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Programmable Logic Controller

## XGB Positioning Module



## Safety Instructions

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


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.
4
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 maycause 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 oroperation.
- 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 100 mm 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 PE 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.


## 1 <br> 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 30 cm 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

## 1 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 | Page |
| :---: | :---: | :---: | :---: |
| V 1.0 | '10. 1 | 1. First Edition | - |
| V1.1 | '11. 4 | 1. Smart Link $\rightarrow$ I/O Link Revision <br> 2. XEC Type Address Addtion. | $\begin{gathered} 2-7 \\ 5-8,9-63 \end{gathered}$ |
| V1.2 | '13.10 | 1. Clear deviation counter Addtion <br> 2. Mitsubishi Servo driver MR-J3 Wiring Method Added <br> 3. Encoder Preset(EPRS) setting Method Added <br> 4. Teaching Array(TWR) Exam Program Added <br> 5. Operation State Reading(SRD) Device Revision <br> 6. Positioning System Current consumption Added | 2-6 <br> 3-5 <br> 6-24 <br> 6-28 <br> 6-39 <br> Appendix 2 |
| V1.3 | '14. 4 | 1. Added to the deviation counter clear starting point | 2-6 |
| V1.4 | '15. 7 | 1. Domain name changed <br> 2. Cl changed <br> 3. General specifications changed by reason of changed IEC Specifications. <br> 4. XDL-L7S Series Connection Changed | 2-1 $2-10,3-3$ |
| V1.5 | '16. 3 | 1. Smart Link Connction Diagram Added and Changed <br> 2. Position Overide Command Changed | $\begin{gathered} 2-8 \sim 12 \\ 6-16 \end{gathered}$ |

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## About User's Manual

## About User's Manual

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://www.Isis.com/) and download the information as a PDF file.

## Relevant User's Manuals

| Title | Description | No. of User's Manual |
| :---: | :---: | :---: |
| XG5000 User's Manual (for XGK, XBC,XBM) | XG5000 software user manual describing online function such as programming, print, monitoring, debugging by using XGB(MK language) CPU | 10310000511 |
| XG5000 User's Manual (for XGI, XGR, XEC) | XG5000 software user manual describing online function such as programming, print, monitoring, debugging by using XGB(IEC language) CPU | 10310000746 |
|  <br> Programming User's Manual | User's manual for programming to explain how to use instructions that are used PLC system with XGK, XGB CPU. | 10310000509 |
| 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. | 10310000739 |
| Ultimate Performance XGB Unit(MK/IEC) | It describes how to use XGB main unit, system configuration,mechanism,program function ,input/output function, Built-in High-speed Counter, Datalog, PID Control, Built-in Communication function, Built-in Position, Built-in Analog input/output.. | $\begin{aligned} & 10310000893, \\ & 10310001406 \end{aligned}$ |
| XGB hardware | It describes power, IO, extension specification and system configuration, built-in high speed counter of XGB main unit. | $\begin{aligned} & 10310000893, \\ & 10310000981 \end{aligned}$ |
| XBC Standard / Economic Type Main Unit(MK/IEC) | It describes power, IO, extension specification and system configuration, built-in high speed counter of XGB standard / economic type main unit. | $\begin{aligned} & 10310001090, \\ & 10310001273 \end{aligned}$ |

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## 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 XGB Series. (It can be used with expansive memory XBM-Dx-xxS type.)
(2) Various positioning control function

It has various functions needed for positioning system such as positioning control, speed control etc.
(a) Up to 150 operation data including positioning address and operation method, operation pattern is available to set for each axis.
With this operation data, positioning for each axis is carried out
(b) Various operations are available.

1) Position Control
2) Speed Control
3) Synchronous Control
4) Linear Interpolation
5) Circular Interpolation
(c) Switching Control in operation is available.
6) Position/Speed Control Switching
7) Speed/Position Control Switching.
(d) Various Homing Control Function.
8) 5 methods are available for Homing
a) The origin detection after DOG Off
b)The origin detection after deceleration in case of DOG On
c) The origin detection by DOG
d) The origin detection by DOG and upper-lower limit
e) The origin detection by upper-lower limit
9) Available to execute the positioning control (floating origin setting) from random position to the origin of machine
(3) Easy maintenance

Various data such as positioning data, parameter etc. are saved on flash memory in module. Therefore, data will be saved forever (The frequency of writing is limited to 100,000)
(4) The number of positioning module using in one basic unit is not limited
(a) it is available to use within the range satisfied with the capacity of 5 V source supply current of basic unit.
(b) The mounting number of available current consumption of each module, please refer to Appendix 2.
(5) Self-diagnosis, monitoring, test by strong positioning software package is available.
(a) Monitoring (Module \& External Input/output Signal) Function
(b) Reading and Saving Module Parameter/Operation Data
(c) Operation data edition of each axis is available in Excel program

## Chapter 1 Overview

(6) Applicable XGB main unit and XG5000 version for positioning module

| XGB basic unit | Version |
| :--- | :--- |
| XBM - Dx-xxS | Ver 3.00 or upper |
| XBC-DxxS | Ver 1.20 or upper |
| XBC-DxxSU | Ver 1.30 or upper |
| XBC-DxxH | Ver 1.80 or upper |
| XEC-DxxH | Ver 1.20 or upper |
| XEC-DxxSU | Ver 1.10 or upper |
| XG5000 | Ver 3.10 or upper |

### 1.2 Purpose of Positioning Control

The purpose of positioning module is to transfer the moving objects (unprocessed items, tools etc.) with setting speed from the current position and stop them on the setting position correctly. And it also controls the position of high precision by positioning pulse string signal as it is connected to various servo driving devices or stepping motor control driving devices. In application, it can be used widely with engineering machine, semiconductor assembly machine, grinder, small machine center, lifter etc.

< XGB positioning function general >

< Positioning system inner block diagram >

### 1.3 Signal Flow of Positioning Module

### 1.3.1 Operating sequence

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


### 1.3.2 Flow of position signal

Flow of position signal is as follows.

< XGB Positioning signal flow >

### 1.4 Function overview of positioning module

Describe Representative functions of positioning module (Linear Interpolation, Circular Interpolation \& Stop) briefly. For detail, refer to CH. 9

### 1.4.1 Position Control

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

## (1) Control by Absolute coordinates

Execute positioning control from starting position to goal position that positioning data designated
Positioning control is executed by the position(origin position) homing designated.
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

Execute positioning control from starting position as much as goal movement value.
The difference from absolute coordinates control is that the value goal position designated is movement value, not position value.
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 : 5000
■ Goal Position : -7000
In this condition, it moves reversely and positions at -2000.


### 1.4.2 Interpolation Control

## (1) Linear Interpolation Control

Execute Linear interpolation control with designated axis at starting position (Current position).
There are two methods for linear interpolation control (control by absolute coordinate and control by incremental coordinate)
(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 from the position that homing designated.
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.


## Chapter 1 Overview

(b) Linear Interpolation by incremental coordinates

1) Execute Linear interpolation for the position that include starting address designated movement direction \& movement value of each axis.
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 axis in forward direction that already designated for each axis.
Circular interpolation has 3 kinds of forms which are middle point form passing the position auxiliary point designated, center point form designates the position auxiliary point designated as center point and radius form designates the value auxiliary point designated as radius of circular arc.
In addition, it is available to be executed more than $360^{\circ}$ circular interpolation according to the value of 'the number of circular interpolation turn'.
(a) Circular interpolation with middle point designation form.

1) Start operating at starting position and execute circular interpolation through the designated middle point.
2) There will be a circular arc which has crossing point as center point that made by perpendicular bisection between starting position and middle point or middle point and goal position.

3) Movement direction is automatically designated by goal position and auxiliary point of circular interpolation.
(b) Circular interpolation with center point designation form
4) Start operating from starting position and execute circular interpolation along trace of circle that has distance from starting point to designated center point as radius.

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

6) The direction that set on "Circular Interpolation Mode" of operation data (Center point CW, Center point CCW) is designated as movement direction.

## Chapter 1 Overview

## (c) Circular interpolation with radius designation form

1) Start operating from starting position and execute circular interpolation along trace of circular arc that has designated radius as it radius. Depending on size setting of circular $\operatorname{arc}\left(<180^{\circ},>=180^{\circ}\right)$, 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) The direction that set on "Circular Interpolation Mode" of operation data (Radius, CW, Circular arc<180 ${ }^{\circ}$ ) is designated as movement direction.

### 1.4.3 Speed Control

(1) It is executed by positioning operation start command (Direct start, Indirect start, Synchronous start), keep operating at the speed already set 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 the case that operated by speed control, M code mode of setting values will be 'on', only if it is 'With'.
(4) Operating Timing


## Chapter 2 Specifications

### 2.1 General Specifications

The following table shows the general specification of XGB series.


## NOote

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.

## Chapter 2 Specifications

### 2.2 Performance Specifications

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

### 2.2.1 Function Specifications



### 2.3 External I/O Interface Specifications

Here describes the I/O interface for external equipment.

### 2.3.1 Input Specifications

| Signal name | Rated input voltagel current | Use voltage range | On voltagel current | Off voltage/current | Input resistance | Response time |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DOG | DC 24V/4.7mA | DC 20.4~26.4V | $\geq$ DC 16V/3.1mA | $\leq \mathrm{DC} \mathrm{4V/1.0mA}$ | Approx. 5.1k | $\leq 0.7 \mathrm{~ms}$ |
| External upper-limit | DC 24V/4.7mA | DC 20.4~26.4V | $\geq$ DC 16V/3.1mA | $\leq \mathrm{DC} \mathrm{4V/1.0mA}$ | Approx. 5.1k8 | $\leq 0.7 \mathrm{~ms}$ |
| External lower-limit | DC $24 \mathrm{~V} / 4.7 \mathrm{~mA}$ | DC 20.4~26.4V | $\geq \mathrm{DC} \mathrm{16V/3.1mA}$ | $\leq \mathrm{DC} \mathrm{4V} / 1.0 \mathrm{~mA}$ | Approx. 5.1k | $\leq 0.7 \mathrm{~ms}$ |
| Emergency stop | DC 24V/4.7mA | DC 20.4~26.4V | $\geq$ DC 16V/3.1mA | $\leq \mathrm{DC} \mathrm{4V/1.0mA}$ | Approx. 5.1k | $\leq 0.7 \mathrm{~ms}$ |
| In-position | DC $24 \mathrm{~V} / 4.7 \mathrm{~mA}$ | DC 20.4~26.4V | $\geq$ DC 16V/3.1mA | $\leq \mathrm{DC} \mathrm{4V/1.0mA}$ | Approx. 5.1k | $\leq 0.7 \mathrm{~ms}$ |
| Home | DC 5V/8mA | DC 4.25~5.5 V | $\geq$ DC $3 \mathrm{~V} / 3.5 \mathrm{~mA}$ | $\leq \mathrm{DC} \mathrm{1V/0.7mA}$ | Approx. 670 | $\leq 0.2 \mathrm{~ms}$ |
|  |  |  |  |  |  |  |
|  | DC 5V/10mA | DC 4.25~5.5 V | $\geq$ DC 3V/3.0mA | $\leq$ DC 1V/1.0mA | Approx. 470 | $\leq 0.5 \mathrm{~ms}$ |
|  | Encoder input : based on RS-422A Line Driver Level (Am26LS31) |  |  |  |  |  |
| Manual pulse generator /Encoder input | 2) Phase difference |  | Duty rate 50\% <br> If A phase position add <br> If $B$ phase i position add | ut pulse precedes $B$ ss value increases. <br> ut pulse precedes A ss value decreases. | phase input pulse, <br> phase input pulse, |  |

## Chapter 2 Specifications

### 2.3.2 Output Specifications



## 2．3．3 Specifications on Interface with External Equipment

（1）Pin Array of Connector

| Pin Array | Pin no． |  | Signal Name |  | Signal direction positioning－external | Action condition |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Y | X |  |  |  |  |
|  | B20 |  | MPG A＋ | Manual pulse generator／Encoder A＋ | $\leftarrow$ |  |
|  | A20 |  | MPG A－ | Manual pulse generator／Encoder A－ | $\leftarrow$ |  |
|  | B19 |  | MPG B＋ | Manual pulse generator／Encoder B＋ | $\leftarrow$ |  |
|  | A19 |  | MPG B－ | Manual pulse generator／Encoder B－ | $\leftarrow$ |  |
|  | B18 | A18 | FP＋ | Pulse output（Differential Motion＋） | $\rightarrow$ |  |
|  | B17 | A17 | FP－ | Pulse output（Differential Motion－） | $\rightarrow$ |  |
|  | B16 | A16 | RP＋ | Pulse sign（Differential Motion＋） | $\rightarrow$ |  |
|  | B15 | A15 | RP－ | Pulse sign（Differential Motion－） | $\rightarrow$ |  |
|  | B14 | A14 | OV＋ | Upper limit | $\leftarrow$ | $\uparrow$ |
|  | B13 | A13 | OV－ | Lower limit | $\leftarrow$ | $\uparrow$ |
|  | B12 | A12 | DOG | DOG | $\leftarrow$ | $\uparrow$ |
|  | B11 | A11 | NC | Notused |  |  |
|  | B10 | A10 | NC | Notused | － |  |
|  | B9 | A9 | COM | Common（OV＋，OV－，DOG） | － |  |
|  | B8 | A8 | NC | Not used | － |  |
|  | B7 | A7 | INP | In－Position Signal | $\leftarrow$ | $\square$ |
|  | B6 | A6 | $\begin{aligned} & \text { INP } \\ & \text { COM } \end{aligned}$ | Common（INP） | － |  |
|  | B5 | A5 | CLR | Deviation counter clear signal | $\rightarrow$ |  |
|  | B4 | A4 | $\begin{aligned} & \text { CLR } \\ & \text { COM } \end{aligned}$ | Common（CLR） | － |  |
|  | B3 | A3 | HOME | Home（＋5V） | $\leftarrow$ | $\uparrow$ |
|  | B2 | A2 | $\begin{aligned} & \text { COM } \\ & \text { HOME } \end{aligned}$ | Common（Home） | － |  |
|  | B1 | A1 | NC | Not used | － |  |

（2）Internal circuit of connector
（a）Pulse output

| Internal circuit | Pin No． |  | Signal |  |
| :---: | :---: | :---: | :---: | :---: |
|  | Y | X |  |  |
| 大良口 | B18 | A18 | FP＋ | Pulse F＋（CW／Pulse） |
|  | B17 | A17 | FP－ | Pulse F－（CW／Pulse） |
| 大珎 $\triangle$－ | B16 | A16 | RP＋ | Pulse R＋（CCW／Sign） |
|  | B15 | A15 | RP－ | Pulse R－（CCW／Sign） |

## Chapter 2 Specifications

(b) External input signal

*1: Available to use it as Sink or Source type input
*2: Available to use it as Sink type input
(c) External Output Signal

| Pin No. |  | Internal circuit | Signal |  |
| :---: | :---: | :---: | :---: | :---: |
| Y | X |  |  |  |
| B5 | A5 |  | CLR | Deviation counter clear signal |
| B4 | A4 | $y^{1} \geq$ | CLR COM | Deviation counter clear signal Common |

## Remark

1. Deviation counter clear signal is provided on each axis, as the output signal of the servo motor interface, deviation counter of servo motor driver counter cleared. The deviation of the servo motor driver until the count value reaches zero, the motor is driven. Thus, even if the COMMAND pulse output is completed until the motor stops, there may be a short delay. The deviation counter value is cleared to zero, motor can be stopped immediately.
2. Position deviation counter clear signal from the control module is automatically output after completion of homing. Clearing the count of the servo drive for the deviation is used as the output signal.
(d) Manual pulse generator input/encoder input

| Classification | $\begin{gathered} \text { Pin No. } \\ \hline \text { B20 } \end{gathered}$ |  | Signal |  |
| :---: | :---: | :---: | :---: | :---: |
| Open collector voltage type |  |  | MPG A+ | Manual pulse generator $A+$ input |
|  | A20 |  | MPG A- | Manual pulse generator $A$ - input |
|  | B19 |  | MPG B+ | Manual pulse generator $\mathrm{B}+$ input |
|  | A19 |  | MPG B- | Manual pulse generator B- input |
| Line driver voltage type | B20 |  | MPG A+ | Encoder A+ input |
|  | A20 |  | MPG A- | Encoder A- input |
|  | B19 |  | MPG B+ | Encoder B+ input |
|  | A19 |  | MPG B- | Encoder B- input |

## Chapter 2 Specifications

(3) I/O wiring by using Smart Link Board
(a) When using positioning function, easy wiring is available by connecting the I/O connector with Smart Link board. The available Smart Link Board and I/O cable are as follows.

| Model | Specification | No. of Pin |
| :---: | :---: | :---: |
| XBF-PD02A | Positioning Module(Line Drive) | 40 Pin Connector $\times 1$ |

(b) The company prepares smart link products for the convenience of using our Connector type Positioning modules.

