	60678	64908	69138
CAM Data[221] (REAL)	39530	43760	47990	52220	56450	60680	64910	69140
CAM Data[222] (REAL)	39532	43762	47992	52222	56452	60682	64912	69142
CAM Data[223] (REAL)	39534	43764	47994	52224	56454	60684	64914	69144
CAM Data[224] (REAL)	39536	43766	47996	52226	56456	60686	64916	69146
CAM Data[225] (REAL)	39538	43768	47998	52228	56458	60688	64918	69148
CAM Data[226] (REAL)	39540	43770	48000	52230	56460	60690	64920	69150
CAM Data[227] (REAL)	39542	43772	48002	52232	56462	60692	64922	69152
CAM Data[228] (REAL)	39544	43774	48004	52234	56464	60694	64924	69154

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[229] (REAL)	39546	43776	48006	52236	56466	60696	64926	69156
CAM Data[230] (REAL)	39548	43778	48008	52238	56468	60698	64928	69158
CAM Data[231] (REAL)	39550	43780	48010	52240	56470	60700	64930	69160
CAM Data[232] (REAL)	39552	43782	48012	52242	56472	60702	64932	69162
CAM Data[233] (REAL)	39554	43784	48014	52244	56474	60704	64934	69164
CAM Data[234] (REAL)	39556	43786	48016	52246	56476	60706	64936	69166
CAM Data[235] (REAL)	39558	43788	48018	52248	56478	60708	64938	69168
CAM Data[236] (REAL)	39560	43790	48020	52250	56480	60710	64940	69170
CAM Data[237] (REAL)	39562	43792	48022	52252	56482	60712	64942	69172
CAM Data[238] (REAL)	39564	43794	48024	52254	56484	60714	64944	69174
CAM Data[239] (REAL)	39566	43796	48026	52256	56486	60716	64946	69176
CAM Data[240] (REAL)	39568	43798	48028	52258	56488	60718	64948	69178
CAM Data[241] (REAL)	39570	43800	48030	52260	56490	60720	64950	69180
CAM Data[242] (REAL)	39572	43802	48032	52262	56492	60722	64952	69182
CAM Data[243] (REAL)	39574	43804	48034	52264	56494	60724	64954	69184
CAM Data[244] (REAL)	39576	43806	48036	52266	56496	60726	64956	69186
CAM Data[245] (REAL)	39578	43808	48038	52268	56498	60728	64958	69188
CAM Data[246] (REAL)	39580	43810	48040	52270	56500	60730	64960	69190
CAM Data[247] (REAL)	39582	43812	48042	52272	56502	60732	64962	69192
CAM Data[248] (REAL)	39584	43814	48044	52274	56504	60734	64964	69194
CAM Data[249] (REAL)	39586	43816	48046	52276	56506	60736	64966	69196
CAM Data[250] (REAL)	39588	43818	48048	52278	56508	60738	64968	69198
CAM Data[251] (REAL)	39590	43820	48050	52280	56510	60740	64970	69200
CAM Data[252] (REAL)	39592	43822	48052	52282	56512	60742	64972	69202
CAM Data[253] (REAL)	39594	43824	48054	52284	56514	60744	64974	69204
CAM Data[254] (REAL)	39596	43826	48056	52286	56516	60746	64976	69206
CAM Data[255] (REAL)	39598	43828	48058	52288	56518	60748	64978	69208
CAM Data[256] (REAL)	39600	43830	48060	52290	56520	60750	64980	69210
CAM Data[257] (REAL)	39602	43832	48062	52292	56522	60752	64982	69212
CAM Data[258] (REAL)	39604	43834	48064	52294	56524	60754	64984	69214
CAM Data[259] (REAL)	39606	43836	48066	52296	56526	60756	64986	69216
CAM Data[260] (REAL)	39608	43838	48068	52298	56528	60758	64988	69218
CAM Data[261] (REAL)	39610	43840	48070	52300	56530	60760	64990	69220
CAM Data[262] (REAL)	39612	43842	48072	52302	56532	60762	64992	69222
CAM Data[263] (REAL)	39614	43844	48074	52304	56534	60764	64994	69224
CAM Data[264] (REAL)	39616	43846	48076	52306	56536	60766	64996	69226
CAM Data[265] (REAL)	39618	43848	48078	52308	56538	60768	64998	69228
CAM Data[266] (REAL)	39620	43850	48080	52310	56540	60770	65000	69230
CAM Data[267] (REAL)	39622	43852	48082	52312	56542	60772	65002	69232
CAM Data[268] (REAL)	39624	43854	48084	52314	56544	60774	65004	69234
CAM Data[269] (REAL)	39626	43856	48086	52316	56546	60776	65006	69236

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[270] (REAL)	39628	43858	48088	52318	56548	60778	65008	69238
CAM Data[271] (REAL)	39630	43860	48090	52320	56550	60780	65010	69240
CAM Data[272] (REAL)	39632	43862	48092	52322	56552	60782	65012	69242
CAM Data[273] (REAL)	39634	43864	48094	52324	56554	60784	65014	69244
CAM Data[274] (REAL)	39636	43866	48096	52326	56556	60786	65016	69246
CAM Data[275] (REAL)	39638	43868	48098	52328	56558	60788	65018	69248
CAM Data[276] (REAL)	39640	43870	48100	52330	56560	60790	65020	69250
CAM Data[277] (REAL)	39642	43872	48102	52332	56562	60792	65022	69252
CAM Data[278] (REAL)	39644	43874	48104	52334	56564	60794	65024	69254
CAM Data[279] (REAL)	39646	43876	48106	52336	56566	60796	65026	69256
CAM Data[280] (REAL)	39648	43878	48108	52338	56568	60798	65028	69258
CAM Data[281] (REAL)	39650	43880	48110	52340	56570	60800	65030	69260
CAM Data[282] (REAL)	39652	43882	48112	52342	56572	60802	65032	69262
CAM Data[283] (REAL)	39654	43884	48114	52344	56574	60804	65034	69264
CAM Data[284] (REAL)	39656	43886	48116	52346	56576	60806	65036	69266
CAM Data[285] (REAL)	39658	43888	48118	52348	56578	60808	65038	69268
CAM Data[286] (REAL)	39660	43890	48120	52350	56580	60810	65040	69270
CAM Data[287] (REAL)	39662	43892	48122	52352	56582	60812	65042	69272
CAM Data[288] (REAL)	39664	43894	48124	52354	56584	60814	65044	69274
CAM Data[289] (REAL)	39666	43896	48126	52356	56586	60816	65046	69276
CAM Data[290] (REAL)	39668	43898	48128	52358	56588	60818	65048	69278
CAM Data[291] (REAL)	39670	43900	48130	52360	56590	60820	65050	69280
CAM Data[292] (REAL)	39672	43902	48132	52362	56592	60822	65052	69282
CAM Data[293] (REAL)	39674	43904	48134	52364	56594	60824	65054	69284
CAM Data[294] (REAL)	39676	43906	48136	52366	56596	60826	65056	69286
CAM Data[295] (REAL)	39678	43908	48138	52368	56598	60828	65058	69288
CAM Data[296] (REAL)	39680	43910	48140	52370	56600	60830	65060	69290
CAM Data[297] (REAL)	39682	43912	48142	52372	56602	60832	65062	69292
CAM Data[298] (REAL)	39684	43914	48144	52374	56604	60834	65064	69294
CAM Data[299] (REAL)	39686	43916	48146	52376	56606	60836	65066	69296
CAM Data[300] (REAL)	39688	43918	48148	52378	56608	60838	65068	69298
CAM Data[301] (REAL)	39690	43920	48150	52380	56610	60840	65070	69300
CAM Data[302] (REAL)	39692	43922	48152	52382	56612	60842	65072	69302
CAM Data[303] (REAL)	39694	43924	48154	52384	56614	60844	65074	69304
CAM Data[304] (REAL)	39696	43926	48156	52386	56616	60846	65076	69306
CAM Data[305] (REAL)	39698	43928	48158	52388	56618	60848	65078	69308
CAM Data[306] (REAL)	39700	43930	48160	52390	56620	60850	65080	69310
CAM Data[307] (REAL)	39702	43932	48162	52392	56622	60852	65082	69312
CAM Data[308] (REAL)	39704	43934	48164	52394	56624	60854	65084	69314
CAM Data[309] (REAL)	39706	43936	48166	52396	56626	60856	65086	69316
CAM Data[310] (REAL)	39708	43938	48168	52398	56628	60858	65088	69318
CAM Data[311] (REAL)	39710	43940	48170	52400	56630	60860	65090	69320

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[312] (REAL)	39712	43942	48172	52402	56632	60862	65092	69322
CAM Data[313] (REAL)	39714	43944	48174	52404	56634	60864	65094	69324
CAM Data[314] (REAL)	39716	43946	48176	52406	56636	60866	65096	69326
CAM Data[315] (REAL)	39718	43948	48178	52408	56638	60868	65098	69328
CAM Data[316] (REAL)	39720	43950	48180	52410	56640	60870	65100	69330
CAM Data[317] (REAL)	39722	43952	48182	52412	56642	60872	65102	69332
CAM Data[318] (REAL)	39724	43954	48184	52414	56644	60874	65104	69334
CAM Data[319] (REAL)	39726	43956	48186	52416	56646	60876	65106	69336
CAM Data[320] (REAL)	39728	43958	48188	52418	56648	60878	65108	69338
CAM Data[321] (REAL)	39730	43960	48190	52420	56650	60880	65110	69340
CAM Data[322] (REAL)	39732	43962	48192	52422	56652	60882	65112	69342
CAM Data[323] (REAL)	39734	43964	48194	52424	56654	60884	65114	69344
CAM Data[324] (REAL)	39736	43966	48196	52426	56656	60886	65116	69346
CAM Data[325] (REAL)	39738	43968	48198	52428	56658	60888	65118	69348
CAM Data[326] (REAL)	39740	43970	48200	52430	56660	60890	65120	69350
CAM Data[327] (REAL)	39742	43972	48202	52432	56662	60892	65122	69352
CAM Data[328] (REAL)	39744	43974	48204	52434	56664	60894	65124	69354
CAM Data[329] (REAL)	39746	43976	48206	52436	56666	60896	65126	69356
CAM Data[330] (REAL)	39748	43978	48208	52438	56668	60898	65128	69358
CAM Data[331] (REAL)	39750	43980	48210	52440	56670	60900	65130	69360
CAM Data[332] (REAL)	39752	43982	48212	52442	56672	60902	65132	69362
CAM Data[333] (REAL)	39754	43984	48214	52444	56674	60904	65134	69364
CAM Data[334] (REAL)	39756	43986	48216	52446	56676	60906	65136	69366
CAM Data[335] (REAL)	39758	43988	48218	52448	56678	60908	65138	69368
CAM Data[336] (REAL)	39760	43990	48220	52450	56680	60910	65140	69370
CAM Data[337] (REAL)	39762	43992	48222	52452	56682	60912	65142	69372
CAM Data[338] (REAL)	39764	43994	48224	52454	56684	60914	65144	69374
CAM Data[339] (REAL)	39766	43996	48226	52456	56686	60916	65146	69376
CAM Data[340] (REAL)	39768	43998	48228	52458	56688	60918	65148	69378
CAM Data[341] (REAL)	39770	44000	48230	52460	56690	60920	65150	69380
CAM Data[342] (REAL)	39772	44002	48232	52462	56692	60922	65152	69382
CAM Data[343] (REAL)	39774	44004	48234	52464	56694	60924	65154	69384
CAM Data[344] (REAL)	39776	44006	48236	52466	56696	60926	65156	69386
CAM Data[345] (REAL)	39778	44008	48238	52468	56698	60928	65158	69388
CAM Data[346] (REAL)	39780	44010	48240	52470	56700	60930	65160	69390
CAM Data[347] (REAL)	39782	44012	48242	52472	56702	60932	65162	69392
CAM Data[348] (REAL)	39784	44014	48244	52474	56704	60934	65164	69394
CAM Data[349] (REAL)	39786	44016	48246	52476	56706	60936	65166	69396
CAM Data[350] (REAL)	39788	44018	48248	52478	56708	60938	65168	69398
CAM Data[351] (REAL)	39790	44020	48250	52480	56710	60940	65170	69400
CAM Data[352] (REAL)	39792	44022	48252	52482	56712	60942	65172	69402

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[353] (REAL)	39794	44024	48254	52484	56714	60944	65174	69404
CAM Data[354] (REAL)	39796	44026	48256	52486	56716	60946	65176	69406
CAM Data[355] (REAL)	39798	44028	48258	52488	56718	60948	65178	69408
CAM Data[356] (REAL)	39800	44030	48260	52490	56720	60950	65180	69410
CAM Data[357] (REAL)	39802	44032	48262	52492	56722	60952	65182	69412
CAM Data[358] (REAL)	39804	44034	48264	52494	56724	60954	65184	69414
CAM Data[359] (REAL)	39806	44036	48266	52496	56726	60956	65186	69416
CAM Data[360] (REAL)	39808	44038	48268	52498	56728	60958	65188	69418
CAM Data[361] (REAL)	39810	44040	48270	52500	56730	60960	65190	69420
CAM Data[362] (REAL)	39812	44042	48272	52502	56732	60962	65192	69422
CAM Data[363] (REAL)	39814	44044	48274	52504	56734	60964	65194	69424
CAM Data[364] (REAL)	39816	44046	48276	52506	56736	60966	65196	69426
CAM Data[365] (REAL)	39818	44048	48278	52508	56738	60968	65198	69428
CAM Data[366] (REAL)	39820	44050	48280	52510	56740	60970	65200	69430
CAM Data[367] (REAL)	39822	44052	48282	52512	56742	60972	65202	69432
CAM Data[368] (REAL)	39824	44054	48284	52514	56744	60974	65204	69434
CAM Data[369] (REAL)	39826	44056	48286	52516	56746	60976	65206	69436
CAM Data[370] (REAL)	39828	44058	48288	52518	56748	60978	65208	69438
CAM Data[371] (REAL)	39830	44060	48290	52520	56750	60980	65210	69440
CAM Data[372] (REAL)	39832	44062	48292	52522	56752	60982	65212	69442
CAM Data[373] (REAL)	39834	44064	48294	52524	56754	60984	65214	69444
CAM Data[374] (REAL)	39836	44066	48296	52526	56756	60986	65216	69446
CAM Data[375] (REAL)	39838	44068	48298	52528	56758	60988	65218	69448
CAM Data[376] (REAL)	39840	44070	48300	52530	56760	60990	65220	69450
CAM Data[377] (REAL)	39842	44072	48302	52532	56762	60992	65222	69452
CAM Data[378] (REAL)	39844	44074	48304	52534	56764	60994	65224	69454
CAM Data[379] (REAL)	39846	44076	48306	52536	56766	60996	65226	69456
CAM Data[380] (REAL)	39848	44078	48308	52538	56768	60998	65228	69458
CAM Data[381] (REAL)	39850	44080	48310	52540	56770	61000	65230	69460
CAM Data[382] (REAL)	39852	44082	48312	52542	56772	61002	65232	69462
CAM Data[383] (REAL)	39854	44084	48314	52544	56774	61004	65234	69464
CAM Data[384] (REAL)	39856	44086	48316	52546	56776	61006	65236	69466
CAM Data[385] (REAL)	39858	44088	48318	52548	56778	61008	65238	69468
CAM Data[386] (REAL)	39860	44090	48320	52550	56780	61010	65240	69470
CAM Data[387] (REAL)	39862	44092	48322	52552	56782	61012	65242	69472
CAM Data[388] (REAL)	39864	44094	48324	52554	56784	61014	65244	69474
CAM Data[389] (REAL)	39866	44096	48326	52556	56786	61016	65246	69476
CAM Data[390] (REAL)	39868	44098	48328	52558	56788	61018	65248	69478
CAM Data[391] (REAL)	39870	44100	48330	52560	56790	61020	65250	69480
CAM Data[392] (REAL)	39872	44102	48332	52562	56792	61022	65252	69482
CAM Data[393] (REAL)	39874	44104	48334	52564	56794	61024	65254	69484
CAM Data[394] (REAL)	39876	44106	48336	52566	56796	61026	65256	69486

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[395] (REAL)	39878	44108	48338	52568	56798	61028	65258	69488
CAM Data[396] (REAL)	39880	44110	48340	52570	56800	61030	65260	69490
CAM Data[397] (REAL)	39882	44112	48342	52572	56802	61032	65262	69492
CAM Data[398] (REAL)	39884	44114	48344	52574	56804	61034	65264	69494
CAM Data[399] (REAL)	39886	44116	48346	52576	56806	61036	65266	69496
CAM Data[400] (REAL)	39888	44118	48348	52578	56808	61038	65268	69498
CAM Data[401] (REAL)	39890	44120	48350	52580	56810	61040	65270	69500
CAM Data[402] (REAL)	39892	44122	48352	52582	56812	61042	65272	69502
CAM Data[403] (REAL)	39894	44124	48354	52584	56814	61044	65274	69504
CAM Data[404] (REAL)	39896	44126	48356	52586	56816	61046	65276	69506
CAM Data[405] (REAL)	39898	44128	48358	52588	56818	61048	65278	69508
CAM Data[406] (REAL)	39900	44130	48360	52590	56820	61050	65280	69510
CAM Data[407] (REAL)	39902	44132	48362	52592	56822	61052	65282	69512
CAM Data[408] (REAL)	39904	44134	48364	52594	56824	61054	65284	69514
CAM Data[409] (REAL)	39906	44136	48366	52596	56826	61056	65286	69516
CAM Data[410] (REAL)	39908	44138	48368	52598	56828	61058	65288	69518
CAM Data[411] (REAL)	39910	44140	48370	52600	56830	61060	65290	69520
CAM Data[412] (REAL)	39912	44142	48372	52602	56832	61062	65292	69522
CAM Data[413] (REAL)	39914	44144	48374	52604	56834	61064	65294	69524
CAM Data[414] (REAL)	39916	44146	48376	52606	56836	61066	65296	69526
CAM Data[415] (REAL)	39918	44148	48378	52608	56838	61068	65298	69528
CAM Data[416] (REAL)	39920	44150	48380	52610	56840	61070	65300	69530
CAM Data[417] (REAL)	39922	44152	48382	52612	56842	61072	65302	69532
CAM Data[418] (REAL)	39924	44154	48384	52614	56844	61074	65304	69534
CAM Data[419] (REAL)	39926	44156	48386	52616	56846	61076	65306	69536
CAM Data[420] (REAL)	39928	44158	48388	52618	56848	61078	65308	69538
CAM Data[421] (REAL)	39930	44160	48390	52620	56850	61080	65310	69540
CAM Data[422] (REAL)	39932	44162	48392	52622	56852	61082	65312	69542
CAM Data[423] (REAL)	39934	44164	48394	52624	56854	61084	65314	69544
CAM Data[424] (REAL)	39936	44166	48396	52626	56856	61086	65316	69546
CAM Data[425] (REAL)	39938	44168	48398	52628	56858	61088	65318	69548
CAM Data[426] (REAL)	39940	44170	48400	52630	56860	61090	65320	69550
CAM Data[427] (REAL)	39942	44172	48402	52632	56862	61092	65322	69552
CAM Data[428] (REAL)	39944	44174	48404	52634	56864	61094	65324	69554
CAM Data[429] (REAL)	39946	44176	48406	52636	56866	61096	65326	69556
CAM Data[430] (REAL)	39948	44178	48408	52638	56868	61098	65328	69558
CAM Data[431] (REAL)	39950	44180	48410	52640	56870	61100	65330	69560
CAM Data[432] (REAL)	39952	44182	48412	52642	56872	61102	65332	69562
CAM Data[433] (REAL)	39954	44184	48414	52644	56874	61104	65334	69564
CAM Data[434] (REAL)	39956	44186	48416	52646	56876	61106	65336	69566
CAM Data[435] (REAL)	39958	44188	48418	52648	56878	61108	65338	69568

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[436] (REAL)	39960	44190	48420	52650	56880	61110	65340	69570
CAM Data[437] (REAL)	39962	44192	48422	52652	56882	61112	65342	69572
CAM Data[438] (REAL)	39964	44194	48424	52654	56884	61114	65344	69574
CAM Data[439] (REAL)	39966	44196	48426	52656	56886	61116	65346	69576
CAM Data[440] (REAL)	39968	44198	48428	52658	56888	61118	65348	69578
CAM Data[441] (REAL)	39970	44200	48430	52660	56890	61120	65350	69580
CAM Data[442] (REAL)	39972	44202	48432	52662	56892	61122	65352	69582
CAM Data[443] (REAL)	39974	44204	48434	52664	56894	61124	65354	69584
CAM Data[444] (REAL)	39976	44206	48436	52666	56896	61126	65356	69586
CAM Data[445] (REAL)	39978	44208	48438	52668	56898	61128	65358	69588
CAM Data[446] (REAL)	39980	44210	48440	52670	56900	61130	65360	69590
CAM Data[447] (REAL)	39982	44212	48442	52672	56902	61132	65362	69592
CAM Data[448] (REAL)	39984	44214	48444	52674	56904	61134	65364	69594
CAM Data[449] (REAL)	39986	44216	48446	52676	56906	61136	65366	69596
CAM Data[450] (REAL)	39988	44218	48448	52678	56908	61138	65368	69598
CAM Data[451] (REAL)	39990	44220	48450	52680	56910	61140	65370	69600
CAM Data[452] (REAL)	39992	44222	48452	52682	56912	61142	65372	69602
CAM Data[453] (REAL)	39994	44224	48454	52684	56914	61144	65374	69604
CAM Data[454] (REAL)	39996	44226	48456	52686	56916	61146	65376	69606
CAM Data[455] (REAL)	39998	44228	48458	52688	56918	61148	65378	69608
CAM Data[456] (REAL)	40000	44230	48460	52690	56920	61150	65380	69610
CAM Data[457] (REAL)	40002	44232	48462	52692	56922	61152	65382	69612
CAM Data[458] (REAL)	40004	44234	48464	52694	56924	61154	65384	69614
CAM Data[459] (REAL)	40006	44236	48466	52696	56926	61156	65386	69616
CAM Data[460] (REAL)	40008	44238	48468	52698	56928	61158	65388	69618
CAM Data[461] (REAL)	40010	44240	48470	52700	56930	61160	65390	69620
CAM Data[462] (REAL)	40012	44242	48472	52702	56932	61162	65392	69622
CAM Data[463] (REAL)	40014	44244	48474	52704	56934	61164	65394	69624
CAM Data[464] (REAL)	40016	44246	48476	52706	56936	61166	65396	69626
CAM Data[465] (REAL)	40018	44248	48478	52708	56938	61168	65398	69628
CAM Data[466] (REAL)	40020	44250	48480	52710	56940	61170	65400	69630
CAM Data[467] (REAL)	40022	44252	48482	52712	56942	61172	65402	69632
CAM Data[468] (REAL)	40024	44254	48484	52714	56944	61174	65404	69634
CAM Data[469] (REAL)	40026	44256	48486	52716	56946	61176	65406	69636
CAM Data[470] (REAL)	40028	44258	48488	52718	56948	61178	65408	69638
CAM Data[471] (REAL)	40030	44260	48490	52720	56950	61180	65410	69640
CAM Data[472] (REAL)	40032	44262	48492	52722	56952	61182	65412	69642
CAM Data[473] (REAL)	40034	44264	48494	52724	56954	61184	65414	69644
CAM Data[474] (REAL)	40036	44266	48496	52726	56956	61186	65416	69646
CAM Data[475] (REAL)	40038	44268	48498	52728	56958	61188	65418	69648
CAM Data[476] (REAL)	40040	44270	48500	52730	56960	61190	65420	69650
CAM Data[477] (REAL)	40042	44272	48502	52732	56962	61192	65422	69652

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[478] (REAL)	40044	44274	48504	52734	56964	61194	65424	69654
CAM Data[479] (REAL)	40046	44276	48506	52736	56966	61196	65426	69656
CAM Data[480] (REAL)	40048	44278	48508	52738	56968	61198	65428	69658
CAM Data[481] (REAL)	40050	44280	48510	52740	56970	61200	65430	69660
CAM Data[482] (REAL)	40052	44282	48512	52742	56972	61202	65432	69662
CAM Data[483] (REAL)	40054	44284	48514	52744	56974	61204	65434	69664
CAM Data[484] (REAL)	40056	44286	48516	52746	56976	61206	65436	69666
CAM Data[485] (REAL)	40058	44288	48518	52748	56978	61208	65438	69668
CAM Data[486] (REAL)	40060	44290	48520	52750	56980	61210	65440	69670
CAM Data[487] (REAL)	40062	44292	48522	52752	56982	61212	65442	69672
CAM Data[488] (REAL)	40064	44294	48524	52754	56984	61214	65444	69674
CAM Data[489] (REAL)	40066	44296	48526	52756	56986	61216	65446	69676
CAM Data[490] (REAL)	40068	44298	48528	52758	56988	61218	65448	69678
CAM Data[491] (REAL)	40070	44300	48530	52760	56990	61220	65450	69680
CAM Data[492] (REAL)	40072	44302	48532	52762	56992	61222	65452	69682
CAM Data[493] (REAL)	40074	44304	48534	52764	56994	61224	65454	69684
CAM Data[494] (REAL)	40076	44306	48536	52766	56996	61226	65456	69686
CAM Data[495] (REAL)	40078	44308	48538	52768	56998	61228	65458	69688
CAM Data[496] (REAL)	40080	44310	48540	52770	57000	61230	65460	69690
CAM Data[497] (REAL)	40082	44312	48542	52772	57002	61232	65462	69692
CAM Data[498] (REAL)	40084	44314	48544	52774	57004	61234	65464	69694
CAM Data[499] (REAL)	40086	44316	48546	52776	57006	61236	65466	69696
CAM Data[500] (REAL)	40088	44318	48548	52778	57008	61238	65468	69698
CAM Data[501] (REAL)	40090	44320	48550	52780	57010	61240	65470	69700
CAM Data[502] (REAL)	40092	44322	48552	52782	57012	61242	65472	69702
CAM Data[503] (REAL)	40094	44324	48554	52784	57014	61244	65474	69704
CAM Data[504] (REAL)	40096	44326	48556	52786	57016	61246	65476	69706
CAM Data[505] (REAL)	40098	44328	48558	52788	57018	61248	65478	69708
CAM Data[506] (REAL)	40100	44330	48560	52790	57020	61250	65480	69710
CAM Data[507] (REAL)	40102	44332	48562	52792	57022	61252	65482	69712
CAM Data[508] (REAL)	40104	44334	48564	52794	57024	61254	65484	69714
CAM Data[509] (REAL)	40106	44336	48566	52796	57026	61256	65486	69716
CAM Data[510] (REAL)	40108	44338	48568	52798	57028	61258	65488	69718
CAM Data[511] (REAL)	40110	44340	48570	52800	57030	61260	65490	69720
CAM Data[512] (REAL)	40112	44342	48572	52802	57032	61262	65492	69722
CAM Data[513] (REAL)	40114	44344	48574	52804	57034	61264	65494	69724
CAM Data[514] (REAL)	40116	44346	48576	52806	57036	61266	65496	69726
CAM Data[515] (REAL)	40118	44348	48578	52808	57038	61268	65498	69728
CAM Data[516] (REAL)	40120	44350	48580	52810	57040	61270	65500	69730
CAM Data[517] (REAL)	40122	44352	48582	52812	57042	61272	65502	69732
CAM Data[518] (REAL)	40124	44354	48584	52814	57044	61274	65504	69734

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[519] (REAL)	40126	44356	48586	52816	57046	61276	65506	69736
CAM Data[520] (REAL)	40128	44358	48588	52818	57048	61278	65508	69738
CAM Data[521] (REAL)	40130	44360	48590	52820	57050	61280	65510	69740
CAM Data[522] (REAL)	40132	44362	48592	52822	57052	61282	65512	69742
CAM Data[523] (REAL)	40134	44364	48594	52824	57054	61284	65514	69744
CAM Data[524] (REAL)	40136	44366	48596	52826	57056	61286	65516	69746
CAM Data[525] (REAL)	40138	44368	48598	52828	57058	61288	65518	69748
CAM Data[526] (REAL)	40140	44370	48600	52830	57060	61290	65520	69750
CAM Data[527] (REAL)	40142	44372	48602	52832	57062	61292	65522	69752
CAM Data[528] (REAL)	40144	44374	48604	52834	57064	61294	65524	69754
CAM Data[529] (REAL)	40146	44376	48606	52836	57066	61296	65526	69756
CAM Data[530] (REAL)	40148	44378	48608	52838	57068	61298	65528	69758
CAM Data[531] (REAL)	40150	44380	48610	52840	57070	61300	65530	69760
CAM Data[532] (REAL)	40152	44382	48612	52842	57072	61302	65532	69762
CAM Data[533] (REAL)	40154	44384	48614	52844	57074	61304	65534	69764
CAM Data[534] (REAL)	40156	44386	48616	52846	57076	61306	65536	69766
CAM Data[535] (REAL)	40158	44388	48618	52848	57078	61308	65538	69768
CAM Data[536] (REAL)	40160	44390	48620	52850	57080	61310	65540	69770
CAM Data[537] (REAL)	40162	44392	48622	52852	57082	61312	65542	69772
CAM Data[538] (REAL)	40164	44394	48624	52854	57084	61314	65544	69774
CAM Data[539] (REAL)	40166	44396	48626	52856	57086	61316	65546	69776
CAM Data[540] (REAL)	40168	44398	48628	52858	57088	61318	65548	69778
CAM Data[541] (REAL)	40170	44400	48630	52860	57090	61320	65550	69780
CAM Data[542] (REAL)	40172	44402	48632	52862	57092	61322	65552	69782
CAM Data[543] (REAL)	40174	44404	48634	52864	57094	61324	65554	69784
CAM Data[544] (REAL)	40176	44406	48636	52866	57096	61326	65556	69786
CAM Data[545] (REAL)	40178	44408	48638	52868	57098	61328	65558	69788
CAM Data[546] (REAL)	40180	44410	48640	52870	57100	61330	65560	69790
CAM Data[547] (REAL)	40182	44412	48642	52872	57102	61332	65562	69792
CAM Data[548] (REAL)	40184	44414	48644	52874	57104	61334	65564	69794
CAM Data[549] (REAL)	40186	44416	48646	52876	57106	61336	65566	69796
CAM Data[550] (REAL)	40188	44418	48648	52878	57108	61338	65568	69798
CAM Data[551] (REAL)	40190	44420	48650	52880	57110	61340	65570	69800
CAM Data[552] (REAL)	40192	44422	48652	52882	57112	61342	65572	69802
CAM Data[553] (REAL)	40194	44424	48654	52884	57114	61344	65574	69804
CAM Data[554] (REAL)	40196	44426	48656	52886	57116	61346	65576	69806
CAM Data[555] (REAL)	40198	44428	48658	52888	57118	61348	65578	69808
CAM Data[556] (REAL)	40200	44430	48660	52890	57120	61350	65580	69810
CAM Data[557] (REAL)	40202	44432	48662	52892	57122	61352	65582	69812
CAM Data[558] (REAL)	40204	44434	48664	52894	57124	61354	65584	69814
CAM Data[559] (REAL)	40206	44436	48666	52896	57126	61356	65586	69816
CAM Data[560] (REAL)	40208	44438	48668	52898	57128	61358	65588	69818

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[561] (REAL)	40210	44440	48670	52900	57130	61360	65590	69820
CAM Data[562] (REAL)	40212	44442	48672	52902	57132	61362	65592	69822
CAM Data[563] (REAL)	40214	44444	48674	52904	57134	61364	65594	69824
CAM Data[564] (REAL)	40216	44446	48676	52906	57136	61366	65596	69826
CAM Data[565] (REAL)	40218	44448	48678	52908	57138	61368	65598	69828
CAM Data[566] (REAL)	40220	44450	48680	52910	57140	61370	65600	69830
CAM Data[567] (REAL)	40222	44452	48682	52912	57142	61372	65602	69832
CAM Data[568] (REAL)	40224	44454	48684	52914	57144	61374	65604	69834
CAM Data[569] (REAL)	40226	44456	48686	52916	57146	61376	65606	69836
CAM Data[570] (REAL)	40228	44458	48688	52918	57148	61378	65608	69838
CAM Data[571] (REAL)	40230	44460	48690	52920	57150	61380	65610	69840
CAM Data[572] (REAL)	40232	44462	48692	52922	57152	61382	65612	69842
CAM Data[573] (REAL)	40234	44464	48694	52924	57154	61384	65614	69844
CAM Data[574] (REAL)	40236	44466	48696	52926	57156	61386	65616	69846
CAM Data[575] (REAL)	40238	44468	48698	52928	57158	61388	65618	69848
CAM Data[576] (REAL)	40240	44470	48700	52930	57160	61390	65620	69850
CAM Data[577] (REAL)	40242	44472	48702	52932	57162	61392	65622	69852
CAM Data[578] (REAL)	40244	44474	48704	52934	57164	61394	65624	69854
CAM Data[579] (REAL)	40246	44476	48706	52936	57166	61396	65626	69856
CAM Data[580] (REAL)	40248	44478	48708	52938	57168	61398	65628	69858
CAM Data[581] (REAL)	40250	44480	48710	52940	57170	61400	65630	69860
CAM Data[582] (REAL)	40252	44482	48712	52942	57172	61402	65632	69862
CAM Data[583] (REAL)	40254	44484	48714	52944	57174	61404	65634	69864
CAM Data[584] (REAL)	40256	44486	48716	52946	57176	61406	65636	69866
CAM Data[585] (REAL)	40258	44488	48718	52948	57178	61408	65638	69868
CAM Data[586] (REAL)	40260	44490	48720	52950	57180	61410	65640	69870
CAM Data[587] (REAL)	40262	44492	48722	52952	57182	61412	65642	69872
CAM Data[588] (REAL)	40264	44494	48724	52954	57184	61414	65644	69874
CAM Data[589] (REAL)	40266	44496	48726	52956	57186	61416	65646	69876
CAM Data[590] (REAL)	40268	44498	48728	52958	57188	61418	65648	69878
CAM Data[591] (REAL)	40270	44500	48730	52960	57190	61420	65650	69880
CAM Data[592] (REAL)	40272	44502	48732	52962	57192	61422	65652	69882
CAM Data[593] (REAL)	40274	44504	48734	52964	57194	61424	65654	69884
CAM Data[594] (REAL)	40276	44506	48736	52966	57196	61426	65656	69886
CAM Data[595] (REAL)	40278	44508	48738	52968	57198	61428	65658	69888
CAM Data[596] (REAL)	40280	44510	48740	52970	57200	61430	65660	69890
CAM Data[597] (REAL)	40282	44512	48742	52972	57202	61432	65662	69892
CAM Data[598] (REAL)	40284	44514	48744	52974	57204	61434	65664	69894
CAM Data[599] (REAL)	40286	44516	48746	52976	57206	61436	65666	69896
CAM Data[600] (REAL)	40288	44518	48748	52978	57208	61438	65668	69898
CAM Data[601] (REAL)	40290	44520	48750	52980	57210	61440	65670	69900

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[602] (REAL)	40292	44522	48752	52982	57212	61442	65672	69902
CAM Data[603] (REAL)	40294	44524	48754	52984	57214	61444	65674	69904
CAM Data[604] (REAL)	40296	44526	48756	52986	57216	61446	65676	69906
CAM Data[605] (REAL)	40298	44528	48758	52988	57218	61448	65678	69908
CAM Data[606] (REAL)	40300	44530	48760	52990	57220	61450	65680	69910
CAM Data[607] (REAL)	40302	44532	48762	52992	57222	61452	65682	69912
CAM Data[608] (REAL)	40304	44534	48764	52994	57224	61454	65684	69914
CAM Data[609] (REAL)	40306	44536	48766	52996	57226	61456	65686	69916
CAM Data[610] (REAL)	40308	44538	48768	52998	57228	61458	65688	69918
CAM Data[611] (REAL)	40310	44540	48770	53000	57230	61460	65690	69920
CAM Data[612] (REAL)	40312	44542	48772	53002	57232	61462	65692	69922
CAM Data[613] (REAL)	40314	44544	48774	53004	57234	61464	65694	69924
CAM Data[614] (REAL)	40316	44546	48776	53006	57236	61466	65696	69926
CAM Data[615] (REAL)	40318	44548	48778	53008	57238	61468	65698	69928
CAM Data[616] (REAL)	40320	44550	48780	53010	57240	61470	65700	69930
CAM Data[617] (REAL)	40322	44552	48782	53012	57242	61472	65702	69932
CAM Data[618] (REAL)	40324	44554	48784	53014	57244	61474	65704	69934
CAM Data[619] (REAL)	40326	44556	48786	53016	57246	61476	65706	69936
CAM Data[620] (REAL)	40328	44558	48788	53018	57248	61478	65708	69938
CAM Data[621] (REAL)	40330	44560	48790	53020	57250	61480	65710	69940
CAM Data[622] (REAL)	40332	44562	48792	53022	57252	61482	65712	69942
CAM Data[623] (REAL)	40334	44564	48794	53024	57254	61484	65714	69944
CAM Data[624] (REAL)	40336	44566	48796	53026	57256	61486	65716	69946
CAM Data[625] (REAL)	40338	44568	48798	53028	57258	61488	65718	69948
CAM Data[626] (REAL)	40340	44570	48800	53030	57260	61490	65720	69950
CAM Data[627] (REAL)	40342	44572	48802	53032	57262	61492	65722	69952
CAM Data[628] (REAL)	40344	44574	48804	53034	57264	61494	65724	69954
CAM Data[629] (REAL)	40346	44576	48806	53036	57266	61496	65726	69956
CAM Data[630] (REAL)	40348	44578	48808	53038	57268	61498	65728	69958
CAM Data[631] (REAL)	40350	44580	48810	53040	57270	61500	65730	69960
CAM Data[632] (REAL)	40352	44582	48812	53042	57272	61502	65732	69962
CAM Data[633] (REAL)	40354	44584	48814	53044	57274	61504	65734	69964
CAM Data[634] (REAL)	40356	44586	48816	53046	57276	61506	65736	69966
CAM Data[635] (REAL)	40358	44588	48818	53048	57278	61508	65738	69968
CAM Data[636] (REAL)	40360	44590	48820	53050	57280	61510	65740	69970
CAM Data[637] (REAL)	40362	44592	48822	53052	57282	61512	65742	69972
CAM Data[638] (REAL)	40364	44594	48824	53054	57284	61514	65744	69974
CAM Data[639] (REAL)	40366	44596	48826	53056	57286	61516	65746	69976
CAM Data[640] (REAL)	40368	44598	48828	53058	57288	61518	65748	69978
CAM Data[641] (REAL)	40370	44600	48830	53060	57290	61520	65750	69980
CAM Data[642] (REAL)	40372	44602	48832	53062	57292	61522	65752	69982
CAM Data[643] (REAL)	40374	44604	48834	53064	57294	61524	65754	69984