For further information, please refer to the data sheet contained in a Smart Link product.
(Refer to (d) Connection Diagram to confirm the differences between TG7-1H40CA and TG7-1H40S)

|  | Model | Cable | Length of Cable |
| :---: | :---: | :---: | :---: |
| Terminal board | TG7-1H40S | C40HH-05SB-XBI | 0.5m |
|  |  | C40HH-10SB-XBI | 1 m |
|  |  | C40HH-15SB-XBI | 1.5 m |
|  |  | C40HH-20SB-XBI | 2 m |
|  |  | C40HH-30SB-XBI | 3 m |
|  | TG7-1H40CA <br> (20Pin Common Added) | C40HH-05SB-XBI | 0.5m |
|  |  | C40HH-10SB-XBI | 1 m |
|  |  | C40HH-15SB-XBI | 1.5 m |
|  |  | C40HH-20SB-XBI | 2 m |
|  |  | C40HH-30SB-XBI | 3 m |

C) Smart Link Connection

(d) Smart Link Connection Diagram

- TG7-1H40S


Axis $Y$
Axis $X$

## Chapter 2 Specifications

- TG7-1H40CA

(e) Smart Link Specifications and Dimensions
- TG7-1H40S
i ) Specifications

| Rated Voltage | AC, DC 125 V |
| :--- | :--- |
| Rated Current | 1 A |
| Withstanding Voltage | 600 V 1 min |
| Insulation resistance | $100 \mathrm{M} \Omega(\mathrm{DC} \mathrm{500V})$ |
| Applicable Wire | $1.25 \mathrm{~mm} / \mathrm{MAX}$ |
| T/B Screw | $\mathrm{M} 3 \times 10 \mathrm{~L}$ |
| Screw Torque | $1.2 \mathrm{~N} \cdot \mathrm{~m}(12 \mathrm{Kgf} \cdot \mathrm{cm})$ |
| Case | Modified PPO(Noryl)(UL 94V-0) |

ii) Dimensions(mm)

i) Specifications

| Rated Voltage |  | 125V AC / 24V DC |
| :---: | :---: | :---: |
| Rated Current | 10 | 1A |
|  | Common | 10A (Total) |
| Insulation resistance |  | 100M 2 (DC 500V) |
| Withstanding Voltage |  | AC500V 1min |
| Applicable Wire |  | AWG22-16 (MAX / $1.5 \mathrm{~mm} \mathrm{~m}^{2}$ ) |
| Contact Screw |  | M3 X 10L |
| Screw Torque |  | $1.2 \mathrm{~N} \cdot \mathrm{~m}(12 \mathrm{Kgf} \cdot \mathrm{cm})$ |
| Ambient Temperature |  | $-10^{\circ} \mathrm{C} \sim+50^{\circ} \mathrm{C}$ (Non-condensing) |
| Terminal Block \& Cover |  | Modified PPO |
| Protective Cover |  | Polycarbonate |
| PCB |  | Epoxy 1.6t |

ii) Dimensions(mm)


### 2.4 The Name of Each Part

### 2.4.1 The name of each part



| No. | Name | Description <br> (1) | Operating indication <br> LED |
| :---: | :---: | :---: | :---: |
| (2) | 1. RUN : indicates whether power is supplied or not <br> 2. X-AXIS, Y-AXI <br> On : during corresponding axis operation <br> Off : when the corresponding axis stops <br> Blink : error of the corresponding axis(LED of axis has error would be <br> blinking) |  |  |
| connector |  |  |  |$\quad$| Drive device, machinery input, Connector to encoder |
| :---: |

## Remark

1. In case dip switch is set as O/S download mode, positioning module doesn't operate. Make sure to set dip switch as off except for O/S download.

## Chapter 2 Specifications

### 2.5 Connection to XGT Servo System

The following shows the basic wiring diagram of XGB positioning module and XGT Servo System XDA-S Series.

※ This is a wiring example based on 1 axis.

## Note

*Note 1
Input signals DI1 to DIA and output signals DO1 to DO5 are default signals allocated by the factory.
*Note 2
These are non-allocated signals. You can change their allocation by setting parameters. For more information, refer to XDL-S sereis servo manual.

## Chapter 3 Operation Order and Installation

### 3.1 Installation

### 3.1.1 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
(a) Install the control panel available for water-proof, anti-vibration.
(b) The place free from continuous impact or vibration.
(c) The place not exposed to direct rays.
(d) The place with no dew phenomena by rapid temperature change.
(e) The place where surrounding temperature maintains 0-55 . . C
(2) Installation Construction
(a) In case of processing the screw hole or wiring, cares should be taken not to put the wiring remnants to PLC inside.
(b) Install on the good place to operate.
(c) Do not install the high voltage machine on the same Panel.
(d) The distance from duct or surrounding module shall be more than 50 mm .
(e) Ground to the place where surrounding noise environment is good enough.

### 3.1.2 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.
(5) When using the system of positioning control, please use it after you've set up the origin.

When Power On or Off, changes of pulse output could occurred by Power On or Off.

## Chapter 3 Operation Order and Installation

### 3.2 Notices in Wiring

### 3.2.1 Notices in Wiring

(1)The length of connecting cable between positioning module and drive machine shall be as short as possible. (Max. length : 10m).
(2)For cross 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 cross current.
(3)The wires should be selected considering surrounding temperature, allowable current and it is recommended to be more than max. size AWG22(0.3mmi).
(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 obstacle occurs that may cause the malfunction or failure.
(7)In case of wiring by the pipe, the grounding of pipe is required.
(8)In case that there is considered to be the noise source in wiring between positioning module and drive machine, it is required to use and connect Twist pair and sealed cable for the wiring of output pulse that comes from the positioning and enters into the motor drive.

### 3.2.2 Connection Example of Servo and Stepping Motor Drive Machine

## Notes

- Connection example shows the case that the input signal parameter of positioning module is set as follows.
- High limit signal/Low limit signal: B contact point
- DOG/HOME/In-position signal: A contact point
- The following example is based on axis $X$
(1) LS MECAPION
(a) XDL-L7S Series Connection

※ This is a wiring example based on 1 axis.
Note 1) Input signals DI1 to DIA and output signals DO1 to DO5 are default signals allocated by the factory.
Note 2) ** These are non-allocated signals. You can change their allocation by setting parameters.
For more information, refer to L7 sereis servo manual.


## Chapter 3 Operation Order and Installation

(1) MITSUBISHI
(a) MR-H■A Connection (Line Driver)

(b) MR-J2/J2S-■A Connection


## Chapter 3 Operation Order and Installation

(c) MR-J3- $\square$ A Connection

(d) MR-JロA Connection


## Chapter 3 Operation Order and Installation

(e) MR-C $\square$ A Connection

(2) PANASONIC
(a) A Series Connection (Line Driver)


## Chapter 3 Operation Order and Installation

(3) VEXTA
(a) UDX2107 Connection

(b) UPD Connection

(c) FX Connection


## Chapter 3 Operation Order and Installation

(4) Hagen Motor
(a) FDA-5000/6000/7000 AC Servo Drive Connection

(5) YASKAWA
(a) $\operatorname{CACR}$ (R Series) Connection

(b) SGDA-ap Connection


## Chapter 3 Operation Order and Installation

(c) $\sum$-II Series SGDH AC Servo Drive Connection

(d) $\sum$-III Series SGDS AC Servo Drive Connection (Line Driver)


## Chapter 3 Operation Order and Installation

### 3.2.3 Encoder Input (DC 5V Voltage Output) Wiring Example

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

In case of pulse generator uses by voltage output style by totem-pole output, wiring is equal.


## Notes

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

### 3.2.4 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
Item of Parameter and operation data should be set at each axis. (But common parameter shall be applied to all axes equally)

### 4.1 Parameter \& Operation data

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



## Chapter 4 Positioning Parameter \& Operation Data

### 4.2 Basic Parameter

Here describes about basic parameter of positioning module.

### 4.2.1 Basic parameter

| Basic parameter item | Setting range |
| :---: | :---: |
| Pulse output level | 0: Low Active, 1: High Active |
| Pulse output mode | 0: CW/CCW, 1: PLS/DIR |
| M code output mode | 0: None, 1: With, 2: After |
| Bias speed | 1 ~ 2,000,000[pulse/s] |
| Speed limit | 1 ~ 2,000,000[pulse/s] |
| Acceleration time 1 |  |
| Deceleration time 1 |  |
| Acceleration time 2 |  |
| Deceleration time 2 |  |
| Acceleration time 3 |  |
| Deceleration time 3 |  |
| Acceleration time 4 |  |
| Deceleration time 4 |  |
| S/W upper limit | -2,147,483,648 ~ 2, 147,483,647[pulse] |
| S/W lower limit | -2,147,483,648 ~ 2,147,483,647[pulse] |
| Backlash compensation | $0 \sim 65,535[p u l s e]$ |
| S/W limit detect | 0: Not detect, 1: Detect |
| Positioning complete condition | 0 : Dwell time, 1: inposition <br> 2: dwell time AND inposition <br> 3: dwell time OR inposition |
| Use upper-lower limit | 0 : Not use, 1: use |

## Notes

Deceleration time will be followed by set deceleration time in order in case of deceleration stop when it is stop. Then, if declaration time was set as 0 , Deceleration time will be decreased by set time before begin to operation. In case of sudden stop by internal factors (not by external factors), the deceleration time will be decreased by set time with sudden stop deceleration time.

## Chapter 4 Positioning Parameter \& Operation Data

### 4.2.2 Basic parameter setting

## (1) Pulse output level

You can select one between Low Active and High Active as pulse output level. For Low Active output, select 0. For High Active output, select 1.

## (2) Pulse 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)
(3) Pulse per Rotation
(a) Only in case of using mm , inch, degree as a positioning command unit, you should set pulse per rotation
(b) In case of using SERVO, you should set the value of "the number of output 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)

## (4) Travel per rotation and unit miltiplier

(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 ( $\mathrm{mm} / \mathrm{rev}$ ) is PB and the rate of deceleration is $1 / \mathrm{n}$,
Transfer amount per rotation $(A L)=P B \times 1 / n$.
(c) Settable Travel per rotation (AI) is listed below

| Setting unit | $\mathbf{m m}$ | Inch | degree |
| :---: | :---: | :---: | :---: |
| Travel per rotation | $0.1 \sim 20000000.0$ <br> um | $0.00001 \sim 2000.00000$ <br> inch | $0.00001 \sim 2000.00000$ <br> degree |

In case AL exceeds the above range, The travel per rotation (AI) should be set as follows:
Transfer amount (AL) $=\mathrm{PB} \times 1 / \mathrm{n}$

$$
=\text { Travel per rotation (AI) } \times \text { Unit multiplier (Am) }
$$

## Note)

In case unit is mm , unit multiplier (Am) is $1,10,100,1000$. If the value of " $\mathrm{PB} \times 1 / \mathrm{n}$ " exceeds $20000000.0 \mu \mathrm{~m}$, it is required to adjust the unit multiplier so that the travel per rotation (Al) does not exceed $20000000.0 \mu \mathrm{~m}$.

Ex1) In case that $(A L)=P B \times 1 / n=2500000.0 \mu m(=2500 \mathrm{~mm})$,

$$
(\mathrm{AL})=(\mathrm{Al}) \times(\mathrm{Am})=25000000 \times 1
$$

Ex2) In case that $(A L)=P B \times 1 / \mathrm{n}=25000000.0 \mu \mathrm{~m}(=25000 \mathrm{~mm})$,

$$
\begin{aligned}
(\mathrm{AL})=(\mathrm{Al}) \times(\mathrm{Am}) & =25000000 \times 10 \\
& =2500000 \times 100
\end{aligned}
$$

## Chapter 4 Positioning Parameter \& Operation Data

## (5) Pulse Output Mode

As input method to be used for SERVO Driver or Stepping Driver is different, it is required to select pulse output mode of positioning module according to the input method.
(a) CWICCW mode

CW/CCW mode shows the case that forward pulse and reverse pulse comes from different terminal. The following shows that pulse output level is Low Active.


## (b) PLS/DIR mode

PLS/DIR mode shows the case that forward pulse and reverse pulse are outputted from one terminal and the forward/reverse discrimination signal is outputted from different terminal. The following shows the case that pulse output level is low active.

(6) M code output mode
(a) M code output mode set in the parameter is applied to all operation step of each axis
(b) You can set different Mo code number for each operating step number
(c) $M$ code number setting range: $1 \sim 65,535$ (If it is set as $0, M$ code may not operate.)
(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.

## Chapter 4 Positioning Parameter \& Operation Data

## Notes

If M code signal is "ON" even if the positioning is completed, the next operation step no. does not work and the error (E233) will occur. Therefore, in order to act 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 it was set M code No. )

1) With mode

This is the mode that outputs M code number which is set by position data with start command of positioning action [indirect start, direct start, Circular interpolation, Simultaneous start, linear interpolation] and at the same time outputs M code ON signal.


## Chapter 4 Positioning Parameter \& Operation Data

## 2) After mode

This is the mode that outputs M code number to be set by position data after completing the positioning by start command (indirect start, direct start, circular interpolation, simultaneous start, linear interpolation) and at the same time outputs M code ON signal


## (7) Bias Speed

As the stepping motor has unstable torque near speed $=0$, the start speed shall be set in the beginning of operation in command to smooth the rotation of motor and reduce the positioning time. The speed to be set at this time is called "Bias Speed".
(a) The setting range is $0 \sim 2,000,000[\mathrm{pps}]$
(b) Bias speed shall be used for the main axis of

1) Positioning operation by start command,
2) Homing operation,
3) JOG operation,
4) Main axis of interpolation operation (subordinate axis is not available).

Chapter 4 Positioning Parameter \& Operation Data


## Note

1. If Bias speed is set as high, total operation time shall be reduced but if the setting value is too high, it may cause the occurrence of impact sound in the start/end time and forces the excessive effect to the machine. Cares shall be taken in using.
2. The bias speed should be set within the range as follows :
1) Bias speed $\leq$ Positioning speed data
2) Bias speed $\leq$ Homing-low speed $\leq$ Homing-high speed
3) Bias speed $\leq$ JOG low speed $\leq$ JOG high speed
3. It causes error in connection with bias speed in the following example.
1) Bias speed > Positioning speed data : error code 153
2) Bias speed > Homing-high speed : error code 133
3) Bias speed >Homing-low speed : error code 134
4) Bias speed > JOG high speed : error code 121
5) Bias speed >JOG high speed : error code 122
6) Bias speed $>$ inching speed : error code 123

## (8) Speed Limit, Acceleration Time, Deceleration Time

(a) Speed Limit

Speed limit is maximum speed set by positioning operation.
All of the operating speed should be set by below speed limit when it was 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 (stop state).
(It doesn't mean that the time require to reach from the operation speed to the speed " 0 ".)

## Chapter 4 Positioning Parameter \& Operation Data



## (9) 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 as software upper limit and software lower limit. That is, this function is used to prevent any derailment of incorrect operation position setting and incorrect operation by user program fault.
(b) External input upper/lower limit can be also set besides the software high/low limits.

(c) The range check of software upper/lower limit shall be done when the operation starts.
(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 and release the 'output disabled' before using.
(e) Setting range is $-2,147,483,648 \sim 2,147,483,647$ [pulse].

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 high/low limit.

## Chapter 4 Positioning Parameter \& Operation Data

## (10) Backlash Compensation Amount

(a) The tolerance that the machine does not work by the wear when the rotation direction changes in case that a gear, screw etc is combined to run at the motor axle, is called as "Backlash". Therefore, when you change the rotation direction, it is required to add the backlash compensation amount to the positioning amount for output.
(b) This is used for positioning operation, inching operation and jog operation
(c) Setting range is $0 \sim 65,535$ [pulse]
(d) As presented in the following figure, if the position moved 1 m to the right and again 1 m to the left, it is not possible to reach the original position by backlash. At this time, it is required to add backlash compensation amount.


## (11) SW limit detect

This is used to stop pulse output by software upper/lower limit in steady speed operation by speed control. If you set this item as "Detect", detects the software upper/lower limit regardless of origin fix

## (12) Positioning End Condition

(a) Positioning End signal means the signal to notify that the operation set without stop factor after position operation has been completed.
(b) There are 4 kinds of methods for positioning end 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) It is required to reach the goal position until the positioning end condition is satisfied with, and maintain 'in operation' status even if the positioning operation is finished. If the positioning end condition is satisfied, 'in operation status' shall be OFF and it becomes the positioning end status.
(d) That is a timing for each method.

## Chapter 4 Positioning Parameter \& Operation Data

## 1) Method by dwell time

In case that in-position signal is ON when positioning is completed after dwell time.


## 2) Method by in-position signal

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

b) In case of In-positioning signal to be On after positioning is ended.


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

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


## Chapter 4 Positioning Parameter \& Operation Data

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

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


## Chapter 4 Positioning Parameter \& Operation Data

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) Use of upper/lower limit

When you use upper/lower limit, set this tiem as "Use". If you set this item as "Not use", module doesn't detect upper/lower limit signal.

## Chapter 4 Positioning Parameter \& Operation Data

### 4.3 Home/Manual parameter

Describes Home/Manual parameter of XGB positioning module

### 4.3.1 Contents of Home/Manual parameter

| Home parameter items | Setting range |
| :---: | :---: |
| Home method | 0:DOG/HOME(Off), 1:DOG/HOME(On), 2: DOG, <br> 3: U.L Limit/Home, 4: U.L Limit |
| Home direction | 0:CW, 1: CCW |
| Home address | -2,147,483,648 ~ 2,147,483,647 [pulse] |
| Home high speed | 1 ~ 2,000,000 [pulse/s] |
| Home low speed | 2,000,000 [pulse/s] |
| Home compensation | -32,768 ~ 32,767 [pulse] |
| Home ACC time |  |
| Home DEC time | 0 ~ 65,535[ms] |
| Dwell time |  |
| JOG high speed |  |
| JOG low speed |  |
| JOG ACC time (ms) |  |
| JOG DEC time (ms) |  |
| Inching speed | $0 \sim 65,535[p u l s e / s]$ |

### 4.3.2 Home/Manual parameter setting

## (1) Home method

(a) There are five home return methods as follows.

| Home method | Parameter |
| :--- | :---: |
| Detect Home after DOG Off | 0:DOG/HOME(Off) |
| Detect Home after deceleration in <br> case of DOG On | 1:DOG/HOME(On) |
| Detect Home by DOG and | 2: DOG |
| Detect Home by Home Limit/Home <br> upper/lower limit |  |
| Detect home by upper/lower limit | 4: U.L Limit |

(b) For more detail on home method, refer to 9.1 Home return

## (2) Home Return direction

(a) There are 2 kinds of homing direction, forward direction and reverse direction.
(b) In case of homing command was set by forward, begin to homing operation to currently increasing direction of position, searching needed signal for homing from external.
(c) In case of homing command was set by reverse, begin to homing operation to currently decreasing direction of position, searching needed signal for homing from external.

## Chapter 4 Positioning Parameter \& Operation Data

## (3) Origin Address

(a) When homing is completed by homing command, the value set by homing address shall be used to change the present address value.
(b) Setting range of homing address: $-2,147,483,648 \sim 2,147,483,647$ (pulse)

## (4) Homing-High speed

(a) The speed when returning to the origin by homing command : high speed and low speed.
(b) There are two homing action ; 'detecting the origin signal'\& 'detecting origin signal area'.
'Detecting the origin signal'; when detect the origin signal, be stop. If it has high speed, can be occurred errors between the origin signal and stop spot of machine. And should be operated under the steady speed.

Then, the speed is homing low speed.
Homing action can complete by higher operation speed in detecting origin position. This is the speed that it is set by homing high speed.
(c) All of the control by positioning module doing work within speed limit. And Homing high speed also can't exceed speed limit.

And, homing high speed is faster than homing low speed or at least same.
Bias speed $\leq$ Homing-low speed $\leq$ Homing-high speed $\leq$ Speed limit

## (5) Homing-Low speed

(a) The speed that acts to the constant speed section from high speed section via deceleration section by homing command.
(b) In case of detecting Homing signal, use this function.

## Notes

When setting the homing speed, it is recommended to set the homing-low speed as low speed as possible. If setting the low speed as "too fast", it may cause the incorrect origin signal detection.

## (6) Origin compensation amount

(a) If the machine origin is deviated slightly - the difference between the setting value and the actual transfer amount caused by the mechanical tolerance - at the origin detection (Z phase input), this is used to compensate the tolerance.
(b) If origin compensation amount is already set, when you carry out the homing command, if you detect the origin and set (+) as much as data amount set as origin compensation amount, it move to the homing direction and if you set (-), it moves to the opposite of homing direction and then complete the homing action.
(c) Origin compensation amount setting range : - $2,147,483,648 \sim 2,147,483,647$ (unit: pulse)
(d) This picture is one of the examples about homing method that was applied by homing compensation amount from "Origin detection after approximate origin OFF".

## Chapter 4 Positioning Parameter \& Operation Data



## (7) Homing accelerating speed/ deceleration speed

(a) When it returns by homing command, it will be accelerated or decelerated by set acceleration time and deceleration time.
(b) Setting range is $0 \sim 65,535$ [ms].
(c) It will be accelerated or decelerated according to speed limit set at basic parameter

## (8) Homing dwell time

(a) This is the time needed to maintain the precise stop accuracy of SERVO motor when using the SERVO motor for positioning.
(b) Practically, Dwell time is the time needed to remove the residual pulse of deviation counter after completion of positioning and especially Dwell time when returning to the origin is called as "homing dwell time".
(c) Setting range of Homing dwell time : $0 \sim 65,535$ (unit: 1 ms)

## (9) 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) Range of JOG High speed

All speed in positioning control is lower than speed limit. So JOG high speed also can't be higher than speed limit. And JOG high speed should be higher than JOG low speed or equal.
(Bias speed $\leq$ Jog low speed $\leq$ Jog high speed $\leq$ Speed limit)

## Chapter 4 Positioning Parameter \& Operation Data

(10) JOG Low Speed
(a) JOG low speed operation has operation pattern as acceleration, constant speed, deceleration section.
(b) JOG low speed setting range: Bias speed ~ Jog high speed
(11) 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.
(12) Inching Speed
(a) The speed necessary for inching operation is set here.
(b) Inching speed setting range : $1 \sim 65,535$ (unit: 1 pps)

### 4.4 Common Parameter

Here describes common parameter of positioning module
The parameter is applied to all of axes which is connected to positioning module.

### 4.4.1 Common parameter

| Item of common parameter | Setting range |
| :---: | :---: |
| Encoder Max. value |  |
| encoder Min. value | $-2,147,483,648 \sim 2,147,283,647$ |
| Speed override | $0: \%$ override, $1:$ spd. override |
| Encoder input signal | $0: C W / C C W, 1: P L S / D I R, 2: P h a s e$ |

### 4.4.2 Common Parameter Setting

(1) Max/Min value of encoder
(a) When count Inputted pulse (from a hand pulse generator or encoder signal of Survo 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


## Chapter 4 Positioning Parameter \& Operation Data

2) In case of decreasing encoder value


## (2) 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\%.

## (3) Encoder pulse input mode

(a) If you want to use by signal of a hand pulse generator or Servo drive encoder, can select suitable signal of a hand pulse generator or Survo drive encoder for using
(b) Should select and set one from among CW/CCW, PULSE/DIR 1, PHASE A/B as an encoder input signal.

## 1) CWICCW

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 act to cutback when the Phase A is 'Low' and the Phase B input pulse is grow.

|  | Phase A input pulse High | Phase A input pulse Low |
| :---: | :---: | :---: |
| Phase B input pulse High | - | Decrease count |
| Phase B input pulse Low | Increase count | - |



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## 2) PULSE/DIR 1 multiplier

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

|  | Increasing Phase A input <br> pulse | Decreasing Phase A input <br> pulse |
| :---: | :---: | :---: |
| Phase B input pulse Off | Increase count | - |
| Phase B input pulse On | Decrease count | - |



## 3) 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 synchro with manual pulse generator (MPG). Synchro rate can take "Encoder $\leq$ Motor" or "Encoder $\geq$ Moter" what you want .

## Chapter 4 Positioning Parameter \& Operation Data

### 4.5 I/O Signal Parameter

Here describes using input/output signal parameter in positioning module.
Input/output signal parameter use to decide act level of input signal.

### 4.5.1 I/O Signal Parameter

| Input/output signal parameter <br> configuration |  |
| :---: | :---: |
| Upper limit signal |  |
| Lower limit signal | Setting range |
| DOG signal |  |
| Home signal |  |
| In position signal |  |

### 4.5.2 Setting of I/O Signal Parameter

In case of setting the input signal by A contact, it acts when external is ON and in case of setting by B contact, it acts when external signal is OFF
(1) If setting the high limit signal of input signal parameter by A contact and the low limit signal by B contact, the high limit is detected when external high limit signal is ON while the low limit is detected when external low signal is OFF.
(2) If setting the origin signal of input signal parameter by A contact, the origin is detected when external origin signal is 'Rising edge', while if setting by B contact, the origin is detected when external origin signal is 'Falling edge'.

## Chapter 4 Positioning Parameter \& Operation Data

### 4.6 Operation Data

- Here describes Operation Data of positioning module.
- Can set 150 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

| Operation data item | Setting range |
| :---: | :---: |
| Coordinate | 0 :absolute, 1:incremental |
| Pattern | 0:End, 1: Keep, 2: Continue |
| Control | 0 : Position, 1: speed |
| Method | 0 :Single, 1:repetition |
| Repeat step | $0 \sim 150$ |
| Address |  |
| Circular interpolation auxiliary point |  |
| Circular interpolation mode | 0:MID, 1:CENTER, 2:RADIUS |
| M code | $0 \sim 65,535$ |
| ACC. no. |  |
| DEC. no. |  |
| Speed | 1 ~ 2,000,000 [pulse/s] |
| Dwell time | $0 \sim 65,535[\mathrm{~ms}]$ |
| Cir. Int. turns | $0 \sim 65,535$ |
| Cir. Int. dir. | 0:CW, 1:CCW |
| Cir. Int. size | $0:$ Arc<180 1:Arc>=180 |

### 4.6.2 Operation Data Setting

(1) Step No.
(a) The setting range of positioning data as serial no. is $0 \sim 150$
(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.

## Chapter 4 Positioning Parameter \& Operation Data

## (2) Coordinate

(a) Coordinate of position data includes absolute coordinate and incremental 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]
$\triangleright$ When current position : 1000, Goal position : 8000, forward direction transfer amount is 7000(8000-1000).
- Software Package Setting


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]

$\triangleright$ When current position: 5000, Goal position: -7000, the positioning shall be done at -2000 position.
$\triangleright$ Software Package Setting


## Chapter 4 Positioning Parameter \& Operation Data

## (3) Control Method (End/KEEP/CONT)

(a) Decides how to connect the current and next step
(b) Select one among END, KEEP, CONT as you desire
(c) For further information, please refer to 9.2 .2 operation mode of positioning control of Chapter 9 "Function".

## (4) Method

(a) There are SPD, POS in method. Select one between SPD, POS as you desire.
(b) For further information, please refer to 9.2 .2 operation mode of positioning control of Chapter 9 "Function".

## (5) Operation Method (Singular/Repeat)

(a) Operating Method is a option for selecting a 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 setted step. If you set by Repeat, It will be select setted Repeat step after finish operating setted 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".

## (6) Repeat step

(a) In case operation method is repeat, set this item.
(b) Rage is $1 \sim 150$

## (7) Goal Position

(a) This is the area to set the transfer amount of position data as "position value".
(b) The setting range is $-2,147,483,648 \sim 2,147,483,647$ (setting unit: pulse).

## (8) 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 auxilary position of principal axis.
(d) For further information, please refer to 9.2.6 ~ 9.2.8.

## (9) 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 9.2.6 ~ 9.2.8.

## Chapter 4 Positioning Parameter \& Operation Data

## (10) 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 $1 \sim 65,535$
(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 4.2.2.

## (11) 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.

## (12) 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.

## (13) Dwell Time

(a) This is the waiting time before carrying out the next positioning operation after completing one positioning operation.
(b) Setting range is $0 \sim 50,000(\mathrm{~ms})$.
(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".

## (14) Circular interpolate turns

(a) When operating circular interpolation more than 360 degree, sets turns of circle
(b) Range is $0 \sim 65,535$.

## (15) 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 9.2.6 ~ 9.2.8.

## Chapter 4 Positioning Parameter \& Operation Data

(16) 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 9.2.6~9.2.8

## Chapter 5 Internal Memory and I/O Signal

## Chapter 5 Internal Memory and I/O Signal

### 5.1 Internal Memory

- Here describes the internal memory used for XGB positioning module
- Internal memory is used when executing direct Data read/write between positioning module and PLC main unit 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 Teaching Data

(1) Memory Address of Teaching Data

| Memory Address |  | Information |
| :---: | :---: | :---: |
| Axis X | Axis Y |  |
| C0 | 100 | Teaching Data1(LOWER) |
| C1 | 101 | Teaching Data 1(UPPER) |
| C2 | 102 | Teaching Data 2(LOWER) |
| C3 | 103 | Teaching Data 2(UPPER) |
| C4 | 104 | Teaching Data 3(LOWER) |
| C5 | 105 | Teaching Data 3(UPPER) |
| C6 | 106 | Teaching Data 4(LOWER) |
| C7 | 107 | Teaching Data 4(UPPER) |
| C8 | 108 | Teaching Data 5(LOWER) |
| C9 | 109 | Teaching Data 5(UPPER) |
| CA | 10A | Teaching Data 6(LOWER) |
| CB | 10B | Teaching Data 6(UPPER) |
| CC | 10C | Teaching Data 7(LOWER) |
| CD | 10D | Teaching Data 7(UPPER) |
| CE | 10E | Teaching Data 8(LOWER) |
| CF | 10F | Teaching Data 8(UPPER) |
| D0 | 110 | Teaching Data 9(LOWER) |
| D1 | 111 | Teaching Data 9(UPPER) |
| D2 | 112 | Teaching Data 10(LOWER) |
| D3 | 113 | Teaching Data 10(UPPER) |
| D4 | 114 | Teaching Data 11(LOWER) |
| D5 | 115 | Teaching Data 11(UPPER) |
| D6 | 116 | Teaching Data 12(LOWER) |
| D7 | 117 | Teaching Data 12(UPPER) |
| D8 | 118 | Teaching Data 13(LOWER) |
| D9 | 119 | Teaching Data 13(UPPER) |
| DA | 11A | Teaching Data 14(LOWER) |
| DB | 11B | Teaching Data 14(UPPER) |
| DC | 11C | Teaching Data 15(LOWER) |
| DD | 11D | Teaching Data 15(UPPER) |
| DE | 11E | Teaching Data 16(LOWER) |
| DF | 11F | Teaching Data 16(UPPER) |

## Chapter 5 Internal Memory and I/O Signal

(2) Setting
(a) The command of Teaching data setting is TWR.
(b) References for TEAA and TWR are on 'Chapter 6.3.24.
(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.

### 5.1.2 State Information

(1) Memory Address of State Information

| Memory address (HEX) |  | Information |
| :---: | :---: | :--- |
| Axis X | Axis Y |  |
| 140 | 180 | Operation state bit information (Lower) |
| 141 | 181 | Operation state bit information (Upper) |
| 142 | 182 | Axis information |
| 143 | 183 | External I/O signal state |
| 144 | 184 | Current Position ( Lower) |
| 145 | 185 | Current Position ( Upper) |
| 146 | 186 | Current Speed (Lower) |
| 147 | 187 | Current Speed (Upper) |
| 148 | 188 | Step number |
| 149 | 189 | M code |
| 14 A | 18 A | Error information |
| 14 B | 18 B | Encoder value (Lower) |
| 14 C | 18 C | Encoder value (Upper) |

(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 dedicated command of State Information ready only is SRD (refer to 6.3.33 command for reading operation status).
(c) If you use only command SRD, the information of axis status is read at once.
(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

## Chapter 5 Internal Memory and I/O Signal

(e) Use of State Information

1) Operation State Bit Information (Lower)

| Memory Address |  | Information |
| :---: | :---: | :---: |
| Axis X | Axis Y |  |
| 140 | 180 | 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, <br> 1: Positioning completed] |
| Bit 3 | M Code Signal | [0: M Code Off, 1: M Code On] |
| Bit 4 | Homing State | [0: Homing not completed <br> 1: Homing completed] |
| Bit 5 | No Use | [0] |
| Bit 6 | Stop State | [0: Stop State not by Stop Command, 1: Stop State by Stop Command] |
| Bit 7 | No Use | [0] |
| Bit 8 | High-end detection | [0: No Detection, 1: Detection] |
| Bit 9 | The lower limit of 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 , <br> 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 |  |  |
| :---: | :---: | :---: |
| Axis X | Axis Y | Information |
| 141 | 181 |  |


| Bit 0 | In position control | [0: Not in position control, 1: In position control] |
| :---: | :---: | :---: |
| Bit 1 | In speed control | [0: Not in speed control, 1: In speed control] |
| Bit 2 | In liner interpolcation | [0: Not in linear interpolation, 1: In linear interpolation] |
| Bit 3 | Not used | [0] |
| Bit 4 | In circular interpolcation | [0: Not in circular interpolation, 1: In circular interpolation] |
| Bit 5 | Homing | [0: Not in homing, 1: Homing] |
| Bit 6 | In position synchrous | [0: Not in position synchronous, 1: In position synchronous] |
| Bit 7 | In speed synchrous | [0: Not in speed synchronous, 1: In speed synchronous] |
| Bit 8 | JOG low speed | [0: Not in JOG low speed, 1: In JOG high speed] |
| Bit 9 | JOG high speed | [0: Not in JOG high speed, 1: In JOG high speed] |
| Bit 10 | In inching operation | [0: Not in inching, 1: In inching] |
| Bit 11 | Not used | [0] |
| Bit 12 | Not used | [0] |
| Bit 13 | Not used | [0] |
| Bit 14 | Not used | [0] |
| Bit 15 | Not used | [0] |

## Chapter 5 Internal Memory and I/O Signal

3) Axis Information

| Memory address |  |  |
| :---: | :---: | :--- |
| Axis X | Axis Y |  |
| 142 | 182 | Axis information |


4) External I/O Signal State

| Memory address |  | Information |
| :---: | :---: | :---: |
| Axis X | Axis $\mathbf{Y}$ |  |
| 143 | 183 | Axis information |



## Chapter 5 Internal Memory and I/O 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 main unit.

### 5.2.1 Contents of I/O Signal

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

This is the signal which transfers to positioning module from main unit
(4) The following table is based on XBC and XEC.

| Axis | Signal Direction: Main unit $\rightarrow$ Positioning module |  |  |
| :---: | :---: | :---: | :---: |
|  | Output signal |  | Description |
|  | XBC Type | XEC Type |  |
| Axis X | Uxy.01.0 | \%UXx.y. 16 | Axis X forward direction JOG |
|  | Uxy.01.1 | \%UXx.y. 17 | Axis X reverse direction JOG |
|  | Uxy.01.2 | \%UXx.y. 18 | Axis X JOG low/high speed |
|  | Uxy.01.3 | \%UXx.y. 19 | Axis X positioning complete signal clear |
| Axis Y | Uxy.01.4 | \%UXx.y. 20 | Axis Y forward direction JOG |
|  | Uxy.01.5 | \%UXx.y. 21 | Axis Y reverse direction JOG |
|  | Uxy.01.6 | \%UXx.y. 22 | Axis Y JOG low/high speed |
|  | Uxy.01.7 | \%UXx.y. 23 | Axis Y positioning compete signal clear |

(5) Input signal

This is the signal which transfers to main unit from positioning module

| Axis | Signal direction: Main unit $\leftarrow$ Positioning module |  |  |  |
| :---: | :---: | :---: | :--- | :---: |
|  | Input signal |  | Description |  |
|  | XBC Type | XEC Type |  |  |
| - | Uxx.00.0 $\sim$ <br> Uxx.00.E | \%UXX.y.0~ <br> \%UXX.y.14 | Not used |  |
|  | Uxx.00.F | \%UXX.y.15 | Positioning module ready |  |

## Chapter 5 Internal Memory and I/O Signal

### 5.2.2 Use of I/O Signal

(1) 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 stops

| Forward Jog Signal | Reverse Jog Signal | Jog Operation Status |
| :---: | :---: | :--- |
| On | Off | Forward Jog Operation |
| Off | On | Reverse Jog Operation |
| Off | Off | Stop |
| On | On | Stop |

(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 5 Internal Memory and I/O Signal

(2) Positioning complete signal clear
(a) It is used to turn off positioning complete signal after complete of single operation, repeated operation, continuous operation, liner interpolation operation, circular interpolation operation, speed/position conversion control operation and inching operation.
(b) In the following two cases, positioning complete signal is off

- If positioning complete signal clear bits (Axis $X$ : Uxx.01.3. Axis $Y$ : Uxx.01.7) is on, it will clear the positioning complete signal.
- It is turned off when positioning dedicated command is executed while positioning complete signal is on.