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[644] (REAL)	40376	44606	48836	53066	57296	61526	65756	69986
CAM Data[645] (REAL)	40378	44608	48838	53068	57298	61528	65758	69988
CAM Data[646] (REAL)	40380	44610	48840	53070	57300	61530	65760	69990
CAM Data[647] (REAL)	40382	44612	48842	53072	57302	61532	65762	69992
CAM Data[648] (REAL)	40384	44614	48844	53074	57304	61534	65764	69994
CAM Data[649] (REAL)	40386	44616	48846	53076	57306	61536	65766	69996
CAM Data[650] (REAL)	40388	44618	48848	53078	57308	61538	65768	69998
CAM Data[651] (REAL)	40390	44620	48850	53080	57310	61540	65770	70000
CAM Data[652] (REAL)	40392	44622	48852	53082	57312	61542	65772	70002
CAM Data[653] (REAL)	40394	44624	48854	53084	57314	61544	65774	70004
CAM Data[654] (REAL)	40396	44626	48856	53086	57316	61546	65776	70006
CAM Data[655] (REAL)	40398	44628	48858	53088	57318	61548	65778	70008
CAM Data[656] (REAL)	40400	44630	48860	53090	57320	61550	65780	70010
CAM Data[657] (REAL)	40402	44632	48862	53092	57322	61552	65782	70012
CAM Data[658] (REAL)	40404	44634	48864	53094	57324	61554	65784	70014
CAM Data[659] (REAL)	40406	44636	48866	53096	57326	61556	65786	70016
CAM Data[660] (REAL)	40408	44638	48868	53098	57328	61558	65788	70018
CAM Data[661] (REAL)	40410	44640	48870	53100	57330	61560	65790	70020
CAM Data[662] (REAL)	40412	44642	48872	53102	57332	61562	65792	70022
CAM Data[663] (REAL)	40414	44644	48874	53104	57334	61564	65794	70024
CAM Data[664] (REAL)	40416	44646	48876	53106	57336	61566	65796	70026
CAM Data[665] (REAL)	40418	44648	48878	53108	57338	61568	65798	70028
CAM Data[666] (REAL)	40420	44650	48880	53110	57340	61570	65800	70030
CAM Data[667] (REAL)	40422	44652	48882	53112	57342	61572	65802	70032
CAM Data[668] (REAL)	40424	44654	48884	53114	57344	61574	65804	70034
CAM Data[669] (REAL)	40426	44656	48886	53116	57346	61576	65806	70036
CAM Data[670] (REAL)	40428	44658	48888	53118	57348	61578	65808	70038
CAM Data[671] (REAL)	40430	44660	48890	53120	57350	61580	65810	70040
CAM Data[672] (REAL)	40432	44662	48892	53122	57352	61582	65812	70042
CAM Data[673] (REAL)	40434	44664	48894	53124	57354	61584	65814	70044
CAM Data[674] (REAL)	40436	44666	48896	53126	57356	61586	65816	70046
CAM Data[675] (REAL)	40438	44668	48898	53128	57358	61588	65818	70048
CAM Data[676] (REAL)	40440	44670	48900	53130	57360	61590	65820	70050
CAM Data[677] (REAL)	40442	44672	48902	53132	57362	61592	65822	70052
CAM Data[678] (REAL)	40444	44674	48904	53134	57364	61594	65824	70054
CAM Data[679] (REAL)	40446	44676	48906	53136	57366	61596	65826	70056
CAM Data[680] (REAL)	40448	44678	48908	53138	57368	61598	65828	70058
CAM Data[681] (REAL)	40450	44680	48910	53140	57370	61600	65830	70060
CAM Data[682] (REAL)	40452	44682	48912	53142	57372	61602	65832	70062
CAM Data[683] (REAL)	40454	44684	48914	53144	57374	61604	65834	70064
CAM Data[684] (REAL)	40456	44686	48916	53146	57376	61606	65836	70066

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[685] (REAL)	40458	44688	48918	53148	57378	61608	65838	70068
CAM Data[686] (REAL)	40460	44690	48920	53150	57380	61610	65840	70070
CAM Data[687] (REAL)	40462	44692	48922	53152	57382	61612	65842	70072
CAM Data[688] (REAL)	40464	44694	48924	53154	57384	61614	65844	70074
CAM Data[689] (REAL)	40466	44696	48926	53156	57386	61616	65846	70076
CAM Data[690] (REAL)	40468	44698	48928	53158	57388	61618	65848	70078
CAM Data[691] (REAL)	40470	44700	48930	53160	57390	61620	65850	70080
CAM Data[692] (REAL)	40472	44702	48932	53162	57392	61622	65852	70082
CAM Data[693] (REAL)	40474	44704	48934	53164	57394	61624	65854	70084
CAM Data[694] (REAL)	40476	44706	48936	53166	57396	61626	65856	70086
CAM Data[695] (REAL)	40478	44708	48938	53168	57398	61628	65858	70088
CAM Data[696] (REAL)	40480	44710	48940	53170	57400	61630	65860	70090
CAM Data[697] (REAL)	40482	44712	48942	53172	57402	61632	65862	70092
CAM Data[698] (REAL)	40484	44714	48944	53174	57404	61634	65864	70094
CAM Data[699] (REAL)	40486	44716	48946	53176	57406	61636	65866	70096
CAM Data[700] (REAL)	40488	44718	48948	53178	57408	61638	65868	70098
CAM Data[701] (REAL)	40490	44720	48950	53180	57410	61640	65870	70100
CAM Data[702] (REAL)	40492	44722	48952	53182	57412	61642	65872	70102
CAM Data[703] (REAL)	40494	44724	48954	53184	57414	61644	65874	70104
CAM Data[704] (REAL)	40496	44726	48956	53186	57416	61646	65876	70106
CAM Data[705] (REAL)	40498	44728	48958	53188	57418	61648	65878	70108
CAM Data[706] (REAL)	40500	44730	48960	53190	57420	61650	65880	70110
CAM Data[707] (REAL)	40502	44732	48962	53192	57422	61652	65882	70112
CAM Data[708] (REAL)	40504	44734	48964	53194	57424	61654	65884	70114
CAM Data[709] (REAL)	40506	44736	48966	53196	57426	61656	65886	70116
CAM Data[710] (REAL)	40508	44738	48968	53198	57428	61658	65888	70118
CAM Data[711] (REAL)	40510	44740	48970	53200	57430	61660	65890	70120
CAM Data[712] (REAL)	40512	44742	48972	53202	57432	61662	65892	70122
CAM Data[713] (REAL)	40514	44744	48974	53204	57434	61664	65894	70124
CAM Data[714] (REAL)	40516	44746	48976	53206	57436	61666	65896	70126
CAM Data[715] (REAL)	40518	44748	48978	53208	57438	61668	65898	70128
CAM Data[716] (REAL)	40520	44750	48980	53210	57440	61670	65900	70130
CAM Data[717] (REAL)	40522	44752	48982	53212	57442	61672	65902	70132
CAM Data[718] (REAL)	40524	44754	48984	53214	57444	61674	65904	70134
CAM Data[719] (REAL)	40526	44756	48986	53216	57446	61676	65906	70136
CAM Data[720] (REAL)	40528	44758	48988	53218	57448	61678	65908	70138
CAM Data[721] (REAL)	40530	44760	48990	53220	57450	61680	65910	70140
CAM Data[722] (REAL)	40532	44762	48992	53222	57452	61682	65912	70142
CAM Data[723] (REAL)	40534	44764	48994	53224	57454	61684	65914	70144
CAM Data[724] (REAL)	40536	44766	48996	53226	57456	61686	65916	70146
CAM Data[725] (REAL)	40538	44768	48998	53228	57458	61688	65918	70148
CAM Data[726] (REAL)	40540	44770	49000	53230	57460	61690	65920	70150

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[727] (REAL)	40542	44772	49002	53232	57462	61692	65922	70152
CAM Data[728] (REAL)	40544	44774	49004	53234	57464	61694	65924	70154
CAM Data[729] (REAL)	40546	44776	49006	53236	57466	61696	65926	70156
CAM Data[730] (REAL)	40548	44778	49008	53238	57468	61698	65928	70158
CAM Data[731] (REAL)	40550	44780	49010	53240	57470	61700	65930	70160
CAM Data[732] (REAL)	40552	44782	49012	53242	57472	61702	65932	70162
CAM Data[733] (REAL)	40554	44784	49014	53244	57474	61704	65934	70164
CAM Data[734] (REAL)	40556	44786	49016	53246	57476	61706	65936	70166
CAM Data[735] (REAL)	40558	44788	49018	53248	57478	61708	65938	70168
CAM Data[736] (REAL)	40560	44790	49020	53250	57480	61710	65940	70170
CAM Data[737] (REAL)	40562	44792	49022	53252	57482	61712	65942	70172
CAM Data[738] (REAL)	40564	44794	49024	53254	57484	61714	65944	70174
CAM Data[739] (REAL)	40566	44796	49026	53256	57486	61716	65946	70176
CAM Data[740] (REAL)	40568	44798	49028	53258	57488	61718	65948	70178
CAM Data[741] (REAL)	40570	44800	49030	53260	57490	61720	65950	70180
CAM Data[742] (REAL)	40572	44802	49032	53262	57492	61722	65952	70182
CAM Data[743] (REAL)	40574	44804	49034	53264	57494	61724	65954	70184
CAM Data[744] (REAL)	40576	44806	49036	53266	57496	61726	65956	70186
CAM Data[745] (REAL)	40578	44808	49038	53268	57498	61728	65958	70188
CAM Data[746] (REAL)	40580	44810	49040	53270	57500	61730	65960	70190
CAM Data[747] (REAL)	40582	44812	49042	53272	57502	61732	65962	70192
CAM Data[748] (REAL)	40584	44814	49044	53274	57504	61734	65964	70194
CAM Data[749] (REAL)	40586	44816	49046	53276	57506	61736	65966	70196
CAM Data[750] (REAL)	40588	44818	49048	53278	57508	61738	65968	70198
CAM Data[751] (REAL)	40590	44820	49050	53280	57510	61740	65970	70200
CAM Data[752] (REAL)	40592	44822	49052	53282	57512	61742	65972	70202
CAM Data[753] (REAL)	40594	44824	49054	53284	57514	61744	65974	70204
CAM Data[754] (REAL)	40596	44826	49056	53286	57516	61746	65976	70206
CAM Data[755] (REAL)	40598	44828	49058	53288	57518	61748	65978	70208
CAM Data[756] (REAL)	40600	44830	49060	53290	57520	61750	65980	70210
CAM Data[757] (REAL)	40602	44832	49062	53292	57522	61752	65982	70212
CAM Data[758] (REAL)	40604	44834	49064	53294	57524	61754	65984	70214
CAM Data[759] (REAL)	40606	44836	49066	53296	57526	61756	65986	70216
CAM Data[760] (REAL)	40608	44838	49068	53298	57528	61758	65988	70218
CAM Data[761] (REAL)	40610	44840	49070	53300	57530	61760	65990	70220
CAM Data[762] (REAL)	40612	44842	49072	53302	57532	61762	65992	70222
CAM Data[763] (REAL)	40614	44844	49074	53304	57534	61764	65994	70224
CAM Data[764] (REAL)	40616	44846	49076	53306	57536	61766	65996	70226
CAM Data[765] (REAL)	40618	44848	49078	53308	57538	61768	65998	70228
CAM Data[766] (REAL)	40620	44850	49080	53310	57540	61770	66000	70230
CAM Data[767] (REAL)	40622	44852	49082	53312	57542	61772	66002	70232

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[768] (REAL)	40624	44854	49084	53314	57544	61774	66004	70234
CAM Data[769] (REAL)	40626	44856	49086	53316	57546	61776	66006	70236
CAM Data[770] (REAL)	40628	44858	49088	53318	57548	61778	66008	70238
CAM Data[771] (REAL)	40630	44860	49090	53320	57550	61780	66010	70240
CAM Data[772] (REAL)	40632	44862	49092	53322	57552	61782	66012	70242
CAM Data[773] (REAL)	40634	44864	49094	53324	57554	61784	66014	70244
CAM Data[774] (REAL)	40636	44866	49096	53326	57556	61786	66016	70246
CAM Data[775] (REAL)	40638	44868	49098	53328	57558	61788	66018	70248
CAM Data[776] (REAL)	40640	44870	49100	53330	57560	61790	66020	70250
CAM Data[777] (REAL)	40642	44872	49102	53332	57562	61792	66022	70252
CAM Data[778] (REAL)	40644	44874	49104	53334	57564	61794	66024	70254
CAM Data[779] (REAL)	40646	44876	49106	53336	57566	61796	66026	70256
CAM Data[780] (REAL)	40648	44878	49108	53338	57568	61798	66028	70258
CAM Data[781] (REAL)	40650	44880	49110	53340	57570	61800	66030	70260
CAM Data[782] (REAL)	40652	44882	49112	53342	57572	61802	66032	70262
CAM Data[783] (REAL)	40654	44884	49114	53344	57574	61804	66034	70264
CAM Data[784] (REAL)	40656	44886	49116	53346	57576	61806	66036	70266
CAM Data[785] (REAL)	40658	44888	49118	53348	57578	61808	66038	70268
CAM Data[786] (REAL)	40660	44890	49120	53350	57580	61810	66040	70270
CAM Data[787] (REAL)	40662	44892	49122	53352	57582	61812	66042	70272
CAM Data[788] (REAL)	40664	44894	49124	53354	57584	61814	66044	70274
CAM Data[789] (REAL)	40666	44896	49126	53356	57586	61816	66046	70276
CAM Data[790] (REAL)	40668	44898	49128	53358	57588	61818	66048	70278
CAM Data[791] (REAL)	40670	44900	49130	53360	57590	61820	66050	70280
CAM Data[792] (REAL)	40672	44902	49132	53362	57592	61822	66052	70282
CAM Data[793] (REAL)	40674	44904	49134	53364	57594	61824	66054	70284
CAM Data[794] (REAL)	40676	44906	49136	53366	57596	61826	66056	70286
CAM Data[795] (REAL)	40678	44908	49138	53368	57598	61828	66058	70288
CAM Data[796] (REAL)	40680	44910	49140	53370	57600	61830	66060	70290
CAM Data[797] (REAL)	40682	44912	49142	53372	57602	61832	66062	70292
CAM Data[798] (REAL)	40684	44914	49144	53374	57604	61834	66064	70294
CAM Data[799] (REAL)	40686	44916	49146	53376	57606	61836	66066	70296
CAM Data[800] (REAL)	40688	44918	49148	53378	57608	61838	66068	70298
CAM Data[801] (REAL)	40690	44920	49150	53380	57610	61840	66070	70300
CAM Data[802] (REAL)	40692	44922	49152	53382	57612	61842	66072	70302
CAM Data[803] (REAL)	40694	44924	49154	53384	57614	61844	66074	70304
CAM Data[804] (REAL)	40696	44926	49156	53386	57616	61846	66076	70306
CAM Data[805] (REAL)	40698	44928	49158	53388	57618	61848	66078	70308
CAM Data[806] (REAL)	40700	44930	49160	53390	57620	61850	66080	70310
CAM Data[807] (REAL)	40702	44932	49162	53392	57622	61852	66082	70312
CAM Data[808] (REAL)	40704	44934	49164	53394	57624	61854	66084	70314
CAM Data[809] (REAL)	40706	44936	49166	53396	57626	61856	66086	70316

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[810] (REAL)	40708	44938	49168	53398	57628	61858	66088	70318
CAM Data[811] (REAL)	40710	44940	49170	53400	57630	61860	66090	70320
CAM Data[812] (REAL)	40712	44942	49172	53402	57632	61862	66092	70322
CAM Data[813] (REAL)	40714	44944	49174	53404	57634	61864	66094	70324
CAM Data[814] (REAL)	40716	44946	49176	53406	57636	61866	66096	70326
CAM Data[815] (REAL)	40718	44948	49178	53408	57638	61868	66098	70328
CAM Data[816] (REAL)	40720	44950	49180	53410	57640	61870	66100	70330
CAM Data[817] (REAL)	40722	44952	49182	53412	57642	61872	66102	70332
CAM Data[818] (REAL)	40724	44954	49184	53414	57644	61874	66104	70334
CAM Data[819] (REAL)	40726	44956	49186	53416	57646	61876	66106	70336
CAM Data[820] (REAL)	40728	44958	49188	53418	57648	61878	66108	70338
CAM Data[821] (REAL)	40730	44960	49190	53420	57650	61880	66110	70340
CAM Data[822] (REAL)	40732	44962	49192	53422	57652	61882	66112	70342
CAM Data[823] (REAL)	40734	44964	49194	53424	57654	61884	66114	70344
CAM Data[824] (REAL)	40736	44966	49196	53426	57656	61886	66116	70346
CAM Data[825] (REAL)	40738	44968	49198	53428	57658	61888	66118	70348
CAM Data[826] (REAL)	40740	44970	49200	53430	57660	61890	66120	70350
CAM Data[827] (REAL)	40742	44972	49202	53432	57662	61892	66122	70352
CAM Data[828] (REAL)	40744	44974	49204	53434	57664	61894	66124	70354
CAM Data[829] (REAL)	40746	44976	49206	53436	57666	61896	66126	70356
CAM Data[830] (REAL)	40748	44978	49208	53438	57668	61898	66128	70358
CAM Data[831] (REAL)	40750	44980	49210	53440	57670	61900	66130	70360
CAM Data[832] (REAL)	40752	44982	49212	53442	57672	61902	66132	70362
CAM Data[833] (REAL)	40754	44984	49214	53444	57674	61904	66134	70364
CAM Data[834] (REAL)	40756	44986	49216	53446	57676	61906	66136	70366
CAM Data[835] (REAL)	40758	44988	49218	53448	57678	61908	66138	70368
CAM Data[836] (REAL)	40760	44990	49220	53450	57680	61910	66140	70370
CAM Data[837] (REAL)	40762	44992	49222	53452	57682	61912	66142	70372
CAM Data[838] (REAL)	40764	44994	49224	53454	57684	61914	66144	70374
CAM Data[839] (REAL)	40766	44996	49226	53456	57686	61916	66146	70376
CAM Data[840] (REAL)	40768	44998	49228	53458	57688	61918	66148	70378
CAM Data[841] (REAL)	40770	45000	49230	53460	57690	61920	66150	70380
CAM Data[842] (REAL)	40772	45002	49232	53462	57692	61922	66152	70382
CAM Data[843] (REAL)	40774	45004	49234	53464	57694	61924	66154	70384
CAM Data[844] (REAL)	40776	45006	49236	53466	57696	61926	66156	70386
CAM Data[845] (REAL)	40778	45008	49238	53468	57698	61928	66158	70388
CAM Data[846] (REAL)	40780	45010	49240	53470	57700	61930	66160	70390
CAM Data[847] (REAL)	40782	45012	49242	53472	57702	61932	66162	70392
CAM Data[848] (REAL)	40784	45014	49244	53474	57704	61934	66164	70394
CAM Data[849] (REAL)	40786	45016	49246	53476	57706	61936	66166	70396
CAM Data[850] (REAL)	40788	45018	49248	53478	57708	61938	66168	70398

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[851] (REAL)	40790	45020	49250	53480	57710	61940	66170	70400
CAM Data[852] (REAL)	40792	45022	49252	53482	57712	61942	66172	70402
CAM Data[853] (REAL)	40794	45024	49254	53484	57714	61944	66174	70404
CAM Data[854] (REAL)	40796	45026	49256	53486	57716	61946	66176	70406
CAM Data[855] (REAL)	40798	45028	49258	53488	57718	61948	66178	70408
CAM Data[856] (REAL)	40800	45030	49260	53490	57720	61950	66180	70410
CAM Data[857] (REAL)	40802	45032	49262	53492	57722	61952	66182	70412
CAM Data[858] (REAL)	40804	45034	49264	53494	57724	61954	66184	70414
CAM Data[859] (REAL)	40806	45036	49266	53496	57726	61956	66186	70416
CAM Data[860] (REAL)	40808	45038	49268	53498	57728	61958	66188	70418
CAM Data[861] (REAL)	40810	45040	49270	53500	57730	61960	66190	70420
CAM Data[862] (REAL)	40812	45042	49272	53502	57732	61962	66192	70422
CAM Data[863] (REAL)	40814	45044	49274	53504	57734	61964	66194	70424
CAM Data[864] (REAL)	40816	45046	49276	53506	57736	61966	66196	70426
CAM Data[865] (REAL)	40818	45048	49278	53508	57738	61968	66198	70428
CAM Data[866] (REAL)	40820	45050	49280	53510	57740	61970	66200	70430
CAM Data[867] (REAL)	40822	45052	49282	53512	57742	61972	66202	70432
CAM Data[868] (REAL)	40824	45054	49284	53514	57744	61974	66204	70434
CAM Data[869] (REAL)	40826	45056	49286	53516	57746	61976	66206	70436
CAM Data[870] (REAL)	40828	45058	49288	53518	57748	61978	66208	70438
CAM Data[871] (REAL)	40830	45060	49290	53520	57750	61980	66210	70440
CAM Data[872] (REAL)	40832	45062	49292	53522	57752	61982	66212	70442
CAM Data[873] (REAL)	40834	45064	49294	53524	57754	61984	66214	70444
CAM Data[874] (REAL)	40836	45066	49296	53526	57756	61986	66216	70446
CAM Data[875] (REAL)	40838	45068	49298	53528	57758	61988	66218	70448
CAM Data[876] (REAL)	40840	45070	49300	53530	57760	61990	66220	70450
CAM Data[877] (REAL)	40842	45072	49302	53532	57762	61992	66222	70452
CAM Data[878] (REAL)	40844	45074	49304	53534	57764	61994	66224	70454
CAM Data[879] (REAL)	40846	45076	49306	53536	57766	61996	66226	70456
CAM Data[880] (REAL)	40848	45078	49308	53538	57768	61998	66228	70458
CAM Data[881] (REAL)	40850	45080	49310	53540	57770	62000	66230	70460
CAM Data[882] (REAL)	40852	45082	49312	53542	57772	62002	66232	70462
CAM Data[883] (REAL)	40854	45084	49314	53544	57774	62004	66234	70464
CAM Data[884] (REAL)	40856	45086	49316	53546	57776	62006	66236	70466
CAM Data[885] (REAL)	40858	45088	49318	53548	57778	62008	66238	70468
CAM Data[886] (REAL)	40860	45090	49320	53550	57780	62010	66240	70470
CAM Data[887] (REAL)	40862	45092	49322	53552	57782	62012	66242	70472
CAM Data[888] (REAL)	40864	45094	49324	53554	57784	62014	66244	70474
CAM Data[889] (REAL)	40866	45096	49326	53556	57786	62016	66246	70476
CAM Data[890] (REAL)	40868	45098	49328	53558	57788	62018	66248	70478
CAM Data[891] (REAL)	40870	45100	49330	53560	57790	62020	66250	70480
CAM Data[892] (REAL)	40872	45102	49332	53562	57792	62022	66252	70482

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[893] (REAL)	40874	45104	49334	53564	57794	62024	66254	70484
CAM Data[894] (REAL)	40876	45106	49336	53566	57796	62026	66256	70486
CAM Data[895] (REAL)	40878	45108	49338	53568	57798	62028	66258	70488
CAM Data[896] (REAL)	40880	45110	49340	53570	57800	62030	66260	70490
CAM Data[897] (REAL)	40882	45112	49342	53572	57802	62032	66262	70492
CAM Data[898] (REAL)	40884	45114	49344	53574	57804	62034	66264	70494
CAM Data[899] (REAL)	40886	45116	49346	53576	57806	62036	66266	70496
CAM Data[900] (REAL)	40888	45118	49348	53578	57808	62038	66268	70498
CAM Data[901] (REAL)	40890	45120	49350	53580	57810	62040	66270	70500
CAM Data[902] (REAL)	40892	45122	49352	53582	57812	62042	66272	70502
CAM Data[903] (REAL)	40894	45124	49354	53584	57814	62044	66274	70504
CAM Data[904] (REAL)	40896	45126	49356	53586	57816	62046	66276	70506
CAM Data[905] (REAL)	40898	45128	49358	53588	57818	62048	66278	70508
CAM Data[906] (REAL)	40900	45130	49360	53590	57820	62050	66280	70510
CAM Data[907] (REAL)	40902	45132	49362	53592	57822	62052	66282	70512
CAM Data[908] (REAL)	40904	45134	49364	53594	57824	62054	66284	70514
CAM Data[909] (REAL)	40906	45136	49366	53596	57826	62056	66286	70516
CAM Data[910] (REAL)	40908	45138	49368	53598	57828	62058	66288	70518
CAM Data[911] (REAL)	40910	45140	49370	53600	57830	62060	66290	70520
CAM Data[912] (REAL)	40912	45142	49372	53602	57832	62062	66292	70522
CAM Data[913] (REAL)	40914	45144	49374	53604	57834	62064	66294	70524
CAM Data[914] (REAL)	40916	45146	49376	53606	57836	62066	66296	70526
CAM Data[915] (REAL)	40918	45148	49378	53608	57838	62068	66298	70528
CAM Data[916] (REAL)	40920	45150	49380	53610	57840	62070	66300	70530
CAM Data[917] (REAL)	40922	45152	49382	53612	57842	62072	66302	70532
CAM Data[918] (REAL)	40924	45154	49384	53614	57844	62074	66304	70534
CAM Data[919] (REAL)	40926	45156	49386	53616	57846	62076	66306	70536
CAM Data[920] (REAL)	40928	45158	49388	53618	57848	62078	66308	70538
CAM Data[921] (REAL)	40930	45160	49390	53620	57850	62080	66310	70540
CAM Data[922] (REAL)	40932	45162	49392	53622	57852	62082	66312	70542
CAM Data[923] (REAL)	40934	45164	49394	53624	57854	62084	66314	70544
CAM Data[924] (REAL)	40936	45166	49396	53626	57856	62086	66316	70546
CAM Data[925] (REAL)	40938	45168	49398	53628	57858	62088	66318	70548
CAM Data[926] (REAL)	40940	45170	49400	53630	57860	62090	66320	70550
CAM Data[927] (REAL)	40942	45172	49402	53632	57862	62092	66322	70552
CAM Data[928] (REAL)	40944	45174	49404	53634	57864	62094	66324	70554
CAM Data[929] (REAL)	40946	45176	49406	53636	57866	62096	66326	70556
CAM Data[930] (REAL)	40948	45178	49408	53638	57868	62098	66328	70558
CAM Data[931] (REAL)	40950	45180	49410	53640	57870	62100	66330	70560
CAM Data[932] (REAL)	40952	45182	49412	53642	57872	62102	66332	70562
CAM Data[933] (REAL)	40954	45184	49414	53644	57874	62104	66334	70564

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[934] (REAL)	40956	45186	49416	53646	57876	62106	66336	70566
CAM Data[935] (REAL)	40958	45188	49418	53648	57878	62108	66338	70568
CAM Data[936] (REAL)	40960	45190	49420	53650	57880	62110	66340	70570
CAM Data[937] (REAL)	40962	45192	49422	53652	57882	62112	66342	70572
CAM Data[938] (REAL)	40964	45194	49424	53654	57884	62114	66344	70574
CAM Data[939] (REAL)	40966	45196	49426	53656	57886	62116	66346	70576
CAM Data[940] (REAL)	40968	45198	49428	53658	57888	62118	66348	70578
CAM Data[941] (REAL)	40970	45200	49430	53660	57890	62120	66350	70580
CAM Data[942] (REAL)	40972	45202	49432	53662	57892	62122	66352	70582
CAM Data[943] (REAL)	40974	45204	49434	53664	57894	62124	66354	70584
CAM Data[944] (REAL)	40976	45206	49436	53666	57896	62126	66356	70586
CAM Data[945] (REAL)	40978	45208	49438	53668	57898	62128	66358	70588
CAM Data[946] (REAL)	40980	45210	49440	53670	57900	62130	66360	70590
CAM Data[947] (REAL)	40982	45212	49442	53672	57902	62132	66362	70592
CAM Data[948] (REAL)	40984	45214	49444	53674	57904	62134	66364	70594
CAM Data[949] (REAL)	40986	45216	49446	53676	57906	62136	66366	70596
CAM Data[950] (REAL)	40988	45218	49448	53678	57908	62138	66368	70598
CAM Data[951] (REAL)	40990	45220	49450	53680	57910	62140	66370	70600
CAM Data[952] (REAL)	40992	45222	49452	53682	57912	62142	66372	70602
CAM Data[953] (REAL)	40994	45224	49454	53684	57914	62144	66374	70604
CAM Data[954] (REAL)	40996	45226	49456	53686	57916	62146	66376	70606
CAM Data[955] (REAL)	40998	45228	49458	53688	57918	62148	66378	70608
CAM Data[956] (REAL)	41000	45230	49460	53690	57920	62150	66380	70610
CAM Data[957] (REAL)	41002	45232	49462	53692	57922	62152	66382	70612
CAM Data[958] (REAL)	41004	45234	49464	53694	57924	62154	66384	70614
CAM Data[959] (REAL)	41006	45236	49466	53696	57926	62156	66386	70616
CAM Data[960] (REAL)	41008	45238	49468	53698	57928	62158	66388	70618
CAM Data[961] (REAL)	41010	45240	49470	53700	57930	62160	66390	70620
CAM Data[962] (REAL)	41012	45242	49472	53702	57932	62162	66392	70622
CAM Data[963] (REAL)	41014	45244	49474	53704	57934	62164	66394	70624
CAM Data[964] (REAL)	41016	45246	49476	53706	57936	62166	66396	70626
CAM Data[965] (REAL)	41018	45248	49478	53708	57938	62168	66398	70628
CAM Data[966] (REAL)	41020	45250	49480	53710	57940	62170	66400	70630
CAM Data[967] (REAL)	41022	45252	49482	53712	57942	62172	66402	70632
CAM Data[968] (REAL)	41024	45254	49484	53714	57944	62174	66404	70634
CAM Data[969] (REAL)	41026	45256	49486	53716	57946	62176	66406	70636
CAM Data[970] (REAL)	41028	45258	49488	53718	57948	62178	66408	70638
CAM Data[971] (REAL)	41030	45260	49490	53720	57950	62180	66410	70640
CAM Data[972] (REAL)	41032	45262	49492	53722	57952	62182	66412	70642
CAM Data[973] (REAL)	41034	45264	49494	53724	57954	62184	66414	70644
CAM Data[974] (REAL)	41036	45266	49496	53726	57956	62186	66416	70646
CAM Data[975] (REAL)	41038	45268	49498	53728	57958	62188	66418	70648

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[976] (REAL)	41040	45270	49500	53730	57960	62190	66420	70650
CAM Data[977] (REAL)	41042	45272	49502	53732	57962	62192	66422	70652
CAM Data[978] (REAL)	41044	45274	49504	53734	57964	62194	66424	70654
CAM Data[979] (REAL)	41046	45276	49506	53736	57966	62196	66426	70656
CAM Data[980] (REAL)	41048	45278	49508	53738	57968	62198	66428	70658
CAM Data[981] (REAL)	41050	45280	49510	53740	57970	62200	66430	70660
CAM Data[982] (REAL)	41052	45282	49512	53742	57972	62202	66432	70662
CAM Data[983] (REAL)	41054	45284	49514	53744	57974	62204	66434	70664
CAM Data[984] (REAL)	41056	45286	49516	53746	57976	62206	66436	70666
CAM Data[985] (REAL)	41058	45288	49518	53748	57978	62208	66438	70668
CAM Data[986] (REAL)	41060	45290	49520	53750	57980	62210	66440	70670
CAM Data[987] (REAL)	41062	45292	49522	53752	57982	62212	66442	70672
CAM Data[988] (REAL)	41064	45294	49524	53754	57984	62214	66444	70674
CAM Data[989] (REAL)	41066	45296	49526	53756	57986	62216	66446	70676
CAM Data[990] (REAL)	41068	45298	49528	53758	57988	62218	66448	70678
CAM Data[991] (REAL)	41070	45300	49530	53760	57990	62220	66450	70680
CAM Data[992] (REAL)	41072	45302	49532	53762	57992	62222	66452	70682
CAM Data[993] (REAL)	41074	45304	49534	53764	57994	62224	66454	70684
CAM Data[994] (REAL)	41076	45306	49536	53766	57996	62226	66456	70686
CAM Data[995] (REAL)	41078	45308	49538	53768	57998	62228	66458	70688
CAM Data[996] (REAL)	41080	45310	49540	53770	58000	62230	66460	70690
CAM Data[997] (REAL)	41082	45312	49542	53772	58002	62232	66462	70692
CAM Data[998] (REAL)	41084	45314	49544	53774	58004	62234	66464	70694
CAM Data[999] (REAL)	41086	45316	49546	53776	58006	62236	66466	70696
CAM Data[1000] (REAL)	41088	45318	49548	53778	58008	62238	66468	70698
CAM Data[1001] (REAL)	41090	45320	49550	53780	58010	62240	66470	70700
CAM Data[1002] (REAL)	41092	45322	49552	53782	58012	62242	66472	70702
CAM Data[1003] (REAL)	41094	45324	49554	53784	58014	62244	66474	70704
CAM Data[1004] (REAL)	41096	45326	49556	53786	58016	62246	66476	70706
CAM Data[1005] (REAL)	41098	45328	49558	53788	58018	62248	66478	70708
CAM Data[1006] (REAL)	41100	45330	49560	53790	58020	62250	66480	70710
CAM Data[1007] (REAL)	41102	45332	49562	53792	58022	62252	66482	70712
CAM Data[1008] (REAL)	41104	45334	49564	53794	58024	62254	66484	70714
CAM Data[1009] (REAL)	41106	45336	49566	53796	58026	62256	66486	70716
CAM Data[1010] (REAL)	41108	45338	49568	53798	58028	62258	66488	70718
CAM Data[1011] (REAL)	41110	45340	49570	53800	58030	62260	66490	70720
CAM Data[1012] (REAL)	41112	45342	49572	53802	58032	62262	66492	70722
CAM Data[1013] (REAL)	41114	45344	49574	53804	58034	62264	66494	70724
CAM Data[1014] (REAL)	41116	45346	49576	53806	58036	62266	66496	70726
CAM Data[1015] (REAL)	41118	45348	49578	53808	58038	62268	66498	70728
CAM Data[1016] (REAL)	41120	45350	49580	53810	58040	62270	66500	70730

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[1017] (REAL)	41122	45352	49582	53812	58042	62272	66502	70732
CAM Data[1018] (REAL)	41124	45354	49584	53814	58044	62274	66504	70734
CAM Data[1019] (REAL)	41126	45356	49586	53816	58046	62276	66506	70736
CAM Data[1020] (REAL)	41128	45358	49588	53818	58048	62278	66508	70738
CAM Data[1021] (REAL)	41130	45360	49590	53820	58050	62280	66510	70740
CAM Data[1022] (REAL)	41132	45362	49592	53822	58052	62282	66512	70742
CAM Data[1023] (REAL)	41134	45364	49594	53824	58054	62284	66514	70744
CAM Data[1024] (REAL)	41136	45366	49596	53826	58056	62286	66516	70746
CAM Data[1025] (REAL)	41138	45368	49598	53828	58058	62288	66518	70748
CAM Data[1026] (REAL)	41140	45370	49600	53830	58060	62290	66520	70750
CAM Data[1027] (REAL)	41142	45372	49602	53832	58062	62292	66522	70752
CAM Data[1028] (REAL)	41144	45374	49604	53834	58064	62294	66524	70754
CAM Data[1029] (REAL)	41146	45376	49606	53836	58066	62296	66526	70756
CAM Data[1030] (REAL)	41148	45378	49608	53838	58068	62298	66528	70758
CAM Data[1031] (REAL)	41150	45380	49610	53840	58070	62300	66530	70760
CAM Data[1032] (REAL)	41152	45382	49612	53842	58072	62302	66532	70762
CAM Data[1033] (REAL)	41154	45384	49614	53844	58074	62304	66534	70764
CAM Data[1034] (REAL)	41156	45386	49616	53846	58076	62306	66536	70766
CAM Data[1035] (REAL)	41158	45388	49618	53848	58078	62308	66538	70768
CAM Data[1036] (REAL)	41160	45390	49620	53850	58080	62310	66540	70770
CAM Data[1037] (REAL)	41162	45392	49622	53852	58082	62312	66542	70772
CAM Data[1038] (REAL)	41164	45394	49624	53854	58084	62314	66544	70774
CAM Data[1039] (REAL)	41166	45396	49626	53856	58086	62316	66546	70776
CAM Data[1040] (REAL)	41168	45398	49628	53858	58088	62318	66548	70778
CAM Data[1041] (REAL)	41170	45400	49630	53860	58090	62320	66550	70780
CAM Data[1042] (REAL)	41172	45402	49632	53862	58092	62322	66552	70782
CAM Data[1043] (REAL)	41174	45404	49634	53864	58094	62324	66554	70784
CAM Data[1044] (REAL)	41176	45406	49636	53866	58096	62326	66556	70786
CAM Data[1045] (REAL)	41178	45408	49638	53868	58098	62328	66558	70788
CAM Data[1046] (REAL)	41180	45410	49640	53870	58100	62330	66560	70790
CAM Data[1047] (REAL)	41182	45412	49642	53872	58102	62332	66562	70792
CAM Data[1048] (REAL)	41184	45414	49644	53874	58104	62334	66564	70794
CAM Data[1049] (REAL)	41186	45416	49646	53876	58106	62336	66566	70796
CAM Data[1050] (REAL)	41188	45418	49648	53878	58108	62338	66568	70798
CAM Data[1051] (REAL)	41190	45420	49650	53880	58110	62340	66570	70800
CAM Data[1052] (REAL)	41192	45422	49652	53882	58112	62342	66572	70802
CAM Data[1053] (REAL)	41194	45424	49654	53884	58114	62344	66574	70804
CAM Data[1054] (REAL)	41196	45426	49656	53886	58116	62346	66576	70806
CAM Data[1055] (REAL)	41198	45428	49658	53888	58118	62348	66578	70808
CAM Data[1056] (REAL)	41200	45430	49660	53890	58120	62350	66580	70810
CAM Data[1057] (REAL)	41202	45432	49662	53892	58122	62352	66582	70812
CAM Data[1058] (REAL)	41204	45434	49664	53894	58124	62354	66584	70814