## Chapter 6 Command

Here describes the positioning command.

### 6.1 Contents of General Command

| Command | Command description |  |  | Command condition |
| :---: | :---: | :---: | :---: | :---: |
| PUT | Internal (Level) | memory | write | Base, memory address, save device leading address, data number to write at one time |
| PUTP | Internal <br> (Edge) | memory | write | Base, memory address, save device leading address, data number to write at one time |
| GET | Internal (Level) | memory | read | Base, memory address, save device leading address, data number to write at one time |
| GETP | Internal (Edge) | emory | $\mathrm{dd}$ | 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 |
| :---: | :---: | :---: |
| n 1 | 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 | $\mathrm{M}, \mathrm{P}, \mathrm{K}, \mathrm{L}, \mathrm{U}, \mathrm{N}, \mathrm{D}, \mathrm{R}$ |
| n 3 | Word number of data to read | $\mathrm{M}, \mathrm{P}, \mathrm{K}, \mathrm{L}, \mathrm{Constant}$ |

(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 Y 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.



## Chapter 6 Command

### 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 | $M, P, K, L, C o n s t a n t$ |

(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.

| D00000 | Teaching data1(lower) |
| :---: | :---: |
| D00001 | Teaching data1(upper) |
| D00002 | Teaching data2(lower) |
| D00003 | Teaching data2(upper) |
| D00004 | Teaching data3(lower) |
| D00005 | Teaching data3(upper) |
| D00006 | Teaching data4(lower) |
| D00007 | Teaching data4(upper) |
| D00008 | Teaching data5(lower) |
| D00009 | Teaching data5(upper) |
| D00010 | Teaching data6(lower) |
| D00011 | Teaching data6(upper) |
| D00012 | Teaching data7(lower) |
| D00013 | Teaching data7(upper) |
| D00014 | Teaching data8(lower) |
| D00015 | Teaching data8(upper) |



### 6.2 Dedicated Commands

| Command | Description | Condition |
| :---: | :---: | :---: |
| ORG | Homing start | Slot, command axis |
| FLT | Floating origin setting | Slot, command axis |
| DST | Direct start | Slot, command axis, position, speed, dwell time, M code, control word |
| IST | Indirect start | Slot, command axis, step number |
| LIN | Linear interpolation | Slot, command axis, step number, axis setting |
| CIN | Circular interpolation | Slot, command axis, step number, axis setting |
| SST | Simultaneous start | Slot, Axis $X$ step number, Axis $Y$ step number, Axis $Z$ step number, axis setting |
| VTP | Speed/position switching control | Slot, command axis |
| PTV | Position/speed switching control | Slot, command axis |
| STP | Deceleration stop | Slot, command axis, deceleration time |
| SSP | Position synchronous start | Slot, command axis, main axis position, step number, main axis setting |
| SSS | Speed synchronous start | Slot, command axis, main axis rate, sub axis rate, main axis setting |
| POR | Position override | Slot, command axis, position |
| SOR | Speed override | Slot, command axis, speed |
| PSO | Speed override with position | Slot, command axis, position, speed |
| INCH | Inching operation | Slot, command axis, inching amount |
| SNS | Start step no. change | Slot, command axis, step number |
| SRS | Repeat step no. change | Slot, command axis, step number |
| MOF | M code release | Slot, command axis |
| PRS | Current position preset | Slot, command axis, position |
| EPRS | Encoder preset | Slot, command axis, position |
| TEA | Single teaching | Slot, command axis, teaching data, step number, RAM/ROM, position/speed |
| TEAA | Teaching array | Slot, command axis, step number, RAM/ROM, position/speed, number of teaching |
| TWR | Teaching array data setting | Slot, command axis, teaching data, number of teaching |
| TBP | Basic parameter teaching | Slot, command axis, basic parameter change value, item to change |
| THP | Home parameter teaching | Slot, command axis, home parameter change value, item to change |
| TSP | Input signal parameter teaching | Slot, command axis, I/O signal parameter change value |
| TCP | Common parameter teaching | Slot, command axis, common parameter change value, item to change |
| TMD | Operation data teaching | Slot, command axis, operation data, operation data item, step number |
| WRT | Save parameter/operation data | Slot, command axis, axis information |
| EMG | Emergency stop | Slot, command axis |
| CLR | Error reset | Slot, command axis, Enable/disable pulse output |
| SRD | Read operation status | Slot, command axis, device number to save operation status |

## Note

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."

## Chapter 6 Command

### 6.3 Use of Dedicated Command

### 6.3.1 Homing start (Command : ORG)

(1) Program

| $\begin{aligned} & \text { M000000 } \\ & =\|P\| \vdash \end{aligned}$ | D00000.0 | D00000. 1 | ORG | 1 | 0 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Start Homing | Axis $X$ in operatin | $\text { Axis } \mathrm{Xerror}$ |  |  |  |  |

(2) Description

| Device | Description |
| :---: | :--- |
| M00000 | Axis X homing start input |
| D00000.0 | Axis X in operation |
| D00000.1 | Axis X error |


| Command | ORG |  |  | Homing start |  |
| :---: | :---: | :---: | :---: | :---: | :--- |
| Operand | OP1 | Slot | Constant | WORD | Slot No. installed with positioning module |
|  | OP2 | Axis | PMLK, constant, $\mathrm{D}, \mathrm{Z}, \mathrm{R}$, <br> ZR | WORD | Command axis (0: axis $\mathrm{X}, 1$ : axis Y) |

※ 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 (axis $X$ in operating, etc) which used in the example above is an assumption that saving the axis state value in D device area with SRD command.

### 6.3.2 Floating origin setting (Command : FLT)

(1) Program

(2) Description

| Device | Description |
| :---: | :--- |
| M00001 | Axis X floating origin setting |
| D00000.0 | Axis X in operation |
| D00000.1 | Axis X error |


| Command | FLT |  |  | Floating origin setting |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Operand | OP1 | Slot | Constant | WORD | Slot No. installed with positioning <br> module |
|  | OP2 | Axis | PMLK,Constant,D,Z,R,ZR | WORD | Command axis (0: axis X, 1: axis Y) |

※ 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 of homing parameter 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 (axis $X$ in operation, etc) which used in the example above is an assumption that saving the axis state value in $D$ device area with SRD command.

## Chapter 6 Command

### 6.3.3 Direct start (Command : DST)

(1) Program

| $\begin{gathered} \text { M00002 } \\ \|P\| \end{gathered}$ | $\begin{gathered} \mathrm{D} 00000.0 \\ \mathrm{l} / \mathrm{F} \end{gathered}$ | $\begin{gathered} \mathrm{D} 00000.1 \\ \mathrm{C} \end{gathered} /$ | DST | 1 | 0 | D01100 | D01200 | 0 | 0 | 0 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Direct start | Axis $X$ in operatin | Axis Xerror |  |  |  | Axis target address | Axis X operation speed |  |  |  |

(2) Description

| Device | Description |
| :---: | :--- |
| M00002 | Axis $X$ direct start input |
| D00000.0 | Axis X in operation |
| D00000.1 | Axis X error state |


| Command | DST |  |  |  | Direct start |
| :---: | :---: | :---: | :---: | :---: | :--- |
| Operand | OP1 | Slot | Constant | WORD | Slot No. installed with positioning <br> module |
|  | OP2 | Axis | PMLK,constant,D,Z,R,ZR | WORD | Command axis(0: axis X, 1: axis Y) |
|  | OP3 | Goal <br> position | PMLK,constant,D,Z,R,ZR | DINT | Goal position <br> $(-2,147,483,648 \sim 2,147,483,647) ~$ |
|  | 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.

| $15 \sim 12$ | $11 \sim 10$ | $9 \sim 8$ | $7 \sim 5$ | 4 | $3 \sim 1$ | 0 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Dec. Time | Acc. Time |  | $0:$ Absolute |  |  |
|  | 0: Dec. time1 | 0: Acc. Time1 |  | 0:Absolition Control |  |  |
| - | 1: Dec. time2 | 1: Acc. Time2 | - | 1:Increment | - | 0: Position Control <br> al |
|  | 2: Dec. time3 | 2: Acc. Time3 |  |  |  |  |
|  | 3: Dec.time4 | 3: Acc. Time4 |  |  |  |  |

(b) If control word is h0010, it shall be set by position control, Incremental, acc. Time1, dec. time 1.
(c) No.1~3, 5~7, 12~15 Bit of control word is the unused area and does not affect the setting.
(d) $D$ device signal (axis $X$ in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with SRD command.

## Chapter 6 Command

### 6.3.4 Indirect start (Command : IST)

(1) Program

(2) Description

| Device | Description |
| :---: | :--- |
| M00003 | Axis X indirect start input |
| D00000.0 | Axis X in operation |
| D00000.1 | Axis X error state |
| D01300 | Axis X step no. |


| 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 (0: axis X, 1: axis Y) |
|  | OP3 | Operation step number | PMLK,constant,D,Z,R,ZR | WORD | Step No. to operate (0~150) |

※ 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 continuance or go-on, several steps can be operated by an indirect start command.
(c) $D$ device signal (axis $X$ in Operation, etc) which used in the example above is an assumption that saving the axis state value in $D$ device area with SRD command.

## Chapter 6 Command

### 6.3.5 Linear Interpolation (Command: LIN)

(1) Program

(2) Description

| Device | Description |
| :---: | :--- |
| M00006 | Linear interpolation |
| D00000.0 | Axis X in operation |
| D00000.1 | Axis X error status |
| D00100.0 | Axis Y in operation |
| D00100.1 | Axis Y error status |
| D01500 | Operation step |


| Command | LIN |  |  |  | Direct start |
| :---: | :---: | :---: | :---: | :---: | :--- |
| Operand | OP1 | Slot | Constant | WORD | Slot No. installed with positioning module |
|  | OP2 | Axis | PMLK, constant, <br> D,Z,R,ZR | WORD | Command axis (0: axis X, 1: axis Y) |
|  | OP3 | Operation <br> step | PMLK, constant, <br> D,Z,R,ZR | WORD | Linear interpolation step number (0~150) |
|  | OP4 | Axis <br> setting | PMLK, constant, <br> D,Z,R,ZR | WORD | Operation axis setting <br> (Bit0: axis X, Bit1: axis Y) |

※ PMLK means $P, M, L$ and $K$ areas.
(a) Starts linear interpolation with axes set in OP4 (Axis setting)
(b) For axis setting, set the each Bit corresponding to each axis

| $15 \sim 2$ Bit | 1 Bit | 0 Bit |
| :---: | :---: | :---: |
| Not used | Axis $Y$ | Axis $X$ |

Since XBF-PD02A has 2 axes, set OP4 as 3.
(c) For detail on linear interpolation, refer to " 9.2 "
(d) $D$ device signal (axis $X$ in Operation, etc) which used in the example above is an assumption that saving the axis state value in $D$ device area with SRD command.

### 6.3.6 Circular Interpolation (Command: CIN)

(1) Program

(2) Description

| Device | Description |
| :---: | :--- |
| M00007 | Circular interpolation |
| D00000.0 | Axis $X$ in operation |
| D00000.1 | Axis $X$ error status |
| D00100.0 | Axis Y in operation |
| D00100.1 | Axis Y error status |
| D01500 | Operation step |


| Command | CIN |  |  |  | Direct start |
| :---: | :---: | :---: | :---: | :---: | :--- |
| Operand | OP1 | Slot | Constant | WORD | Slot No. installed with positioning module |
|  | OP2 | Axis | PMLK, constant, <br> D,Z,R,ZR | WORD | Command axis (0: axis X, 1: axis Y) |
|  | OP3 | Operation <br> step | PMLK, constant, <br> D,Z,R,ZR | WORD | Circular interpolation step number (0~150) |
|  | OP4 | Axis <br> setting | PMLK, constant, <br> D,Z,R,ZR | WORD | Operation axis setting <br> (Bit0: axis X, Bit1: axis Y) |

※ PMLK means $P, M, L$ and $K$ areas.
(a) Starts linear interpolation with axes set in OP4 (Axis setting)
(b) For axis setting, set the each Bit corresponding to each axis

| $15 \sim 2$ Bit | 1 Bit | 0 Bit |
| :---: | :---: | :---: |
| Not used | Axis $Y$ | Axis $X$ |

Since XBF-PD02A has 2 axes, set OP4 as 3.
(c) For detail on linear interpolation, refer to " 9.2 "
(d) $D$ device signal (axis $X$ in Operation, etc) which used in the example above is an assumption that saving the axis state value in $D$ device area with SRD command.

## Chapter 6 Command

### 6.3.7 Simultaneous Start (Command : SST)

(1) Program

| $\begin{gathered} \text { M00004 } \\ -\|p\| \end{gathered}$ | $\begin{gathered} \mathrm{D} 00000.0 \\ \mathrm{i} \end{gathered} \mathrm{~F}$ | $\begin{gathered} \mathrm{D} 00100.0 \\ \mathrm{l} \end{gathered} /$ | $\begin{gathered} \mathrm{D} 00000.1 \\ \mathrm{C} \end{gathered} /$ | $\begin{gathered} \mathrm{D} 00100.1 \\ \mathrm{~d} / \end{gathered}$ | SST | 1 | 0 | D01300 | D01400 | 0 | 3 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Simultaneo us start | Axis $X$ in operatin | Axis $Y$ in operation | Axis Xerror | Axis Y error |  |  |  | Axis $X$ step number | Axis $Y$ step number |  |  |

(2) Description

| Device | Description |
| :---: | :--- |
| M00004 | Simultaneous start |
| D00000.0 | Axis X in operation |
| D00000.1 | Axis X error status |
| D00100.0 | Axis Y in operation |
| D00100.1 | Axis Y error status |
| D01300 | Axis X simultaneous start step |
| D01400 | Axis Y simultaneous start step |


| Command | SST |  |  |  | Linear interpolation |
| :---: | :---: | :---: | :---: | :--- | :--- |
| Operand | OP1 | Slot | Constant | WORD | Slot No. installed with positioning <br> module |
|  | OP2 | Axis | PMLK,constant,D,Z,R,Z <br> $R$ | WORD | Command axis (0: axis X, 1: axis Y) |
|  | OP3 | Axis X step | PMLK,constant,D,Z,R,Z <br> $R$ | WORD | Axis X operation step number (0~150) |
|  | OP4 | Axis Y step | PMLK,constant,D,Z,R,Z <br> $R$ | WORD | Axis Y operation step number (0~150) |
|  | OP5 | Axis Z step | PMLK,constant,D,Z,R,Z <br> $R$ | WORD | Axis X operation step number (0~150) |
|  | OP6 | Axis <br> setting | PMLK,constant,D,Z,R,Z <br> $R$ | WORD | Simultaneous start axis setting |

※ PMLK means $P, M, L$ and $K$ areas.
(a) Simultaneous command is the command operates simultaneous steps saved in 'operation axis(OP6)' at a time.
(b) Axis setting is set by setting the bits to the axis

| $15 \sim 2$ Bit | 1 Bit | 0 Bit |
| :---: | :---: | :---: |
| Not use | Axis Y | Axis X |

Since XBF-PD02A has 2 axes, set OP4 as 3.
(c) In case of XBF-PD02A, there is no axis $Z$, value in OP5 is meaningless.
(d) $D$ device signal (axis $X$ in Operation, etc) which used in the example above is an assumption that saving the axis state value in $D$ device area with SRD command.

### 6.3.8 Speed/Position Switching Control (Command : VTP)

(1) Program

|  | $\begin{gathered} \mathrm{MOOOOP} \\ \|\mathrm{P}\| \end{gathered}$ |  |  |  | VTP | 1 | 0 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | Speed/posit ion switching | Axis X in operatin | Axis Xerror | Speed control |  |  |  |

(2) Description

| Device | Description |
| :---: | :--- |
| M00008 | Axis X speed/position switching control input |
| D00000.0 | Axis X in operation |
| D00000.1 | Axis X error state |
| D00001.1 | Axis X in speed control |


| Command | VTP |  |  | 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 (0: axis X, 1: axis Y) |

※ 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 "9.2.9 Speed/Position Switching Control"
(c) D device signal (axis $X$ Signal in Operation, etc) which used in the example above is an assumption that saving the axis state value in $D$ device area with SRD command.

## Chapter 6 Command

### 6.3.9 Position/Speed Switching Control (Command : PTV)

(1) Program

(2) Description

| Device | Description |
| :---: | :--- |
| M00009 | Axis X position/speed switching control input |
| D00000.0 | Axis X in operation |
| D00000.1 | Axis X error state |
| D00001.0 | Axis X 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 (0: axis $\mathrm{X}, 1:$ axis Y) |

※ 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 "9.2.15 Position/Speed Switching Control".
(c) $D$ device signal (axis X in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with SRD command.

## Chapter 6 Command

### 6.3.10 Deceleration Stop (Command : STP)

(1) Program

(2) Description

| Device | Description |
| :---: | :--- |
| M0000A | Axis X deceleration stop input |
| D00000.0 | Axis X in operation |
| D00000.1 | Axis X error state |
| D01500 | Axis $X$ deceleration stop time <br> set |


| Command | STP |  |  |  | Deceleration stop |
| :---: | :---: | :---: | :---: | :---: | :--- |
| Operand | OP1 | Slot | Constant | WORD | Slot No. installed with positioning <br> module |
|  | OP2 | Axis | PMLK,constant, $\mathrm{D}, \mathrm{Z,R,ZR}$ | WORD | Command axis (0: axis X, 1: axis Y) |
|  | OP3 | Deceleration <br> time | PMLK,constant,D,Z,R,ZR | WORD | deceleration time <br> $(0 \sim 65,535 \mathrm{~ms})$ |

※ 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 $0 \sim 65,535 \mathrm{~ms}$. But if setting as " 0 ", it stops only by deceleration time set at the beginning of operation.
(c) If deceleration stop command is executed in speed sync., position sync., it stops speed sync., position sync. depending on current operation control state.
(d) $D$ device signal (axis $X$ in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with SRD command.

## Chapter 6 Command

### 6.3.11 Synchronous Start by Position (Command : SSP)

(1) Program

(2) Description

| Device | Description |
| :---: | :--- |
| M0000C | Axis $X$ synchronous start by position input |
| M00002 | Axis X direct start input |
| D000000.0 | Axis X in operation |
| D00000.1 | Axis X error signal |
| D00100.0 | Axis Y in operation |
| D00100.1 | Axis Y error state |


| Command | SSP |  |  |  | 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 (0: axis X, 1: axis Y) |
|  | OP3 | Main axis <br> 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~ 150) |
|  | OP5 | Main axis | PMLK,constant,D,Z,R,ZR | WORD | Main axis (0: axis X, 1: axis Y) |

※ 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 axis X as main axis setting starts and its current position is 100,000 , axis Y will start and the motor will operate.
(b) For the detail description about position synchronous start, refer to "9.4.2 position synchronous control"
(c) $D$ device signal (axis $X$ in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with SRD command.

### 6.3.12 Synchronous Start by Speed (Command : SSS)

(1) Program

| $\begin{gathered} \text { M00002 } \\ \text { P } \end{gathered}$ | $\stackrel{\text { D00000.0 }}{1}$ | $\begin{gathered} \mathrm{D00000.1} \\ \mathrm{~V} / \stackrel{丶}{2} \end{gathered}$ | DST | 1 | 0 | D01100 | D01200 | 0 | 0 | 0 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Direct start | Axis X in operatin | Axis X error |  |  |  | Axis target address | Axis X operation speed |  |  |  |
| MOOOOE | $\begin{gathered} \text { D00100.0 } \\ 1 / \vdash \end{gathered}$ | $\begin{gathered} \text { D00100.1 } \\ \mid / / \vdash \end{gathered}$ |  |  | SSS | 1 | 1 | 1 | 2 | 0 |
| Speed synch. | Axis $Y$ in operation | Axis $Y$ error |  |  |  |  |  |  |  |  |

(2) Description

| Device | Description |
| :---: | :--- | :--- |
| M0000E | Axis Y speed synchronous start <br> input |
| M00002 | Axis X direct start input |
| D00000.0 | Axis X in operation |
| D00000.1 | Axis X error state |
| D00100.0 | Axis Y in operation |
| D00100.1 | Axis Y error state |


| Command | SSS |  |  |  | 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 (0: axis X, 1: axis Y) |
|  | OP3 | Main axis ratio | PMLK,constant,D,Z,R,ZR | WORD | Speed sync. main axis ratio (1~65,535) |
|  | OP4 | Subordinate <br> axis ratio | PMLK,constant,D,Z,R,ZR | WORD | Speed sync. sub axis ratio (1~65,535) |
|  | OP5 | Main axis | PMLK,constant,D,Z,R,ZR | WORD | Main axis( $0 \sim 1:$ axisX ~ axisY, $9:$ Encoder) |

※ PMLK means P, M, L and $K$ areas.
(a) In the example program above, if the command of synchronous start by speed is executed, axis $Y$ (subordinate axis) is indicated as 'in operation' but the motor does not operate. If operating axis $X$ set as the main axis, axis $Y$ (subordinate axis) is operated depending on the designated ratio between main axis(OP3) and sub axis(OP4).
(b) For example, if main axis ratio is 2 , sub axis ratio is 1 , when main axis moves by 4000 , sub axis moves 2000.
(c) For the detail description about speed sync., refer to "9.4.1 Speed Synchronous Start Control".
(d) D device signal (axis $X$ in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with SRD command.

## Chapter 6 Command

### 6.3.13 Position Override (Command : POR)

(1) Program

(2) Description

| Device | Description |
| :---: | :--- |
| M0000F | Axis X position override input |
| M00002 | Axis X direct start input |
| D00000.0 | Axis XI in operation |
| D00000.1 | Axis X error state |
| D01100 | Goal position value |
| D02800 | Position override value |


| Command | POR |  |  |  | Position override |
| :---: | :---: | :---: | :---: | :---: | :--- |
| Operand | OP1 | Slot | Constant | WORD | Slot No. installed with positioning module |
|  | OP2 | Axis | PMLK,constant, $\mathrm{D}, \mathrm{Z,R,ZR}$ | WORD | Command axis (0: axis X, 1: axis Y) |
|  | OP3 | Position <br> value | PMLK,constant, $\mathrm{D}, \mathrm{Z,R,ZR}$ | DINT | Goal position value to change <br> (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 by the value set in D02800, based on the start-up starting position. If executing positioning position override after passing a position to execute position override, it stops at the current position.
(b) For the detail description about position override, refer to "9.5.2 Position Override".
(c) $D$ device signal (axis $X$ in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with SRD command.

### 6.3.14 Speed Override (Command : SOR)

(1) Program

| $\begin{gathered} \text { M00002 } \\ \hline \mathrm{P} \mid \end{gathered}$ | $\stackrel{\text { D00000.0 }}{ }$ | $\begin{gathered} \mathrm{D} 00000.1 \\ / /{ }^{2} \end{gathered}$ | DST | 1 | 0 | D01100 | D01200 | 0 | 0 | 0 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Direct start | Axis Xin operatin | Axis X error |  |  |  | Axis target address | Axis X operation speed |  |  |  |
| $\begin{gathered} \text { M00012 } \\ \hline \mathrm{P} \mid \end{gathered}$ | D00000.0 | $\begin{gathered} \mathrm{D} 00000.1 \\ 1 / \vdash \end{gathered}$ |  |  |  |  | SOR | 1 | 0 | D01600 |
| Speed overide | Axis X in operatin | Axis X error |  |  |  |  |  |  |  | Overide speed |

(2) Description

| Device | Description |
| :---: | :--- |
| M00012 | Axis X speed override input |
| M00002 | Axis X direct start input |
| D00000.0 | Axis X in operation |
| D00000.1 | Axis X error state |
| D01200 | Goal speed value |
| D01600 | Speed override value |


| Command | SOR |  |  |  | Speed override |
| :---: | :---: | :---: | :---: | :---: | :--- |
| Operand | OP1 | Slot | Constant | WORD | Slot No. installed with positioning module |
|  | OP2 | Axis | PMLK,constant,D,Z,R,ZR | WORD | Command axis (0: axis X, 1: axis Y) |
|  | OP3 | Speed <br> 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 $0.01 \% \sim 655.35 \%$.
(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 "9.5.3 Speed Override".
(e) $D$ device signal (axis $X$ in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with SRD command.

## Chapter 6 Command

### 6.3.15 Position Assigned Speed Override (Command : PSO)

(1) Program

(2) Description

| Device | Description |
| :---: | :--- |
| M00013 | Axis X position assigned speed override input |
| M00002 | Axis X direct start input |
| D00000.0 | Axis X in operation |
| D00000.1 | Axis X error state |
| D01200 | Goal speed value |
| D01600 | Speed override value |
| D02800 | Position value to execute speed change |


| Command | XPSO |  |  |  | Position assigned speed override |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Operand | OP1 | Slot | Constant | WORD | Slot No. installed with positioning <br> module |  |
|  | OP2 | Axis | PMLK,constant,D,Z,R,ZR | WORD | Command axis (0: axis X, 1: axis Y) |  |
|  | OP3 | Position <br> 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 $0.01 \% \sim 655.35 \%$.
(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, axis X position assigned speed override input(M00013) become "on" to execute position assigned speed override after axis $X$ direct start input (M00002) become "on". When the position of axis $X$ 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 "9.5.4 Position Assigned Speed Override".
(f) $D$ device signal (axis $X$ in Operation, etc) which used in the example above is an assumption that saving the axis state value in $D$ device area with SRD command.

### 6.3.16 Inching Operation (Command : INCH)

(1) Program

| $\begin{gathered} \mathrm{M00014} \\ \hline \mathrm{P} \mid \end{gathered}$ | $\begin{gathered} \mathrm{D} 00000.0 \\ -1 / 1 \end{gathered}$ | $\begin{gathered} \mathrm{D} 00000.1 \\ \mathrm{l} / \mathrm{F} \end{gathered}$ | INCH | 1 | 0 | D01000 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Inching start | Axis X in operatin | Axis X error |  |  |  | Inching amount |

(2) Description

| Device | Description |
| :---: | :--- |
| M00014 | Axis X inching operation input |
| D00000.0 | Axis X in operation |
| D00000.1 | Axis X error state |
| D01000 | Axis X 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 (0: axis X, 1: axis Y) |
|  | OP3 | Position <br> 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 theincremental 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 (axis $X$ in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with SRD command.

## Chapter 6 Command

### 6.3.17 Start Step No. Change (Command : SNS)

(1) Program

| $\begin{gathered} \text { M00018 } \\ \hline \mathrm{P} \mid \end{gathered}$ | $\begin{gathered} \mathrm{D} 00000.0 \\ 1 / 1 \end{gathered}$ | $\begin{gathered} \text { D00000.1 } \\ \cdot / / \vdash \end{gathered}$ | SNS | 1 | 0 | D01300 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Start step change | Axis X in operatin | Axis Xerror |  |  |  | Axis X step number |

(2) Description

| Device | Description |
| :---: | :--- |
| M00018 | Axis X start step No. change input |
| D00000.0 | Axis X in operation |
| D00000.1 | Axis X error state |
| D01300 | Axis X start step no. to change |


| Command | SNS |  |  |  | Start 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 (0: axis X, 1: axis Y) |
|  | OP3 | Step No. | PMLK,constant,D,Z,R,ZR | WORD | step No. to change with start step (1~150) |

※ 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 (axis $X$ in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with SRD command.

### 6.3.18 Repeat Step No. Change (Command : SRS)

(1) Program

| $\begin{gathered} \text { M00019 } \\ \hline \end{gathered}$ | $\begin{gathered} \text { D00000.0 } \\ 1 / \vdash \end{gathered}$ | $\begin{gathered} \mathrm{D} 00000.1 \\ / / \vdash \end{gathered}$ | SNS | 1 | 0 | D01300 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Repeat step no. change | Axis $X$ in operatin | Axis Xerror |  |  |  | Axis X step number |

(2) Description

| Device | Description |
| :---: | :--- |
| M00019 | Axis X start step No. change input |
| D00000.1 | Axis X error state |
| D01300 | Axis X 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, $D, Z, R, Z R$ | WORD | Command axis (0: axis X, 1: axis Y) |
|  | OP3 | Step No. | PMLK,constant, $D, Z, R, Z R$ | WORD | step No. to change into repeat step (0~150) |

※ 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) The detail description about "9.5.8 Repeat Operation Step no. Change".
(d) 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 SRD command.

## Chapter 6 Command

### 6.3.19 M code Release (Command : MOF)

(1) Program

| M0001A | $0000000$ | $000000.3$ | MOF | 1 | 0 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| M code | Axis $X$ in operatin | M code on |  |  |  |

(2) Description

| Device | Description |
| :---: | :--- |
| M0001A | Axis X M code release input |
| D00000.1 | Axis X error state |
| D00000.3 | Axis X M code signal |


| Command | MOF |  |  | 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 (0: axis $\mathrm{X}, 1$ : axis Y ) |

※ PMLK means $P, M, L$ and $K$ areas.
(a) When $M$ code occurs, $M$ code signal and $M$ code $N o$. 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 (axis $X$ in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with SRD command.

### 6.3.20 Current Position Preset (Command : PRS)

(1) Program

(2) Description

| Device | Description |
| :---: | :--- |
| M0001B | Axis X current position preset input |
| D00000.0 | Axis X in operation |
| D00000.1 | Axis X error state |
| D02900 | axis1 preset position value |


| Command | PRS |  |  |  | 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 (0: axis X, 1: axis Y) |
|  | 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 (axis $X$ in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with SRD command.

## Chapter 6 Command

### 6.3.21 Encoder Preset (Command : EPRS)

(1) Program

| MO001C | EPRS | 1 | 0 | D02910 |
| :---: | :---: | ---: | ---: | ---: |
| Encoder <br> preset |  |  | Encoder <br> position |  |

(2) Description

| Device | Description |
| :---: | :--- |
| M0001C | Encoder preset input |
| D02910 | Encoder preset position value |


| Command | EPRS |  |  |  | Encoder preset |
| :---: | :---: | :---: | :---: | :---: | :--- |
| Operand | OP1 | Slot | Constant | WORD | Slot No. installed with positioning module |
|  | OP2 | Axis | PMLK,constant, $\mathrm{D}, \mathrm{Z,R,ZR}$ | WORD | Command axis (0: axis $\mathrm{X}, 1:$ axis Y ) |
|  | OP3 | Setting <br> value | PMLK,constant, $\mathrm{D}, \mathrm{Z,R,ZR}$ | DWORD | Encoder value to change |

※ PMLK means $P, M, L$ and $K$ areas.
(a) This is the command that changes the current position to the designated position (OP3).
(b) Since there can be only one encoder in positioning module, value of OP2 is meaningless.

### 6.3.22 Single Teaching (Command: TEA)

(1) Program

| M0001D | D00000.0 | D00000.1 | TEA | 1 | 0 | D03000 | D01300 | D03010 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Single <br> teaching | Axis X in <br> operation | Axis X error |  |  |  |  |  |  |

(2) Description

| Device | Description |
| :---: | :--- |
| M0001D | Axis $X$ single teaching input |
| D00000.0 | Axis $X$ in operation |
| D00000.1 | Axis $X$ error status |
| D03000 | Teaching |
| D01300 | Teaching step |
| D03010 | Select RAM/ROM teaching |
| D02000 | Select position/speed |


| Command | TEA |  |  |  | Single teaching |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Operand | OP1 | Slot | 상수 | WORD | Slot No. installed with positioning module |
|  | OP2 | Axis | $\begin{aligned} & \text { PMLK,constant,D,Z,R,Z } \\ & \text { R } \end{aligned}$ | WORD | Command axis (0: axis $\mathrm{X}, 1$ : axis Y ) |
|  | OP3 | Teaching value | $\begin{aligned} & \text { PMLK,constant,D,Z,R,Z } \\ & \text { R } \end{aligned}$ | WORD | Data value for teaching |
|  | OP4 | Teaching step | $\begin{aligned} & \text { PMLK,constant,D,Z,R,Z } \\ & \text { R } \end{aligned}$ | WORD | Step number for teaching (0~150) |
|  | OP5 | Teaching method | $\begin{aligned} & \text { PMLK, constant,D,Z,R,Z } \\ & \text { R } \end{aligned}$ | WORD | 0:RAM teaching 1:ROM teaching |
|  | OP6 | Teaching item | PMLK, constant,D,Z,R,Z <br> R | WORD | 0:position, 1:speed |

※ PMLK means P, M, L and $K$ areas.
(a) This command changing goal position or goal speed among operation data of positioning module. At this time, according to teaching method (OP5), if you select RAM teaching, the changed value is effective while module's power is on. If you select ROM teaching, the changed values is kept after power is off.
(b) Teaching is available while relevant axis is operating. But when relevant axis is operating, teaching of current step number is not available.
(c) Since operation data of positioning module is saved in flash memory, frequency of ROM teaching is limited to 100,000.
(d) $D$ device signal (axis $X$ in Operation, etc) which used in the example above is an assumption that saving the axis state value in $D$ device area with SRD command.