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[1059] (REAL)	41206	45436	49666	53896	58126	62356	66586	70816
CAM Data[1060] (REAL)	41208	45438	49668	53898	58128	62358	66588	70818
CAM Data[1061] (REAL)	41210	45440	49670	53900	58130	62360	66590	70820
CAM Data[1062] (REAL)	41212	45442	49672	53902	58132	62362	66592	70822
CAM Data[1063] (REAL)	41214	45444	49674	53904	58134	62364	66594	70824
CAM Data[1064] (REAL)	41216	45446	49676	53906	58136	62366	66596	70826
CAM Data[1065] (REAL)	41218	45448	49678	53908	58138	62368	66598	70828
CAM Data[1066] (REAL)	41220	45450	49680	53910	58140	62370	66600	70830
CAM Data[1067] (REAL)	41222	45452	49682	53912	58142	62372	66602	70832
CAM Data[1068] (REAL)	41224	45454	49684	53914	58144	62374	66604	70834
CAM Data[1069] (REAL)	41226	45456	49686	53916	58146	62376	66606	70836
CAM Data[1070] (REAL)	41228	45458	49688	53918	58148	62378	66608	70838
CAM Data[1071] (REAL)	41230	45460	49690	53920	58150	62380	66610	70840
CAM Data[1072] (REAL)	41232	45462	49692	53922	58152	62382	66612	70842
CAM Data[1073] (REAL)	41234	45464	49694	53924	58154	62384	66614	70844
CAM Data[1074] (REAL)	41236	45466	49696	53926	58156	62386	66616	70846
CAM Data[1075] (REAL)	41238	45468	49698	53928	58158	62388	66618	70848
CAM Data[1076] (REAL)	41240	45470	49700	53930	58160	62390	66620	70850
CAM Data[1077] (REAL)	41242	45472	49702	53932	58162	62392	66622	70852
CAM Data[1078] (REAL)	41244	45474	49704	53934	58164	62394	66624	70854
CAM Data[1079] (REAL)	41246	45476	49706	53936	58166	62396	66626	70856
CAM Data[1080] (REAL)	41248	45478	49708	53938	58168	62398	66628	70858
CAM Data[1081] (REAL)	41250	45480	49710	53940	58170	62400	66630	70860
CAM Data[1082] (REAL)	41252	45482	49712	53942	58172	62402	66632	70862
CAM Data[1083] (REAL)	41254	45484	49714	53944	58174	62404	66634	70864
CAM Data[1084] (REAL)	41256	45486	49716	53946	58176	62406	66636	70866
CAM Data[1085] (REAL)	41258	45488	49718	53948	58178	62408	66638	70868
CAM Data[1086] (REAL)	41260	45490	49720	53950	58180	62410	66640	70870
CAM Data[1087] (REAL)	41262	45492	49722	53952	58182	62412	66642	70872
CAM Data[1088] (REAL)	41264	45494	49724	53954	58184	62414	66644	70874
CAM Data[1089] (REAL)	41266	45496	49726	53956	58186	62416	66646	70876
CAM Data[1090] (REAL)	41268	45498	49728	53958	58188	62418	66648	70878
CAM Data[1091] (REAL)	41270	45500	49730	53960	58190	62420	66650	70880
CAM Data[1092] (REAL)	41272	45502	49732	53962	58192	62422	66652	70882
CAM Data[1093] (REAL)	41274	45504	49734	53964	58194	62424	66654	70884
CAM Data[1094] (REAL)	41276	45506	49736	53966	58196	62426	66656	70886
CAM Data[1095] (REAL)	41278	45508	49738	53968	58198	62428	66658	70888
CAM Data[1096] (REAL)	41280	45510	49740	53970	58200	62430	66660	70890
CAM Data[1097] (REAL)	41282	45512	49742	53972	58202	62432	66662	70892
CAM Data[1098] (REAL)	41284	45514	49744	53974	58204	62434	66664	70894
CAM Data[1099] (REAL)	41286	45516	49746	53976	58206	62436	66666	70896

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[1100] (REAL)	41288	45518	49748	53978	58208	62438	66668	70898
CAM Data[1101] (REAL)	41290	45520	49750	53980	58210	62440	66670	70900
CAM Data[1102] (REAL)	41292	45522	49752	53982	58212	62442	66672	70902
CAM Data[1103] (REAL)	41294	45524	49754	53984	58214	62444	66674	70904
CAM Data[1104] (REAL)	41296	45526	49756	53986	58216	62446	66676	70906
CAM Data[1105] (REAL)	41298	45528	49758	53988	58218	62448	66678	70908
CAM Data[1106] (REAL)	41300	45530	49760	53990	58220	62450	66680	70910
CAM Data[1107] (REAL)	41302	45532	49762	53992	58222	62452	66682	70912
CAM Data[1108] (REAL)	41304	45534	49764	53994	58224	62454	66684	70914
CAM Data[1109] (REAL)	41306	45536	49766	53996	58226	62456	66686	70916
CAM Data[1110] (REAL)	41308	45538	49768	53998	58228	62458	66688	70918
CAM Data[1111] (REAL)	41310	45540	49770	54000	58230	62460	66690	70920
CAM Data[1112] (REAL)	41312	45542	49772	54002	58232	62462	66692	70922
CAM Data[1113] (REAL)	41314	45544	49774	54004	58234	62464	66694	70924
CAM Data[1114] (REAL)	41316	45546	49776	54006	58236	62466	66696	70926
CAM Data[1115] (REAL)	41318	45548	49778	54008	58238	62468	66698	70928
CAM Data[1116] (REAL)	41320	45550	49780	54010	58240	62470	66700	70930
CAM Data[1117] (REAL)	41322	45552	49782	54012	58242	62472	66702	70932
CAM Data[1118] (REAL)	41324	45554	49784	54014	58244	62474	66704	70934
CAM Data[1119] (REAL)	41326	45556	49786	54016	58246	62476	66706	70936
CAM Data[1120] (REAL)	41328	45558	49788	54018	58248	62478	66708	70938
CAM Data[1121] (REAL)	41330	45560	49790	54020	58250	62480	66710	70940
CAM Data[1122] (REAL)	41332	45562	49792	54022	58252	62482	66712	70942
CAM Data[1123] (REAL)	41334	45564	49794	54024	58254	62484	66714	70944
CAM Data[1124] (REAL)	41336	45566	49796	54026	58256	62486	66716	70946
CAM Data[1125] (REAL)	41338	45568	49798	54028	58258	62488	66718	70948
CAM Data[1126] (REAL)	41340	45570	49800	54030	58260	62490	66720	70950
CAM Data[1127] (REAL)	41342	45572	49802	54032	58262	62492	66722	70952
CAM Data[1128] (REAL)	41344	45574	49804	54034	58264	62494	66724	70954
CAM Data[1129] (REAL)	41346	45576	49806	54036	58266	62496	66726	70956
CAM Data[1130] (REAL)	41348	45578	49808	54038	58268	62498	66728	70958
CAM Data[1131] (REAL)	41350	45580	49810	54040	58270	62500	66730	70960
CAM Data[1132] (REAL)	41352	45582	49812	54042	58272	62502	66732	70962
CAM Data[1133] (REAL)	41354	45584	49814	54044	58274	62504	66734	70964
CAM Data[1134] (REAL)	41356	45586	49816	54046	58276	62506	66736	70966
CAM Data[1135] (REAL)	41358	45588	49818	54048	58278	62508	66738	70968
CAM Data[1136] (REAL)	41360	45590	49820	54050	58280	62510	66740	70970
CAM Data[1137] (REAL)	41362	45592	49822	54052	58282	62512	66742	70972
CAM Data[1138] (REAL)	41364	45594	49824	54054	58284	62514	66744	70974
CAM Data[1139] (REAL)	41366	45596	49826	54056	58286	62516	66746	70976
CAM Data[1140] (REAL)	41368	45598	49828	54058	58288	62518	66748	70978
CAM Data[1141] (REAL)	41370	45600	49830	54060	58290	62520	66750	70980

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[1142] (REAL)	41372	45602	49832	54062	58292	62522	66752	70982
CAM Data[1143] (REAL)	41374	45604	49834	54064	58294	62524	66754	70984
CAM Data[1144] (REAL)	41376	45606	49836	54066	58296	62526	66756	70986
CAM Data[1145] (REAL)	41378	45608	49838	54068	58298	62528	66758	70988
CAM Data[1146] (REAL)	41380	45610	49840	54070	58300	62530	66760	70990
CAM Data[1147] (REAL)	41382	45612	49842	54072	58302	62532	66762	70992
CAM Data[1148] (REAL)	41384	45614	49844	54074	58304	62534	66764	70994
CAM Data[1149] (REAL)	41386	45616	49846	54076	58306	62536	66766	70996
CAM Data[1150] (REAL)	41388	45618	49848	54078	58308	62538	66768	70998
CAM Data[1151] (REAL)	41390	45620	49850	54080	58310	62540	66770	71000
CAM Data[1152] (REAL)	41392	45622	49852	54082	58312	62542	66772	71002
CAM Data[1153] (REAL)	41394	45624	49854	54084	58314	62544	66774	71004
CAM Data[1154] (REAL)	41396	45626	49856	54086	58316	62546	66776	71006
CAM Data[1155] (REAL)	41398	45628	49858	54088	58318	62548	66778	71008
CAM Data[1156] (REAL)	41400	45630	49860	54090	58320	62550	66780	71010
CAM Data[1157] (REAL)	41402	45632	49862	54092	58322	62552	66782	71012
CAM Data[1158] (REAL)	41404	45634	49864	54094	58324	62554	66784	71014
CAM Data[1159] (REAL)	41406	45636	49866	54096	58326	62556	66786	71016
CAM Data[1160] (REAL)	41408	45638	49868	54098	58328	62558	66788	71018
CAM Data[1161] (REAL)	41410	45640	49870	54100	58330	62560	66790	71020
CAM Data[1162] (REAL)	41412	45642	49872	54102	58332	62562	66792	71022
CAM Data[1163] (REAL)	41414	45644	49874	54104	58334	62564	66794	71024
CAM Data[1164] (REAL)	41416	45646	49876	54106	58336	62566	66796	71026
CAM Data[1165] (REAL)	41418	45648	49878	54108	58338	62568	66798	71028
CAM Data[1166] (REAL)	41420	45650	49880	54110	58340	62570	66800	71030
CAM Data[1167] (REAL)	41422	45652	49882	54112	58342	62572	66802	71032
CAM Data[1168] (REAL)	41424	45654	49884	54114	58344	62574	66804	71034
CAM Data[1169] (REAL)	41426	45656	49886	54116	58346	62576	66806	71036
CAM Data[1170] (REAL)	41428	45658	49888	54118	58348	62578	66808	71038
CAM Data[1171] (REAL)	41430	45660	49890	54120	58350	62580	66810	71040
CAM Data[1172] (REAL)	41432	45662	49892	54122	58352	62582	66812	71042
CAM Data[1173] (REAL)	41434	45664	49894	54124	58354	62584	66814	71044
CAM Data[1174] (REAL)	41436	45666	49896	54126	58356	62586	66816	71046
CAM Data[1175] (REAL)	41438	45668	49898	54128	58358	62588	66818	71048
CAM Data[1176] (REAL)	41440	45670	49900	54130	58360	62590	66820	71050
CAM Data[1177] (REAL)	41442	45672	49902	54132	58362	62592	66822	71052
CAM Data[1178] (REAL)	41444	45674	49904	54134	58364	62594	66824	71054
CAM Data[1179] (REAL)	41446	45676	49906	54136	58366	62596	66826	71056
CAM Data[1180] (REAL)	41448	45678	49908	54138	58368	62598	66828	71058
CAM Data[1181] (REAL)	41450	45680	49910	54140	58370	62600	66830	71060
CAM Data[1182] (REAL)	41452	45682	49912	54142	58372	62602	66832	71062

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[1183] (REAL)	41454	45684	49914	54144	58374	62604	66834	71064
CAM Data[1184] (REAL)	41456	45686	49916	54146	58376	62606	66836	71066
CAM Data[1185] (REAL)	41458	45688	49918	54148	58378	62608	66838	71068
CAM Data[1186] (REAL)	41460	45690	49920	54150	58380	62610	66840	71070
CAM Data[1187] (REAL)	41462	45692	49922	54152	58382	62612	66842	71072
CAM Data[1188] (REAL)	41464	45694	49924	54154	58384	62614	66844	71074
CAM Data[1189] (REAL)	41466	45696	49926	54156	58386	62616	66846	71076
CAM Data[1190] (REAL)	41468	45698	49928	54158	58388	62618	66848	71078
CAM Data[1191] (REAL)	41470	45700	49930	54160	58390	62620	66850	71080
CAM Data[1192] (REAL)	41472	45702	49932	54162	58392	62622	66852	71082
CAM Data[1193] (REAL)	41474	45704	49934	54164	58394	62624	66854	71084
CAM Data[1194] (REAL)	41476	45706	49936	54166	58396	62626	66856	71086
CAM Data[1195] (REAL)	41478	45708	49938	54168	58398	62628	66858	71088
CAM Data[1196] (REAL)	41480	45710	49940	54170	58400	62630	66860	71090
CAM Data[1197] (REAL)	41482	45712	49942	54172	58402	62632	66862	71092
CAM Data[1198] (REAL)	41484	45714	49944	54174	58404	62634	66864	71094
CAM Data[1199] (REAL)	41486	45716	49946	54176	58406	62636	66866	71096
CAM Data[1200] (REAL)	41488	45718	49948	54178	58408	62638	66868	71098
CAM Data[1201] (REAL)	41490	45720	49950	54180	58410	62640	66870	71100
CAM Data[1202] (REAL)	41492	45722	49952	54182	58412	62642	66872	71102
CAM Data[1203] (REAL)	41494	45724	49954	54184	58414	62644	66874	71104
CAM Data[1204] (REAL)	41496	45726	49956	54186	58416	62646	66876	71106
CAM Data[1205] (REAL)	41498	45728	49958	54188	58418	62648	66878	71108
CAM Data[1206] (REAL)	41500	45730	49960	54190	58420	62650	66880	71110
CAM Data[1207] (REAL)	41502	45732	49962	54192	58422	62652	66882	71112
CAM Data[1208] (REAL)	41504	45734	49964	54194	58424	62654	66884	71114
CAM Data[1209] (REAL)	41506	45736	49966	54196	58426	62656	66886	71116
CAM Data[1210] (REAL)	41508	45738	49968	54198	58428	62658	66888	71118
CAM Data[1211] (REAL)	41510	45740	49970	54200	58430	62660	66890	71120
CAM Data[1212] (REAL)	41512	45742	49972	54202	58432	62662	66892	71122
CAM Data[1213] (REAL)	41514	45744	49974	54204	58434	62664	66894	71124
CAM Data[1214] (REAL)	41516	45746	49976	54206	58436	62666	66896	71126
CAM Data[1215] (REAL)	41518	45748	49978	54208	58438	62668	66898	71128
CAM Data[1216] (REAL)	41520	45750	49980	54210	58440	62670	66900	71130
CAM Data[1217] (REAL)	41522	45752	49982	54212	58442	62672	66902	71132
CAM Data[1218] (REAL)	41524	45754	49984	54214	58444	62674	66904	71134
CAM Data[1219] (REAL)	41526	45756	49986	54216	58446	62676	66906	71136
CAM Data[1220] (REAL)	41528	45758	49988	54218	58448	62678	66908	71138
CAM Data[1221] (REAL)	41530	45760	49990	54220	58450	62680	66910	71140
CAM Data[1222] (REAL)	41532	45762	49992	54222	58452	62682	66912	71142
CAM Data[1223] (REAL)	41534	45764	49994	54224	58454	62684	66914	71144
CAM Data[1224] (REAL)	41536	45766	49996	54226	58456	62686	66916	71146

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[1225] (REAL)	41538	45768	49998	54228	58458	62688	66918	71148
CAM Data[1226] (REAL)	41540	45770	50000	54230	58460	62690	66920	71150
CAM Data[1227] (REAL)	41542	45772	50002	54232	58462	62692	66922	71152
CAM Data[1228] (REAL)	41544	45774	50004	54234	58464	62694	66924	71154
CAM Data[1229] (REAL)	41546	45776	50006	54236	58466	62696	66926	71156
CAM Data[1230] (REAL)	41548	45778	50008	54238	58468	62698	66928	71158
CAM Data[1231] (REAL)	41550	45780	50010	54240	58470	62700	66930	71160
CAM Data[1232] (REAL)	41552	45782	50012	54242	58472	62702	66932	71162
CAM Data[1233] (REAL)	41554	45784	50014	54244	58474	62704	66934	71164
CAM Data[1234] (REAL)	41556	45786	50016	54246	58476	62706	66936	71166
CAM Data[1235] (REAL)	41558	45788	50018	54248	58478	62708	66938	71168
CAM Data[1236] (REAL)	41560	45790	50020	54250	58480	62710	66940	71170
CAM Data[1237] (REAL)	41562	45792	50022	54252	58482	62712	66942	71172
CAM Data[1238] (REAL)	41564	45794	50024	54254	58484	62714	66944	71174
CAM Data[1239] (REAL)	41566	45796	50026	54256	58486	62716	66946	71176
CAM Data[1240] (REAL)	41568	45798	50028	54258	58488	62718	66948	71178
CAM Data[1241] (REAL)	41570	45800	50030	54260	58490	62720	66950	71180
CAM Data[1242] (REAL)	41572	45802	50032	54262	58492	62722	66952	71182
CAM Data[1243] (REAL)	41574	45804	50034	54264	58494	62724	66954	71184
CAM Data[1244] (REAL)	41576	45806	50036	54266	58496	62726	66956	71186
CAM Data[1245] (REAL)	41578	45808	50038	54268	58498	62728	66958	71188
CAM Data[1246] (REAL)	41580	45810	50040	54270	58500	62730	66960	71190
CAM Data[1247] (REAL)	41582	45812	50042	54272	58502	62732	66962	71192
CAM Data[1248] (REAL)	41584	45814	50044	54274	58504	62734	66964	71194
CAM Data[1249] (REAL)	41586	45816	50046	54276	58506	62736	66966	71196
CAM Data[1250] (REAL)	41588	45818	50048	54278	58508	62738	66968	71198
CAM Data[1251] (REAL)	41590	45820	50050	54280	58510	62740	66970	71200
CAM Data[1252] (REAL)	41592	45822	50052	54282	58512	62742	66972	71202
CAM Data[1253] (REAL)	41594	45824	50054	54284	58514	62744	66974	71204
CAM Data[1254] (REAL)	41596	45826	50056	54286	58516	62746	66976	71206
CAM Data[1255] (REAL)	41598	45828	50058	54288	58518	62748	66978	71208
CAM Data[1256] (REAL)	41600	45830	50060	54290	58520	62750	66980	71210
CAM Data[1257] (REAL)	41602	45832	50062	54292	58522	62752	66982	71212
CAM Data[1258] (REAL)	41604	45834	50064	54294	58524	62754	66984	71214
CAM Data[1259] (REAL)	41606	45836	50066	54296	58526	62756	66986	71216
CAM Data[1260] (REAL)	41608	45838	50068	54298	58528	62758	66988	71218
CAM Data[1261] (REAL)	41610	45840	50070	54300	58530	62760	66990	71220
CAM Data[1262] (REAL)	41612	45842	50072	54302	58532	62762	66992	71222
CAM Data[1263] (REAL)	41614	45844	50074	54304	58534	62764	66994	71224
CAM Data[1264] (REAL)	41616	45846	50076	54306	58536	62766	66996	71226
CAM Data[1265] (REAL)	41618	45848	50078	54308	58538	62768	66998	71228

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[1266] (REAL)	41620	45850	50080	54310	58540	62770	67000	71230
CAM Data[1267] (REAL)	41622	45852	50082	54312	58542	62772	67002	71232
CAM Data[1268] (REAL)	41624	45854	50084	54314	58544	62774	67004	71234
CAM Data[1269] (REAL)	41626	45856	50086	54316	58546	62776	67006	71236
CAM Data[1270] (REAL)	41628	45858	50088	54318	58548	62778	67008	71238
CAM Data[1271] (REAL)	41630	45860	50090	54320	58550	62780	67010	71240
CAM Data[1272] (REAL)	41632	45862	50092	54322	58552	62782	67012	71242
CAM Data[1273] (REAL)	41634	45864	50094	54324	58554	62784	67014	71244
CAM Data[1274] (REAL)	41636	45866	50096	54326	58556	62786	67016	71246
CAM Data[1275] (REAL)	41638	45868	50098	54328	58558	62788	67018	71248
CAM Data[1276] (REAL)	41640	45870	50100	54330	58560	62790	67020	71250
CAM Data[1277] (REAL)	41642	45872	50102	54332	58562	62792	67022	71252
CAM Data[1278] (REAL)	41644	45874	50104	54334	58564	62794	67024	71254
CAM Data[1279] (REAL)	41646	45876	50106	54336	58566	62796	67026	71256
CAM Data[1280] (REAL)	41648	45878	50108	54338	58568	62798	67028	71258
CAM Data[1281] (REAL)	41650	45880	50110	54340	58570	62800	67030	71260
CAM Data[1282] (REAL)	41652	45882	50112	54342	58572	62802	67032	71262
CAM Data[1283] (REAL)	41654	45884	50114	54344	58574	62804	67034	71264
CAM Data[1284] (REAL)	41656	45886	50116	54346	58576	62806	67036	71266
CAM Data[1285] (REAL)	41658	45888	50118	54348	58578	62808	67038	71268
CAM Data[1286] (REAL)	41660	45890	50120	54350	58580	62810	67040	71270
CAM Data[1287] (REAL)	41662	45892	50122	54352	58582	62812	67042	71272
CAM Data[1288] (REAL)	41664	45894	50124	54354	58584	62814	67044	71274
CAM Data[1289] (REAL)	41666	45896	50126	54356	58586	62816	67046	71276
CAM Data[1290] (REAL)	41668	45898	50128	54358	58588	62818	67048	71278
CAM Data[1291] (REAL)	41670	45900	50130	54360	58590	62820	67050	71280
CAM Data[1292] (REAL)	41672	45902	50132	54362	58592	62822	67052	71282
CAM Data[1293] (REAL)	41674	45904	50134	54364	58594	62824	67054	71284
CAM Data[1294] (REAL)	41676	45906	50136	54366	58596	62826	67056	71286
CAM Data[1295] (REAL)	41678	45908	50138	54368	58598	62828	67058	71288
CAM Data[1296] (REAL)	41680	45910	50140	54370	58600	62830	67060	71290
CAM Data[1297] (REAL)	41682	45912	50142	54372	58602	62832	67062	71292
CAM Data[1298] (REAL)	41684	45914	50144	54374	58604	62834	67064	71294
CAM Data[1299] (REAL)	41686	45916	50146	54376	58606	62836	67066	71296
CAM Data[1300] (REAL)	41688	45918	50148	54378	58608	62838	67068	71298
CAM Data[1301] (REAL)	41690	45920	50150	54380	58610	62840	67070	71300
CAM Data[1302] (REAL)	41692	45922	50152	54382	58612	62842	67072	71302
CAM Data[1303] (REAL)	41694	45924	50154	54384	58614	62844	67074	71304
CAM Data[1304] (REAL)	41696	45926	50156	54386	58616	62846	67076	71306
CAM Data[1305] (REAL)	41698	45928	50158	54388	58618	62848	67078	71308
CAM Data[1306] (REAL)	41700	45930	50160	54390	58620	62850	67080	71310
CAM Data[1307] (REAL)	41702	45932	50162	54392	58622	62852	67082	71312

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[1308] (REAL)	41704	45934	50164	54394	58624	62854	67084	71314
CAM Data[1309] (REAL)	41706	45936	50166	54396	58626	62856	67086	71316
CAM Data[1310] (REAL)	41708	45938	50168	54398	58628	62858	67088	71318
CAM Data[1311] (REAL)	41710	45940	50170	54400	58630	62860	67090	71320
CAM Data[1312] (REAL)	41712	45942	50172	54402	58632	62862	67092	71322
CAM Data[1313] (REAL)	41714	45944	50174	54404	58634	62864	67094	71324
CAM Data[1314] (REAL)	41716	45946	50176	54406	58636	62866	67096	71326
CAM Data[1315] (REAL)	41718	45948	50178	54408	58638	62868	67098	71328
CAM Data[1316] (REAL)	41720	45950	50180	54410	58640	62870	67100	71330
CAM Data[1317] (REAL)	41722	45952	50182	54412	58642	62872	67102	71332
CAM Data[1318] (REAL)	41724	45954	50184	54414	58644	62874	67104	71334
CAM Data[1319] (REAL)	41726	45956	50186	54416	58646	62876	67106	71336
CAM Data[1320] (REAL)	41728	45958	50188	54418	58648	62878	67108	71338
CAM Data[1321] (REAL)	41730	45960	50190	54420	58650	62880	67110	71340
CAM Data[1322] (REAL)	41732	45962	50192	54422	58652	62882	67112	71342
CAM Data[1323] (REAL)	41734	45964	50194	54424	58654	62884	67114	71344
CAM Data[1324] (REAL)	41736	45966	50196	54426	58656	62886	67116	71346
CAM Data[1325] (REAL)	41738	45968	50198	54428	58658	62888	67118	71348
CAM Data[1326] (REAL)	41740	45970	50200	54430	58660	62890	67120	71350
CAM Data[1327] (REAL)	41742	45972	50202	54432	58662	62892	67122	71352
CAM Data[1328] (REAL)	41744	45974	50204	54434	58664	62894	67124	71354
CAM Data[1329] (REAL)	41746	45976	50206	54436	58666	62896	67126	71356
CAM Data[1330] (REAL)	41748	45978	50208	54438	58668	62898	67128	71358
CAM Data[1331] (REAL)	41750	45980	50210	54440	58670	62900	67130	71360
CAM Data[1332] (REAL)	41752	45982	50212	54442	58672	62902	67132	71362
CAM Data[1333] (REAL)	41754	45984	50214	54444	58674	62904	67134	71364
CAM Data[1334] (REAL)	41756	45986	50216	54446	58676	62906	67136	71366
CAM Data[1335] (REAL)	41758	45988	50218	54448	58678	62908	67138	71368
CAM Data[1336] (REAL)	41760	45990	50220	54450	58680	62910	67140	71370
CAM Data[1337] (REAL)	41762	45992	50222	54452	58682	62912	67142	71372
CAM Data[1338] (REAL)	41764	45994	50224	54454	58684	62914	67144	71374
CAM Data[1339] (REAL)	41766	45996	50226	54456	58686	62916	67146	71376
CAM Data[1340] (REAL)	41768	45998	50228	54458	58688	62918	67148	71378
CAM Data[1341] (REAL)	41770	46000	50230	54460	58690	62920	67150	71380
CAM Data[1342] (REAL)	41772	46002	50232	54462	58692	62922	67152	71382
CAM Data[1343] (REAL)	41774	46004	50234	54464	58694	62924	67154	71384
CAM Data[1344] (REAL)	41776	46006	50236	54466	58696	62926	67156	71386
CAM Data[1345] (REAL)	41778	46008	50238	54468	58698	62928	67158	71388
CAM Data[1346] (REAL)	41780	46010	50240	54470	58700	62930	67160	71390
CAM Data[1347] (REAL)	41782	46012	50242	54472	58702	62932	67162	71392
CAM Data[1348] (REAL)	41784	46014	50244	54474	58704	62934	67164	71394

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[1349] (REAL)	41786	46016	50246	54476	58706	62936	67166	71396
CAM Data[1350] (REAL)	41788	46018	50248	54478	58708	62938	67168	71398
CAM Data[1351] (REAL)	41790	46020	50250	54480	58710	62940	67170	71400
CAM Data[1352] (REAL)	41792	46022	50252	54482	58712	62942	67172	71402
CAM Data[1353] (REAL)	41794	46024	50254	54484	58714	62944	67174	71404
CAM Data[1354] (REAL)	41796	46026	50256	54486	58716	62946	67176	71406
CAM Data[1355] (REAL)	41798	46028	50258	54488	58718	62948	67178	71408
CAM Data[1356] (REAL)	41800	46030	50260	54490	58720	62950	67180	71410
CAM Data[1357] (REAL)	41802	46032	50262	54492	58722	62952	67182	71412
CAM Data[1358] (REAL)	41804	46034	50264	54494	58724	62954	67184	71414
CAM Data[1359] (REAL)	41806	46036	50266	54496	58726	62956	67186	71416
CAM Data[1360] (REAL)	41808	46038	50268	54498	58728	62958	67188	71418
CAM Data[1361] (REAL)	41810	46040	50270	54500	58730	62960	67190	71420
CAM Data[1362] (REAL)	41812	46042	50272	54502	58732	62962	67192	71422
CAM Data[1363] (REAL)	41814	46044	50274	54504	58734	62964	67194	71424
CAM Data[1364] (REAL)	41816	46046	50276	54506	58736	62966	67196	71426
CAM Data[1365] (REAL)	41818	46048	50278	54508	58738	62968	67198	71428
CAM Data[1366] (REAL)	41820	46050	50280	54510	58740	62970	67200	71430
CAM Data[1367] (REAL)	41822	46052	50282	54512	58742	62972	67202	71432
CAM Data[1368] (REAL)	41824	46054	50284	54514	58744	62974	67204	71434
CAM Data[1369] (REAL)	41826	46056	50286	54516	58746	62976	67206	71436
CAM Data[1370] (REAL)	41828	46058	50288	54518	58748	62978	67208	71438
CAM Data[1371] (REAL)	41830	46060	50290	54520	58750	62980	67210	71440
CAM Data[1372] (REAL)	41832	46062	50292	54522	58752	62982	67212	71442
CAM Data[1373] (REAL)	41834	46064	50294	54524	58754	62984	67214	71444
CAM Data[1374] (REAL)	41836	46066	50296	54526	58756	62986	67216	71446
CAM Data[1375] (REAL)	41838	46068	50298	54528	58758	62988	67218	71448
CAM Data[1376] (REAL)	41840	46070	50300	54530	58760	62990	67220	71450
CAM Data[1377] (REAL)	41842	46072	50302	54532	58762	62992	67222	71452
CAM Data[1378] (REAL)	41844	46074	50304	54534	58764	62994	67224	71454
CAM Data[1379] (REAL)	41846	46076	50306	54536	58766	62996	67226	71456
CAM Data[1380] (REAL)	41848	46078	50308	54538	58768	62998	67228	71458
CAM Data[1381] (REAL)	41850	46080	50310	54540	58770	63000	67230	71460
CAM Data[1382] (REAL)	41852	46082	50312	54542	58772	63002	67232	71462
CAM Data[1383] (REAL)	41854	46084	50314	54544	58774	63004	67234	71464
CAM Data[1384] (REAL)	41856	46086	50316	54546	58776	63006	67236	71466
CAM Data[1385] (REAL)	41858	46088	50318	54548	58778	63008	67238	71468
CAM Data[1386] (REAL)	41860	46090	50320	54550	58780	63010	67240	71470
CAM Data[1387] (REAL)	41862	46092	50322	54552	58782	63012	67242	71472
CAM Data[1388] (REAL)	41864	46094	50324	54554	58784	63014	67244	71474
CAM Data[1389] (REAL)	41866	46096	50326	54556	58786	63016	67246	71476
CAM Data[1390] (REAL)	41868	46098	50328	54558	58788	63018	67248	71478

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[1391] (REAL)	41870	46100	50330	54560	58790	63020	67250	71480
CAM Data[1392] (REAL)	41872	46102	50332	54562	58792	63022	67252	71482
CAM Data[1393] (REAL)	41874	46104	50334	54564	58794	63024	67254	71484
CAM Data[1394] (REAL)	41876	46106	50336	54566	58796	63026	67256	71486
CAM Data[1395] (REAL)	41878	46108	50338	54568	58798	63028	67258	71488
CAM Data[1396] (REAL)	41880	46110	50340	54570	58800	63030	67260	71490
CAM Data[1397] (REAL)	41882	46112	50342	54572	58802	63032	67262	71492
CAM Data[1398] (REAL)	41884	46114	50344	54574	58804	63034	67264	71494
CAM Data[1399] (REAL)	41886	46116	50346	54576	58806	63036	67266	71496
CAM Data[1400] (REAL)	41888	46118	50348	54578	58808	63038	67268	71498
CAM Data[1401] (REAL)	41890	46120	50350	54580	58810	63040	67270	71500
CAM Data[1402] (REAL)	41892	46122	50352	54582	58812	63042	67272	71502
CAM Data[1403] (REAL)	41894	46124	50354	54584	58814	63044	67274	71504
CAM Data[1404] (REAL)	41896	46126	50356	54586	58816	63046	67276	71506
CAM Data[1405] (REAL)	41898	46128	50358	54588	58818	63048	67278	71508
CAM Data[1406] (REAL)	41900	46130	50360	54590	58820	63050	67280	71510
CAM Data[1407] (REAL)	41902	46132	50362	54592	58822	63052	67282	71512
CAM Data[1408] (REAL)	41904	46134	50364	54594	58824	63054	67284	71514
CAM Data[1409] (REAL)	41906	46136	50366	54596	58826	63056	67286	71516
CAM Data[1410] (REAL)	41908	46138	50368	54598	58828	63058	67288	71518
CAM Data[1411] (REAL)	41910	46140	50370	54600	58830	63060	67290	71520
CAM Data[1412] (REAL)	41912	46142	50372	54602	58832	63062	67292	71522
CAM Data[1413] (REAL)	41914	46144	50374	54604	58834	63064	67294	71524
CAM Data[1414] (REAL)	41916	46146	50376	54606	58836	63066	67296	71526
CAM Data[1415] (REAL)	41918	46148	50378	54608	58838	63068	67298	71528
CAM Data[1416] (REAL)	41920	46150	50380	54610	58840	63070	67300	71530
CAM Data[1417] (REAL)	41922	46152	50382	54612	58842	63072	67302	71532
CAM Data[1418] (REAL)	41924	46154	50384	54614	58844	63074	67304	71534
CAM Data[1419] (REAL)	41926	46156	50386	54616	58846	63076	67306	71536
CAM Data[1420] (REAL)	41928	46158	50388	54618	58848	63078	67308	71538
CAM Data[1421] (REAL)	41930	46160	50390	54620	58850	63080	67310	71540
CAM Data[1422] (REAL)	41932	46162	50392	54622	58852	63082	67312	71542
CAM Data[1423] (REAL)	41934	46164	50394	54624	58854	63084	67314	71544
CAM Data[1424] (REAL)	41936	46166	50396	54626	58856	63086	67316	71546
CAM Data[1425] (REAL)	41938	46168	50398	54628	58858	63088	67318	71548
CAM Data[1426] (REAL)	41940	46170	50400	54630	58860	63090	67320	71550
CAM Data[1427] (REAL)	41942	46172	50402	54632	58862	63092	67322	71552
CAM Data[1428] (REAL)	41944	46174	50404	54634	58864	63094	67324	71554
CAM Data[1429] (REAL)	41946	46176	50406	54636	58866	63096	67326	71556
CAM Data[1430] (REAL)	41948	46178	50408	54638	58868	63098	67328	71558
CAM Data[1431] (REAL)	41950	46180	50410	54640	58870	63100	67330	71560

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[1432] (REAL)	41952	46182	50412	54642	58872	63102	67332	71562
CAM Data[1433] (REAL)	41954	46184	50414	54644	58874	63104	67334	71564
CAM Data[1434] (REAL)	41956	46186	50416	54646	58876	63106	67336	71566
CAM Data[1435] (REAL)	41958	46188	50418	54648	58878	63108	67338	71568
CAM Data[1436] (REAL)	41960	46190	50420	54650	58880	63110	67340	71570
CAM Data[1437] (REAL)	41962	46192	50422	54652	58882	63112	67342	71572
CAM Data[1438] (REAL)	41964	46194	50424	54654	58884	63114	67344	71574
CAM Data[1439] (REAL)	41966	46196	50426	54656	58886	63116	67346	71576
CAM Data[1440] (REAL)	41968	46198	50428	54658	58888	63118	67348	71578
CAM Data[1441] (REAL)	41970	46200	50430	54660	58890	63120	67350	71580
CAM Data[1442] (REAL)	41972	46202	50432	54662	58892	63122	67352	71582
CAM Data[1443] (REAL)	41974	46204	50434	54664	58894	63124	67354	71584
CAM Data[1444] (REAL)	41976	46206	50436	54666	58896	63126	67356	71586
CAM Data[1445] (REAL)	41978	46208	50438	54668	58898	63128	67358	71588
CAM Data[1446] (REAL)	41980	46210	50440	54670	58900	63130	67360	71590
CAM Data[1447] (REAL)	41982	46212	50442	54672	58902	63132	67362	71592
CAM Data[1448] (REAL)	41984	46214	50444	54674	58904	63134	67364	71594
CAM Data[1449] (REAL)	41986	46216	50446	54676	58906	63136	67366	71596
CAM Data[1450] (REAL)	41988	46218	50448	54678	58908	63138	67368	71598
CAM Data[1451] (REAL)	41990	46220	50450	54680	58910	63140	67370	71600
CAM Data[1452] (REAL)	41992	46222	50452	54682	58912	63142	67372	71602
CAM Data[1453] (REAL)	41994	46224	50454	54684	58914	63144	67374	71604
CAM Data[1454] (REAL)	41996	46226	50456	54686	58916	63146	67376	71606
CAM Data[1455] (REAL)	41998	46228	50458	54688	58918	63148	67378	71608
CAM Data[1456] (REAL)	42000	46230	50460	54690	58920	63150	67380	71610
CAM Data[1457] (REAL)	42002	46232	50462	54692	58922	63152	67382	71612
CAM Data[1458] (REAL)	42004	46234	50464	54694	58924	63154	67384	71614
CAM Data[1459] (REAL)	42006	46236	50466	54696	58926	63156	67386	71616
CAM Data[1460] (REAL)	42008	46238	50468	54698	58928	63158	67388	71618
CAM Data[1461] (REAL)	42010	46240	50470	54700	58930	63160	67390	71620
CAM Data[1462] (REAL)	42012	46242	50472	54702	58932	63162	67392	71622
CAM Data[1463] (REAL)	42014	46244	50474	54704	58934	63164	67394	71624
CAM Data[1464] (REAL)	42016	46246	50476	54706	58936	63166	67396	71626
CAM Data[1465] (REAL)	42018	46248	50478	54708	58938	63168	67398	71628
CAM Data[1466] (REAL)	42020	46250	50480	54710	58940	63170	67400	71630
CAM Data[1467] (REAL)	42022	46252	50482	54712	58942	63172	67402	71632
CAM Data[1468] (REAL)	42024	46254	50484	54714	58944	63174	67404	71634
CAM Data[1469] (REAL)	42026	46256	50486	54716	58946	63176	67406	71636
CAM Data[1470] (REAL)	42028	46258	50488	54718	58948	63178	67408	71638
CAM Data[1471] (REAL)	42030	46260	50490	54720	58950	63180	67410	71640
CAM Data[1472] (REAL)	42032	46262	50492	54722	58952	63182	67412	71642
CAM Data[1473] (REAL)	42034	46264	50494	54724	58954	63184	67414	71644

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[1474] (REAL)	42036	46266	50496	54726	58956	63186	67416	71646
CAM Data[1475] (REAL)	42038	46268	50498	54728	58958	63188	67418	71648
CAM Data[1476] (REAL)	42040	46270	50500	54730	58960	63190	67420	71650
CAM Data[1477] (REAL)	42042	46272	50502	54732	58962	63192	67422	71652
CAM Data[1478] (REAL)	42044	46274	50504	54734	58964	63194	67424	71654
CAM Data[1479] (REAL)	42046	46276	50506	54736	58966	63196	67426	71656
CAM Data[1480] (REAL)	42048	46278	50508	54738	58968	63198	67428	71658
CAM Data[1481] (REAL)	42050	46280	50510	54740	58970	63200	67430	71660
CAM Data[1482] (REAL)	42052	46282	50512	54742	58972	63202	67432	71662
CAM Data[1483] (REAL)	42054	46284	50514	54744	58974	63204	67434	71664
CAM Data[1484] (REAL)	42056	46286	50516	54746	58976	63206	67436	71666
CAM Data[1485] (REAL)	42058	46288	50518	54748	58978	63208	67438	71668
CAM Data[1486] (REAL)	42060	46290	50520	54750	58980	63210	67440	71670
CAM Data[1487] (REAL)	42062	46292	50522	54752	58982	63212	67442	71672
CAM Data[1488] (REAL)	42064	46294	50524	54754	58984	63214	67444	71674
CAM Data[1489] (REAL)	42066	46296	50526	54756	58986	63216	67446	71676
CAM Data[1490] (REAL)	42068	46298	50528	54758	58988	63218	67448	71678
CAM Data[1491] (REAL)	42070	46300	50530	54760	58990	63220	67450	71680
CAM Data[1492] (REAL)	42072	46302	50532	54762	58992	63222	67452	71682
CAM Data[1493] (REAL)	42074	46304	50534	54764	58994	63224	67454	71684
CAM Data[1494] (REAL)	42076	46306	50536	54766	58996	63226	67456	71686
CAM Data[1495] (REAL)	42078	46308	50538	54768	58998	63228	67458	71688
CAM Data[1496] (REAL)	42080	46310	50540	54770	59000	63230	67460	71690
CAM Data[1497] (REAL)	42082	46312	50542	54772	59002	63232	67462	71692
CAM Data[1498] (REAL)	42084	46314	50544	54774	59004	63234	67464	71694
CAM Data[1499] (REAL)	42086	46316	50546	54776	59006	63236	67466	71696
CAM Data[1500] (REAL)	42088	46318	50548	54778	59008	63238	67468	71698
CAM Data[1501] (REAL)	42090	46320	50550	54780	59010	63240	67470	71700
CAM Data[1502] (REAL)	42092	46322	50552	54782	59012	63242	67472	71702
CAM Data[1503] (REAL)	42094	46324	50554	54784	59014	63244	67474	71704
CAM Data[1504] (REAL)	42096	46326	50556	54786	59016	63246	67476	71706
CAM Data[1505] (REAL)	42098	46328	50558	54788	59018	63248	67478	71708
CAM Data[1506] (REAL)	42100	46330	50560	54790	59020	63250	67480	71710
CAM Data[1507] (REAL)	42102	46332	50562	54792	59022	63252	67482	71712
CAM Data[1508] (REAL)	42104	46334	50564	54794	59024	63254	67484	71714
CAM Data[1509] (REAL)	42106	46336	50566	54796	59026	63256	67486	71716
CAM Data[1510] (REAL)	42108	46338	50568	54798	59028	63258	67488	71718
CAM Data[1511] (REAL)	42110	46340	50570	54800	59030	63260	67490	71720
CAM Data[1512] (REAL)	42112	46342	50572	54802	59032	63262	67492	71722
CAM Data[1513] (REAL)	42114	46344	50574	54804	59034	63264	67494	71724
CAM Data[1514] (REAL)	42116	46346	50576	54806	59036	63266	67496	71726

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[1515] (REAL)	42118	46348	50578	54808	59038	63268	67498	71728
CAM Data[1516] (REAL)	42120	46350	50580	54810	59040	63270	67500	71730
CAM Data[1517] (REAL)	42122	46352	50582	54812	59042	63272	67502	71732
CAM Data[1518] (REAL)	42124	46354	50584	54814	59044	63274	67504	71734
CAM Data[1519] (REAL)	42126	46356	50586	54816	59046	63276	67506	71736
CAM Data[1520] (REAL)	42128	46358	50588	54818	59048	63278	67508	71738
CAM Data[1521] (REAL)	42130	46360	50590	54820	59050	63280	67510	71740
CAM Data[1522] (REAL)	42132	46362	50592	54822	59052	63282	67512	71742
CAM Data[1523] (REAL)	42134	46364	50594	54824	59054	63284	67514	71744
CAM Data[1524] (REAL)	42136	46366	50596	54826	59056	63286	67516	71746
CAM Data[1525] (REAL)	42138	46368	50598	54828	59058	63288	67518	71748
CAM Data[1526] (REAL)	42140	46370	50600	54830	59060	63290	67520	71750
CAM Data[1527] (REAL)	42142	46372	50602	54832	59062	63292	67522	71752
CAM Data[1528] (REAL)	42144	46374	50604	54834	59064	63294	67524	71754
CAM Data[1529] (REAL)	42146	46376	50606	54836	59066	63296	67526	71756
CAM Data[1530] (REAL)	42148	46378	50608	54838	59068	63298	67528	71758
CAM Data[1531] (REAL)	42150	46380	50610	54840	59070	63300	67530	71760
CAM Data[1532] (REAL)	42152	46382	50612	54842	59072	63302	67532	71762
CAM Data[1533] (REAL)	42154	46384	50614	54844	59074	63304	67534	71764
CAM Data[1534] (REAL)	42156	46386	50616	54846	59076	63306	67536	71766
CAM Data[1535] (REAL)	42158	46388	50618	54848	59078	63308	67538	71768
CAM Data[1536] (REAL)	42160	46390	50620	54850	59080	63310	67540	71770
CAM Data[1537] (REAL)	42162	46392	50622	54852	59082	63312	67542	71772
CAM Data[1538] (REAL)	42164	46394	50624	54854	59084	63314	67544	71774
CAM Data[1539] (REAL)	42166	46396	50626	54856	59086	63316	67546	71776
CAM Data[1540] (REAL)	42168	46398	50628	54858	59088	63318	67548	71778
CAM Data[1541] (REAL)	42170	46400	50630	54860	59090	63320	67550	71780
CAM Data[1542] (REAL)	42172	46402	50632	54862	59092	63322	67552	71782
CAM Data[1543] (REAL)	42174	46404	50634	54864	59094	63324	67554	71784
CAM Data[1544] (REAL)	42176	46406	50636	54866	59096	63326	67556	71786
CAM Data[1545] (REAL)	42178	46408	50638	54868	59098	63328	67558	71788
CAM Data[1546] (REAL)	42180	46410	50640	54870	59100	63330	67560	71790
CAM Data[1547] (REAL)	42182	46412	50642	54872	59102	63332	67562	71792
CAM Data[1548] (REAL)	42184	46414	50644	54874	59104	63334	67564	71794
CAM Data[1549] (REAL)	42186	46416	50646	54876	59106	63336	67566	71796
CAM Data[1550] (REAL)	42188	46418	50648	54878	59108	63338	67568	71798
CAM Data[1551] (REAL)	42190	46420	50650	54880	59110	63340	67570	71800
CAM Data[1552] (REAL)	42192	46422	50652	54882	59112	63342	67572	71802
CAM Data[1553] (REAL)	42194	46424	50654	54884	59114	63344	67574	71804
CAM Data[1554] (REAL)	42196	46426	50656	54886	59116	63346	67576	71806
CAM Data[1555] (REAL)	42198	46428	50658	54888	59118	63348	67578	71808
CAM Data[1556] (REAL)	42200	46430	50660	54890	59120	63350	67580	71810

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[1557] (REAL)	42202	46432	50662	54892	59122	63352	67582	71812
CAM Data[1558] (REAL)	42204	46434	50664	54894	59124	63354	67584	71814
CAM Data[1559] (REAL)	42206	46436	50666	54896	59126	63356	67586	71816
CAM Data[1560] (REAL)	42208	46438	50668	54898	59128	63358	67588	71818
CAM Data[1561] (REAL)	42210	46440	50670	54900	59130	63360	67590	71820
CAM Data[1562] (REAL)	42212	46442	50672	54902	59132	63362	67592	71822
CAM Data[1563] (REAL)	42214	46444	50674	54904	59134	63364	67594	71824
CAM Data[1564] (REAL)	42216	46446	50676	54906	59136	63366	67596	71826
CAM Data[1565] (REAL)	42218	46448	50678	54908	59138	63368	67598	71828
CAM Data[1566] (REAL)	42220	46450	50680	54910	59140	63370	67600	71830
CAM Data[1567] (REAL)	42222	46452	50682	54912	59142	63372	67602	71832
CAM Data[1568] (REAL)	42224	46454	50684	54914	59144	63374	67604	71834
CAM Data[1569] (REAL)	42226	46456	50686	54916	59146	63376	67606	71836
CAM Data[1570] (REAL)	42228	46458	50688	54918	59148	63378	67608	71838
CAM Data[1571] (REAL)	42230	46460	50690	54920	59150	63380	67610	71840
CAM Data[1572] (REAL)	42232	46462	50692	54922	59152	63382	67612	71842
CAM Data[1573] (REAL)	42234	46464	50694	54924	59154	63384	67614	71844
CAM Data[1574] (REAL)	42236	46466	50696	54926	59156	63386	67616	71846
CAM Data[1575] (REAL)	42238	46468	50698	54928	59158	63388	67618	71848
CAM Data[1576] (REAL)	42240	46470	50700	54930	59160	63390	67620	71850
CAM Data[1577] (REAL)	42242	46472	50702	54932	59162	63392	67622	71852
CAM Data[1578] (REAL)	42244	46474	50704	54934	59164	63394	67624	71854
CAM Data[1579] (REAL)	42246	46476	50706	54936	59166	63396	67626	71856
CAM Data[1580] (REAL)	42248	46478	50708	54938	59168	63398	67628	71858
CAM Data[1581] (REAL)	42250	46480	50710	54940	59170	63400	67630	71860
CAM Data[1582] (REAL)	42252	46482	50712	54942	59172	63402	67632	71862
CAM Data[1583] (REAL)	42254	46484	50714	54944	59174	63404	67634	71864
CAM Data[1584] (REAL)	42256	46486	50716	54946	59176	63406	67636	71866
CAM Data[1585] (REAL)	42258	46488	50718	54948	59178	63408	67638	71868
CAM Data[1586] (REAL)	42260	46490	50720	54950	59180	63410	67640	71870
CAM Data[1587] (REAL)	42262	46492	50722	54952	59182	63412	67642	71872
CAM Data[1588] (REAL)	42264	46494	50724	54954	59184	63414	67644	71874
CAM Data[1589] (REAL)	42266	46496	50726	54956	59186	63416	67646	71876
CAM Data[1590] (REAL)	42268	46498	50728	54958	59188	63418	67648	71878
CAM Data[1591] (REAL)	42270	46500	50730	54960	59190	63420	67650	71880
CAM Data[1592] (REAL)	42272	46502	50732	54962	59192	63422	67652	71882
CAM Data[1593] (REAL)	42274	46504	50734	54964	59194	63424	67654	71884
CAM Data[1594] (REAL)	42276	46506	50736	54966	59196	63426	67656	71886
CAM Data[1595] (REAL)	42278	46508	50738	54968	59198	63428	67658	71888
CAM Data[1596] (REAL)	42280	46510	50740	54970	59200	63430	67660	71890
CAM Data[1597] (REAL)	42282	46512	50742	54972	59202	63432	67662	71892

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[1598] (REAL)	42284	46514	50744	54974	59204	63434	67664	71894
CAM Data[1599] (REAL)	42286	46516	50746	54976	59206	63436	67666	71896
CAM Data[1600] (REAL)	42288	46518	50748	54978	59208	63438	67668	71898
CAM Data[1601] (REAL)	42290	46520	50750	54980	59210	63440	67670	71900
CAM Data[1602] (REAL)	42292	46522	50752	54982	59212	63442	67672	71902
CAM Data[1603] (REAL)	42294	46524	50754	54984	59214	63444	67674	71904
CAM Data[1604] (REAL)	42296	46526	50756	54986	59216	63446	67676	71906
CAM Data[1605] (REAL)	42298	46528	50758	54988	59218	63448	67678	71908
CAM Data[1606] (REAL)	42300	46530	50760	54990	59220	63450	67680	71910
CAM Data[1607] (REAL)	42302	46532	50762	54992	59222	63452	67682	71912
CAM Data[1608] (REAL)	42304	46534	50764	54994	59224	63454	67684	71914
CAM Data[1609] (REAL)	42306	46536	50766	54996	59226	63456	67686	71916
CAM Data[1610] (REAL)	42308	46538	50768	54998	59228	63458	67688	71918
CAM Data[1611] (REAL)	42310	46540	50770	55000	59230	63460	67690	71920
CAM Data[1612] (REAL)	42312	46542	50772	55002	59232	63462	67692	71922
CAM Data[1613] (REAL)	42314	46544	50774	55004	59234	63464	67694	71924
CAM Data[1614] (REAL)	42316	46546	50776	55006	59236	63466	67696	71926
CAM Data[1615] (REAL)	42318	46548	50778	55008	59238	63468	67698	71928
CAM Data[1616] (REAL)	42320	46550	50780	55010	59240	63470	67700	71930
CAM Data[1617] (REAL)	42322	46552	50782	55012	59242	63472	67702	71932
CAM Data[1618] (REAL)	42324	46554	50784	55014	59244	63474	67704	71934
CAM Data[1619] (REAL)	42326	46556	50786	55016	59246	63476	67706	71936
CAM Data[1620] (REAL)	42328	46558	50788	55018	59248	63478	67708	71938
CAM Data[1621] (REAL)	42330	46560	50790	55020	59250	63480	67710	71940
CAM Data[1622] (REAL)	42332	46562	50792	55022	59252	63482	67712	71942
CAM Data[1623] (REAL)	42334	46564	50794	55024	59254	63484	67714	71944
CAM Data[1624] (REAL)	42336	46566	50796	55026	59256	63486	67716	71946
CAM Data[1625] (REAL)	42338	46568	50798	55028	59258	63488	67718	71948
CAM Data[1626] (REAL)	42340	46570	50800	55030	59260	63490	67720	71950
CAM Data[1627] (REAL)	42342	46572	50802	55032	59262	63492	67722	71952
CAM Data[1628] (REAL)	42344	46574	50804	55034	59264	63494	67724	71954
CAM Data[1629] (REAL)	42346	46576	50806	55036	59266	63496	67726	71956
CAM Data[1630] (REAL)	42348	46578	50808	55038	59268	63498	67728	71958
CAM Data[1631] (REAL)	42350	46580	50810	55040	59270	63500	67730	71960
CAM Data[1632] (REAL)	42352	46582	50812	55042	59272	63502	67732	71962
CAM Data[1633] (REAL)	42354	46584	50814	55044	59274	63504	67734	71964
CAM Data[1634] (REAL)	42356	46586	50816	55046	59276	63506	67736	71966
CAM Data[1635] (REAL)	42358	46588	50818	55048	59278	63508	67738	71968
CAM Data[1636] (REAL)	42360	46590	50820	55050	59280	63510	67740	71970
CAM Data[1637] (REAL)	42362	46592	50822	55052	59282	63512	67742	71972
CAM Data[1638] (REAL)	42364	46594	50824	55054	59284	63514	67744	71974
CAM Data[1639] (REAL)	42366	46596	50826	55056	59286	63516	67746	71976

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[1640] (REAL)	42368	46598	50828	55058	59288	63518	67748	71978
CAM Data[1641] (REAL)	42370	46600	50830	55060	59290	63520	67750	71980
CAM Data[1642] (REAL)	42372	46602	50832	55062	59292	63522	67752	71982
CAM Data[1643] (REAL)	42374	46604	50834	55064	59294	63524	67754	71984
CAM Data[1644] (REAL)	42376	46606	50836	55066	59296	63526	67756	71986
CAM Data[1645] (REAL)	42378	46608	50838	55068	59298	63528	67758	71988
CAM Data[1646] (REAL)	42380	46610	50840	55070	59300	63530	67760	71990
CAM Data[1647] (REAL)	42382	46612	50842	55072	59302	63532	67762	71992
CAM Data[1648] (REAL)	42384	46614	50844	55074	59304	63534	67764	71994
CAM Data[1649] (REAL)	42386	46616	50846	55076	59306	63536	67766	71996
CAM Data[1650] (REAL)	42388	46618	50848	55078	59308	63538	67768	71998
CAM Data[1651] (REAL)	42390	46620	50850	55080	59310	63540	67770	72000
CAM Data[1652] (REAL)	42392	46622	50852	55082	59312	63542	67772	72002
CAM Data[1653] (REAL)	42394	46624	50854	55084	59314	63544	67774	72004
CAM Data[1654] (REAL)	42396	46626	50856	55086	59316	63546	67776	72006
CAM Data[1655] (REAL)	42398	46628	50858	55088	59318	63548	67778	72008
CAM Data[1656] (REAL)	42400	46630	50860	55090	59320	63550	67780	72010
CAM Data[1657] (REAL)	42402	46632	50862	55092	59322	63552	67782	72012
CAM Data[1658] (REAL)	42404	46634	50864	55094	59324	63554	67784	72014
CAM Data[1659] (REAL)	42406	46636	50866	55096	59326	63556	67786	72016
CAM Data[1660] (REAL)	42408	46638	50868	55098	59328	63558	67788	72018
CAM Data[1661] (REAL)	42410	46640	50870	55100	59330	63560	67790	72020
CAM Data[1662] (REAL)	42412	46642	50872	55102	59332	63562	67792	72022
CAM Data[1663] (REAL)	42414	46644	50874	55104	59334	63564	67794	72024
CAM Data[1664] (REAL)	42416	46646	50876	55106	59336	63566	67796	72026
CAM Data[1665] (REAL)	42418	46648	50878	55108	59338	63568	67798	72028
CAM Data[1666] (REAL)	42420	46650	50880	55110	59340	63570	67800	72030
CAM Data[1667] (REAL)	42422	46652	50882	55112	59342	63572	67802	72032
CAM Data[1668] (REAL)	42424	46654	50884	55114	59344	63574	67804	72034
CAM Data[1669] (REAL)	42426	46656	50886	55116	59346	63576	67806	72036
CAM Data[1670] (REAL)	42428	46658	50888	55118	59348	63578	67808	72038
CAM Data[1671] (REAL)	42430	46660	50890	55120	59350	63580	67810	72040
CAM Data[1672] (REAL)	42432	46662	50892	55122	59352	63582	67812	72042
CAM Data[1673] (REAL)	42434	46664	50894	55124	59354	63584	67814	72044
CAM Data[1674] (REAL)	42436	46666	50896	55126	59356	63586	67816	72046
CAM Data[1675] (REAL)	42438	46668	50898	55128	59358	63588	67818	72048
CAM Data[1676] (REAL)	42440	46670	50900	55130	59360	63590	67820	72050
CAM Data[1677] (REAL)	42442	46672	50902	55132	59362	63592	67822	72052
CAM Data[1678] (REAL)	42444	46674	50904	55134	59364	63594	67824	72054
CAM Data[1679] (REAL)	42446	46676	50906	55136	59366	63596	67826	72056
CAM Data[1680] (REAL)	42448	46678	50908	55138	59368	63598	67828	72058

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[1681] (REAL)	42450	46680	50910	55140	59370	63600	67830	72060
CAM Data[1682] (REAL)	42452	46682	50912	55142	59372	63602	67832	72062
CAM Data[1683] (REAL)	42454	46684	50914	55144	59374	63604	67834	72064
CAM Data[1684] (REAL)	42456	46686	50916	55146	59376	63606	67836	72066
CAM Data[1685] (REAL)	42458	46688	50918	55148	59378	63608	67838	72068
CAM Data[1686] (REAL)	42460	46690	50920	55150	59380	63610	67840	72070
CAM Data[1687] (REAL)	42462	46692	50922	55152	59382	63612	67842	72072
CAM Data[1688] (REAL)	42464	46694	50924	55154	59384	63614	67844	72074
CAM Data[1689] (REAL)	42466	46696	50926	55156	59386	63616	67846	72076
CAM Data[1690] (REAL)	42468	46698	50928	55158	59388	63618	67848	72078
CAM Data[1691] (REAL)	42470	46700	50930	55160	59390	63620	67850	72080
CAM Data[1692] (REAL)	42472	46702	50932	55162	59392	63622	67852	72082
CAM Data[1693] (REAL)	42474	46704	50934	55164	59394	63624	67854	72084
CAM Data[1694] (REAL)	42476	46706	50936	55166	59396	63626	67856	72086
CAM Data[1695] (REAL)	42478	46708	50938	55168	59398	63628	67858	72088
CAM Data[1696] (REAL)	42480	46710	50940	55170	59400	63630	67860	72090
CAM Data[1697] (REAL)	42482	46712	50942	55172	59402	63632	67862	72092
CAM Data[1698] (REAL)	42484	46714	50944	55174	59404	63634	67864	72094
CAM Data[1699] (REAL)	42486	46716	50946	55176	59406	63636	67866	72096
CAM Data[1700] (REAL)	42488	46718	50948	55178	59408	63638	67868	72098
CAM Data[1701] (REAL)	42490	46720	50950	55180	59410	63640	67870	72100
CAM Data[1702] (REAL)	42492	46722	50952	55182	59412	63642	67872	72102
CAM Data[1703] (REAL)	42494	46724	50954	55184	59414	63644	67874	72104
CAM Data[1704] (REAL)	42496	46726	50956	55186	59416	63646	67876	72106
CAM Data[1705] (REAL)	42498	46728	50958	55188	59418	63648	67878	72108
CAM Data[1706] (REAL)	42500	46730	50960	55190	59420	63650	67880	72110
CAM Data[1707] (REAL)	42502	46732	50962	55192	59422	63652	67882	72112
CAM Data[1708] (REAL)	42504	46734	50964	55194	59424	63654	67884	72114
CAM Data[1709] (REAL)	42506	46736	50966	55196	59426	63656	67886	72116
CAM Data[1710] (REAL)	42508	46738	50968	55198	59428	63658	67888	72118
CAM Data[1711] (REAL)	42510	46740	50970	55200	59430	63660	67890	72120
CAM Data[1712] (REAL)	42512	46742	50972	55202	59432	63662	67892	72122
CAM Data[1713] (REAL)	42514	46744	50974	55204	59434	63664	67894	72124
CAM Data[1714] (REAL)	42516	46746	50976	55206	59436	63666	67896	72126
CAM Data[1715] (REAL)	42518	46748	50978	55208	59438	63668	67898	72128
CAM Data[1716] (REAL)	42520	46750	50980	55210	59440	63670	67900	72130
CAM Data[1717] (REAL)	42522	46752	50982	55212	59442	63672	67902	72132
CAM Data[1718] (REAL)	42524	46754	50984	55214	59444	63674	67904	72134
CAM Data[1719] (REAL)	42526	46756	50986	55216	59446	63676	67906	72136
CAM Data[1720] (REAL)	42528	46758	50988	55218	59448	63678	67908	72138
CAM Data[1721] (REAL)	42530	46760	50990	55220	59450	63680	67910	72140
CAM Data[1722] (REAL)	42532	46762	50992	55222	59452	63682	67912	72142

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[1723] (REAL)	42534	46764	50994	55224	59454	63684	67914	72144
CAM Data[1724] (REAL)	42536	46766	50996	55226	59456	63686	67916	72146
CAM Data[1725] (REAL)	42538	46768	50998	55228	59458	63688	67918	72148
CAM Data[1726] (REAL)	42540	46770	51000	55230	59460	63690	67920	72150
CAM Data[1727] (REAL)	42542	46772	51002	55232	59462	63692	67922	72152
CAM Data[1728] (REAL)	42544	46774	51004	55234	59464	63694	67924	72154
CAM Data[1729] (REAL)	42546	46776	51006	55236	59466	63696	67926	72156
CAM Data[1730] (REAL)	42548	46778	51008	55238	59468	63698	67928	72158
CAM Data[1731] (REAL)	42550	46780	51010	55240	59470	63700	67930	72160
CAM Data[1732] (REAL)	42552	46782	51012	55242	59472	63702	67932	72162
CAM Data[1733] (REAL)	42554	46784	51014	55244	59474	63704	67934	72164
CAM Data[1734] (REAL)	42556	46786	51016	55246	59476	63706	67936	72166
CAM Data[1735] (REAL)	42558	46788	51018	55248	59478	63708	67938	72168
CAM Data[1736] (REAL)	42560	46790	51020	55250	59480	63710	67940	72170
CAM Data[1737] (REAL)	42562	46792	51022	55252	59482	63712	67942	72172
CAM Data[1738] (REAL)	42564	46794	51024	55254	59484	63714	67944	72174
CAM Data[1739] (REAL)	42566	46796	51026	55256	59486	63716	67946	72176
CAM Data[1740] (REAL)	42568	46798	51028	55258	59488	63718	67948	72178
CAM Data[1741] (REAL)	42570	46800	51030	55260	59490	63720	67950	72180
CAM Data[1742] (REAL)	42572	46802	51032	55262	59492	63722	67952	72182
CAM Data[1743] (REAL)	42574	46804	51034	55264	59494	63724	67954	72184
CAM Data[1744] (REAL)	42576	46806	51036	55266	59496	63726	67956	72186
CAM Data[1745] (REAL)	42578	46808	51038	55268	59498	63728	67958	72188
CAM Data[1746] (REAL)	42580	46810	51040	55270	59500	63730	67960	72190
CAM Data[1747] (REAL)	42582	46812	51042	55272	59502	63732	67962	72192
CAM Data[1748] (REAL)	42584	46814	51044	55274	59504	63734	67964	72194
CAM Data[1749] (REAL)	42586	46816	51046	55276	59506	63736	67966	72196
CAM Data[1750] (REAL)	42588	46818	51048	55278	59508	63738	67968	72198
CAM Data[1751] (REAL)	42590	46820	51050	55280	59510	63740	67970	72200
CAM Data[1752] (REAL)	42592	46822	51052	55282	59512	63742	67972	72202
CAM Data[1753] (REAL)	42594	46824	51054	55284	59514	63744	67974	72204
CAM Data[1754] (REAL)	42596	46826	51056	55286	59516	63746	67976	72206
CAM Data[1755] (REAL)	42598	46828	51058	55288	59518	63748	67978	72208
CAM Data[1756] (REAL)	42600	46830	51060	55290	59520	63750	67980	72210
CAM Data[1757] (REAL)	42602	46832	51062	55292	59522	63752	67982	72212
CAM Data[1758] (REAL)	42604	46834	51064	55294	59524	63754	67984	72214
CAM Data[1759] (REAL)	42606	46836	51066	55296	59526	63756	67986	72216
CAM Data[1760] (REAL)	42608	46838	51068	55298	59528	63758	67988	72218
CAM Data[1761] (REAL)	42610	46840	51070	55300	59530	63760	67990	72220
CAM Data[1762] (REAL)	42612	46842	51072	55302	59532	63762	67992	72222
CAM Data[1763] (REAL)	42614	46844	51074	55304	59534	63764	67994	72224

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[1764] (REAL)	42616	46846	51076	55306	59536	63766	67996	72226
CAM Data[1765] (REAL)	42618	46848	51078	55308	59538	63768	67998	72228
CAM Data[1766] (REAL)	42620	46850	51080	55310	59540	63770	68000	72230
CAM Data[1767] (REAL)	42622	46852	51082	55312	59542	63772	68002	72232
CAM Data[1768] (REAL)	42624	46854	51084	55314	59544	63774	68004	72234
CAM Data[1769] (REAL)	42626	46856	51086	55316	59546	63776	68006	72236
CAM Data[1770] (REAL)	42628	46858	51088	55318	59548	63778	68008	72238
CAM Data[1771] (REAL)	42630	46860	51090	55320	59550	63780	68010	72240
CAM Data[1772] (REAL)	42632	46862	51092	55322	59552	63782	68012	72242
CAM Data[1773] (REAL)	42634	46864	51094	55324	59554	63784	68014	72244
CAM Data[1774] (REAL)	42636	46866	51096	55326	59556	63786	68016	72246
CAM Data[1775] (REAL)	42638	46868	51098	55328	59558	63788	68018	72248
CAM Data[1776] (REAL)	42640	46870	51100	55330	59560	63790	68020	72250
CAM Data[1777] (REAL)	42642	46872	51102	55332	59562	63792	68022	72252
CAM Data[1778] (REAL)	42644	46874	51104	55334	59564	63794	68024	72254
CAM Data[1779] (REAL)	42646	46876	51106	55336	59566	63796	68026	72256
CAM Data[1780] (REAL)	42648	46878	51108	55338	59568	63798	68028	72258
CAM Data[1781] (REAL)	42650	46880	51110	55340	59570	63800	68030	72260
CAM Data[1782] (REAL)	42652	46882	51112	55342	59572	63802	68032	72262
CAM Data[1783] (REAL)	42654	46884	51114	55344	59574	63804	68034	72264
CAM Data[1784] (REAL)	42656	46886	51116	55346	59576	63806	68036	72266
CAM Data[1785] (REAL)	42658	46888	51118	55348	59578	63808	68038	72268
CAM Data[1786] (REAL)	42660	46890	51120	55350	59580	63810	68040	72270
CAM Data[1787] (REAL)	42662	46892	51122	55352	59582	63812	68042	72272
CAM Data[1788] (REAL)	42664	46894	51124	55354	59584	63814	68044	72274
CAM Data[1789] (REAL)	42666	46896	51126	55356	59586	63816	68046	72276
CAM Data[1790] (REAL)	42668	46898	51128	55358	59588	63818	68048	72278
CAM Data[1791] (REAL)	42670	46900	51130	55360	59590	63820	68050	72280
CAM Data[1792] (REAL)	42672	46902	51132	55362	59592	63822	68052	72282
CAM Data[1793] (REAL)	42674	46904	51134	55364	59594	63824	68054	72284
CAM Data[1794] (REAL)	42676	46906	51136	55366	59596	63826	68056	72286
CAM Data[1795] (REAL)	42678	46908	51138	55368	59598	63828	68058	72288
CAM Data[1796] (REAL)	42680	46910	51140	55370	59600	63830	68060	72290
CAM Data[1797] (REAL)	42682	46912	51142	55372	59602	63832	68062	72292
CAM Data[1798] (REAL)	42684	46914	51144	55374	59604	63834	68064	72294
CAM Data[1799] (REAL)	42686	46916	51146	55376	59606	63836	68066	72296
CAM Data[1800] (REAL)	42688	46918	51148	55378	59608	63838	68068	72298
CAM Data[1801] (REAL)	42690	46920	51150	55380	59610	63840	68070	72300
CAM Data[1802] (REAL)	42692	46922	51152	55382	59612	63842	68072	72302
CAM Data[1803] (REAL)	42694	46924	51154	55384	59614	63844	68074	72304
CAM Data[1804] (REAL)	42696	46926	51156	55386	59616	63846	68076	72306
CAM Data[1805] (REAL)	42698	46928	51158	55388	59618	63848	68078	72308

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[1806] (REAL)	42700	46930	51160	55390	59620	63850	68080	72310
CAM Data[1807] (REAL)	42702	46932	51162	55392	59622	63852	68082	72312
CAM Data[1808] (REAL)	42704	46934	51164	55394	59624	63854	68084	72314
CAM Data[1809] (REAL)	42706	46936	51166	55396	59626	63856	68086	72316
CAM Data[1810] (REAL)	42708	46938	51168	55398	59628	63858	68088	72318
CAM Data[1811] (REAL)	42710	46940	51170	55400	59630	63860	68090	72320
CAM Data[1812] (REAL)	42712	46942	51172	55402	59632	63862	68092	72322
CAM Data[1813] (REAL)	42714	46944	51174	55404	59634	63864	68094	72324
CAM Data[1814] (REAL)	42716	46946	51176	55406	59636	63866	68096	72326
CAM Data[1815] (REAL)	42718	46948	51178	55408	59638	63868	68098	72328
CAM Data[1816] (REAL)	42720	46950	51180	55410	59640	63870	68100	72330
CAM Data[1817] (REAL)	42722	46952	51182	55412	59642	63872	68102	72332
CAM Data[1818] (REAL)	42724	46954	51184	55414	59644	63874	68104	72334
CAM Data[1819] (REAL)	42726	46956	51186	55416	59646	63876	68106	72336
CAM Data[1820] (REAL)	42728	46958	51188	55418	59648	63878	68108	72338
CAM Data[1821] (REAL)	42730	46960	51190	55420	59650	63880	68110	72340
CAM Data[1822] (REAL)	42732	46962	51192	55422	59652	63882	68112	72342
CAM Data[1823] (REAL)	42734	46964	51194	55424	59654	63884	68114	72344
CAM Data[1824] (REAL)	42736	46966	51196	55426	59656	63886	68116	72346
CAM Data[1825] (REAL)	42738	46968	51198	55428	59658	63888	68118	72348
CAM Data[1826] (REAL)	42740	46970	51200	55430	59660	63890	68120	72350
CAM Data[1827] (REAL)	42742	46972	51202	55432	59662	63892	68122	72352
CAM Data[1828] (REAL)	42744	46974	51204	55434	59664	63894	68124	72354
CAM Data[1829] (REAL)	42746	46976	51206	55436	59666	63896	68126	72356
CAM Data[1830] (REAL)	42748	46978	51208	55438	59668	63898	68128	72358
CAM Data[1831] (REAL)	42750	46980	51210	55440	59670	63900	68130	72360
CAM Data[1832] (REAL)	42752	46982	51212	55442	59672	63902	68132	72362
CAM Data[1833] (REAL)	42754	46984	51214	55444	59674	63904	68134	72364
CAM Data[1834] (REAL)	42756	46986	51216	55446	59676	63906	68136	72366
CAM Data[1835] (REAL)	42758	46988	51218	55448	59678	63908	68138	72368
CAM Data[1836] (REAL)	42760	46990	51220	55450	59680	63910	68140	72370
CAM Data[1837] (REAL)	42762	46992	51222	55452	59682	63912	68142	72372
CAM Data[1838] (REAL)	42764	46994	51224	55454	59684	63914	68144	72374
CAM Data[1839] (REAL)	42766	46996	51226	55456	59686	63916	68146	72376
CAM Data[1840] (REAL)	42768	46998	51228	55458	59688	63918	68148	72378
CAM Data[1841] (REAL)	42770	47000	51230	55460	59690	63920	68150	72380
CAM Data[1842] (REAL)	42772	47002	51232	55462	59692	63922	68152	72382
CAM Data[1843] (REAL)	42774	47004	51234	55464	59694	63924	68154	72384
CAM Data[1844] (REAL)	42776	47006	51236	55466	59696	63926	68156	72386
CAM Data[1845] (REAL)	42778	47008	51238	55468	59698	63928	68158	72388
CAM Data[1846] (REAL)	42780	47010	51240	55470	59700	63930	68160	72390

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[1847] (REAL)	42782	47012	51242	55472	59702	63932	68162	72392
CAM Data[1848] (REAL)	42784	47014	51244	55474	59704	63934	68164	72394
CAM Data[1849] (REAL)	42786	47016	51246	55476	59706	63936	68166	72396
CAM Data[1850] (REAL)	42788	47018	51248	55478	59708	63938	68168	72398
CAM Data[1851] (REAL)	42790	47020	51250	55480	59710	63940	68170	72400
CAM Data[1852] (REAL)	42792	47022	51252	55482	59712	63942	68172	72402
CAM Data[1853] (REAL)	42794	47024	51254	55484	59714	63944	68174	72404
CAM Data[1854] (REAL)	42796	47026	51256	55486	59716	63946	68176	72406
CAM Data[1855] (REAL)	42798	47028	51258	55488	59718	63948	68178	72408
CAM Data[1856] (REAL)	42800	47030	51260	55490	59720	63950	68180	72410
CAM Data[1857] (REAL)	42802	47032	51262	55492	59722	63952	68182	72412
CAM Data[1858] (REAL)	42804	47034	51264	55494	59724	63954	68184	72414
CAM Data[1859] (REAL)	42806	47036	51266	55496	59726	63956	68186	72416
CAM Data[1860] (REAL)	42808	47038	51268	55498	59728	63958	68188	72418
CAM Data[1861] (REAL)	42810	47040	51270	55500	59730	63960	68190	72420
CAM Data[1862] (REAL)	42812	47042	51272	55502	59732	63962	68192	72422
CAM Data[1863] (REAL)	42814	47044	51274	55504	59734	63964	68194	72424
CAM Data[1864] (REAL)	42816	47046	51276	55506	59736	63966	68196	72426
CAM Data[1865] (REAL)	42818	47048	51278	55508	59738	63968	68198	72428
CAM Data[1866] (REAL)	42820	47050	51280	55510	59740	63970	68200	72430
CAM Data[1867] (REAL)	42822	47052	51282	55512	59742	63972	68202	72432
CAM Data[1868] (REAL)	42824	47054	51284	55514	59744	63974	68204	72434
CAM Data[1869] (REAL)	42826	47056	51286	55516	59746	63976	68206	72436
CAM Data[1870] (REAL)	42828	47058	51288	55518	59748	63978	68208	72438
CAM Data[1871] (REAL)	42830	47060	51290	55520	59750	63980	68210	72440
CAM Data[1872] (REAL)	42832	47062	51292	55522	59752	63982	68212	72442
CAM Data[1873] (REAL)	42834	47064	51294	55524	59754	63984	68214	72444
CAM Data[1874] (REAL)	42836	47066	51296	55526	59756	63986	68216	72446
CAM Data[1875] (REAL)	42838	47068	51298	55528	59758	63988	68218	72448
CAM Data[1876] (REAL)	42840	47070	51300	55530	59760	63990	68220	72450
CAM Data[1877] (REAL)	42842	47072	51302	55532	59762	63992	68222	72452
CAM Data[1878] (REAL)	42844	47074	51304	55534	59764	63994	68224	72454
CAM Data[1879] (REAL)	42846	47076	51306	55536	59766	63996	68226	72456
CAM Data[1880] (REAL)	42848	47078	51308	55538	59768	63998	68228	72458
CAM Data[1881] (REAL)	42850	47080	51310	55540	59770	64000	68230	72460
CAM Data[1882] (REAL)	42852	47082	51312	55542	59772	64002	68232	72462
CAM Data[1883] (REAL)	42854	47084	51314	55544	59774	64004	68234	72464
CAM Data[1884] (REAL)	42856	47086	51316	55546	59776	64006	68236	72466
CAM Data[1885] (REAL)	42858	47088	51318	55548	59778	64008	68238	72468
CAM Data[1886] (REAL)	42860	47090	51320	55550	59780	64010	68240	72470
CAM Data[1887] (REAL)	42862	47092	51322	55552	59782	64012	68242	72472
CAM Data[1888] (REAL)	42864	47094	51324	55554	59784	64014	68244	72474