## Chapter 6 Command

### 6.3.23 Teaching Array (Command : TEAA)

(1) Program

(2) Description

| Device | Description |
| :---: | :--- |
| M0001F | Axis X teaching data setting input |
| M00020 | Axis X teaching array input |
| D00000.0 | Axis X in operation |
| D00000.1 | Axis X error state |
| D02000 | Axis X teaching array data leading address |


| Command | TEAA |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :--- |
| Operand | OP1 | Slot | Constant | WORD | Slot No. installed with positioning module |
|  | OP2 | Axis | PMLK,constant,D,Z,R,ZR | WORD | Command axis (0: axis X, 1: axis Y) |
|  | OP3 | Teaching step | PMLK,constant,D,Z,R,ZR | WORD | leading step No. for teaching (0~150) |
|  | 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 <br> 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 APM is connected to power. In the case of operating ROM teaching, it is maintained without power connection of APM.
(b) Teaching is available to be executed in operation of teaching axis but won't be executed when the step operating is in the area of step to do teaching.
(c) The number of times for ROM teaching is not limited because operation data of positioning module is saved on flash memory.
(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) $D$ device signal (axis $X$ in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with SRD command.

### 6.3.24 Teaching Array Data Setting (Command: TWR)

(1) Program

(2) Description

| Device | Description |
| :---: | :--- |
| M0001F | Axis X Teaching array data setting input |
| M00020 | Axis X Teaching array input |
| D00000.0 | Axis X in operation |
| D00000.1 | Axis X error state |
| D02000 | Axis X Teaching array data leading address |


| Command | TWR |  |  |  | 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 (0: axis X, 1: axis Y) |
|  | OP3 | Device | PMLK,D,Z,R,ZR | WORD | Leading device No. with teaching array data |
|  | OP3 | Number of <br> 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) 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 "5.1.1 Teaching data" and "6.1.2

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Internal Memory Writing". If use PUT command in the example program above, it displayed like the picture below.
The example program below the X-axis to the internal memory from h00C0 to h00C9 of address D2000 from teaching data 1 (low) to teaching data 5 (high), 10 -word data is stored.

< Teaching Data Memory address >

| Memory address (HEX) |  | Teaching data |
| :---: | :---: | :--- |
| X Axis | Y Axis |  |
| C0 | 100 | Teaching Data 1 (Low) |
| C1 | 101 | Teaching Data 1 (High) |
| C2 | 102 | Teaching Data 2 (Low) |
| C3 | 103 | Teaching Data 2 (High) |
| C4 | 104 | Teaching Data 3 (Low) |
| C5 | 105 | Teaching Data 3 (High) |
| C6 | 106 | Teaching Data 4 (Low) |
| C7 | 107 | Teaching Data 4 (High) |
| C8 | 108 | Teaching Data 5 (Low) |
| C9 | 109 | Teaching Data 5 (High) |

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

### 6.3.25 Basic Parameter Teaching (Command : TBP)

(1) Program

(2) Description

| Device | Description |
| :---: | :--- |
| M00021 | Axis $X$ basic parameter setting input |
| D00000.0 | Axis $X$ in operation |
| D00000.1 | Axis X error state |
| D03000 | Parameter value |
| D03012 | Parameter items |


| Command | TBP |  |  |  | Basic parameter Teaching |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Operand | OP1 | Slot | Constant | WORD | Slot No. installed with positioning <br> module |  |
|  | OP2 | Axis | PMLK,constant,D,Z,R,ZR | WORD | Command axis (0: axis X, 1: axis Y) |  |
|  | OP3 | Parameter <br> 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 (1~19, hFF) |  |

※ 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). At this time, teaching data is saved in RAM and for permanent presser. For permanent preservation, write to flash memory using WRT command.
(b) Basic parameter setting command is unavailable to be executed when the axis is operating.
(c) Basic parameter items

| Setting Value | Items | Setting Range |
| :---: | :---: | :---: |
| 1 | Speed limit value | 1 ~ 2,000,000[pulse/S] |
| 2 | Bias speed | 1 ~ 2,000,000[pulse/S] |
| 3 | Acc. Time 1 | $0 \sim 65,535$ [ms] |
| 4 | Acc. Time 2 |  |
| 5 | Acc. Time 3 |  |
| 6 | Acc. Time 4 |  |
| 7 | Dec. Time 1 |  |
| 8 | Dec. Time 2 |  |
| 9 | Dec. Time 3 |  |
| 10 | Dec. Time 4 |  |
| 11 | SW upper limit | -2,147,483,648 ~ 2,147,483,647 [pulse] |
| 12 | SW lower limit | -2,147,483,648 ~ 2,147,483,647 [pulse] |
| 13 | Backlash compensation | $0 \sim 65,535$ [pulse] |
| 14 | Detect upper/lower imit during constant speed operation | 0: Not detect, 1: detect |
| 15 | Positioning complete condition | 0 :Dwell time, 1:Inposition, <br> 2:Dwell time AND Inposition, 3:dwell time or inposition |
| 16 | Use of upper/lower limit | 0: Not use, 1: Use |
| 17 | Pulse output level | 0: Low Active, 1: High Active |
| 18 | Pulse output mode | 0: CW/CCW, 1: PLS/DIR |

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| Setting <br> Value | Items | Setting Range |
| :---: | :---: | :--- |
| 19 | M code output mode | 0: None, 1: With, 2: After |

(e) For the change value (OP3) setting range of each basic parameter item (OP4) which already set, refer to " 4.2 Basic Parameter Content"
(f) $D$ device signal (axis $X$ in Operation, etc) which used in the example above is an assumption that saving the axis state value in $D$ device area with SRD command.
(g) If you want to set entire item of basic parameter with one execution of TBP command, set hFF(255) at OP4. At this time, basic parameter should be saved in the following address. The data in the following address doesn't affect the operation. To apply to operation, use TBP command.

| Memory address <br> (HEX) |  | Contents |  |
| :---: | :---: | :--- | :--- |
| Axis X | Axis Y |  |  | Setting range

### 6.3.26 Homing/Manual Parameter Teaching (Command : THP)

(1) Program

(2) Description

| Device | Description |
| :---: | :--- |
| M00022 | Axis X homing parameter teaching input |
| D00000.0 | Axis X in operation |
| D00000.1 | Axis X error state |
| D03000 | Parameter value |
| D03012 | Parameter Items |


| Command | THP |  |  |  | Homing parameter Teaching |
| :---: | :---: | :---: | :---: | :---: | :--- |
| Operand | OP1 | Slot | Constant | WORD | Slot No. installed with positioning module |
|  | OP2 | Axis | PMLK,constant,D,Z,R,ZR | WORD | Command axis (0: axis X, 1: axis Y) |
|  | OP3 | Parameter <br> value | PMLK,constant,D,Z,R,ZR | DINT | Parameter value to change |
|  | OP4 | Parameter item | PMLK,constant,D,Z,R,ZR | WORD | Parameter items to change (1~14, hFF) |

※ 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 homing/manual parameter items to setting value (OP3). At this time, teaching data is saved in RAM and for permanent presser. For permanent preservation, write to flash memory using WRT command.
(b) Homing parameter setting command is unavailable to be executed when the axis is operating.
(c) Homing parameter item is as follows.

| Setting Value | Items | Setting value |
| :---: | :---: | :---: |
| 1 | Origin address | -2,147,483,648 $\sim 2,147,483$ |
| 2 | Homing high speed | $1 \sim 2,000,000$ [pulse/s] |
| 3 | Homing low speed |  |
| 4 | Home compensation | -32,768 ~ 32,767 [pulse] |
| 5 | Homing acc. Time | 0 ~ 65,535 [ms] |
| 6 | Homing dec. time |  |
| 7 | Homing dwell time |  |
| 8 | Homing mode | 1:DOG/HOME(Off), 1:DOG/HOME(On), 2: DOG <br> 3: U.L.Limit/Home, 4: U.L.Limit |
| 9 | Homing direction | 0:CW, 1:CCW |
| 10 | JOG high speed | 1 ~ 2,000,000 [pulse/s] |
| 11 | JOG low speed |  |
| 12 | JOG acc. time | 0 ~ 65,535[ms] |
| 13 | JOG dec. time | $0 \sim 65,535[\mathrm{~ms}]$ |
| 14 | Inching speed | $1 \sim 65,535[p u l s e / s]$ |

(e) For the change value (OP3) setting range of each homing parameter item (OP4) which already set, refer to "4.3.1 Homing/Manual Parameter Content"
(f) $D$ device signal (axis $X$ in Operation, etc) which used in the example above is an assumption that saving the axis state value in $D$ device area with SRD command.
(g) If you want to set entire item of basic parameter with one execution of THP command, set $\mathrm{hFF}(255)$ at OP4. At this time, basic

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parameter should be saved in the following address.

| Memory address(HEX) |  | Contents | Setting range |
| :---: | :---: | :---: | :---: |
| Axis X | Axis Y |  |  |
| C0 | 100 | Origin address | -2,147,483,648 ~ 2,147,483,647 [pulse] |
| C1 | 101 |  |  |
| C2 | 102 | Homing high speed | 1 ~ 2,000,000[pulse/s] |
| C3 | 103 |  |  |
| C4 | 104 | Homing high speed |  |
| C5 | 105 |  |  |
| C6 | 106 | Home compensation | 0 ~ 65,535 [ms] |
| C7 | 107 | Homing acc. Time |  |
| C8 | 108 | Homing dec. time |  |
| C9 | 109 | Homing dwell time |  |
| CA | 10A | Homing mode | 0: DOG/HOME(Off), 1:DOG/HOME(On), 2: DOG, <br> 3: U.L.Limit/HOME, 4: U.L.Limit |
| CB | 10B | Homing direction | 0:CW, 1:CCW |
| CC | 10C | JOG high speed | 1 ~ 2,000,000[pulse/s] |
| CD | 10D |  |  |
| CE | 10E | JOG high speed |  |
| CF | 10F |  |  |
| D0 | 110 | JOG acc. time | 0 ~ 65,535[ms] |
| D1 | 111 | JOG dec. time | $0 \sim 65,535[\mathrm{~ms}]$ |
| D2 | 112 | Inching speed | $1 \sim 65,535[p u l s e / s]$ |

### 6.3.27 I/O Signal Parameter Teaching (Command : TSP)

(1) Program

| M00023 | D00000.0 | D00000.1 |  | TSP | 1 | 0 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Input signal <br> parameter <br> teaching | Axis X in <br> operation | Axis X error |  |  |  | Teaching <br> data |

(2) Description

| Device | Description |
| :---: | :--- |
| M00023 | Axis X input signal parameter teaching input |
| D00000.0 | Axis X in operation |
| D00000.1 | Axis X error state |
| D03000 | Parameter value |


| Command | TSP |  |  | Input signal parameter Teaching |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Operand | OP1 | Slot | Constant | WORD | Slot No. installed with positioning module |
|  | OP2 | Axis | PMLK,constant, $D, Z, R, Z R$ | WORD | Command axis (0: axis $X, 1:$ axis $Y$ ) |
|  | OP3 | Parameter value | PMLK,constant, $\mathrm{D}, \mathrm{Z,R,ZR}$ | WORD | parameter value to change |

※ 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 Input/output signal parameter items to setting value (OP3). At this time, relevant teaching data is saved in RAM. For permanent preservation, use to flash memory using WRT command.
(b) Input/output signal operation parameter setting command is unavailable to be executed when the axis is operating.
(c) The input signal applied with each bit of the value to be set in parameter item is as follows. If each bit is set, it operates as "B contact point". If they are clear, it operates as "A contact point"

| Bit | Signal |
| :---: | :---: |
| 0 | High limit signal |
| 1 | Low limit signal |
| 2 | DOG Signal |
| 3 | HOME signal |
| 4 | Inposition signall |
| 5 | Deviation counter clear singal |
| $6 \sim 15$ | Not usedl |

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### 6.3.28 Common Parameter Teaching (Command : TCP)

(1) Program

(2) Description

| Device | Description |
| :---: | :--- |
| M00024 | Common parameter setting input |
| D02100 | Parameter value |
| D02102 | Parameter items |


| Command | XSCP |  |  |  | Common parameter Setting |  |
| :---: | :---: | :---: | :---: | :---: | :--- | :---: |
| Operand | OP1 | Slot | Constant | WORD | Slot No. installed with positioning <br> module |  |
|  | OP2 | Axis | PMLK,constant,D,Z,R,ZR | WORD | Command axis (0: axis X, 1: axis Y) |  |
|  | OP3 | Parameter <br> 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 (1~4, hFF) |  |

※ 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). At this time, relevant teaching data is saved in RAM. For permanent preservation, use to flash memory using WRT command.
(b) Common parameter item is as follows.

| Setting value | Item | Setting range |
| :---: | :---: | :---: |
| 1 | Encoder max. value | $-2147483648 \sim 2147283647$ |
| 2 | Encoder min. value |  |
| 3 | Speed override method | $0: \%$ override, $1:$ spd. override |
| 4 | Encoder input signal | $0:$ CW/CCW, $1:$ PLS/DIR, 2: PHASE |

(c) For the change value (OP3) setting range of each common parameter item (OP4) which already set, refer to "4.4.1 Common Parameter Content"
(d) If you want to set entire item of basic parameter with one execution of TCP command, set hFF(255) at OP4. At this time, basic parameter should be saved in the following address.

| Memory address <br> (HEX) |  | Contents | Setting range |
| :---: | :---: | :--- | :--- |
| Axis X | Axis Y |  |  |
| C0 | 100 | Encoder max. value |  |
| C1 | 101 |  | $-2,147,483,648 \sim 2,147,483,647$ [pulse] |
| C2 | 102 |  | Encoder min. value |

### 6.3.29 Operation Data Teaching (Command: TMD)

(1) Program

(2) Description

| Device | Description |
| :---: | :--- |
| M00025 | Axis X Operation data setting input |
| D00000.0 | Axis X in operation |
| D00000.1 | Axis X error state |
| D03000 | Operation data value |
| D03012 | Operation data items |
| D01300 | Teaching step |


| Command | TMD |  |  |  | Operation data setting |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Operand | OP1 | Slot | Constant | WORD | Slot No. installed with positioning <br> module |
|  | OP2 | Axis | PMLK,constant,D,Z,R,ZR | WORD | Command axis (0: axis X, 1: axis Y) |
|  | 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 (1~16, hFF) |
|  | OP5 | Step No. | PMLK,constant,D,Z,R,ZR | WORD | Operation data step No. to change <br> $(0 \sim 150)$ |

※ 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). At this time, relevant teaching data is saved in RAM. For permanent preservation, use to flash memory using WRT command.
(b) Operation data setting command is unavailable to be executed when the axis is operating.
(c) Item of operation data is as follows.

| Setting value | Item | Setting range |
| :--- | :--- | :--- |
| 1 | Goal address | $-2,147,483,648 \sim 2,147,483,647$ [pulse] |
| 2 | Cir. Int. aux. point |  |
| 3 | Speed | $1 \sim 2,000,000$ [pulse/s] |
| 4 | Dwell time | $0 \sim 65,535[\mathrm{~ms}]$ |
| 5 | $M$ code number | $0 \sim 65,535$ |
| 6 | Cir. Int. turns | $0 \sim 65,535$ |
| 7 | Operation method | $0:$ single, 1:repeat |
| 8 | Control method | $0:$ position control, 1:speed control |
| 9 | Operation pattern | $0:$ End, 1:Keep, 2:CONT |
| 10 | Coordinate | $0:$ Absolute, 1:Incremental |
| 11 | Cir. Int. size | $0:$ Arc<180 1:Arc>=180 |
| 12 | Acc. no. | $0 \sim 3$ |
| 13 | Dec. no. | $0 \sim 3$ |

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| Setting value | Item | Setting range |
| :--- | :--- | :--- |
| 14 | Cir. Int. mode | $0:$ MID, 1:CENTER, 2:RADIUS |
| 15 | Cir. Int. direction | $0: \mathrm{CW}, 1: \mathrm{CCW}$ |
| 16 | Repeat step number | $1 \sim 150$ |

(d) For the change value (OP3) setting range of each position data item (OP4) which already set, refer to "4.6.1 Operation Data Content"
(e) If you want to set entire item of basic parameter with one execution of TMD command, set $\mathrm{hFF}(255)$ at OP4. At this time, basic parameter should be saved in the following address.

| Memory address <br> (HEX) |  | Contents |  |
| :---: | :---: | :--- | :--- | Setting range

### 6.3.30 Parameter/Operation Data Save (Command : WRT)

(1) Program

| MOOO26 |  | $\begin{gathered} \mathrm{D} 00000.1 \\ -/ / \vdash \end{gathered}$ | WRT | 1 | 0 | D03300 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Flash Save | Axis X in operation | Axis X error |  |  |  | Axis setting |

(2) Description

| Device | Description |
| :---: | :--- |
| M00026 | Axis X parameter/operation data save input |
| D00000.1 | Axis X error state |


| Command | WRT |  |  |  | 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 (0: axis X, 1: axis Y) |
|  | OP3 | Selection <br> 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 Flash memory.
(b) The current parameter \& operation data of selected axis will be saved on Flash memory. It is also maintained when the power is off.
(c) OP2 is reference operand to execute command. Select between 0 and 1.
(d) Parameter/operation data save command is unavailable to be executed when the axis is operating. Execute it when all axis are not in operation.
(e) Set the selection axis by setting each bit of axis.

| $15 \sim 2$ Bit | 1Bit | OBit |
| :---: | :---: | :---: |
| Not used | Axis Y | Axis X |

[^1]
## Chapter 6 Command

### 6.3.31 Emergency Stop (Command : EMG)

(1) Program

(2) Description

| Device | Description |
| :---: | :---: |
| M00027 | Axis X internal emergency stop input |


| Command | EMG |  |  | Emergency stop |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Operand | OP1 | Slot | Constant | WORD | Slot No. installed with positioning module |
|  | OP2 | Axis | PMLK, constant, $\mathrm{D}, \mathrm{Z}, \mathrm{R}, \mathrm{ZR}$ | WORD | Command axis (0: axis $\mathrm{X}, 1:$ axis Y ) |

※ PMLK means P, M, L and $K$ areas.
(a) Execute internal emergency stop command to command axis.
(b) In case of EMG stop, it stops promptly without deceleration.
(c) The example program above is the command stop axis X emergently.