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[1889] (REAL)	42866	47096	51326	55556	59786	64016	68246	72476
CAM Data[1890] (REAL)	42868	47098	51328	55558	59788	64018	68248	72478
CAM Data[1891] (REAL)	42870	47100	51330	55560	59790	64020	68250	72480
CAM Data[1892] (REAL)	42872	47102	51332	55562	59792	64022	68252	72482
CAM Data[1893] (REAL)	42874	47104	51334	55564	59794	64024	68254	72484
CAM Data[1894] (REAL)	42876	47106	51336	55566	59796	64026	68256	72486
CAM Data[1895] (REAL)	42878	47108	51338	55568	59798	64028	68258	72488
CAM Data[1896] (REAL)	42880	47110	51340	55570	59800	64030	68260	72490
CAM Data[1897] (REAL)	42882	47112	51342	55572	59802	64032	68262	72492
CAM Data[1898] (REAL)	42884	47114	51344	55574	59804	64034	68264	72494
CAM Data[1899] (REAL)	42886	47116	51346	55576	59806	64036	68266	72496
CAM Data[1900] (REAL)	42888	47118	51348	55578	59808	64038	68268	72498
CAM Data[1901] (REAL)	42890	47120	51350	55580	59810	64040	68270	72500
CAM Data[1902] (REAL)	42892	47122	51352	55582	59812	64042	68272	72502
CAM Data[1903] (REAL)	42894	47124	51354	55584	59814	64044	68274	72504
CAM Data[1904] (REAL)	42896	47126	51356	55586	59816	64046	68276	72506
CAM Data[1905] (REAL)	42898	47128	51358	55588	59818	64048	68278	72508
CAM Data[1906] (REAL)	42900	47130	51360	55590	59820	64050	68280	72510
CAM Data[1907] (REAL)	42902	47132	51362	55592	59822	64052	68282	72512
CAM Data[1908] (REAL)	42904	47134	51364	55594	59824	64054	68284	72514
CAM Data[1909] (REAL)	42906	47136	51366	55596	59826	64056	68286	72516
CAM Data[1910] (REAL)	42908	47138	51368	55598	59828	64058	68288	72518
CAM Data[1911] (REAL)	42910	47140	51370	55600	59830	64060	68290	72520
CAM Data[1912] (REAL)	42912	47142	51372	55602	59832	64062	68292	72522
CAM Data[1913] (REAL)	42914	47144	51374	55604	59834	64064	68294	72524
CAM Data[1914] (REAL)	42916	47146	51376	55606	59836	64066	68296	72526
CAM Data[1915] (REAL)	42918	47148	51378	55608	59838	64068	68298	72528
CAM Data[1916] (REAL)	42920	47150	51380	55610	59840	64070	68300	72530
CAM Data[1917] (REAL)	42922	47152	51382	55612	59842	64072	68302	72532
CAM Data[1918] (REAL)	42924	47154	51384	55614	59844	64074	68304	72534
CAM Data[1919] (REAL)	42926	47156	51386	55616	59846	64076	68306	72536
CAM Data[1920] (REAL)	42928	47158	51388	55618	59848	64078	68308	72538
CAM Data[1921] (REAL)	42930	47160	51390	55620	59850	64080	68310	72540
CAM Data[1922] (REAL)	42932	47162	51392	55622	59852	64082	68312	72542
CAM Data[1923] (REAL)	42934	47164	51394	55624	59854	64084	68314	72544
CAM Data[1924] (REAL)	42936	47166	51396	55626	59856	64086	68316	72546
CAM Data[1925] (REAL)	42938	47168	51398	55628	59858	64088	68318	72548
CAM Data[1926] (REAL)	42940	47170	51400	55630	59860	64090	68320	72550
CAM Data[1927] (REAL)	42942	47172	51402	55632	59862	64092	68322	72552
CAM Data[1928] (REAL)	42944	47174	51404	55634	59864	64094	68324	72554
CAM Data[1929] (REAL)	42946	47176	51406	55636	59866	64096	68326	72556

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[1930] (REAL)	42948	47178	51408	55638	59868	64098	68328	72558
CAM Data[1931] (REAL)	42950	47180	51410	55640	59870	64100	68330	72560
CAM Data[1932] (REAL)	42952	47182	51412	55642	59872	64102	68332	72562
CAM Data[1933] (REAL)	42954	47184	51414	55644	59874	64104	68334	72564
CAM Data[1934] (REAL)	42956	47186	51416	55646	59876	64106	68336	72566
CAM Data[1935] (REAL)	42958	47188	51418	55648	59878	64108	68338	72568
CAM Data[1936] (REAL)	42960	47190	51420	55650	59880	64110	68340	72570
CAM Data[1937] (REAL)	42962	47192	51422	55652	59882	64112	68342	72572
CAM Data[1938] (REAL)	42964	47194	51424	55654	59884	64114	68344	72574
CAM Data[1939] (REAL)	42966	47196	51426	55656	59886	64116	68346	72576
CAM Data[1940] (REAL)	42968	47198	51428	55658	59888	64118	68348	72578
CAM Data[1941] (REAL)	42970	47200	51430	55660	59890	64120	68350	72580
CAM Data[1942] (REAL)	42972	47202	51432	55662	59892	64122	68352	72582
CAM Data[1943] (REAL)	42974	47204	51434	55664	59894	64124	68354	72584
CAM Data[1944] (REAL)	42976	47206	51436	55666	59896	64126	68356	72586
CAM Data[1945] (REAL)	42978	47208	51438	55668	59898	64128	68358	72588
CAM Data[1946] (REAL)	42980	47210	51440	55670	59900	64130	68360	72590
CAM Data[1947] (REAL)	42982	47212	51442	55672	59902	64132	68362	72592
CAM Data[1948] (REAL)	42984	47214	51444	55674	59904	64134	68364	72594
CAM Data[1949] (REAL)	42986	47216	51446	55676	59906	64136	68366	72596
CAM Data[1950] (REAL)	42988	47218	51448	55678	59908	64138	68368	72598
CAM Data[1951] (REAL)	42990	47220	51450	55680	59910	64140	68370	72600
CAM Data[1952] (REAL)	42992	47222	51452	55682	59912	64142	68372	72602
CAM Data[1953] (REAL)	42994	47224	51454	55684	59914	64144	68374	72604
CAM Data[1954] (REAL)	42996	47226	51456	55686	59916	64146	68376	72606
CAM Data[1955] (REAL)	42998	47228	51458	55688	59918	64148	68378	72608
CAM Data[1956] (REAL)	43000	47230	51460	55690	59920	64150	68380	72610
CAM Data[1957] (REAL)	43002	47232	51462	55692	59922	64152	68382	72612
CAM Data[1958] (REAL)	43004	47234	51464	55694	59924	64154	68384	72614
CAM Data[1959] (REAL)	43006	47236	51466	55696	59926	64156	68386	72616
CAM Data[1960] (REAL)	43008	47238	51468	55698	59928	64158	68388	72618
CAM Data[1961] (REAL)	43010	47240	51470	55700	59930	64160	68390	72620
CAM Data[1962] (REAL)	43012	47242	51472	55702	59932	64162	68392	72622
CAM Data[1963] (REAL)	43014	47244	51474	55704	59934	64164	68394	72624
CAM Data[1964] (REAL)	43016	47246	51476	55706	59936	64166	68396	72626
CAM Data[1965] (REAL)	43018	47248	51478	55708	59938	64168	68398	72628
CAM Data[1966] (REAL)	43020	47250	51480	55710	59940	64170	68400	72630
CAM Data[1967] (REAL)	43022	47252	51482	55712	59942	64172	68402	72632
CAM Data[1968] (REAL)	43024	47254	51484	55714	59944	64174	68404	72634
CAM Data[1969] (REAL)	43026	47256	51486	55716	59946	64176	68406	72636
CAM Data[1970] (REAL)	43028	47258	51488	55718	59948	64178	68408	72638
CAM Data[1971] (REAL)	43030	47260	51490	55720	59950	64180	68410	72640

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[1972] (REAL)	43032	47262	51492	55722	59952	64182	68412	72642
CAM Data[1973] (REAL)	43034	47264	51494	55724	59954	64184	68414	72644
CAM Data[1974] (REAL)	43036	47266	51496	55726	59956	64186	68416	72646
CAM Data[1975] (REAL)	43038	47268	51498	55728	59958	64188	68418	72648
CAM Data[1976] (REAL)	43040	47270	51500	55730	59960	64190	68420	72650
CAM Data[1977] (REAL)	43042	47272	51502	55732	59962	64192	68422	72652
CAM Data[1978] (REAL)	43044	47274	51504	55734	59964	64194	68424	72654
CAM Data[1979] (REAL)	43046	47276	51506	55736	59966	64196	68426	72656
CAM Data[1980] (REAL)	43048	47278	51508	55738	59968	64198	68428	72658
CAM Data[1981] (REAL)	43050	47280	51510	55740	59970	64200	68430	72660
CAM Data[1982] (REAL)	43052	47282	51512	55742	59972	64202	68432	72662
CAM Data[1983] (REAL)	43054	47284	51514	55744	59974	64204	68434	72664
CAM Data[1984] (REAL)	43056	47286	51516	55746	59976	64206	68436	72666
CAM Data[1985] (REAL)	43058	47288	51518	55748	59978	64208	68438	72668
CAM Data[1986] (REAL)	43060	47290	51520	55750	59980	64210	68440	72670
CAM Data[1987] (REAL)	43062	47292	51522	55752	59982	64212	68442	72672
CAM Data[1988] (REAL)	43064	47294	51524	55754	59984	64214	68444	72674
CAM Data[1989] (REAL)	43066	47296	51526	55756	59986	64216	68446	72676
CAM Data[1990] (REAL)	43068	47298	51528	55758	59988	64218	68448	72678
CAM Data[1991] (REAL)	43070	47300	51530	55760	59990	64220	68450	72680
CAM Data[1992] (REAL)	43072	47302	51532	55762	59992	64222	68452	72682
CAM Data[1993] (REAL)	43074	47304	51534	55764	59994	64224	68454	72684
CAM Data[1994] (REAL)	43076	47306	51536	55766	59996	64226	68456	72686
CAM Data[1995] (REAL)	43078	47308	51538	55768	59998	64228	68458	72688
CAM Data[1996] (REAL)	43080	47310	51540	55770	60000	64230	68460	72690
CAM Data[1997] (REAL)	43082	47312	51542	55772	60002	64232	68462	72692
CAM Data[1998] (REAL)	43084	47314	51544	55774	60004	64234	68464	72694
CAM Data[1999] (REAL)	43086	47316	51546	55776	60006	64236	68466	72696
CAM Data[2000] (REAL)	43088	47318	51548	55778	60008	64238	68468	72698
CAM Data[2001] (REAL)	43090	47320	51550	55780	60010	64240	68470	72700
CAM Data[2002] (REAL)	43092	47322	51552	55782	60012	64242	68472	72702
CAM Data[2003] (REAL)	43094	47324	51554	55784	60014	64244	68474	72704
CAM Data[2004] (REAL)	43096	47326	51556	55786	60016	64246	68476	72706
CAM Data[2005] (REAL)	43098	47328	51558	55788	60018	64248	68478	72708
CAM Data[2006] (REAL)	43100	47330	51560	55790	60020	64250	68480	72710
CAM Data[2007] (REAL)	43102	47332	51562	55792	60022	64252	68482	72712
CAM Data[2008] (REAL)	43104	47334	51564	55794	60024	64254	68484	72714
CAM Data[2009] (REAL)	43106	47336	51566	55796	60026	64256	68486	72716
CAM Data[2010] (REAL)	43108	47338	51568	55798	60028	64258	68488	72718
CAM Data[2011] (REAL)	43110	47340	51570	55800	60030	64260	68490	72720
CAM Data[2012] (REAL)	43112	47342	51572	55802	60032	64262	68492	72722

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[2013] (REAL)	43114	47344	51574	55804	60034	64264	68494	72724
CAM Data[2014] (REAL)	43116	47346	51576	55806	60036	64266	68496	72726
CAM Data[2015] (REAL)	43118	47348	51578	55808	60038	64268	68498	72728
CAM Data[2016] (REAL)	43120	47350	51580	55810	60040	64270	68500	72730
CAM Data[2017] (REAL)	43122	47352	51582	55812	60042	64272	68502	72732
CAM Data[2018] (REAL)	43124	47354	51584	55814	60044	64274	68504	72734
CAM Data[2019] (REAL)	43126	47356	51586	55816	60046	64276	68506	72736
CAM Data[2020] (REAL)	43128	47358	51588	55818	60048	64278	68508	72738
CAM Data[2021] (REAL)	43130	47360	51590	55820	60050	64280	68510	72740
CAM Data[2022] (REAL)	43132	47362	51592	55822	60052	64282	68512	72742
CAM Data[2023] (REAL)	43134	47364	51594	55824	60054	64284	68514	72744
CAM Data[2024] (REAL)	43136	47366	51596	55826	60056	64286	68516	72746
CAM Data[2025] (REAL)	43138	47368	51598	55828	60058	64288	68518	72748
CAM Data[2026] (REAL)	43140	47370	51600	55830	60060	64290	68520	72750
CAM Data[2027] (REAL)	43142	47372	51602	55832	60062	64292	68522	72752
CAM Data[2028] (REAL)	43144	47374	51604	55834	60064	64294	68524	72754
CAM Data[2029] (REAL)	43146	47376	51606	55836	60066	64296	68526	72756
CAM Data[2030] (REAL)	43148	47378	51608	55838	60068	64298	68528	72758
CAM Data[2031] (REAL)	43150	47380	51610	55840	60070	64300	68530	72760
CAM Data[2032] (REAL)	43152	47382	51612	55842	60072	64302	68532	72762
CAM Data[2033] (REAL)	43154	47384	51614	55844	60074	64304	68534	72764
CAM Data[2034] (REAL)	43156	47386	51616	55846	60076	64306	68536	72766
CAM Data[2035] (REAL)	43158	47388	51618	55848	60078	64308	68538	72768
CAM Data[2036] (REAL)	43160	47390	51620	55850	60080	64310	68540	72770
CAM Data[2037] (REAL)	43162	47392	51622	55852	60082	64312	68542	72772
CAM Data[2038] (REAL)	43164	47394	51624	55854	60084	64314	68544	72774
CAM Data[2039] (REAL)	43166	47396	51626	55856	60086	64316	68546	72776
CAM Data[2040] (REAL)	43168	47398	51628	55858	60088	64318	68548	72778
CAM Data[2041] (REAL)	43170	47400	51630	55860	60090	64320	68550	72780
CAM Data[2042] (REAL)	43172	47402	51632	55862	60092	64322	68552	72782
CAM Data[2043] (REAL)	43174	47404	51634	55864	60094	64324	68554	72784
CAM Data[2044] (REAL)	43176	47406	51636	55866	60096	64326	68556	72786
CAM Data[2045] (REAL)	43178	47408	51638	55868	60098	64328	68558	72788
CAM Data[2046] (REAL)	43180	47410	51640	55870	60100	64330	68560	72790
CAM Data[2047] (REAL)	43182	47412	51642	55872	60102	64332	68562	72792

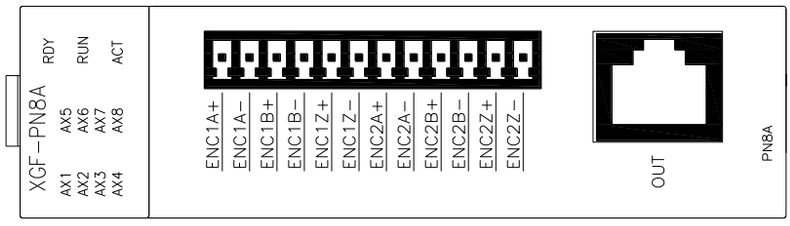
Appendix 2.11 User CAM Data Memory Address

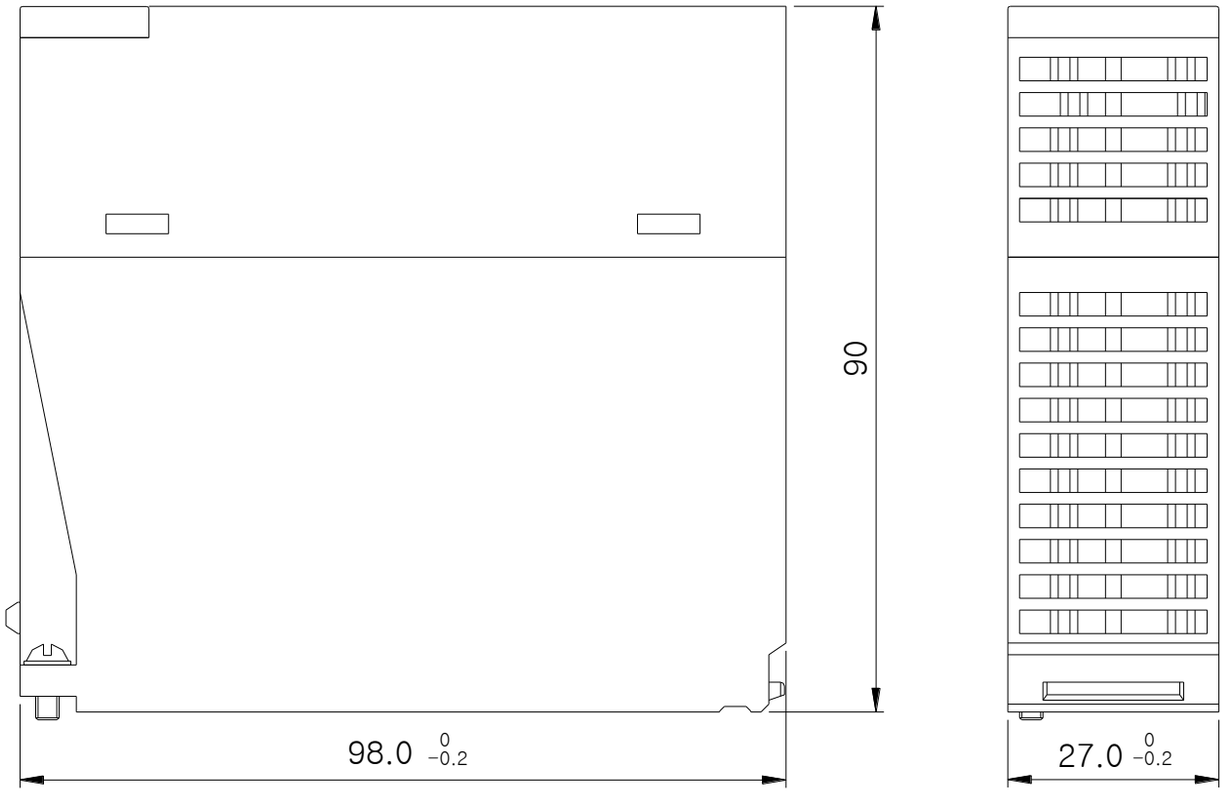
Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
Number of user CAM data	72794	72916	73038	73160	73282	73404	73526	73648
Main axis position 1	72796	72918	73040	73162	73284	73406	73528	73650
Sub axis position 1	72798	72920	73042	73164	73286	73408	73530	73652
Main axis position 2	72800	72922	73044	73166	73288	73410	73532	73654
Sub axis position 2	72802	72924	73046	73168	73290	73412	73534	73656
Main axis position 3	72804	72926	73048	73170	73292	73414	73536	73658
Sub axis position 3	72806	72928	73050	73172	73294	73416	73538	73660
Main axis position 4	72808	72930	73052	73174	73296	73418	73540	73662
Sub axis position 4	72810	72932	73054	73176	73298	73420	73542	73664
Main axis position 5	72812	72934	73056	73178	73300	73422	73544	73666
Sub axis position 5	72814	72936	73058	73180	73302	73424	73546	73668
Main axis position 6	72816	72938	73060	73182	73304	73426	73548	73670
Sub axis position 6	72818	72940	73062	73184	73306	73428	73550	73672
Main axis position 7	72820	72942	73064	73186	73308	73430	73552	73674
Sub axis position 7	72822	72944	73066	73188	73310	73432	73554	73676
Main axis position 8	72824	72946	73068	73190	73312	73434	73556	73678
Sub axis position 8	72826	72948	73070	73192	73314	73436	73558	73680
Main axis position 9	72828	72950	73072	73194	73316	73438	73560	73682
Sub axis position 9	72830	72952	73074	73196	73318	73440	73562	73684
Main axis position 10	72832	72954	73076	73198	73320	73442	73564	73686
Sub axis position 10	72834	72956	73078	73200	73322	73444	73566	73688
Main axis position 11	72836	72958	73080	73202	73324	73446	73568	73690
Sub axis position 11	72838	72960	73082	73204	73326	73448	73570	73692
Main axis position 12	72840	72962	73084	73206	73328	73450	73572	73694
Sub axis position 12	72842	72964	73086	73208	73330	73452	73574	73696
Main axis position 13	72844	72966	73088	73210	73332	73454	73576	73698
Sub axis position 13	72846	72968	73090	73212	73334	73456	73578	73700
Main axis position 14	72848	72970	73092	73214	73336	73458	73580	73702
Sub axis position 14	72850	72972	73094	73216	73338	73460	73582	73704
Main axis position 15	72852	72974	73096	73218	73340	73462	73584	73706
Sub axis position 15	72854	72976	73098	73220	73342	73464	73586	73708
Main axis position 16	72856	72978	73100	73222	73344	73466	73588	73710
Sub axis position 16	72858	72980	73102	73224	73346	73468	73590	73712
Main axis position 17	72860	72982	73104	73226	73348	73470	73592	73714
Sub axis position 17	72862	72984	73106	73228	73350	73472	73594	73716
Main axis position 18	72864	72986	73108	73230	73352	73474	73596	73718
Sub axis position 18	72866	72988	73110	73232	73354	73476	73598	73720
Main axis position 19	72868	72990	73112	73234	73356	73478	73600	73722
Sub axis position 19	72870	72992	73114	73236	73358	73480	73602	73724
Main axis position 20	72872	72994	73116	73238	73360	73482	73604	73726

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
Sub axis position 20	72874	72996	73118	73240	73362	73484	73606	73728
Main axis position 21	72876	72998	73120	73242	73364	73486	73608	73730
Sub axis position 21	72878	73000	73122	73244	73366	73488	73610	73732
Main axis position 22	72880	73002	73124	73246	73368	73490	73612	73734
Sub axis position 22	72882	73004	73126	73248	73370	73492	73614	73736
Main axis position 23	72884	73006	73128	73250	73372	73494	73616	73738
Sub axis position 23	72886	73008	73130	73252	73374	73496	73618	73740
Main axis position 24	72888	73010	73132	73254	73376	73498	73620	73742
Sub axis position 24	72890	73012	73134	73256	73378	73500	73622	73744
Main axis position 25	72892	73014	73136	73258	73380	73502	73624	73746
Sub axis position 25	72894	73016	73138	73260	73382	73504	73626	73748
Main axis position 26	72896	73018	73140	73262	73384	73506	73628	73750
Sub axis position 26	72898	73020	73142	73264	73386	73508	73630	73752
Main axis position 27	72900	73022	73144	73266	73388	73510	73632	73754
Sub axis position 27	72902	73024	73146	73268	73390	73512	73634	73756
Main axis position 28	72904	73026	73148	73270	73392	73514	73636	73758
Sub axis position 28	72906	73028	73150	73272	73394	73516	73638	73760
Main axis position 29	72908	73030	73152	73274	73396	73518	73640	73762
Sub axis position 29	72910	73032	73154	73276	73398	73520	73642	73764
Main axis position 30	72912	73034	73156	73278	73400	73522	73644	73766
Sub axis position 30	72914	73036	73158	73280	73402	73524	73646	73768

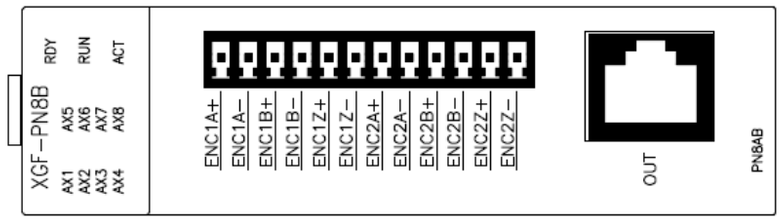
Appendix 3 Dimension

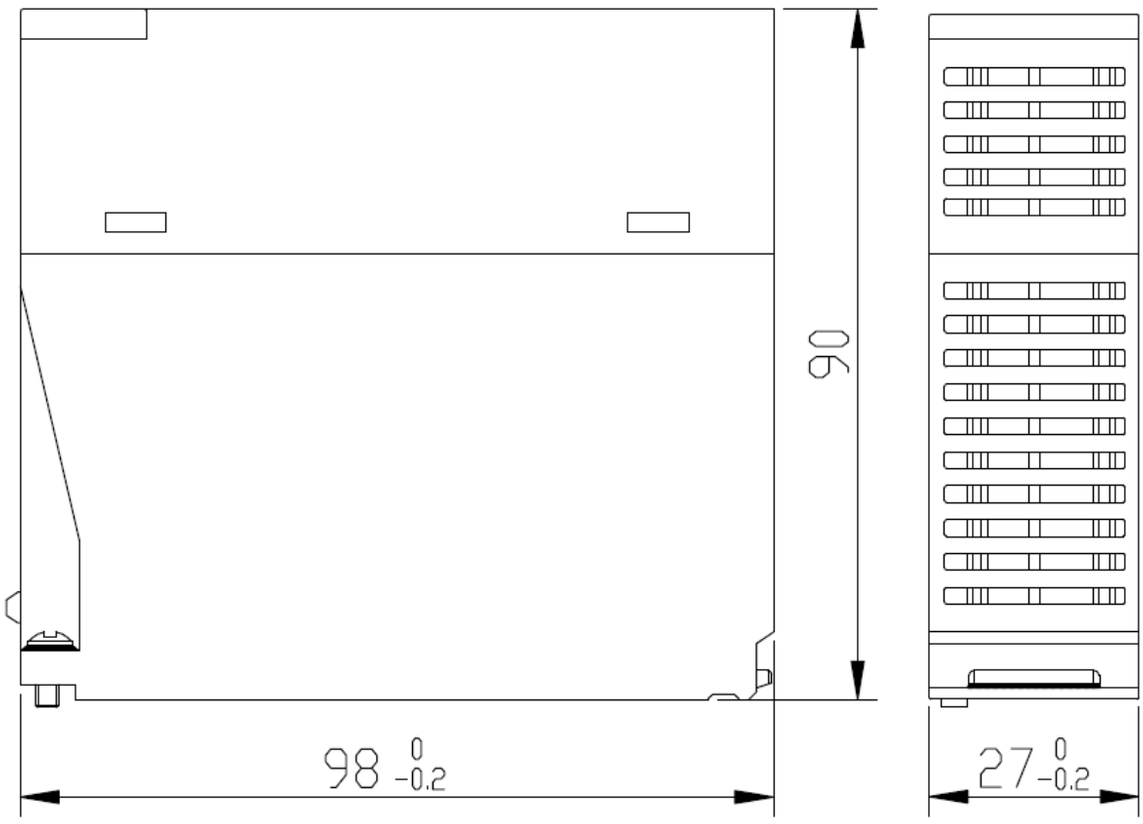
Appendix 3.1 Dimension of XGF-PN8A





Appendix 3.2 Dimension of XGF-PN8B





Appendix 4 Setting Example

It describes how to set when using the positioning module at the beginning.

Appendix 4.1 XGF-PN8A

(1) Install the servo driver.

Connect the power and motor to the servo driver and connect external signal as necessary.

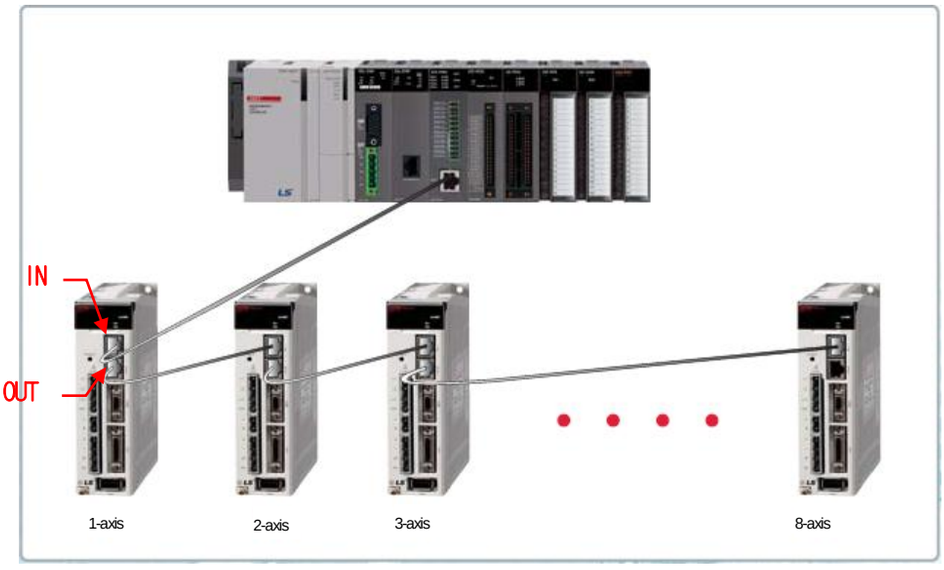
(2) Install PLC.

Install PLC and mount the positioning module. And at the beginning of test-run, for safety's sake, make sure PLC CPU is STOP mode.

(3) Connect the positioning module and servo driver.

Connect the positioning module and first servo driver by using Ethernet cable. And connect other servo drivers.

At this time, check the I/O direction of communication port of the servo driver distinctly. The following is wiring diagram when connecting 8 servo drivers and applicable motor type per servo driver capacity.

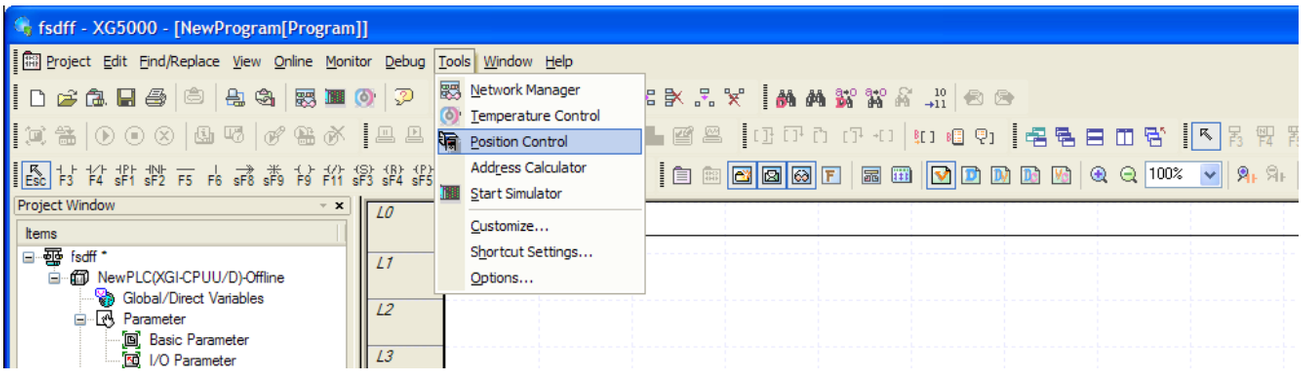


Driver [XDA-N]	Applicable motor						
	CN/CJ Series 3000/6000[rpm]	KN Series 2000/3000[rpm]	TN Series 1500/3000[rpm]	LN Series 1000/2000[rpm]	KF Series 2000/3000[rpm]	TF Series 1500/3000[rpm]	LF Series 1000/2000[rpm]
001	CJZ5 CN01 CJ01	-	-	-	-	-	-
002	CN02 CJ02	-	Driver -	-	-	-	-
004	CN03 CN04 CJ04 CN04A CN05	KN03 KN05	-	LN03	-	-	LF03
005	CN06 CN08 CN09	KN06 KN06A	TN05	LN06	-	TF05	LF06
010	CN10	KN07 KN11	TN09	LN09	KF08 KF10	TF09	LF09
015	CN15	KN16	TN13	LN12 LN12A	KF15	TF13	LF12
020	CN22	KN22 KN22A	TN17 TN20	LN20	KF22	TF20	LF20
030	CN30 CN30A	KN35	TN30	LN30	KF35	TF30	LF30
045	CN50 CN50A	KN55	TN44	LN40	KF50	TF44	-

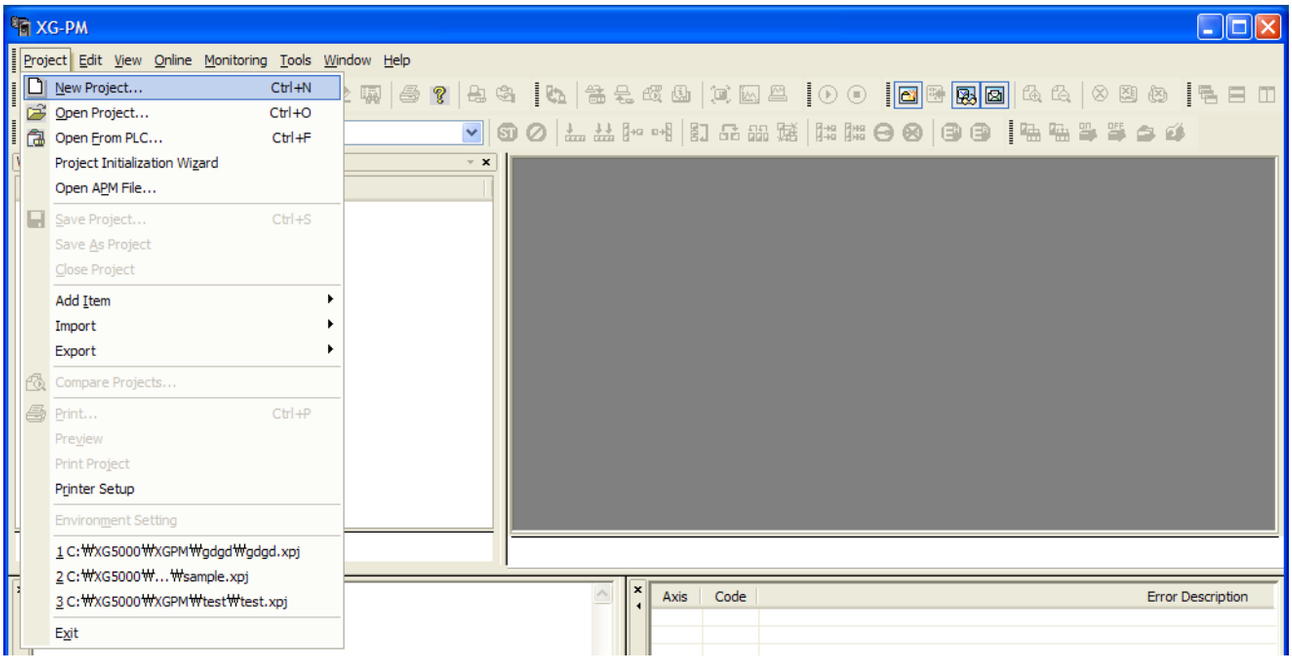
(4) Install XG5000 at the PC.

(5) Execute XG5000 and XG-PM by selecting “Tools – Position control”

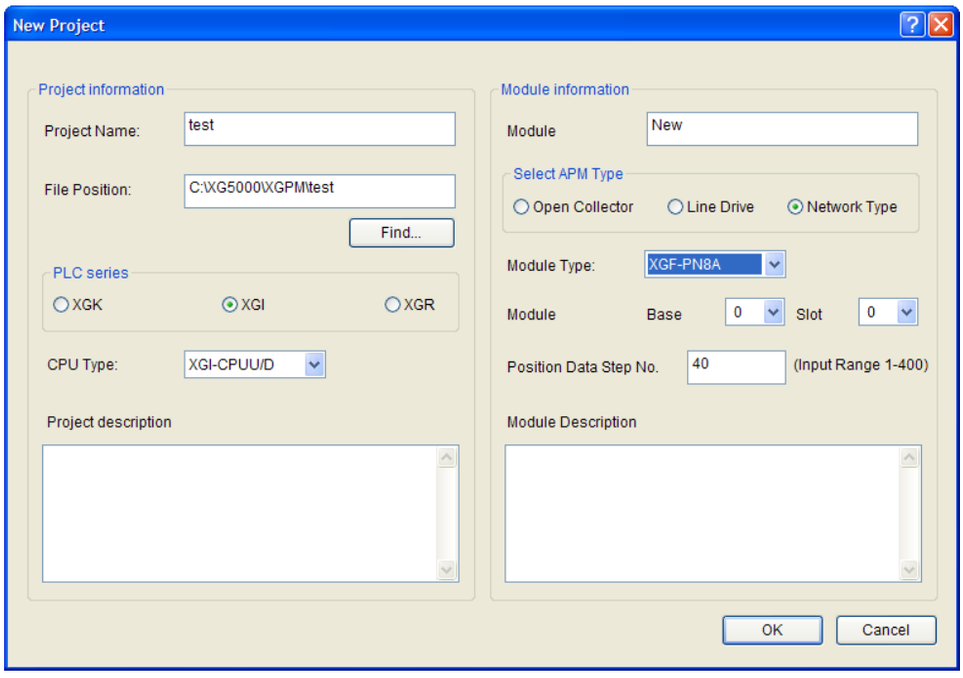
(XG-PM is used for setting operation parameter, operation data and servo parameter or monitoring and etc.)



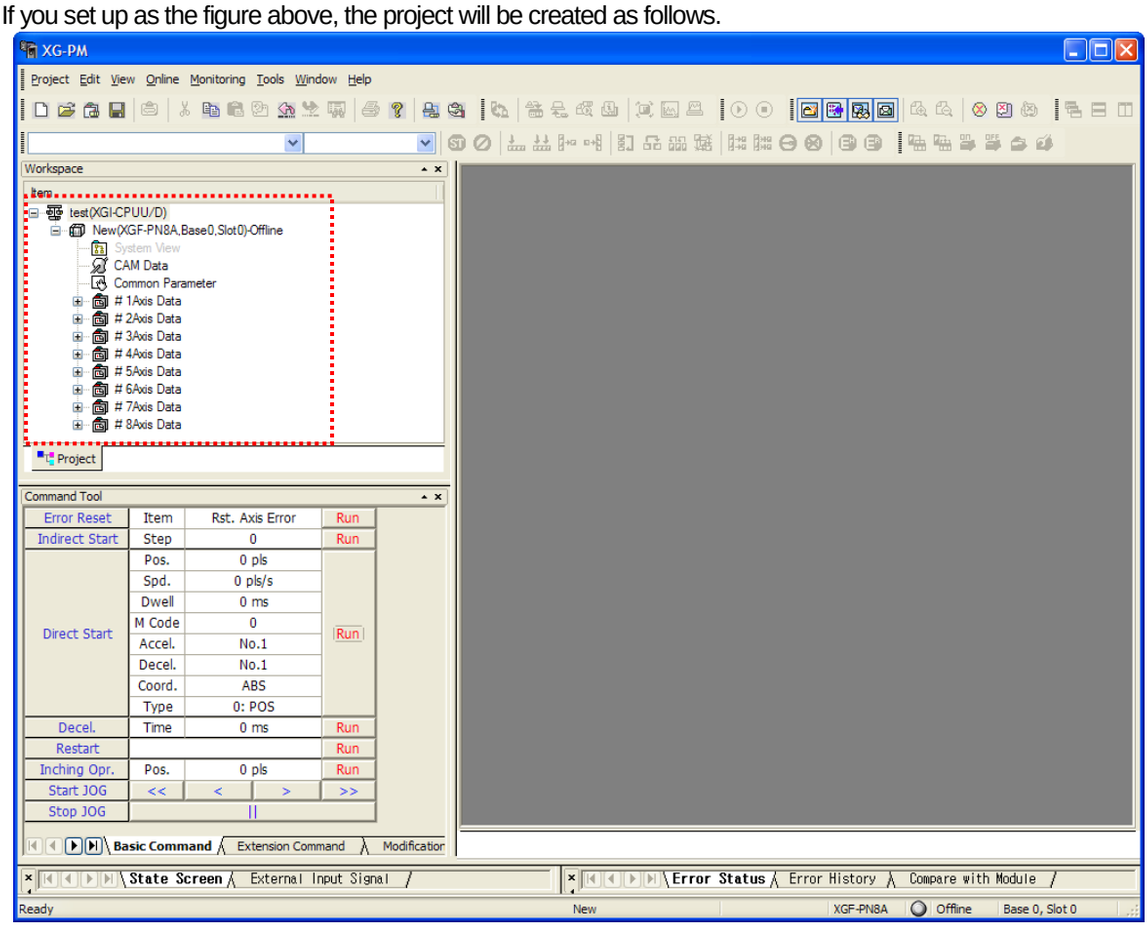
(6) If XG-PM is executed, create positioning project by selecting “Project – New Project”.



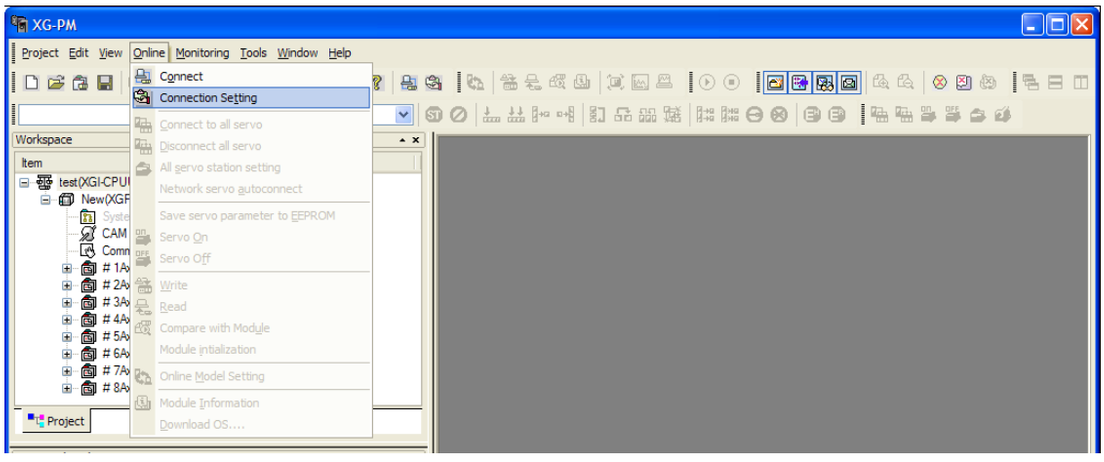
(7) In the figure below, set up Project name, PLC series, CPU type, Module name, Module type, Module position to create new project.

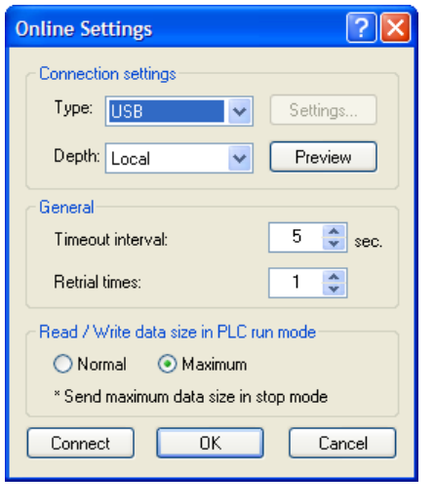


(8) If you set up as the figure above, the project will be created as follows.

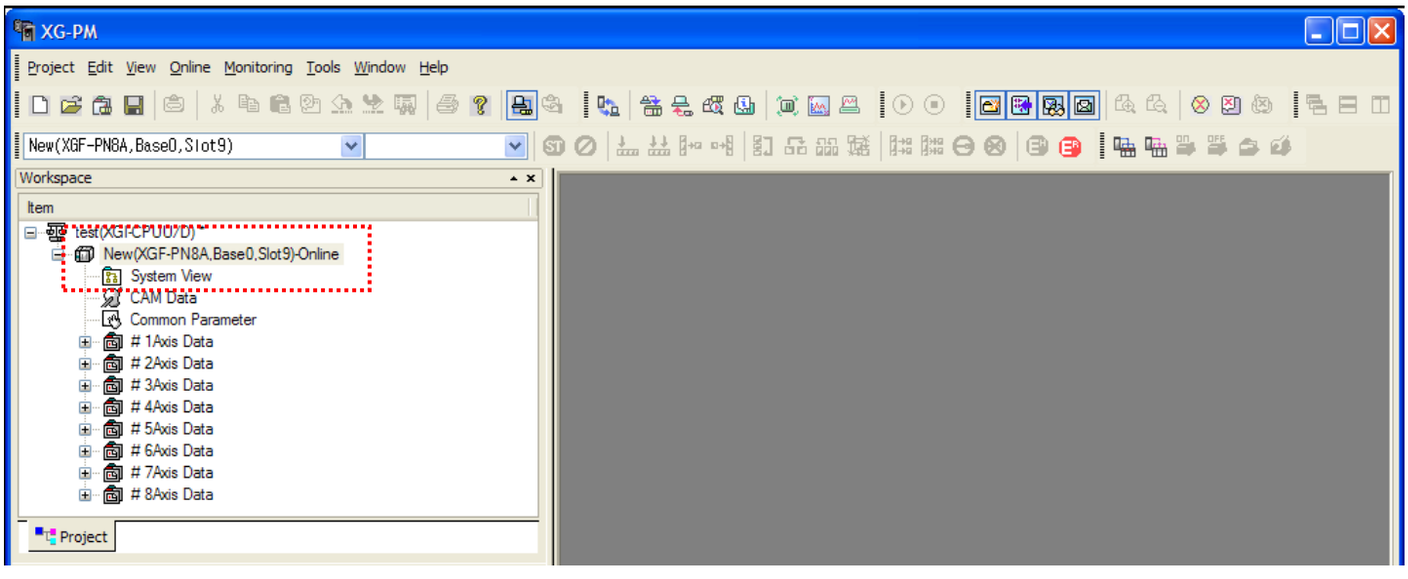


(9) Turn on PLC and servo driver and connect PC with PLC CPU through USB or RS-232C cable.
(10) Select “Online- Connection Setting” and set up connection settings.

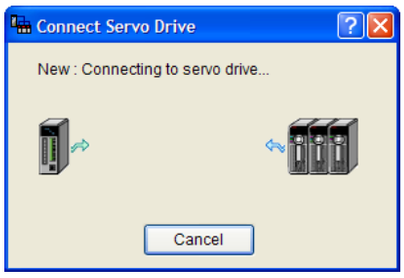




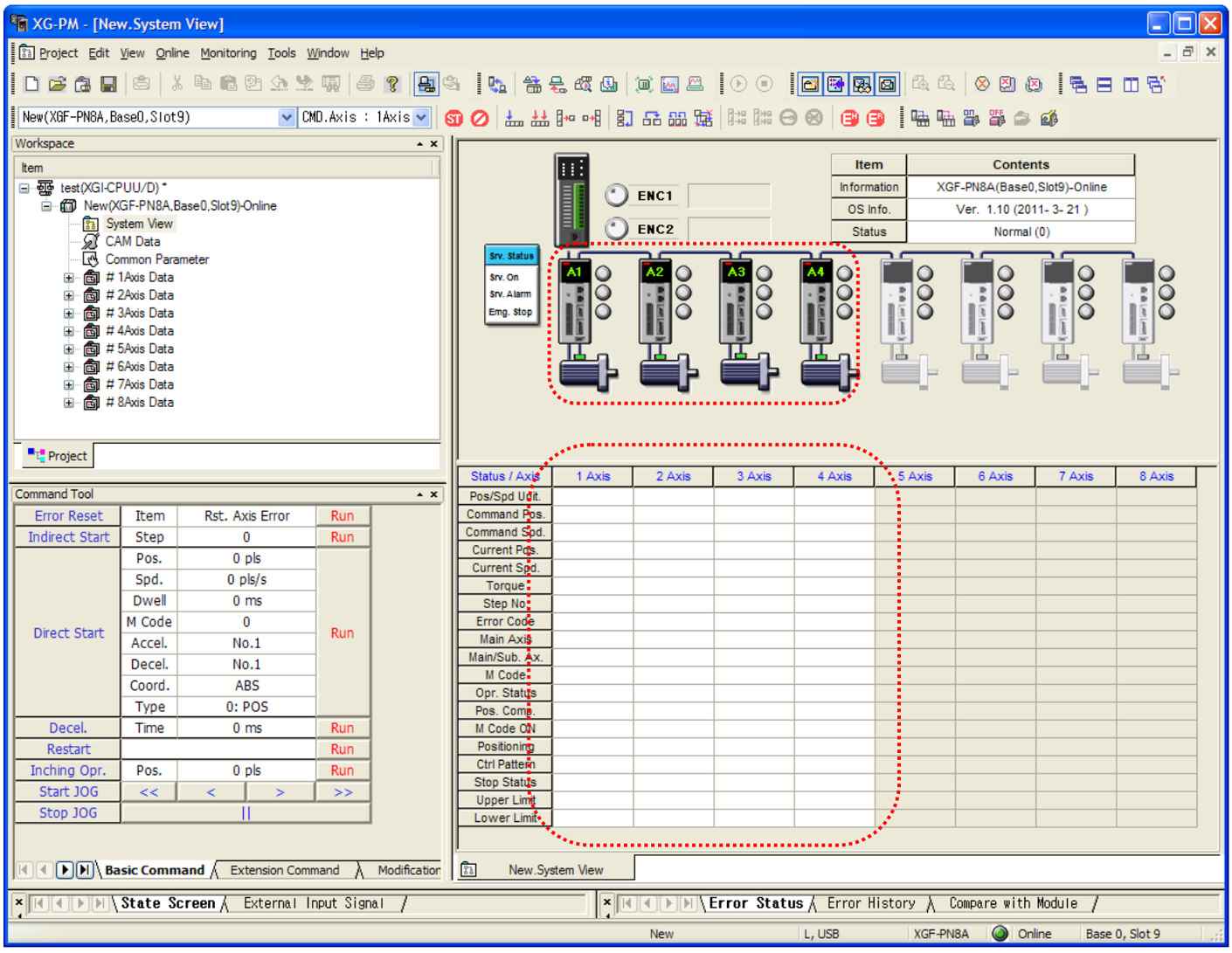
(11) Select “Online-Connect” to connect PC with PLC CPU.
(12) If connection is complete, the module will be shown in ‘Online’ as follows.



(13) If the module doesn't become "Online" and keeps "Offline", check whether the module is mounted, position or type is correct.
(14) Select "Online-Connect to all servo" to connect the position module with servo driver.

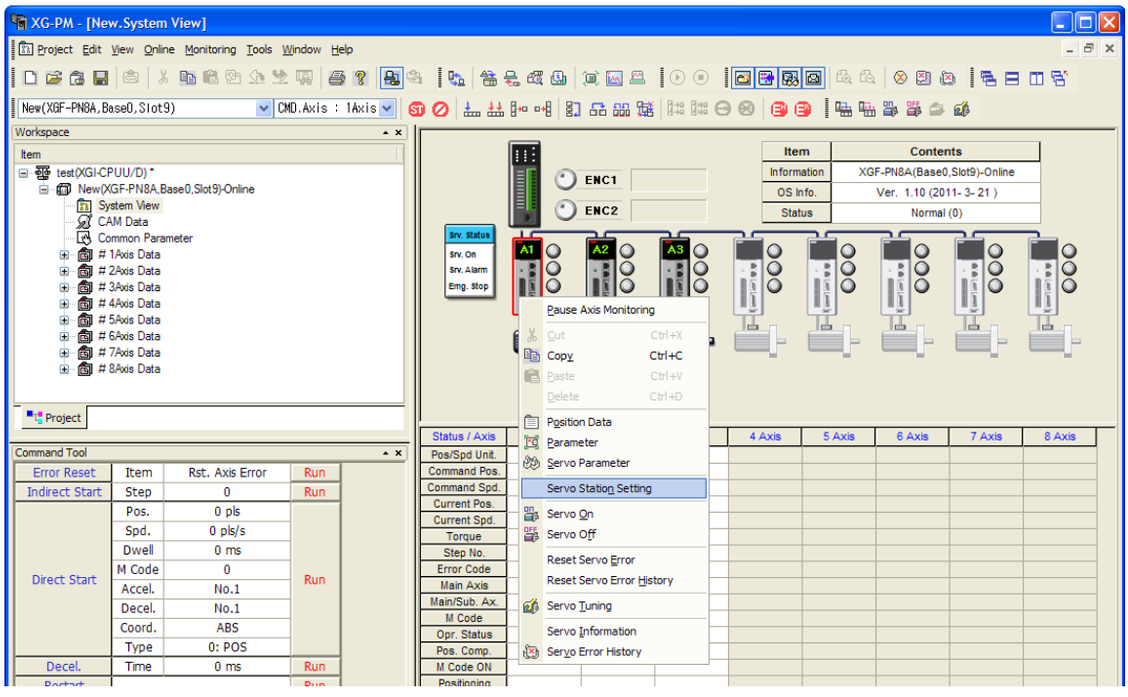


(15) If connection is complete, the connected servo driver is activated in System View.

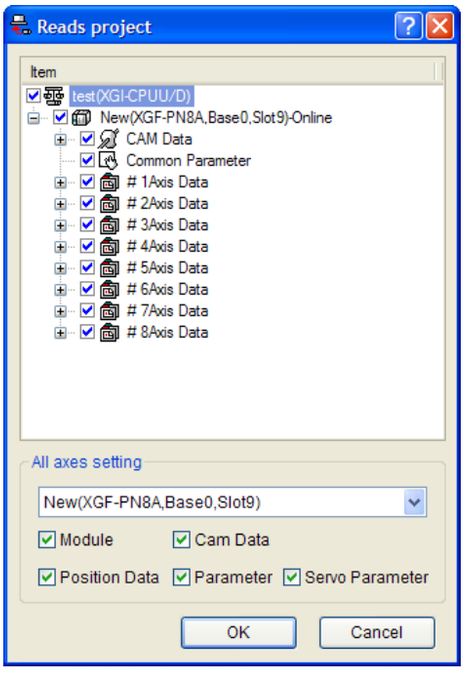


(16) At the first connection, all station numbers of servo driver may be set as 0. In system view, select the servo driver and set up the

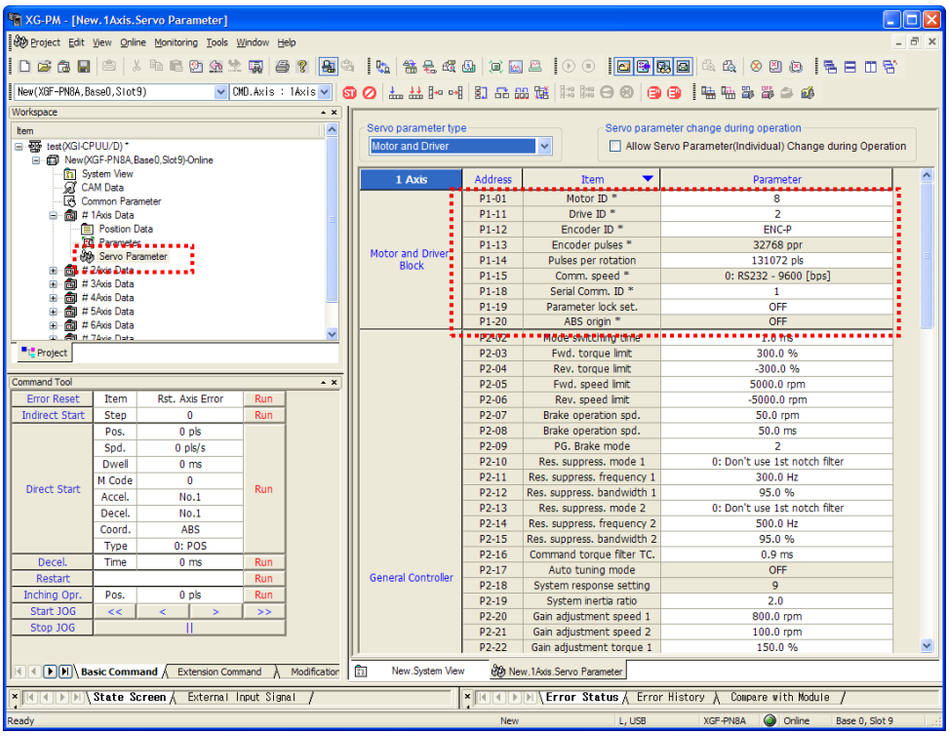
servo station not to be duplicated. And execute “Servo station write” command. For setting servo station number, select the servo in system view and click the right button of the mouse. Or double-click the servo in system view. For “Servo station write” command, select “Online – All servo station setting”.



(17) Read the parameter to set up “operation parameter and servo parameter”.
Select menu “Online - Read” to execute reading.



(18) Set up servo parameter of the each axis. Basically, set up servo driver capacity, motor capacity and encoder pulses.



(a) Motor ID

ID	Model	ID	Model	ID	Model	ID	Model	ID	Model
00	Each	20	TF05	40	LF03	60	KN03	80	LN03
01		21	TF09	41	LF06	61	KN05	81	LN06
02		22	TF13	42	LF09	62	KN06	82	LN09
03		23	TF20	43	LF12	63	KN07	83	LN12
04		24	TF30	44	LF20	64	KN06A	84	LN12A
05	CJZ5	25	TF44	45	LF30	65	KN11	85	LN20
06	CJ01	26		46		66	KN16	86	LN30
07		27		47		67	KN22	87	LN40
08	CJ02	28		48	CN40	68	KN22A	88	
09	CJ04	29		49	CN50	69	KN35	89	
10		30	KF08	50	CN04A	70	TN05	90	
11	CN01	31	KF10	51	CN06	71	TN09	91	
12	CN02	32	KF15	52	CN08	72	TN13	92	LN55
13	CN03	33	KF22	53	CN10	73	TN17	93	
14	CN04	34	KF35	54	CN09	74	TN20	94	
15	CN05	35	KF50	55	CN15	75	TN30	95	
16		36		56	CN22	76	TN44	96	
17		37		57	CN30	77		97	LN10
18		38		58	CN30A	78	TN55	98	
19		39		59	CN50A	79	KN55	99	

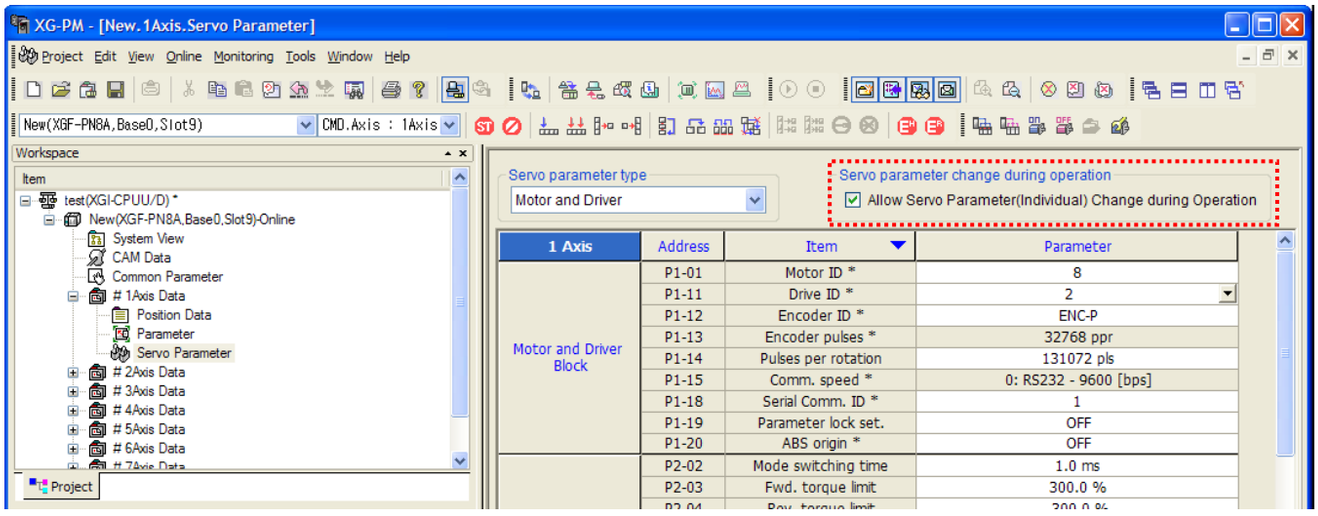
(b) Driver ID

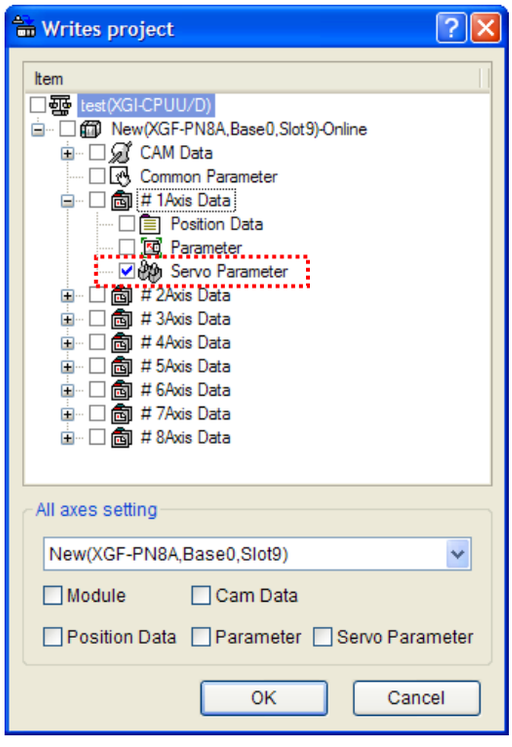
Driver capacity [XDA-N]	001	002	004	005	010	015	020	030	045
P01-11 [***Driver*** ID]	1	2	4	5	10	15	20	30	45

(c) Encoder ID

Encoder type	Encoder ID (P01-12)
17 bit incremental encoder	Enc-P
17 bit absolute encoder	Encd-R

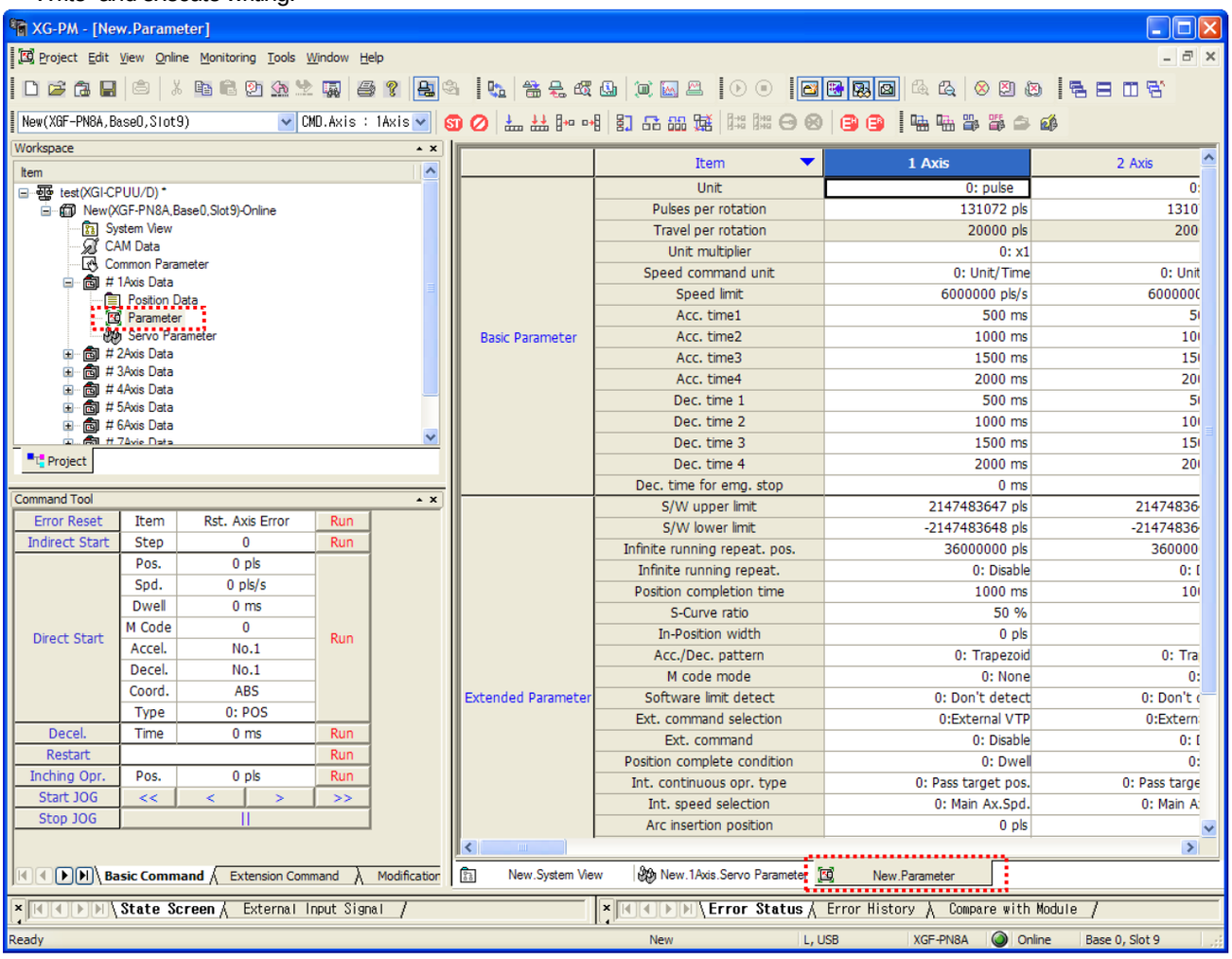
(19) You can set up servo parameter with two methods. After selecting “Allow Servo Parameter (Individual) Change During Operation”, if you set up servo parameter and click “Enter key”, that is applied to the servo driver instantly. Or after setting all servo parameters, execute “Online – Write” to write all servo parameters once.





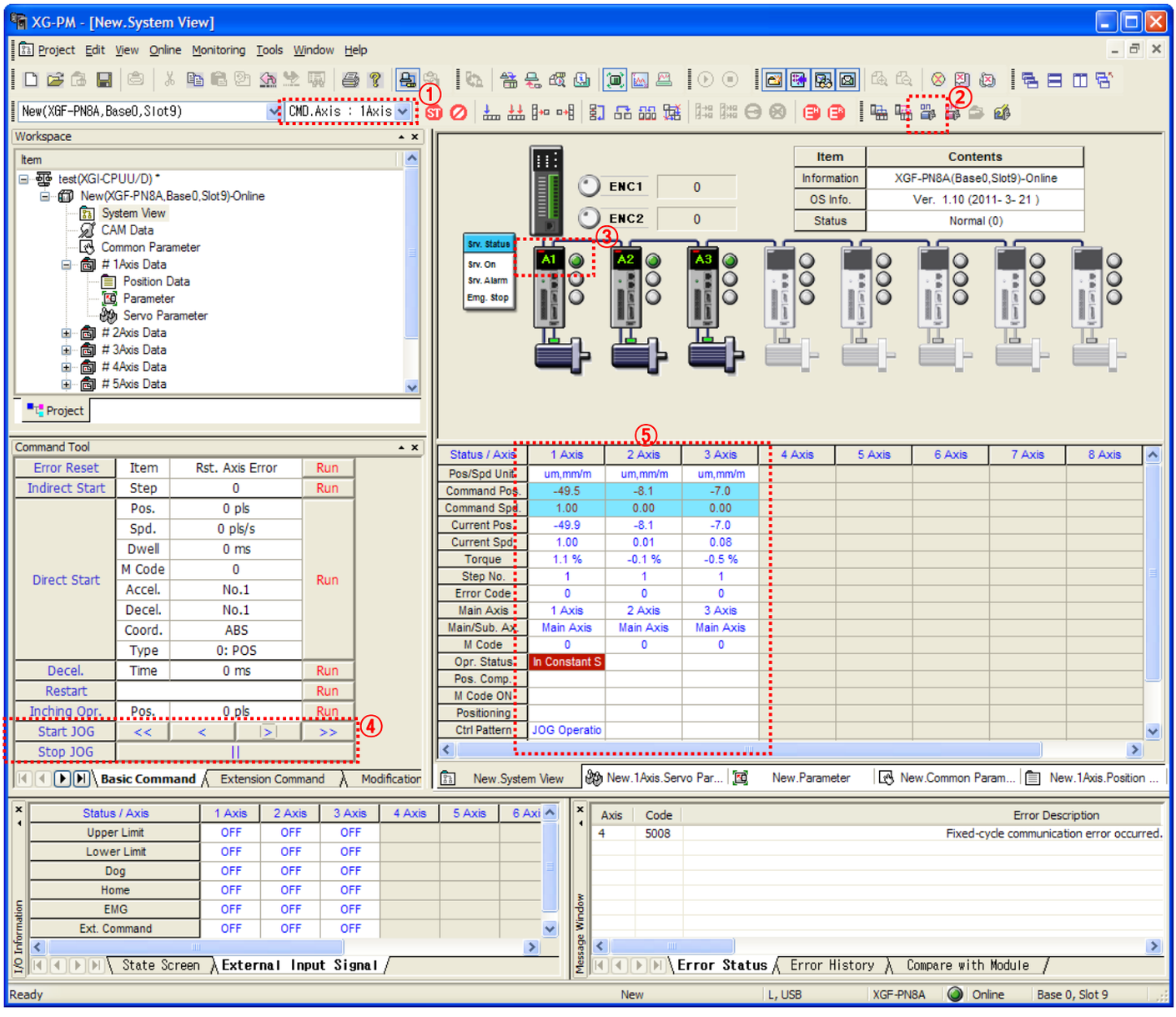
(20) According to servo parameter, you may have to restart servo driver to apply the change. So if you change servo driver and motor, encoder type at the beginning, disconnect the servo driver and restart the servo driver.

(21) If servo parameter setting is compete, set up operation parameter of the each axis and select operation parameter in “Online- Write” and execute writing.



(22) In step (20), if you restart the servo driver, click “Online- Connect to all servo” to connect the servo driver.

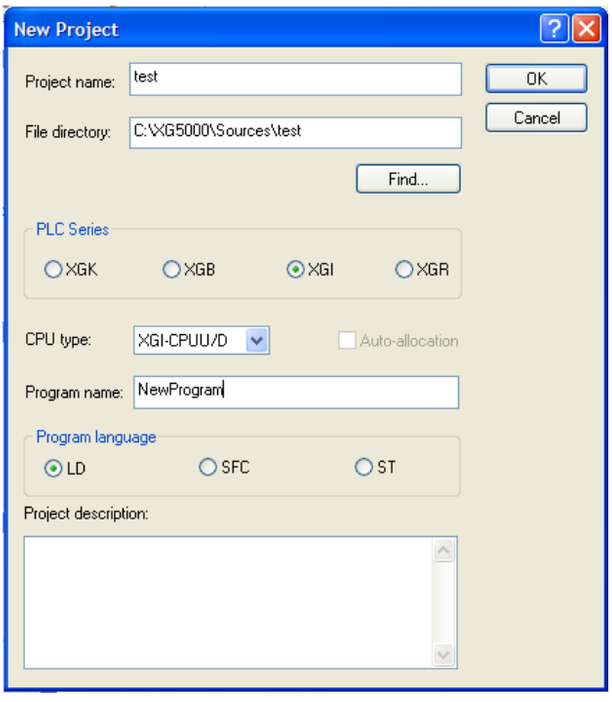
(23) After selecting command axis and executing “servo on”, check “servo on” status. And execute JOG and etc to check whether the motor operates or not.



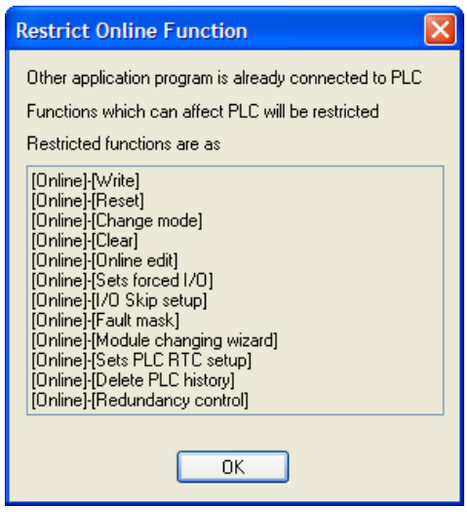
(24) If vibration or noise occurs when operating the motor, adjust response, inertia ratio and etc. in servo parameter and send to the servo driver.

(25) Write PLC program through XG5000

(a) Create new project. After selecting menu “Project-New Project”, set up project name.



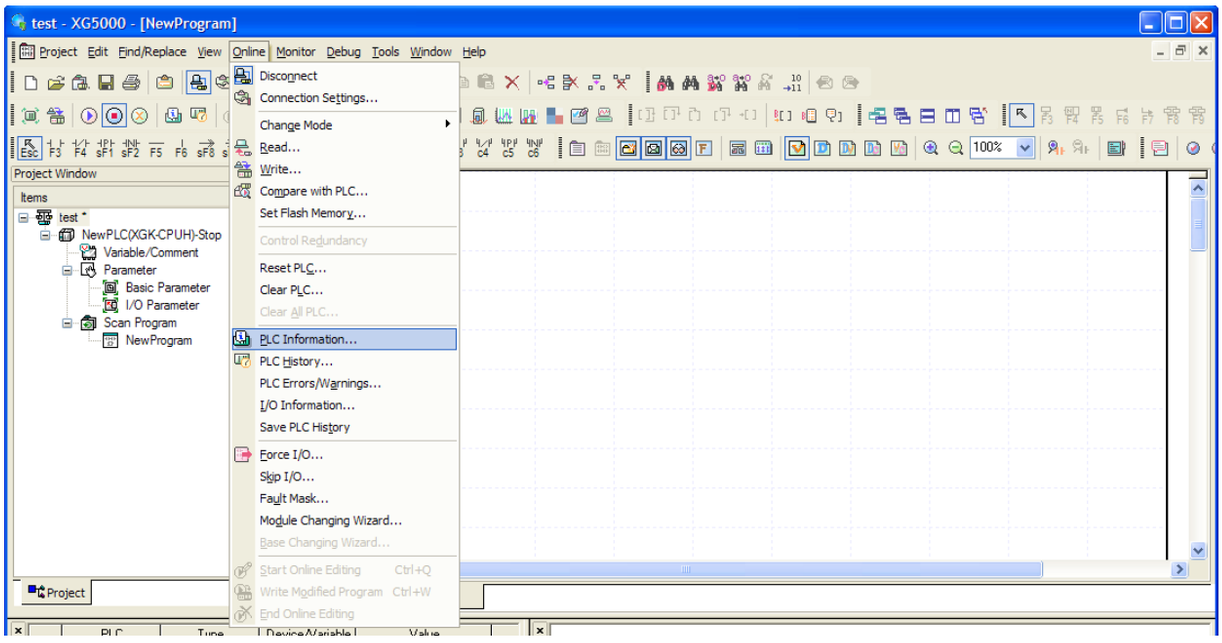
(b) Disconnect XG-PM from PLC CPU. If you connect to XG5000 while XG-PM is connected in XGK CPU, the following dialog box appears and PLC function is limited. If you connect XG-PM after connecting XG5000, that problem will not occur.



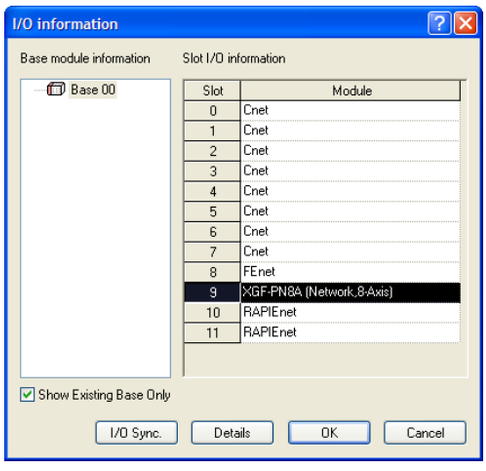
(c) Select “Online - Connection Settings” to set up connection setting and select “Online – Connect” to connect to PLC CPU.

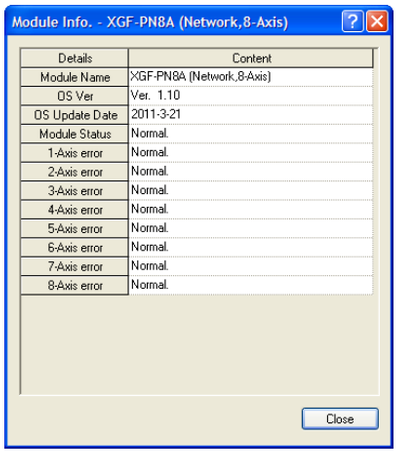
(d) Change PLC PU mode to “STOP”.

(e) Select “Online – I/O information” and check the current I/O information of PLC.