### 6.3.32 Error Reset (Command : CLR)

(1) Program

(2) Description

| Device | Description |
| :---: | :--- |
| M00028 | Axis X error reset input |
| D00000.1 | Axis X error state |


| Command | CLR |  |  | Error reset |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Operand | OP1 | Slot | Constant | WORD | Slot No. installed with positioning module |
|  | OP2 | Axis | PMLK,constant,D,Z,R,ZR | WORD | Command axis (0: axis X, 1: axis Y) |
|  | OP3 | Cancel output <br> inhabition | PMLK,constant,D,Z,R,ZR | WORD | 0: Not cancel output inhibition <br> 1: cancel output inhibetion |

※ PMLK means $P, M, L$ and $K$ areas.
(a) This is the command that reset the error occurred on command axis.
(b) Decides whether to cancel output inhibition or not according to value of OP3
(c) In the above example, resets the error occurred on axis $X$ and cancels output inhibition.

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### 6.3.33 Operation State Reading (Command: SRD)

(1) Program

(2) Description

| Device | Description |
| :---: | :--- |
| F00029 | Axis operation status reading input |
| D04000 | Leading address to save operation status of axis X |


| Command | SRD |  |  | 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 (0: axis X, 1: axis Y) |
|  | OP3 | Device | PMLK,D,Z,R,ZR | WORD | Leading No. of device to read and save the current <br> 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 |
| :---: | :---: | :---: |
| 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 +5 |  |  |
| Device +6 |  | SORD |

(c) It is able to read the current state of axis with GET command. At this time, refer to memory address of "5.1.2 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.

| M00033 | GET | 1 | h01co | 004000 | 31 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Operation status readins |  |  |  | $\begin{aligned} & \text { Axisi in in } \\ & \text { operation } \end{aligned}$ |  |

## 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 <br> - Function block is executed if " $0 \rightarrow 1$ " (edge or level) as long as the connection condition is met during the program. |
|  | BASE | USINT | Base position number <br> - This is the area where the base number on which positioning module is installed is set. <br> - Setting range: $0 \sim 7$ |
|  | SLOT | USINT | Base position number <br> - This is the area where the slot number on which positioning module is installed is set. <br> - Setting range: $0 \sim 7$ |
|  | AXIS | USINT | Axis number used $-1 \sim 4: \text { axis1 ~ axis } 4$ <br> "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 <br> - If an error occurs during function block execution, it generates the error number. |

(2) 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 | $-128 \sim 127$ |
| 3 | USINT | Unsigned Short Integer | 8 | $0 \sim 255$ |
| 4 | INT | Integer | 16 | $-32,768 \sim 32,767$ |
| 5 | UINT | Unsigned Integer | 16 | $0 \sim 65,535$ |
| 6 | DINT | Double Integer | 32 | $-2,147,483,648 \sim 2,147,483,647$ |
| 7 | UDINT | Unsigned Double Integer | 32 | $0 \sim 4,294,967,295$ |

### 7.2 Function Block of Positioning Module

Here describes the positioning function blocks.

| No. | Name | Description | Operation condition |
| :---: | :---: | :---: | :---: |
| 1 | APM_ORG | Homing start | Edge |
| 2 | APM_FLT | Floating origin setting | Edge |
| 3 | APM_DST | Direct start | Edge |
| 4 | APM_IST | Indirect start | Edge |
| 5 | APM_LIN | Linear interpolation | Edge |
| 6 | APM_CIN | Circular interpolation | Edge |
| 7 | APM_SST | Simultaneous start | Edge |
| 8 | APM_VTP | Speed/position switching control | Edge |
| 9 | APM_PTV | Position/speed switching control | Edge |
| 10 | APM_STP | Deceleration stop | Edge |
| 11 | APM_SSP | Position synchronization | Edge |
| 12 | APM_SSS | Speed synchronization | Edge |
| 13 | APM_POR | Position override | Edge |
| 14 | APM_SOR | Speed override | Edge |
| 15 | APM_PSO | Positioning speed override | Edge |
| 16 | APM_INC | Inching operation | Edge |
| 17 | APM_SNS | Start step No. change | Edge |
| 18 | APM_SRS | Repeat step No. change | Edge |
| 19 | APM_MOF | M code release | Edge |
| 20 | APM_PRS | Current position preset | Edge |
| 21 | APM_EPRE | Encoder value preset | Edge |
| 22 | APM_TEA | Position/speed teaching (ROM. RAM) | Edge |
| 23 | APM_ATEA | Position/speed teaching (ROM. RAM) (Array type) | Edge |
| 24 | APM_SBP | Basic parameter teaching | Edge |
| 25 | APM_SHP | Homing/manual parameter teaching | Edge |
| 26 | APM_SIP | External I/O signal parameter teaching | Edge |
| 27 | APM_SCP | Common parameter teaching | Edge |
| 28 | APM_SMD | Operation data teaching | Edge |
| 29 | APM_WRT | Parameter/operation data save | Edge |
| 30 | APM_EMG | Emergency stop | Edge |
| 31 | APM_RST | Error reset | Edge |
| 32 | APM_SRD | Operation state bit information read | Level |
| 33 | APM_CRD | Operation state code information read | Level |
| 34 | APM_ENCRD | Encoder value read | Level |

## 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, APM_SRD, APM_CRD, APM_ENCRD 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.

### 7.3 Function Block related to Module Information Read

### 7.3.1 Operation Information Read (APM_CRD)

| Form of Function Block | Description |
| :---: | :---: |
|  | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command ( 0 : axis X .1 : axis Y ) <br> Output <br> DONE : Maintain 1 after first operating <br> STAT : Output the error no. in operation <br> ERR : Display error <br> CA : Display the current position <br> CV : Display the current speed <br> STEP : Step no. of the current operation data <br> 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 0 and 1 are available to be set. If you set wrongly, "Error6" arises.
(4) You can monitor current position, current speed, operation data step no. and M code value of axis or use them as a condition in user's program.

## Chapter 7 Function Block

### 7.3.2 Operation State Bit Information Read (APM_SRD)

| Form of Function Block | Description |
| :---: | :---: |
|  | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command (0: axis X. 1: axis Y) <br> Output <br> DONE : Maintain 1 after first operating <br> STAT : Output the error no. in operation <br> ST1 : State 1 <br> ST2 : State 2 <br> ST3 : State 3 <br> ST4 : State 4 <br> ST5 : State 5 <br> ST6 : State 6 <br> 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) The contents of output parameters, ST1 ~ ST7 are important information necessarily applied in the program.

| Des. | Bit | Description | Bit | Description |
| :---: | :---: | :---: | :---: | :---: |
| ST1 | [0] | Operating(0:STOP, 1:BUSY) | [4] | Origin fix 1:Completion) |
|  | [1] | Error state | [5] | - |
|  | [2] | Positioning completion | [6] | Stop |
|  | [3] | $M$ code On signal(0:Off, 1:On) | [7] | - |
| ST2 | [0] | High limit detection | [4] | In acceleration |
|  | [1] | Low limit detection | [5] | In stable 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 low operation | [4] | - |
|  | [1] | In JOG high operation | [5] | - |
|  | [2] | In inching operation | [6] | - |
|  | [3] | - | [7] | - |
| ST5 | [0] | Main axis information <br> 1: axis $\mathrm{X}, 2$ : axis Y, 4: Encoder | [4] | - |
|  | [1] |  | [5] | - |


| Des. | Bit | Description | Bit | Description |
| :--- | :--- | :--- | :--- | :--- |
| ST6 | $[2]$ |  | $[6]$ | - |
|  | $[3]$ | Axis state (0: main axis, 1: sub axis) | $[7]$ | - |
|  | $[0]$ | - | $[4]$ | High limit signal |
|  | $[1]$ | - | $[5]$ | Low limit signal |
|  | $[2]$ | - | $[6]$ | Origin signal |
|  | $[3]$ | - | $[7]$ | DOG signal |
|  | $[0]$ | - | $[4]$ | In-position signal |
|  | $[1]$ | - | $[5]$ | Declination counter clear output signal |
|  | $[2]$ | - | $[6]$ | - |
|  | $[3]$ | - | $[7]$ | - |

## Chapter 7 Function Block

### 7.3.3 Encoder Value Read (APM_ENCRD)

| Form of Function Block | Description |
| :---: | :---: |
| $$ | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> Output <br> DONE : Maintain 1 after first operating <br> STAT : Output the error no. in operation <br> 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

### 7.4 Parameter/Operation Data Teaching Function Block

### 7.4.1 Basic Parameter Teaching (APM_SBP)

| Form of Function Block | Description |
| :---: | :---: |
|  | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command <br> BP_VAL : Basic parameter to change <br> BP_NO : Item no. of basic parameter to change <br> Output <br> DONE : Maintain 1 after first operating <br> 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 is valid within power connection. If you want to keep the parameter without power connection, save the value in flash memory APM_WRT
(Parameter/Operation Data Saving command) after basic parameter teaching.
(3) The value that need to be set in basic parameter is as follows.

| Value | Items | Setting Range |
| :---: | :---: | :---: |
| 1 | Speed Limit | 1 ~ 2,000,000[pulse/s] |
| 2 | Bias speed | 1-2,000,000[pulse/s] |
| 3 | Acc. Time 1 |  |
| 4 | Acc. Time 2 |  |
| 5 | Acc. Time 3 |  |
| 6 | Acc. Time 4 | [ |
| 7 | Dec. Time 1 | $0 \sim 65,535$ [ms] |
| 8 | Dec. Time 2 |  |
| 9 | Dec. Time 3 |  |
| 10 | Dec. Time 4 |  |
| 11 | SW upper limit | -2,147,483,648 ~ 2,147,483,647 [pulse] |
| 12 | SW lower limit | -2,147,483,648 ~ 2,147,483,647 [pulse] |
| 13 | Backlash compensation | $0 \sim 65,535$ [pulse] |
| 14 | S/W limit detect | 0: not detect, 1: detect |
| 15 | Position complete condition | 0: dwell time, 1: inposition <br> 2: dwell time and inposition, 3:dwell time or inposition |
| 16 | Upper/lower limit | 0: not use, 1: use |
| 17 | Pulse output level | 0 : Low Active, 1: High Active |
| 18 | Pulse ouput mode | 0: CW/CCW, 1: PLS/DIR |
| 19 | M code output mode | 0: None, 1: With, 2: After |

## Chapter 7 Function Block

### 7.4.2 Homing/Manual Parameter Teaching (APM_SHP)


(1) Give "Homing 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 homing parameter teaching command is valid within power connection. If you want to keep the parameter without power connection, save the value in flash memory APM_WRT
(Parameter/Operation Data Saving command) after basic parameter teaching
(3) The homing/manual parameter items and setting values are as follows.

| Setting value | Items | Setting Range |
| :---: | :---: | :---: |
| 1 | Homing position | -2,147,483,648 ~ 2,147,483,647 [pulse] |
| 2 | High speed for homing | $1 \sim 2,000,000$ [pulse/s] |
| 3 | Low speed for homing |  |
| 4 | Home compensation | -32,768 $\sim 32,767$ [pulse] |
| 5 | Homing Acc. Time | 0 ~ 65,535 [ms] |
| 6 | Homing Dec. Time |  |
| 7 | Homing Dwell Time |  |
| 8 | Homing mode | 0:DOG/HOME(Off), 1:DOG/HOME(On), 2:DOG 3:U.L.Limit/Home, 4:U.L.Limit |
| 9 | Homing direction | 0:Forward, 1:Reverse |
| 10 | JOG high speed | $1 \sim 2,000,000$ [pulse/s] |
| 11 | JOG low speed |  |
| 12 | JOG acceleration time (ms) | 0 ~ 65,535[ms] |
| 13 | JOG deceleration time (ms) | 0 ~ 65,535[ms] |
| 14 | Inching speed | $1 \sim 65,535[p u l s e / s]$ |

### 7.4.3 I/O Signal Parameter Teaching (APM_SIP)


(1) Give "Input Signal 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 input signal parameter teaching command is valid within power connection. If you want to keep the parameter without power connection, save the value in flash memory APM_WRT
(Parameter/Operation Data Saving command) after basic parameter teaching
(3) Set an axis to command from $0 \sim 1$. If you set wrongly, "Error6" arises.
(4) The setting value of each setting area of external signal has the meaning as below. 0 : A contact, 1 : B contact
(5) The I/O signal parameter items and setting values are as follows.

| Bit | Signal |
| :---: | :---: |
| 0 | Upper limit signal |
| 1 | Lower limit signal |
| 2 | DOG signal |
| 3 | HOME signal |
| 4 | In-position signal |
| 5 | Not used |
| $6 \sim 15$ | Deviation counter clear output signal |

## Chapter 7 Function Block

### 7.4.4 Common Parameter Teaching (APM_SCP)

| Form of Function Block | Description |
| :---: | :---: |
|  | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command <br> CP_NO : Item no. of common parameter to modify <br> CP_VAL : Common parameter value to modify <br> Output <br> DONE : Maintain 1 after first operation <br> 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 is valid within power connection. If you want to keep the parameter without power connection, save the value in flash memory APM_WRT (Parameter/Operation Data Saving command) after basic parameter teaching
(3) Set an axis to command from $0 \sim 1$. If you set wrongly, "Error6" arises.
(4) The common parameter items and setting values are as follows.

| Setting <br> value | Item | Setting range |
| :---: | :---: | :---: |
| 1 | Encoder max. value | $-2,147,483,648 \sim 2,147,283,647$ |
| 2 | Encoder min. value |  |
| 3 | Speed override method | $0:$ CW/CCW, $1:$ PLS/DIR, 2: PHASE |
| 4 | Encoder input signal | $0:$ CW/C. |

### 7.4.5 Operation Data Teaching (APM_SMD)

| Form of Function Block | Description |
| :---: | :---: |
|  | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command <br> STEP : Step no. to modify <br> MD_NO : Item no. of operation data to modify <br> MD_VAL : Operation data value to modify <br> Output <br> DONE : Maintain 1 after first operation <br> 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 is valid within power connection. If you want to keep the parameter without power connection, save the value in flash memory APM_WRT (Parameter/Operation Data Saving command) after basic parameter teaching
(3) In case "STEP" is 0 , it changes current step.
(4) The operation data items and setting values are as follows.

| Setting value | Item | Setting range |
| :---: | :---: | :---: |
| 1 | Goal address |  |
| 2 | Cir. Int. aux. point | -2,147,483,648 ~ 2,147,483,647 [puls |
| 3 | Speed | 1 ~ 2,000,000 [pulse/s] |
| 4 | Dwell time | $0 \sim 65,535[\mathrm{~ms}]$ |
| 5 | M code number | $0 \sim 65,535$ |
| 6 | Cir. Int. turns | 0~65,535 |
| 7 | Operation method | $0:$ single, 1:repeat |
| 8 | Control method | 0 :position control, 1:speed control |
| 9 | Operation pattern | 0:End, 1:Keep, 2:CONT |
| 10 | Coordinate | 0 :Absolute, 1:Incremental |
| 11 | Cir. Int. size | $0:$ Arc<180 1:Arc>=180 |
| 12 | Acc. no. | 0-3 |
| 13 | Dec. no. | 0-3 |
| 14 | Cir. Int. mode | 0:MID, 1:CENTER, 2:RADIUS |
| 15 | Cir. Int. direction | 0:CW, 1:CCW |
| 16 | Repeat step number | 1~150 |

## Chapter 7 Function Block

### 7.4.6 Single Teaching (APM_TEA)

| Form of Function Block | Description |
| :---: | :---: |
|  | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command <br> STEP : Set the step no. to do teaching (0~150) <br> RAM/ROM : Selection of RAM/ROM teaching <br> 0 : RAM teaching, 1 : ROM teaching <br> POS/SPD : Selection of position/speed teaching <br> 0 : Position, 1 : Speed <br> TEA_VAL : Set the teaching value <br> Output <br> DONE : Maintain 1 after first operation <br> 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) Set an axis to command from $0 \sim 1$. If you set wrongly, "Error6" arises.
(4) You may set step no.(0~150) of operation data on STEP. If you set wrongly, "Error11" arises.
(5) 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 Flash memory with APM_WRT (Parameter/Operation Data Saving command) after teaching.