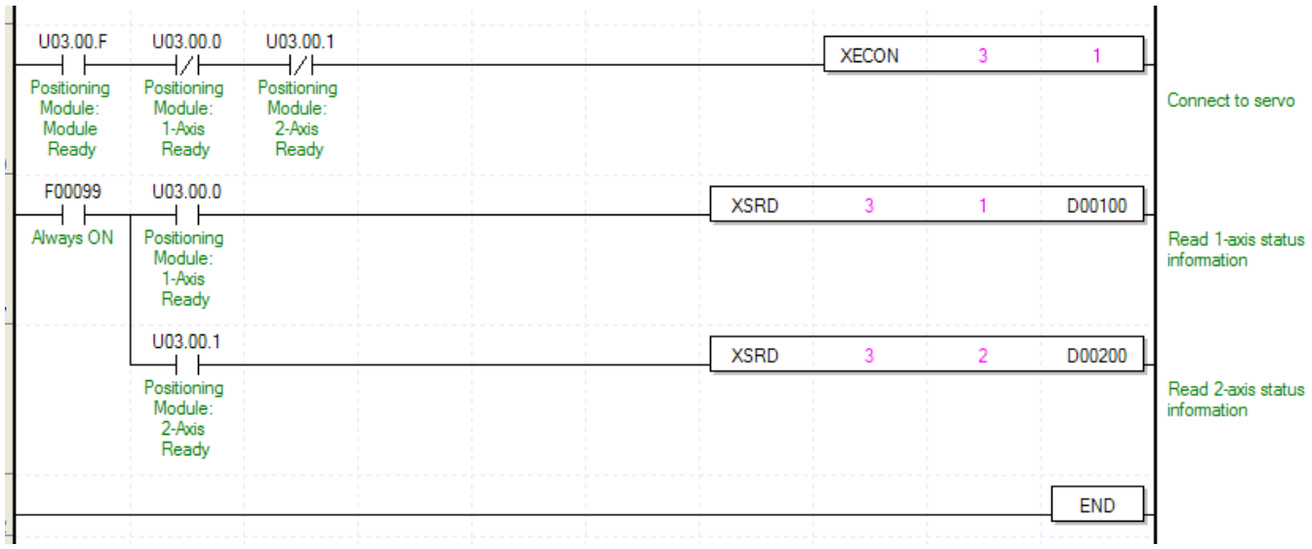


(f) In I/O information window, check whether XGF-PN8A information is shown correctly. If you want to see version of the module, click “Details”.





(g) In I/O information window, click “I/O Sync.” button to set up I/O parameter.
(h) Select “Edit- Register U device” to register U device.
(i) In the following example, XGK CPU and two servos are used. Those servos are set as 1-axis and 2-axis. It connects by using XECON and reads status information of the connected axis. Add other programs as necessary.



Appendix 4.2 XGF-PN8B

(1) Install the servo driver.

Connect the power and motor to the servo driver and connect external signal as necessary.

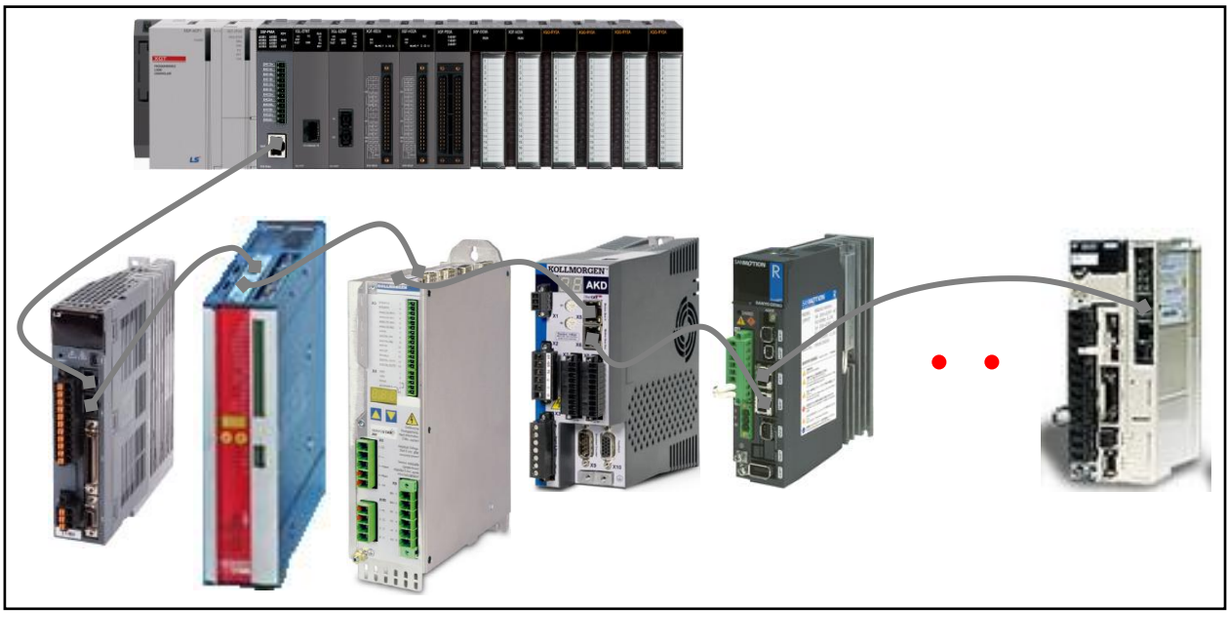
(2) Install PLC.

Install PLC and mount the positioning module. And at the beginning of test-run, for safety's sake, make sure PLC CPU is STOP mode.

(3) Connect the positioning module and servo driver.

Connect the positioning module and first servo driver by using Ethernet cable. And connect other servo drivers.

At this time, check the I/O direction of communication port of the servo driver distinctly. The following is wiring diagram when connecting 8 servo drivers and applicable motor type per servo driver capacity.



Maker	Applicable servo driver
LS Mecapion	APD-L7E
Beckhoff Automation GmbH	AX2000-B110 EtherCAT Drive
Danaher Motion GmbH (KOLLMORGEN)	S300/S400/S600/S700 EtherCAT Drive
	AKD EtherCAT Drive(CoE)
Sanyodenki Co., Ltd	R ADVANCED MODEL with EtherCAT Coe Interface
Yaskawa Electric Corporation	SGDV-E1 EtherCAT(CoE) SERVOPACK Rev1, Rev2, Rev3

Note

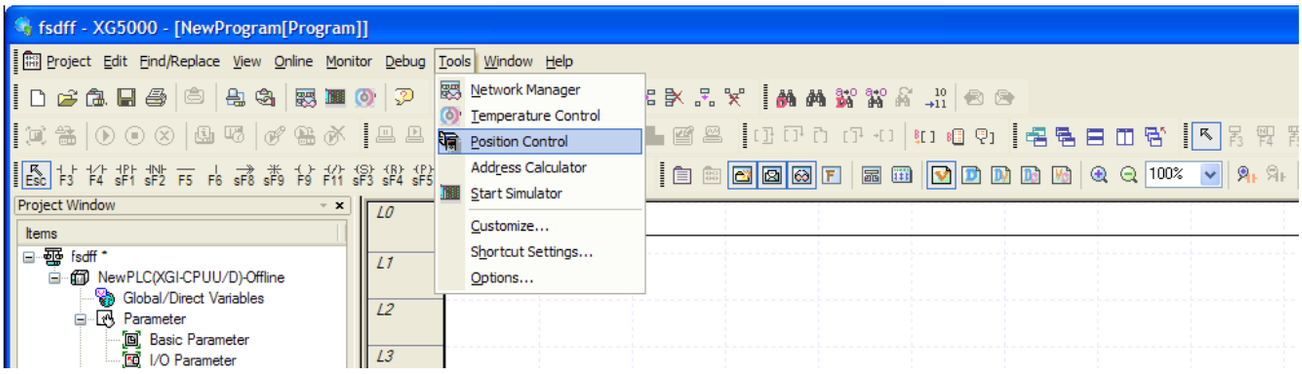
After installing a servo driver, make sure check the following items by using the dedicated tool provided by the servo driver maker. And if there is mismatch with actual settings, you have to set up again according to the condition you are using.

1) Power supply
   Make sure that power connected to the servo driver is same as allowable power condition set in the parameter
   (In some servo driver, there may be no power setting according to servo driver.)
2) Motor and encoder (feedback) type
   Set up the parameter according to actual motor and encoder type.
3) Position unit setting
   When position unit setting is available in servo driver parameter, you have to set up them as pulse unit (Inc. or Counts). And set up "Encoder resolution per rotation" according to encoder bit number.
   (There may be no setting item according to servo driver type)

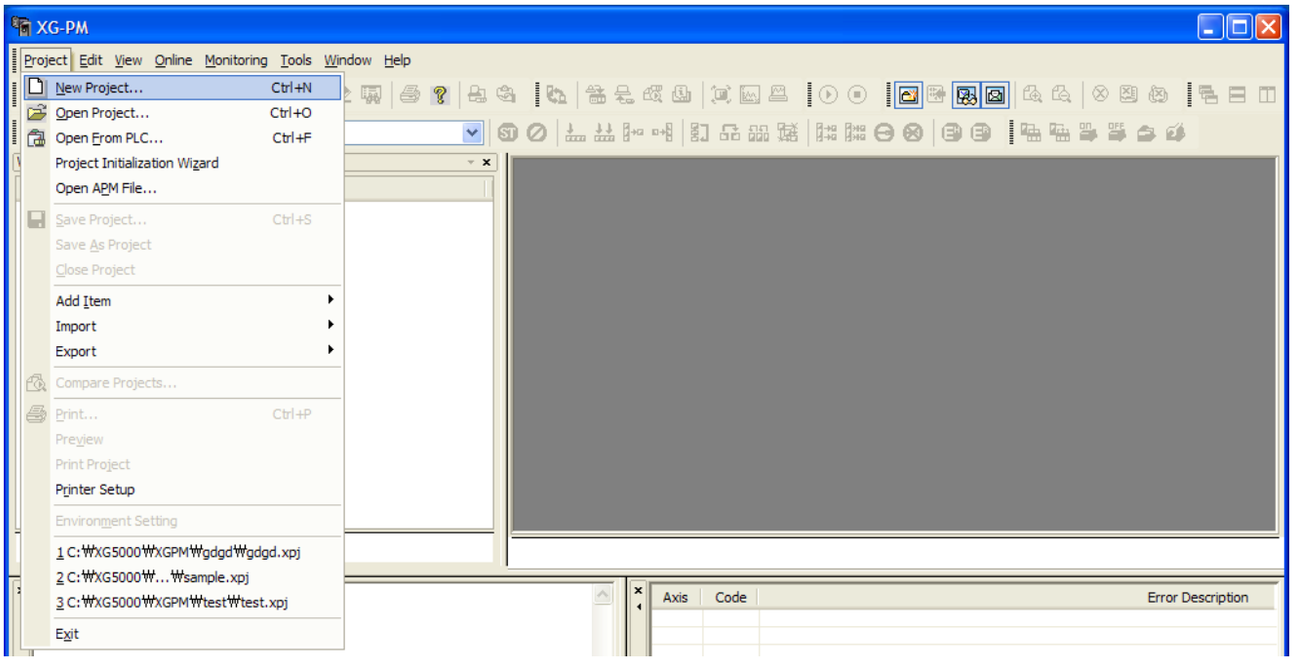
(4) Install XG5000 at the PC.

(5) Execute XG5000 and XG-PM by selecting “Tools – Position control”

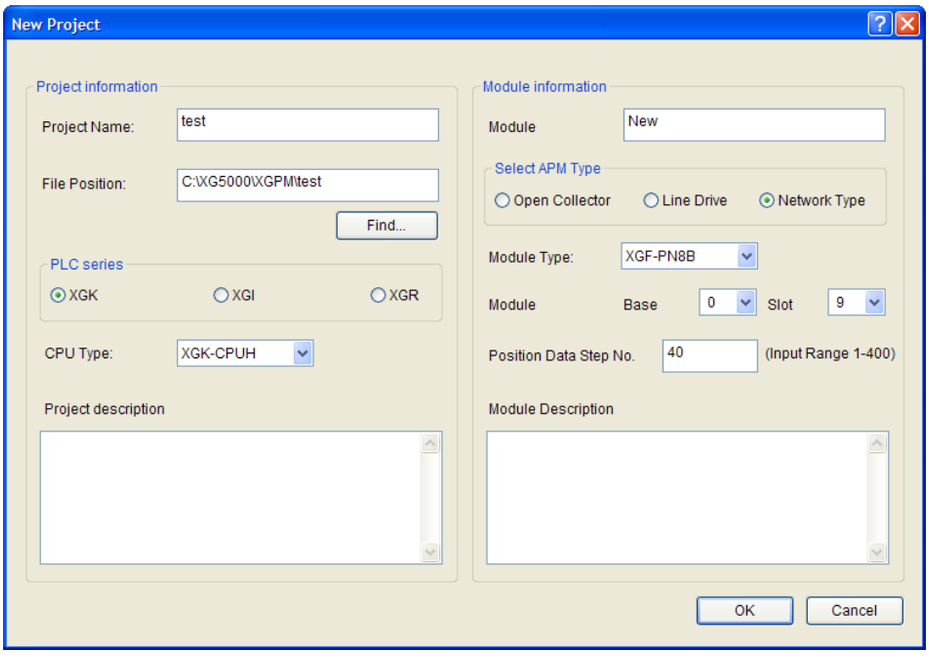
(XG-PM is used for setting operation parameter, operation data and servo parameter or monitoring and etc.)



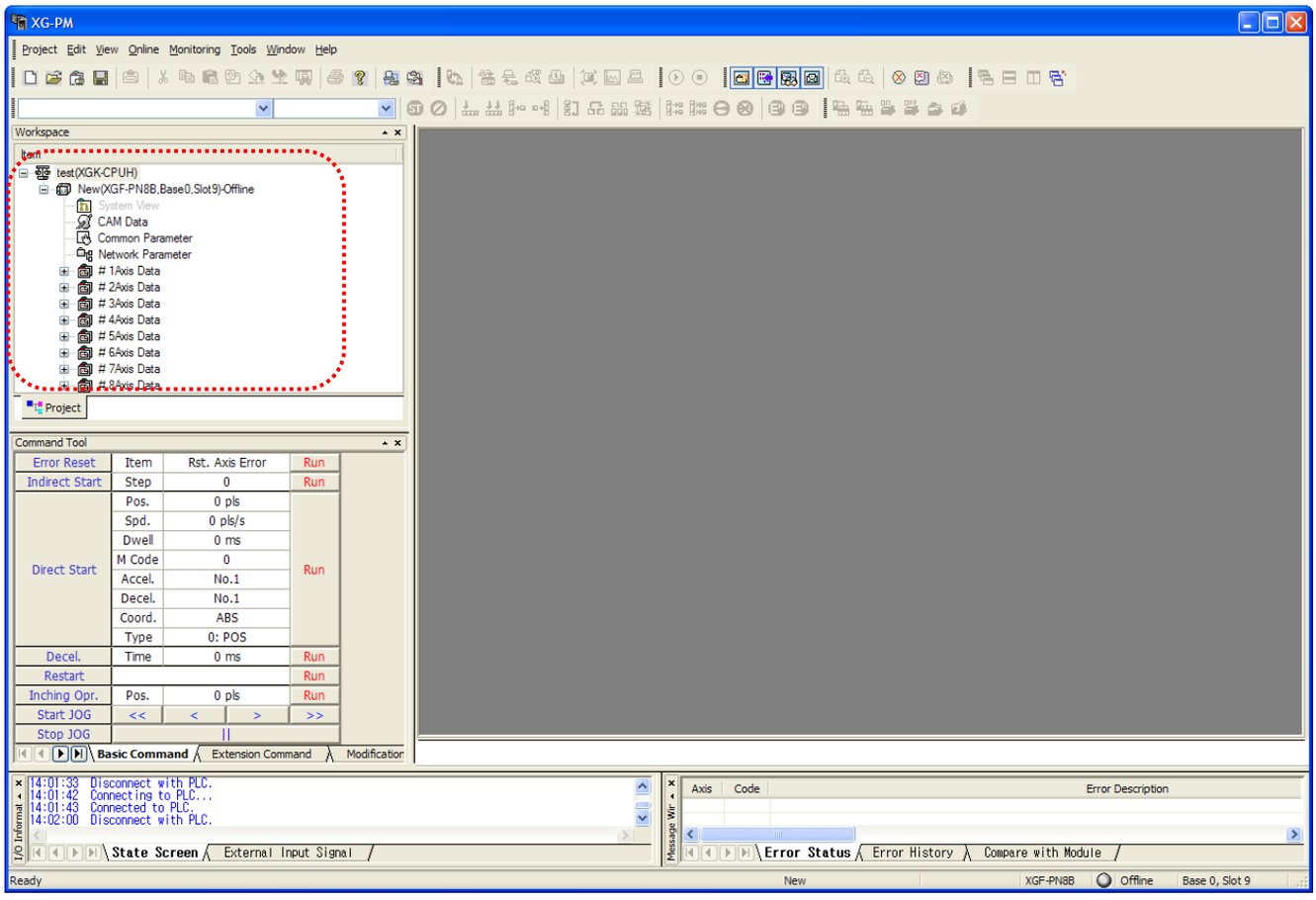
(6) If XG-PM is executed, create positioning project by selecting “Project – New Project”.



(7) In the figure below, set up Project name, PLC series, CPU type, Module name, Module type, Module position to create a new project.

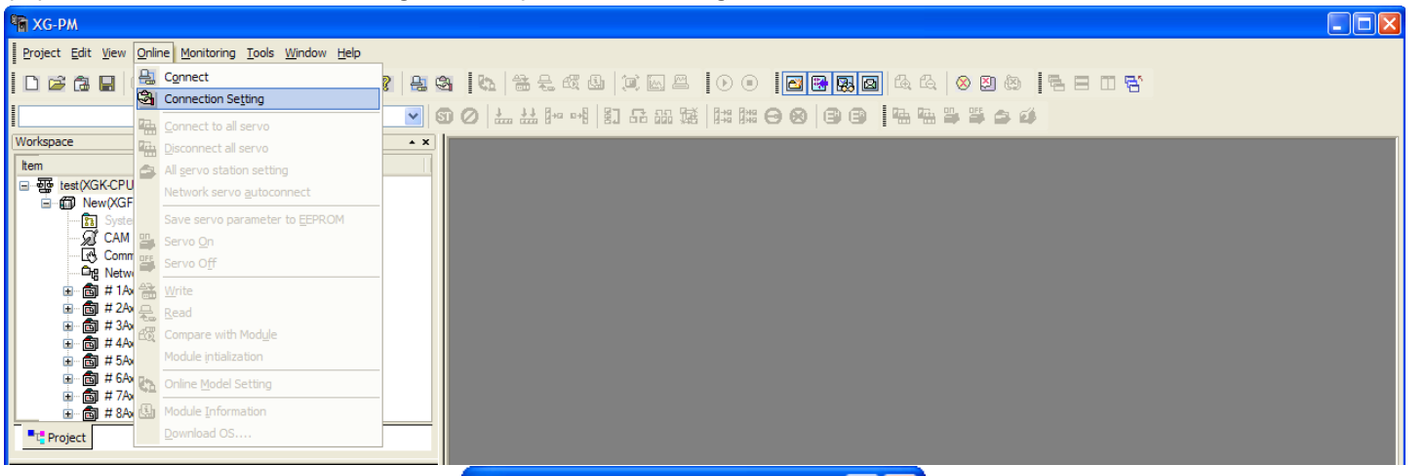


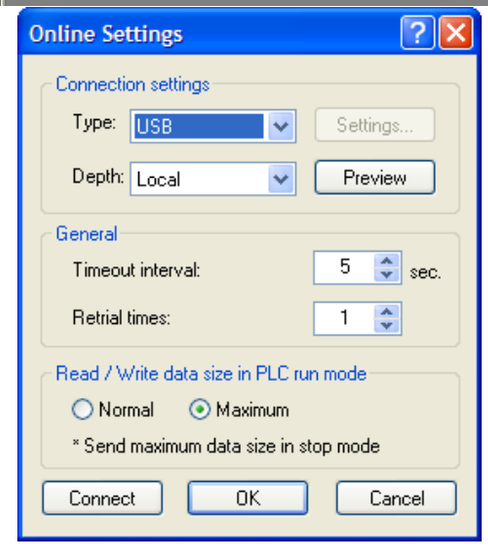
(8) If you set up as the figure above, the project will be created as follows.



(9) Turn on PLC and servo driver and connect PC with PLC CPU through USB or RS-232C cable.

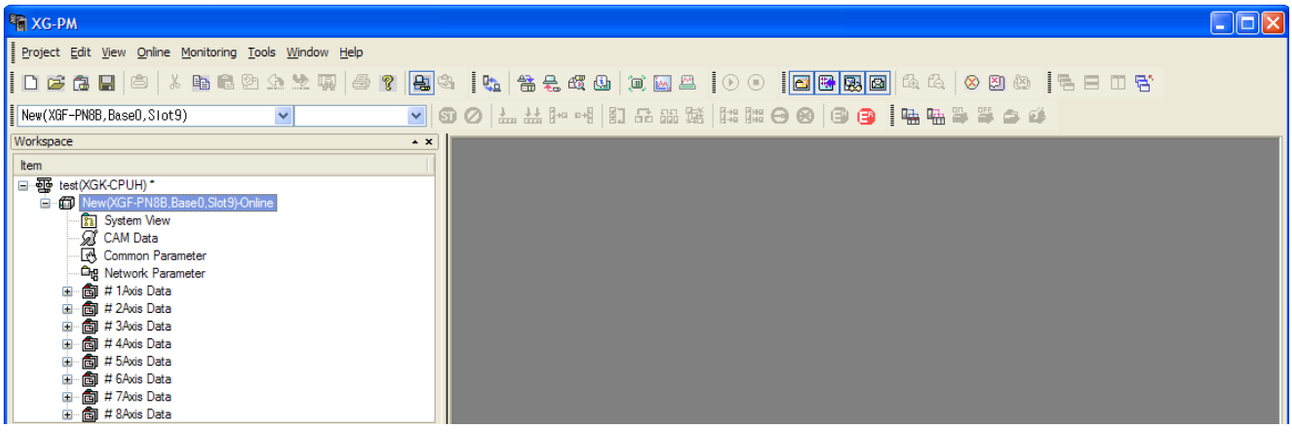
(10) Select “Online- Connection Setting” and set up connection settings.





(11) Select “Online-Connect” to connect PC with PLC CPU.

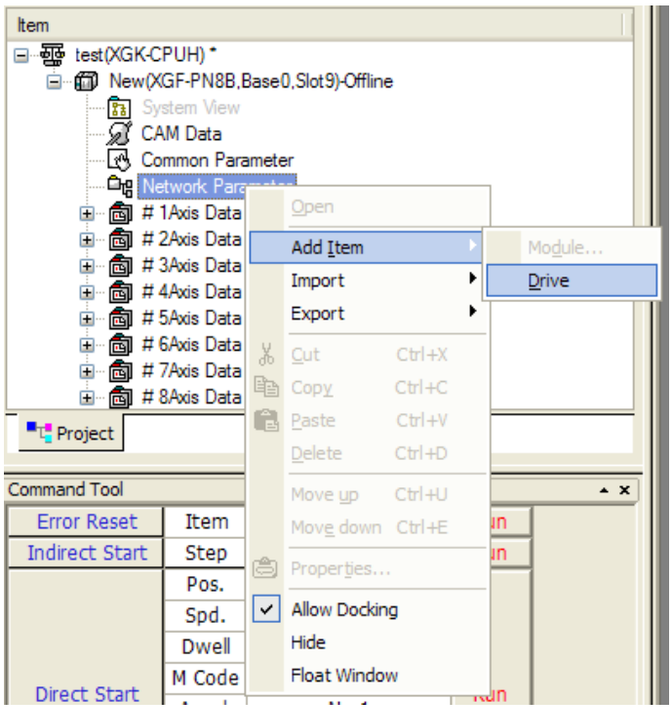
(12) If connection is complete, the module will be shown in ‘Online’ as follows.



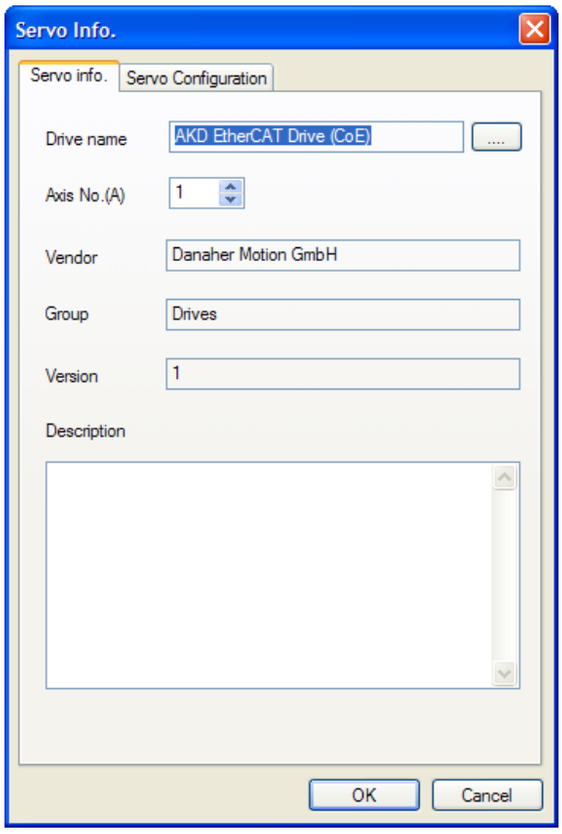
(13) If the module doesn’t become “Online” and keeps “Offline”, check whether the module is mounted, position or type is correct.

(14) In order to connect with the servo driver, set up the actually connected servo driver at the network parameter and write it to the module. Before setting up network parameter, check whether the module is offline. In case of online, change it to offline by executing “Online – Disconnect”.

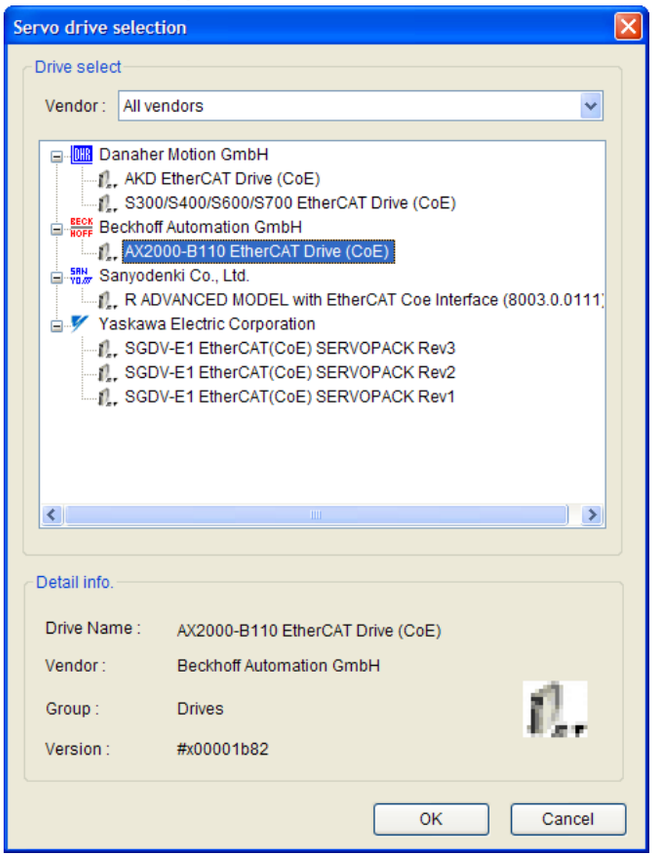
(15) In order to add the servo driver at the network parameter, click the right button of the module while cursor is on Network parameter and select “Add – Drive”.



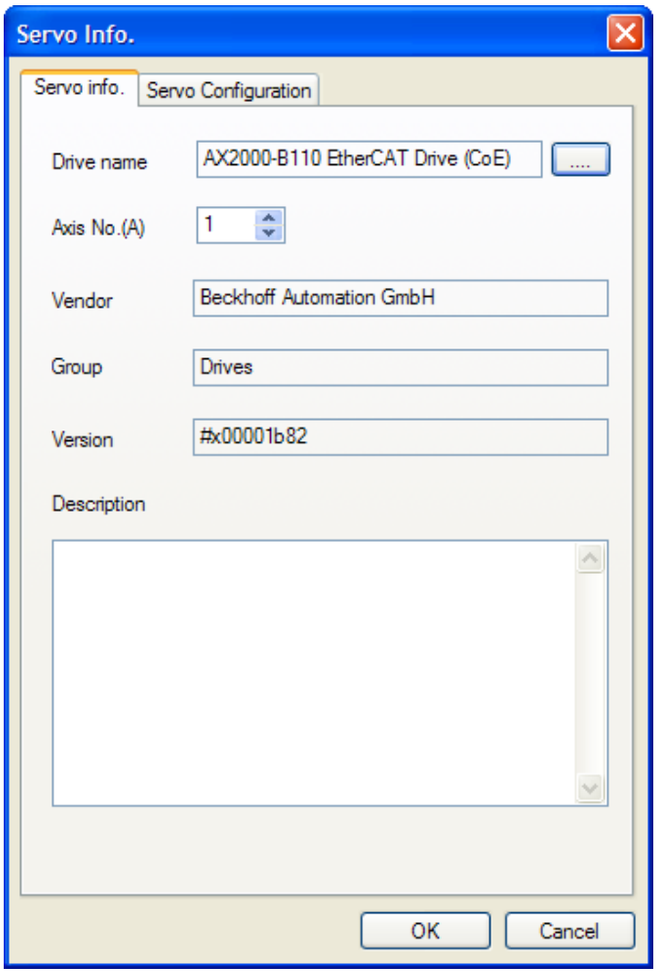
(16) If servo information window appears, click “…” button.



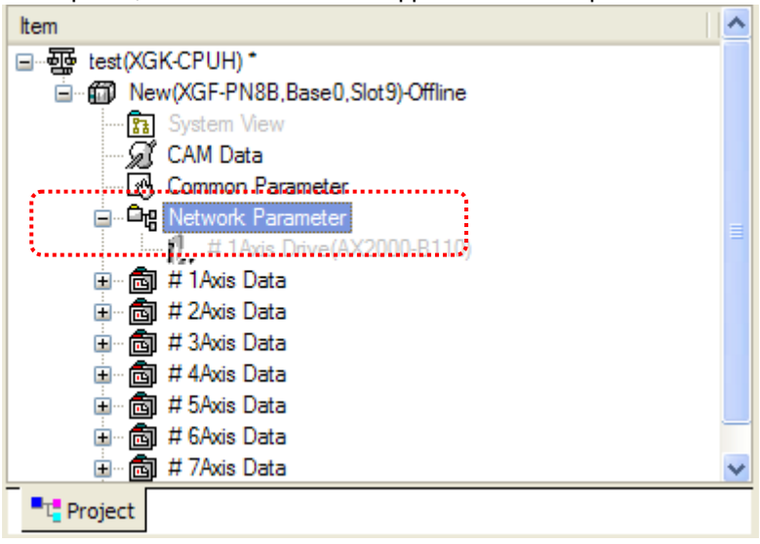
(17) In “Servo drive selection” window, select the firstly connected servo driver and click OK.



(18) In “Servo Info.” window, set up axis number of the selected servo driver. Connection sequence has nothing to do with axis number. This axis number becomes the command axis of the command/function block when programming.

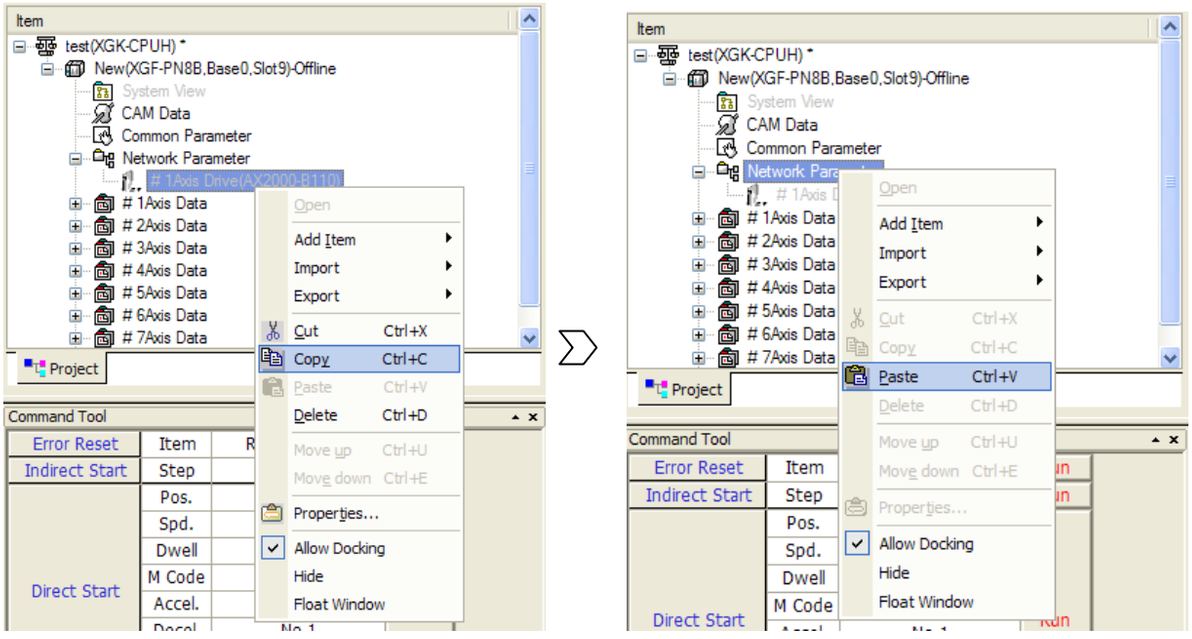


(19) After axis number setting is completed, the added servo driver appears in network parameter.

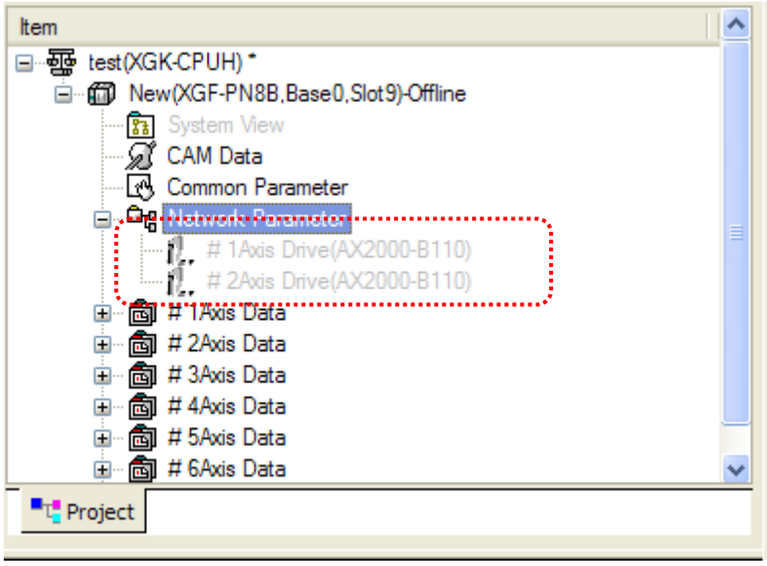


Note

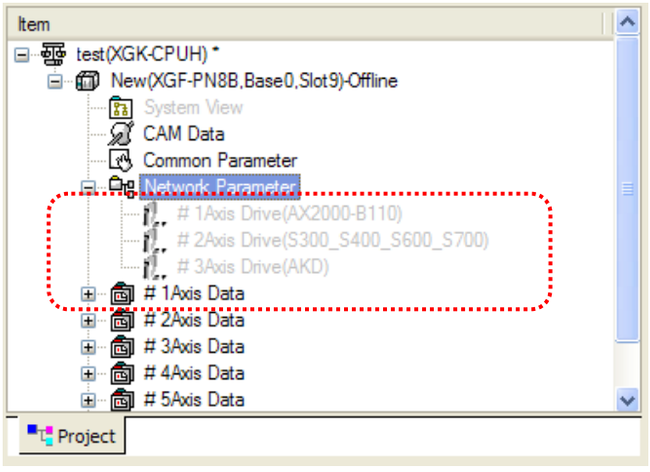
When the servo drivers are same, you can use “Copy”, “Paste”. After selecting “Copy” menu while first servo driver is added, click the right button and execute “Paste” menu while the cursor is on the network parameter.



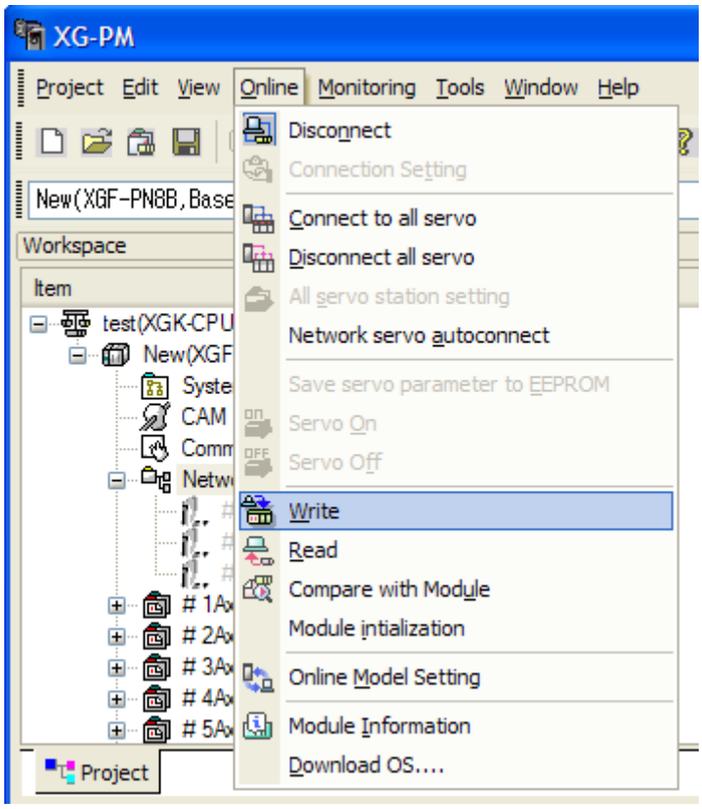
If you do as above, the same servo driver will be added and its axis number will increase by one.



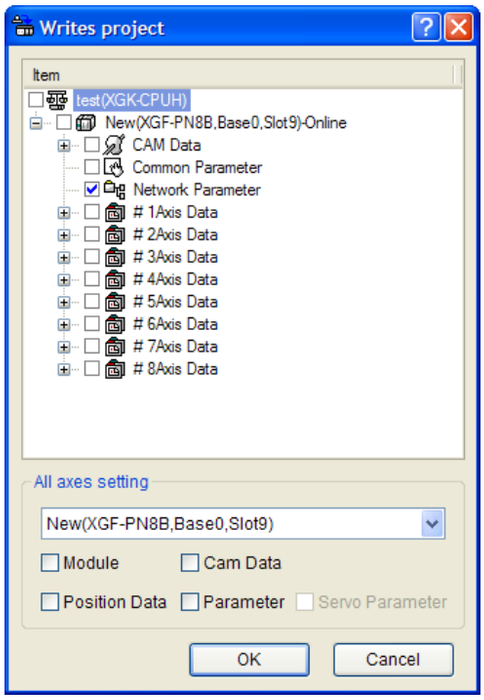
(20) For other servo drivers, add the servo driver equally. The following is the screen where all servo drivers are added. Before connection between positioning module and servo driver is established by “Connect to all servo”, they will be shown with grey color.

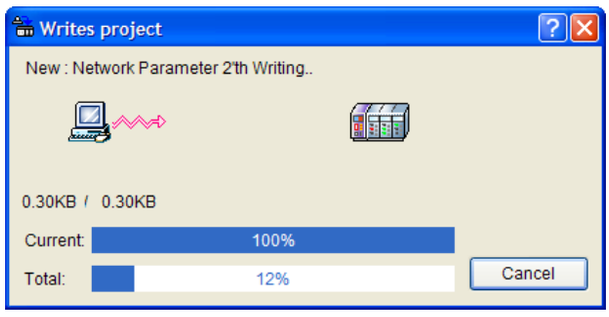


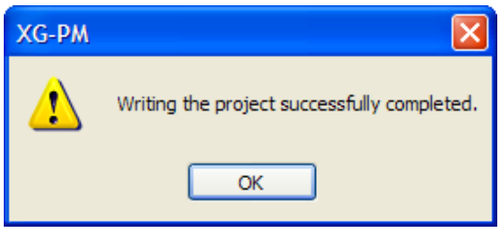
(21) After adding servo drivers, execute “Online-Connect” and execute “Online-Write” to write network parameter to the positioning module.



(22) If "Write project" window appears, check "Network Parameter" and click OK. The following is screen from start to completion.



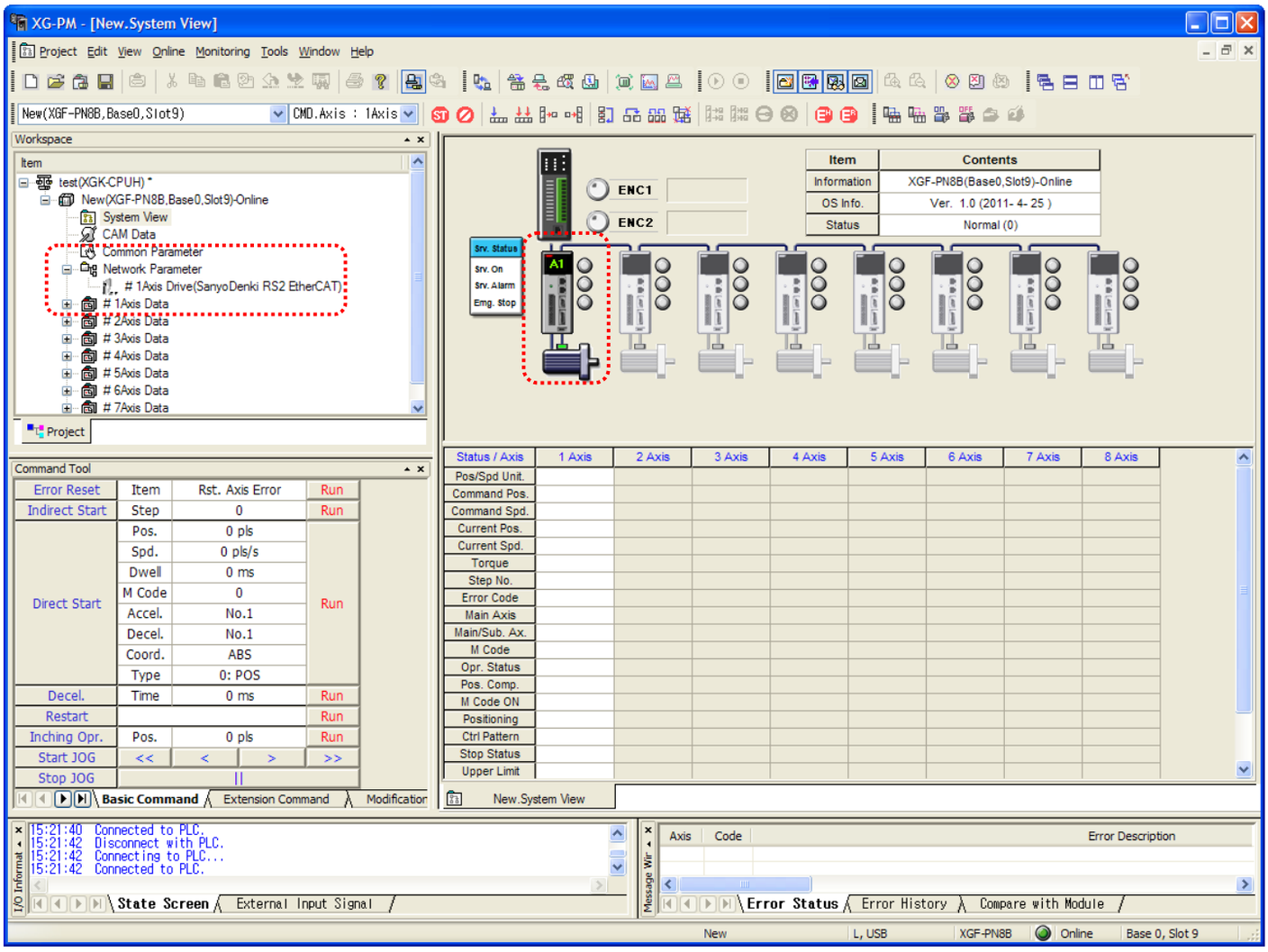




(23) Select "Online – Connect to all servo" and connect the positioning module to the servo drivers.

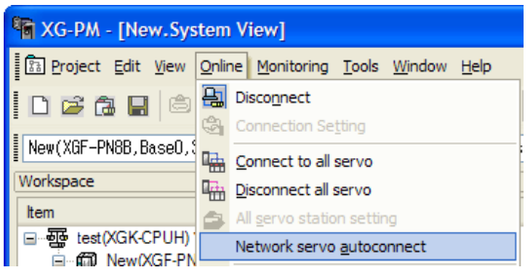
(24) If connection is completed, servo driver name in network parameter is activated and becomes black color from grey color. And in

system view window, the actually conneted servo driver is activated.

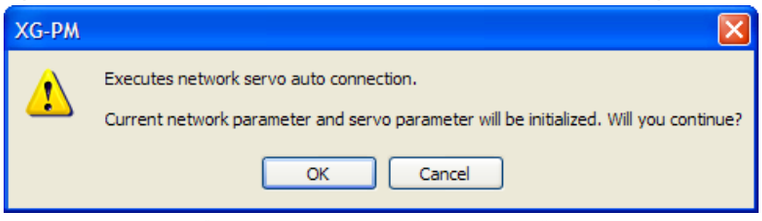


Note

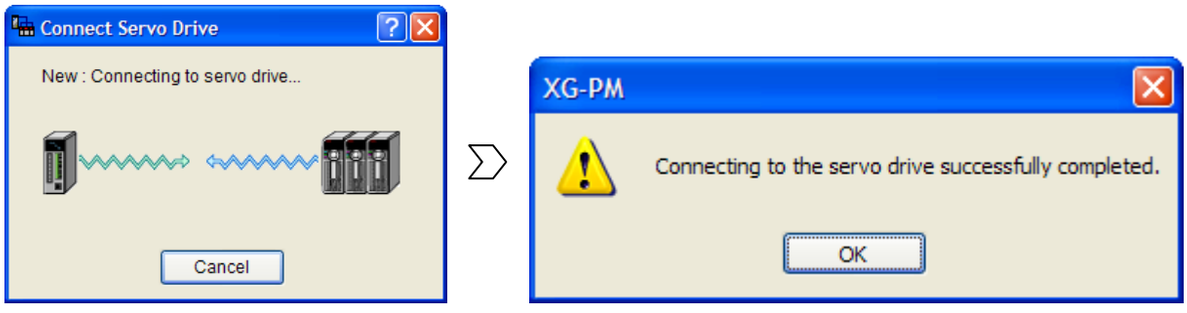
1. When connecting to network for the first time after configuring system with XGF-PN8B, if you use “Network servo auto connect” function, you can connect conveniently without network parameter setting.
   1) Execute “Online – Network servo auto connect” menu.



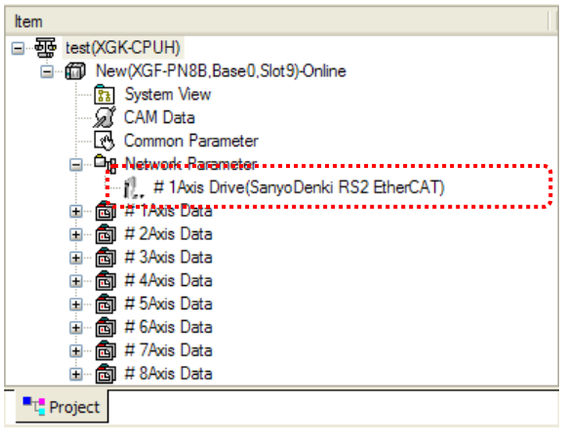
   2) The following alarm message appears. If there is network parameter set in XG-PM and positioning module, it will be initialized and servo parameter in XG-PM also will be initialized. Check the message and click OK.



   3) The following message appears and if connection is completed normally, completion message appears.

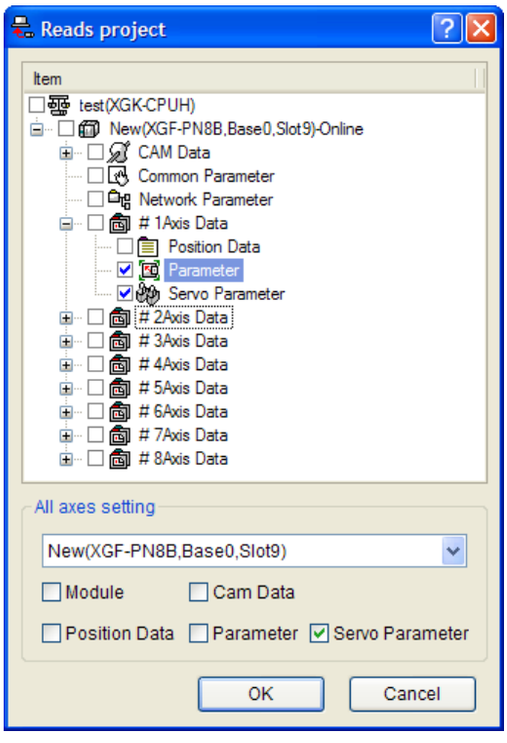


   4) If it is completed normally, the currently connected servo driver will be added in network parameter automatically.

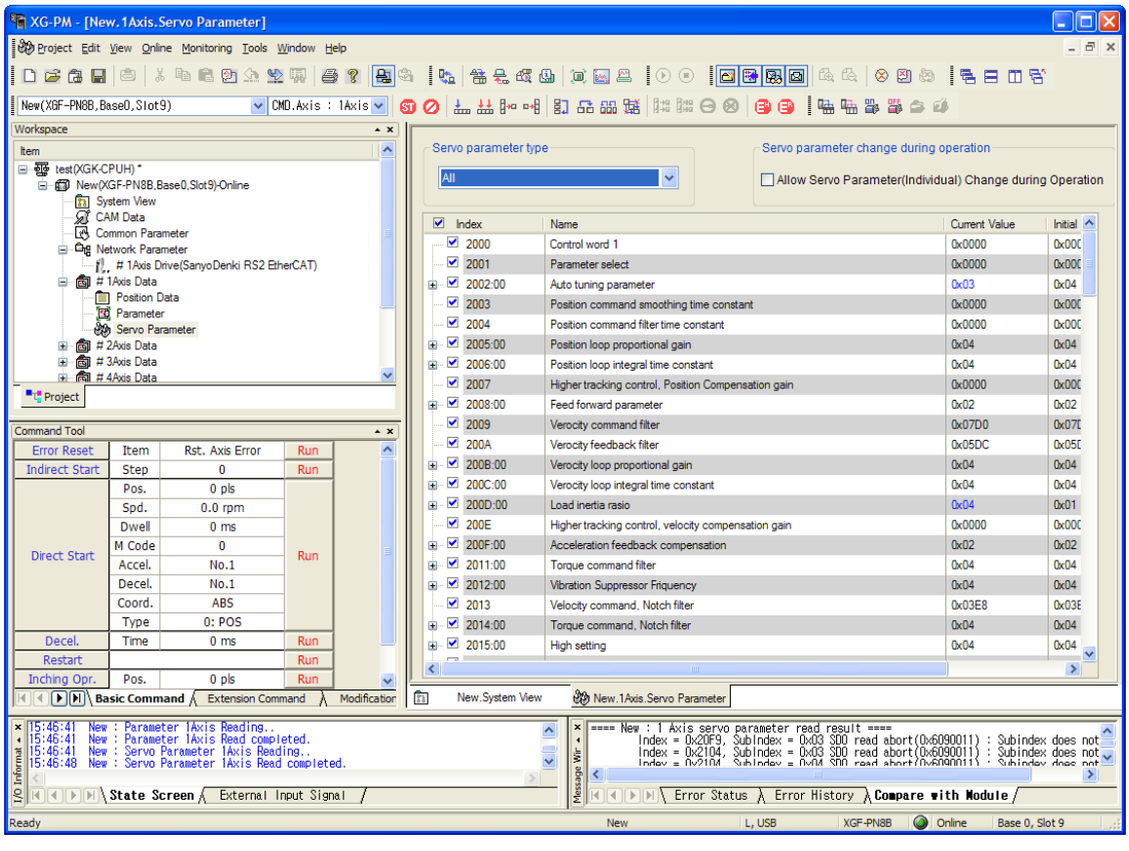


   5) Axis number will be assigned automatically according to connection sequence. That is, the first servo driver becomes 1-axis. If you want to change axis number, disconnect and change axis number and write the network parameter and execute “Online – Connect to all servo”.

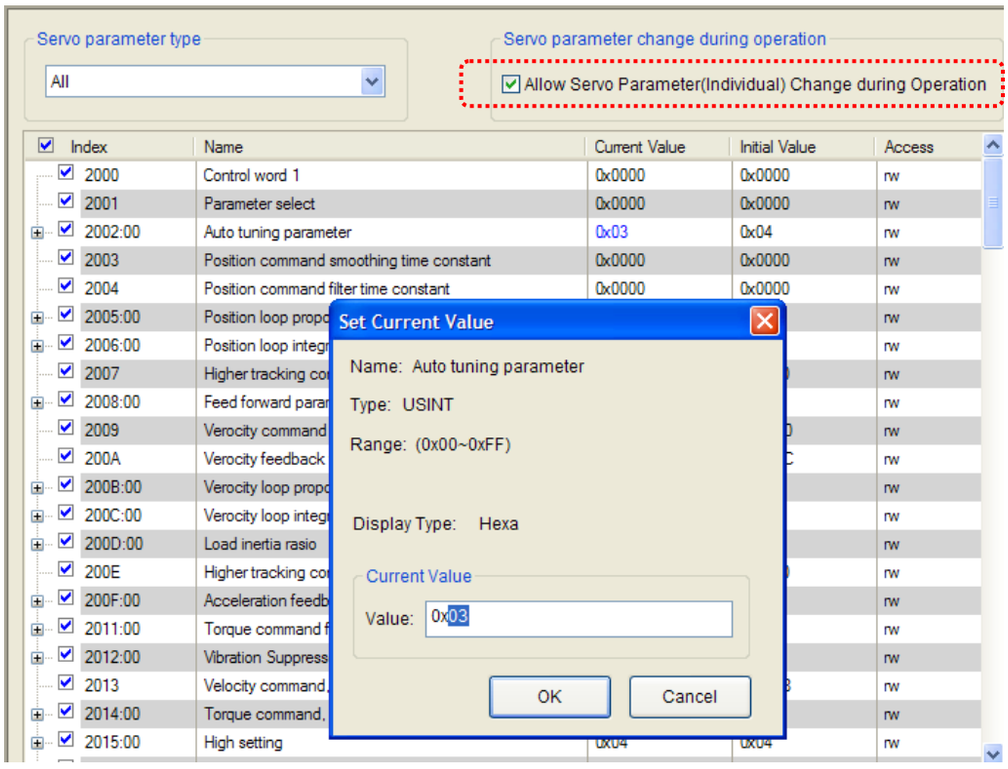
(25) Read the parameter to set up “operation parameter and servo parameter”.
Select menu “Online - Read” to execute reading.



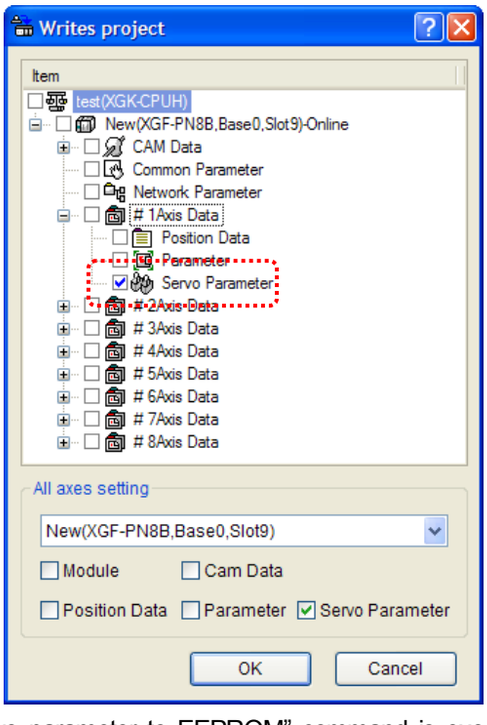
(26) The following is the servo parameter of “SanyoDenki”. The servo parameter may differ according to servo driver type. For detail, refer to the each servo driver manual.



(27) You can set up servo parameter with two methods. After selecting “Allow Servo Parameter (Individual) Change During Operation”, if you set up servo parameter and click “Enter key”, that is applied to the servo driver instantly. If the changed is applied to “Current Value” normally, the value has been transmitted normally.



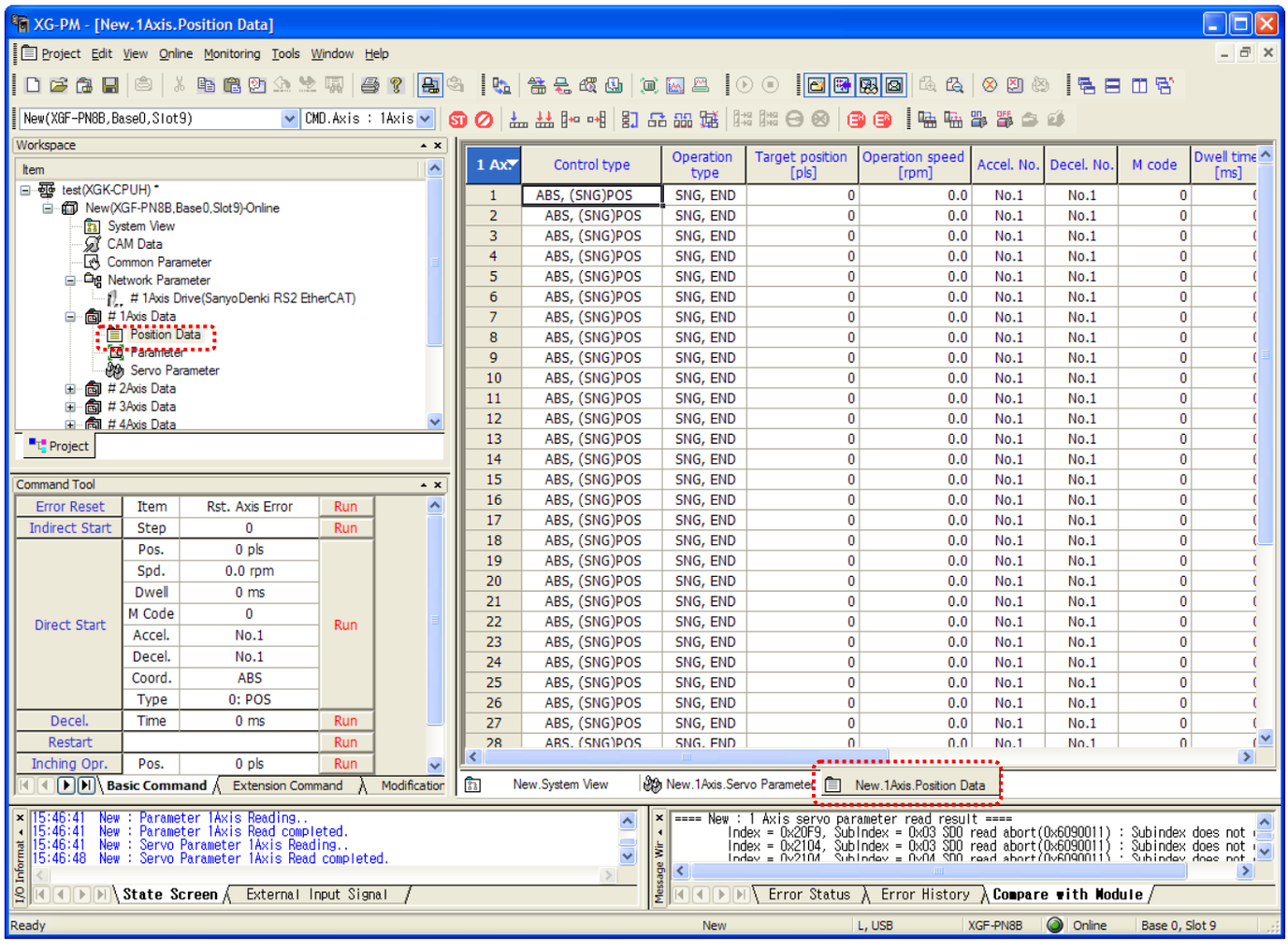
In case of change by “Allow Servo Parameter (Individual) Change During Operation”, that is effective only when power is applied. In order to keep the servo driver data after On/Off, you have to execute “Online – Save servo parameter to EEPROM”
As a second method, after setting all servo parameters, execute “Online – Write” to write all servo parameters once.



In case of method above, “Save servo parameter to EEPROM” command is executed automatically. So you don’t need to execute “Save servo parameter to EEPROM” command. According to servo parameter, you may have to restart servo driver to

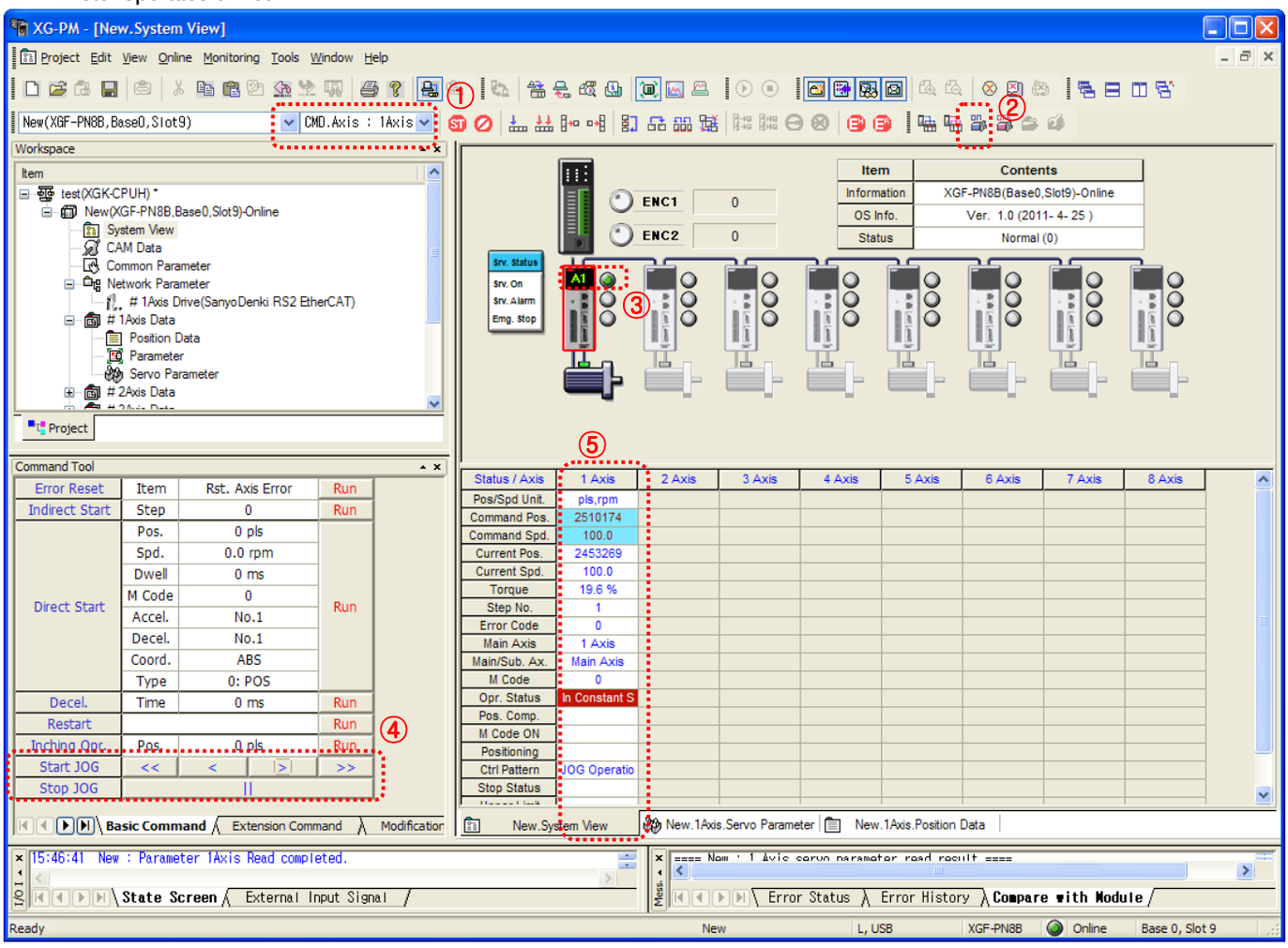
apply the change. Refer to the servo driver manual.

(28) After servo parameter setting is finished, set up position data and write it to the module by selecting “Online – Write”.



(29) If you restart the servo driver in step (27), execute “Online – connect to all servo” again to connect the module to the servo driver.

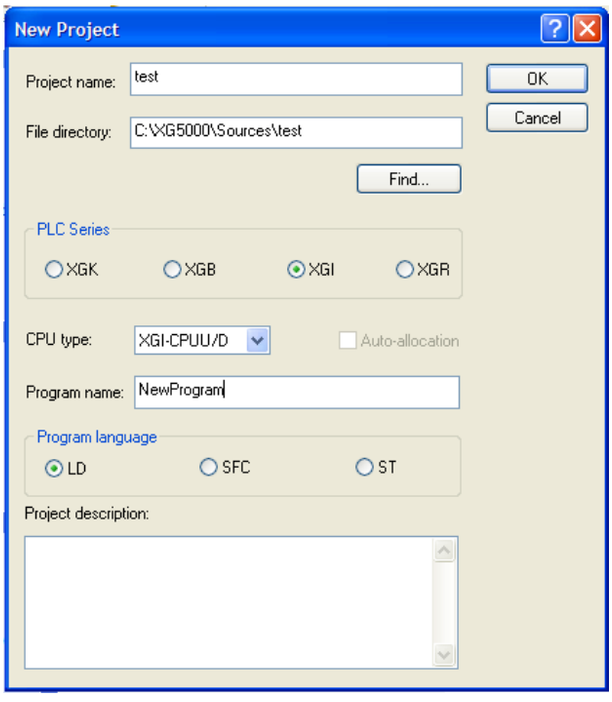
(30) After selecting command axis and executing “servo on”, check “servo on” status. And execute JOG and etc to check whether the motor operates or not.



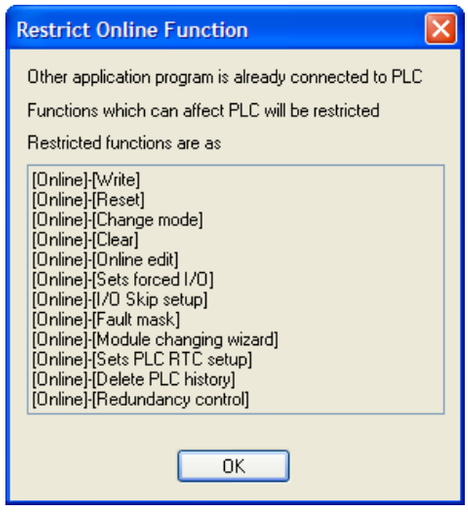
(31) If vibration or noise occurs when operating the motor, adjust response, inertia ratio and etc. in servo parameter and send to the servo driver.

(25) Write PLC program through XG5000

(a) Create new project. After selecting menu “Project-New Project”, set up project name.



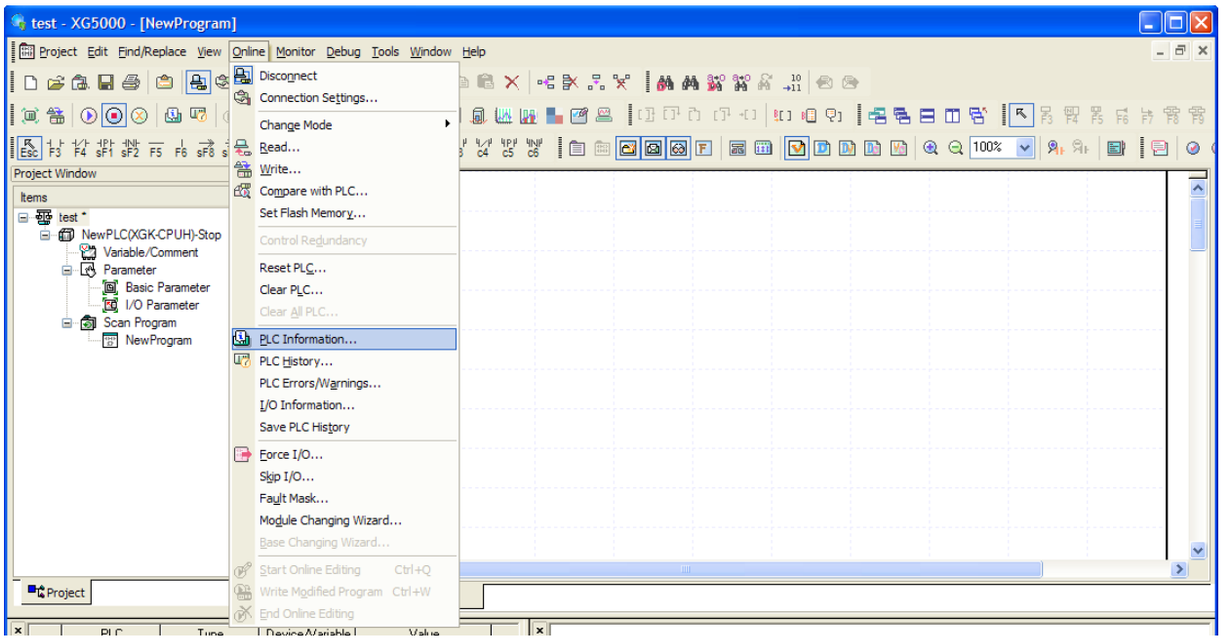
(b) Disconnect XG-PM from PLC CPU. If you connect to XG5000 while XG-PM is connected in XGK CPU, the following dialog box appears and PLC function is limited. If you connect XG-PM after connecting XG5000, that problem will not occur.



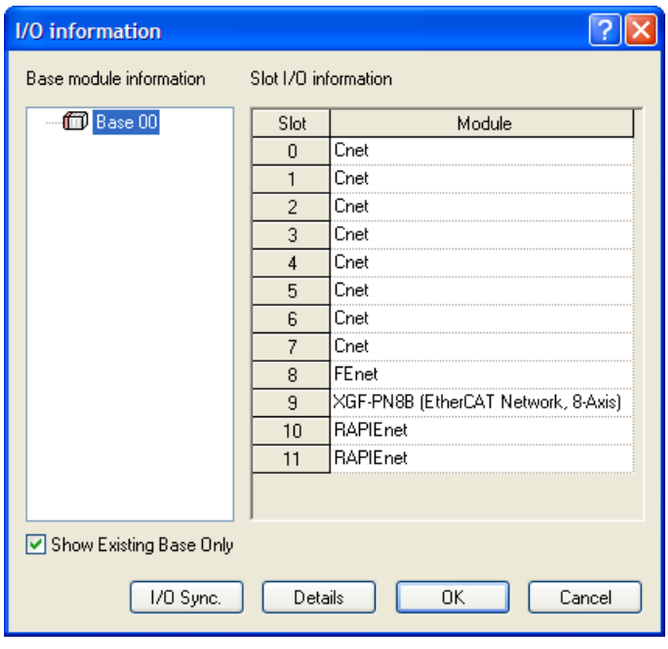
(c) Select “Online - Connection Settings” to set up connection setting and select “Online – Connect” to connect to PLC CPU.

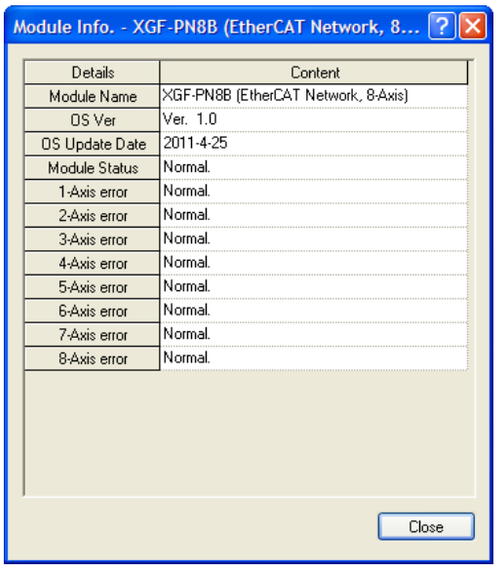
(d) Change PLC PU mode to “STOP”.

(e) “Select “Online – I/O information” and check the current I/O information of PLC.



(f) In I/O information window, check whether XGF-PN8A information is shown correctly. If you want to see version of the module, click “Details”.

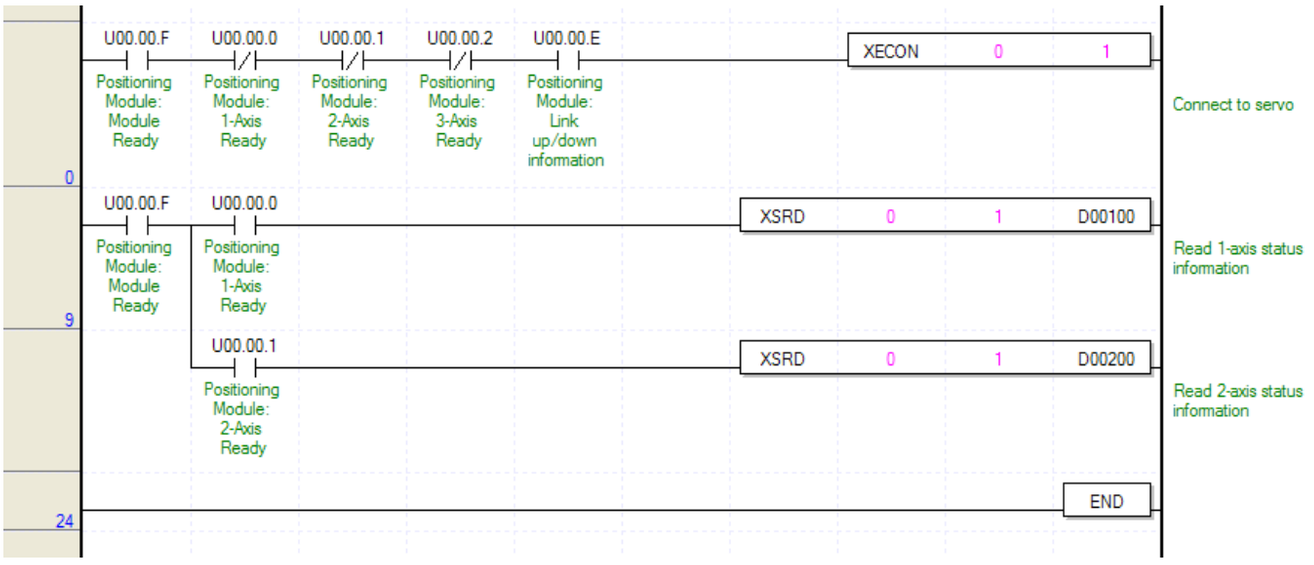




(g) In I/O information window, click "I/O Sync." button to set up I/O parameter.

(h) Select "Edit- Register U device" to register U device.

(i) In the following example, XGK CPU and two servos are used. Those servos are set as 1-axis and 2-axis. It connects by using XECON and reads status information of the connected axis. Add other programs as necessary.



Warranty

1. Warranty Period

The product you purchased will be guaranteed for 18 months from the date of manufacturing.

2. Scope of Warranty

Any trouble or defect occurring for the above-mentioned period will be partially replaced or repaired. However, please note the following cases will be excluded from the scope of warranty.

(1) Any trouble attributable to unreasonable condition, environment or handling otherwise specified in the manual,
(2) Any trouble attributable to others' products,
(3) If the product is modified or repaired in any other place not designated by the company,
(4) Due to unintended purposes
(5) Owing to the reasons unexpected at the level of the contemporary science and technology when delivered.
(6) Not attributable to the company; for instance, natural disasters or fire

3. Since the above warranty is limited to PLC unit only, make sure to use the product considering the safety for system configuration or applications.

Environmental Policy

LS Industrial Systems Co., Ltd supports and observes the environmental policy as below.

Environmental Management

LS Industrial Systems considers the environmental preservation as the preferential management subject and every staff of LS Industrial Systems use the reasonable endeavors for the pleasurably environmental preservation of the earth.

About Disposal

LS Industrial Systems' PLC unit is designed to protect the environment. For the disposal, separate aluminum, iron and synthetic resin (cover) from the product as they are reusable.

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Always at your service, standing for our customers.

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※ LSIS constantly endeavors to improve its product so that information in this manual is subject to change without notice.

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