## Chapter 7 Function Block

### 7.4.7 Teaching Array (APM_ATEA)

| Form of Function Block | Description |
| :---: | :---: |
|  | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command ( 0 : axis X. 1: axis Y) <br> STEP : Set the step no. to do teaching (0~150) <br> RAM/ROM : Selection of RAM/ROM teaching <br> 0 : RAM teaching, 1 : ROM teaching <br> POS/SPD : Selection of position/speed teaching <br> 0 : Position, 1 : Speed <br> TEA_CNT : Set the no. of data to do teaching 1 ~ 16 <br> TEA_VAL : Set the teaching value <br> Output <br> DONE : Maintain 1 after first operation <br> 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) In SLOT, this command is used in extension module. If you set 0 "Error3" arises
(5) Set an axis to command from $0 \sim 1$. If you set wrongly, "Error6" arises.
(6) You may set step no.(0~150) 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 flash memory with APM_WRT (Parameter/Operation Data Saving command) after teaching. When PLC is writing in flash memory, you can't execute the instruction.(refer to Appendix 1 ,ErrorCode176)

## Chapter 7 Function Block

### 7.4.8 Saving Parameter/Operation Data (APM_WRT)

| Form of Function Block | Description |
| :---: | :---: |
|  APM_WRT   <br> BOOL- REQ DONE BOOL <br> USINT- - BASE STAT - UINT  <br> USINT- SLOT   <br> USINT-- AXIS    <br> USINT-    <br> WRT_AXIS    | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command <br> WRT_AXIS : Saving axis setting (by setting bit) Bit0: axis X , Bit1: axis Y <br> Output <br> DONE : Maintain 1 after first operation <br> 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 $0 \sim 1$. If you set wrongly, "Error6" arises.
(3) If function block is executed normally, the current operation parameter and data which saved on WRT_AXIS are saved on Flash memory and maintain the data without the power connection.
(4) For setting of WRT_AXIS, set bit relevant to each axis

| $15 \sim 2$ Bit | 1Bit | 0Bit |
| :---: | :---: | :---: |
| Not Use | Axis Y | Axis X |

## Chapter 7 Function Block

### 7.5 Start/Stop Function Block

### 7.5.1 Homing Start (APM_ORG)

| Form of Function Block | Description |
| :---: | :---: |
|  APM_ORG   <br> BOOL- REQ DONE - BOOL <br> USINT- BASE STAT - UINT <br> USINT- SLOT   <br> USINT-    <br>     <br>     | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command <br> Output <br> DONE : Maintain 1 after first operation <br> STAT : Output the error no in operation |

(1) This is the command that give homing command to positioning 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 $0 \sim 1$. If you set wrongly, "Error6" arises.
(5) If homing command is executed normally, it starts homing according to "homing method" of "homing parameter".

## Chapter 7 Function Block

### 7.5.2 Direct Start (APM_DST)

| Form of Function Block | Description |
| :---: | :---: |
|  | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command <br> ADDR : Goal position address setting $-2147483648 \sim+2147483647$ <br> SPEED : Goal speed setting <br> DWELL : Dwell time setting $0 \text { ~ } 65535[\mathrm{~ms}]$ <br> M code : M code value setting <br> POS/SPD: control method setting <br> 0 : position control, 1: speed control <br> ABS/INC: Coordinates setting <br> 0 : Absolute, 1: Incremental <br> TIME_SEL: Acc./Dec, time number setting <br> Output <br> DONE : Maintain 1 after first operation <br> 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 $0 \sim 1$. If you set wrongly, "Error6" arises.
(4) If the value set on SPEED, TIME_SEL is out of setting range, "Error11" will occur on STAT.
(5) For TIME_SEL, set the bit relevant to each setting as follows.

| $7 \sim 4$ Bit | $3 \sim 2$ Bit | 1~0Bit |
| :---: | :---: | :---: |
|  | $0:$ Dec. time 1 | $0:$ Acc. time 1 |
| Not use | $1:$ Dec. time 2 | $1:$ Acc. time 2 |
|  | $2:$ Dec. time 3 | $2:$ Acc time 3 |
|  | $3:$ Dec. time 4 | $3:$ Acc time. 4 |

### 7.5.3 Indirect Start (APM_IST)

| Form of Function Block | Description |
| :---: | :---: |
|  APM_IST   <br> BOOL- REQ DONE -BOOL <br> USINT- BASE STAT -UINT <br> USINT- SLOT   <br> USINT-    <br> UXIS    <br> UINT-    <br> STEP    | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command <br> STEP : Set the step no. to do teaching $0 \sim 150$ <br> Output <br> DONE : Maintain 1 after first operation <br> 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 $0 \sim 1$. If you set wrongly, "Error6" arises.
(4) If the value set on STEP is out of the setting range (0~150), "Error11" arises on STAT.
(5) If set STEP to 0 , it operates the current step.

## Chapter 7 Function Block

### 7.5.4 Linear Interpolation (APM_LIN)

| Form of Function Block | Description |
| :---: | :---: |
|  | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> LIN_AXIS: linear interpolation axis <br> (fixed as 3 in XGB positioning module) <br> STEP : Step no. to operate <br> Output <br> DONE : Maintain 1 after first operation <br> STAT : Output the error no in operation |

(1) Give "Linear 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) Linear interpolation is executed with step set in STEP of designated step
(3) Set an axis to command from $0 \sim 1$. If you set wrongly, "Error6" arises.
(4) In case STEP is 0 , linear interpolation is executed with current step.

### 7.5.5 Circular interpolation (APM_CIN)

| Form of Function Block | Description |
| :---: | :---: |
| $$ | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command <br> STEP : Step no. to operate <br> RATIO : Ellipse ratio(\%) <br> DEG : Operating angle <br> Output <br> DONE : Maintain 1 after first operation <br> STAT : Output the error no in operation |

(1) Give "circular 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 circular interpolation with main axis set in MST_AXIS and sub axis set in SLV_AXIS according to operation data set in STEP
(3) Set an axis to command from $0 \sim 1$. If you set wrongly, "Error6" arises.
(4) In case STEP is 0 , command is executed with current step.

## Chapter 7 Function Block

### 7.5.6 Simultaneous Start (APM_SST)

| Form of Function Block | Description |
| :---: | :---: |
|  APM_SST   <br> BOOL- REQ DONE BOOL  <br> USINT- - BASE STAT -UINT  <br> USINT- SLOT   <br> USINT-    <br> SST_AXIS    <br> UINT-    <br> X_STEP    <br> UINT- Y_STEP    <br> UINT-    <br>     | ```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 X_STEP: axis \(X\) step number Y_STEP: axis Y step number Z_STEP: not used 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 2axis at once.
(3) If you set a value out of setting range, "Error6" arises. Set with each bit as follows.

| 7 bit | 6 bit | 5 bit | 4 bit | 3bit | 2 bit | 1 bit | 0 bit |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | - | - | - | - | - | Axis Y | Axis X |

(4) Set the step no. of each axis to execute simultaneous start on X_STEP ~ Y_STEP.

## Chapter 7 Function Block

### 7.5.7 Deceleration Stop (APM_STP)

| Form of Function Block | Description |
| :---: | :---: |
|  APM_STP   <br> BOOL- REQ DONE - BOOL <br> USINT- BASE STAT -UINT <br> USINT- SLOT   <br> USINT- AXIS   <br> UINT- DEC_TIME   | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command <br> DEC_TIME : Decelerating stop time <br> 0 : Acc./Dec. time applied when start operating <br> $1 \sim 65,535: 1 \sim 65,535 \mathrm{~ms}$ <br> Output <br> DONE : Maintain 1 after first operation <br> 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 and synchronization, speed/position and synchronization 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 ~ $65,535 \mathrm{~ms}$. But, if it is set to " 0 ", it will stop by the time set at the starting of operation.
(6) Decelerating time means the time between the speed limit of basic parameter and stop.

## Chapter 7 Function Block

### 7.5.8. Emergency Stop (APM_EMG)


(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) If EMG stop is executed, state of axis becomes error, output inhibition, origin-not fixed state. When you start operation again, reset error, cancel output inhibition and fix origin again.

### 7.6 Manual Operation Function Block

### 7.6.1 Inching Operation (APM_INC)

| Form of Function Block | Description |
| :---: | :---: |
|  | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command <br> INCH_VAL: Amount of movement by Inching Operation $-2,147,483,648 \sim 2,147,483,647$ <br> Output <br> DONE : Maintain 1 after first operating <br> 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 $0 \sim 1$. If you set wrongly, "Error6" arises.

### 7.7 Synchronization Start Function Blocks

### 7.7.1 Position Synchronization (APM_SSP)

| Form of Function Block | Description |
| :---: | :---: |
|  | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command <br> STEP : Step no. to operate $0 \sim 150$ <br> MST_AXIS : Set the main axis 0 : axis $X, 1$ : axis $Y$ <br> MST_ADDR : Set the position of main axis $-2,147,483,648 \sim 2,147,483,647$ <br> Output <br> DONE : Maintain 1 after first operating <br> 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 $0 \sim 1$. If you set wrongly, "Error6" arises.
(4) You may set the main axis on MST_AXIS with 0 or 1. If you set wrongly, "Error6" arises.

## Chapter 7 Function Block

### 7.7.2 Speed Synchronization (APM_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 MST_AXIS : Set main axis 0~2: axis \(X\), axis \(Y\), encoder MST_RAT : Set speed rate of main axis 1~65,535 SLV_RAT : Set speed rate of sub axis 1~65,535 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 $0 \sim 1$. If you set wrongly, "Error6" arises.
(5) You may set the main axis on MST_AXIS with following values. If you set wrongly, "Error6" arises. $0 \sim 2$ : axis X , axis Y , encoder

### 7.8 Modification Function Block

### 7.8.1 Position Override (APM_POR)

| Form of Function Block | Description |
| :---: | :---: |
|  APM_POR   <br> BOOL- REQ DONE BOOL  <br> USINT- BASE STAT -UINT  <br> USINT- SLOT   <br> USINT- AXIS    <br> OINT-    <br>     <br>     | Input  <br>  REQ : Request for execution of function block <br> BASE : Set the base no. with module  <br> SLOT : Set the slot no. with module  <br> AXIS : Axis to command  <br> POR_ADDR: Set a new goal position  <br> Output $\quad-2,147,483,648 \sim 2,147,483,647$  <br>   <br>  DONE : Maintain 1 after first operating <br>  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
(4) Set the goal position to modify on POR_ADDR.'
(5) Set an axis to command from $0 \sim 1$. If you set wrongly, "Error6" arises.

## Chapter 7 Function Block

### 7.8.2 Speed Override (APM_SOR)

| Form of Function Block | Description |
| :---: | :---: |
|  APM_SOR   <br> BOOL- REQ DONE BOOL <br> USINT- BASE STAT -UINT <br> USINT- SLOT   <br> USINT-    <br> AXIS    <br> UDINT-    <br>     <br>     | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command <br> SOR_SPD : Set a new operaion speed value <br> Output <br> DONE : Maintain 1 after first operating <br> 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 $0.01 \% \sim 655.35 \%$.
(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 $0 \sim 1$. If you set wrongly, "Error6" arises.

## Chapter 7 Function Block

### 7.8.3 Position Assigned Speed Override (APM_PSO)

| Form of Function Block | Description |
| :---: | :---: |
|  APM_PSO   <br> BOOL REQ DONE - BOOL <br> USINT- BASE STAT -UINT <br> USINT- SLOT   <br> USINT- AXIS   <br> DINT- PSO_ADDR   <br> UDINT- PSO_SPD   <br>     | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command <br> PSO_ADDR : The position to change speed -2,147,483,648 ~ 2,147,483,647 <br> PSO_SPD : Set new speed value <br> Output <br> DONE : Maintain 1 after first operating <br> 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 arrives 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 $1 \sim 65,535$ and it means $0.01 \% \sim 655.35 \%$.
(5) Set an axis to command from $0 \sim 1$. If you set wrongly, "Error6" arises.

## Chapter 7 Function Block

### 7.8.4 Position/Speed Switching Control (APM_PTV)

| Form of Function Block | Description |
| :---: | :---: |
|  | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command <br> Output <br> DONE : Maintain 1 after first operating <br> 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 continue to operate until stop command.
(3) Set an axis to command from $0 \sim 1$. If you set wrongly, "Error6" arises.

## Chapter 7 Function Block

### 7.8.5 Speed/Position Switching Control (APM_VTP)

| Form of Function Block | Description |
| :---: | :---: |
|  APM_VTP   <br> BOOL REQ DONE BOOL <br> USINT BASE STAT -UINT <br> USINT- SLOT   <br> USINT- AXIS   <br>     | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command <br> Output <br> DONE : Maintain 1 after first operating <br> 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) If this command is executed, origin would be decided at the same time and it finishes the positioning after arrive at the goal position.
(4) Set an axis to command from $0 \sim 1$. If you set wrongly, "Error6" arises.

### 7.8.6 Start Step Number Change (APM_SNS)

| Form of Function Block | Description |
| :---: | :---: |
|  APM_SNS   <br> BOOL REQ DONE -BOOL <br> USINT- BASE STAT -UINT <br> USINT- SLOT   <br> USINT-    <br> AXIS    <br> UINT-    <br>  STEP   <br>     | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command <br> STEP : Set the operation step no. to operate $1 \sim 150$ <br> Output <br> DONE : Maintain 1 after first operating <br> 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 $0 \sim 1$. If you set wrongly, "Error6" arises.
(4) Set the step no. on STEP. The setting range is $1 \sim 150$, if you set the setting value wrongly, "Error11" arises.

## Chapter 7 Function Block

### 7.8.7 Repeat Step No. Change (APM_SRS)


(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) In SLOT, this command is used in extension module. If you set 0 "Error3" arises
(4) Set an axis to command from $0 \sim 1$. If you set wrongly, "Error6" arises.
(5) Set the step no. to operate repeatedly on STEP. The setting range is $0 \sim 150$, if you set the setting value wrongly, "Error11" arises.

### 7.8.8 Current Position Change (APM_PRS)

| Form of Function Block | Description |
| :---: | :---: |
|  | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command <br> PRS_ADDR : Set the current position value to change. $-2,147,483,648 \sim 2,147,483,647$ <br> Output <br> DONE : Maintain 1 after first operating <br> 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 $0 \sim 1$. If you set wrongly, "Error6" arises.

## Chapter 7 Function Block

### 7.8.9 Encoder Value Preset (APM_EPRE)

| Form of Function Block | Description |
| :---: | :---: |
|  APM_EPRE   <br> BOOL- REQ DONE -BOOL <br> USINT- BASE STAT - UINT <br> USINT- SLOT   <br> USINT-    <br> AXIS    <br> UDINT- EPRE_VAL   <br>     | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command <br> EPRE_VAL : Set the value of encoder preset 0~2,147,483,647 <br> Output <br> DONE : Maintain 1 after first operating <br> 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 an axis to command from $0 \sim 1$. If you set wrongly, "Error6" arises.

## Chapter 7 Function Block

### 7.9 Error Function blocks

### 7.9.1 Error Reset (APM_RST)

| Form of Function Block | Description |
| :---: | :---: |
|  APM_RST    <br> BOOL- REQ DONE BOOL  <br> USINT- BASE STAT OUINT  <br> USINT- SLOT    <br> USINT- AXIS    <br> BOOL-     <br>      <br>      <br>      | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command <br> INHL_OFF: Cancel output inhibition <br> 0~1 (0: not cancel output inhibition, <br> 1: cancel output inhibition) <br> Output <br> DONE : Maintain 1 after first operating <br> 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 $0 \sim 1$. If you set wrongly, "Error6" arises.
(3) This is for resetting the errors when error such as parameter setting range excess occurs during operation.
(4) For error causing output inhibition, set INHL_OFF as 1 and execute function block to cancel output inhibition.

### 7.10 Other Function Blocks

### 7.10.1 Floating Origin Setting (APM_FLT)

| Form of Function Block | Description |
| :---: | :---: |
|  APM_FLT    <br>  BOOL REQ DONE BOOL <br> USINT- BASE STAT -UINT  <br> USINT- SLOT    <br> USINT-     <br> AXIS     | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command <br> Output <br> DONE : Maintain 1 after first operating <br> 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 $0 \sim 1$. If you set wrongly, "Error6" arises.

## Chapter 7 Function Block

### 7.10.2 M code Release (APM_MOF)

| Form of Function Block | Description |
| :---: | :---: |
| APM_MOF    <br> BOOL REQ DONE -BOOL <br> USINT- BASE STAT - UINT <br> USINT- SLOT   <br> USINT-    <br>     <br>     <br>     | Input <br> REQ : Request for execution of function block <br> BASE : Set the base no. with module <br> SLOT : Set the slot no. with module <br> AXIS : Axis to command <br> Output <br> DONE : Maintain 1 after first operating <br> 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 $0 \sim 1$. If you set wrongly, "Error6" arises.

## Chapter 8 Program

## Chapter 8 Program

Here describes the basic program that operate positioning module case by using its commands.

### 8.1 Example of XBC Programming

### 8.1.1 General description

Here we supposed the positioning module installed at the slot no.3. In the real usage, you need to change its value according to your actual set up.

### 8.1.2 Current State Read

(1) Using SRD command
(b) Module position

(d) First address of device to save current axis state
(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 installed at the slot no.3.
(c) Axis of operation

Positioning module operate as 2 axes. In this example, number 0 through 1 means axis X through axis Y .
(d) 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 X will be saved from D00000 to D00012. How to setup a device function would be explained at the "Chapter 6.3.33 Reading Driving Condition."
(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 X driving signal, you need to setup a data as D00000.0, and to check error condition of axis Y , you need to configure as D0100.1.

## Chapter 8 Program

## (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 state information case by axis. For example, in this program above, "h0140" refers that state information of axis $X$. How to setup a memory address by axis would be explained at "Chapter 5.1.2 state Information."
(c) The first address of device which can save the current state 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 $X$ driving signal, you need to setup a data as D00000.0, and to check error condition of axis Y , you need to configure as D0100.1.

## Chapter 8 Program

### 8.1.3 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 executes Floating Origin Setting (FLT) command.
(b) Operating state by axis

According to exercise from "Chapter 8.1.2 Current State Reading," it is a signal of "Operating" for each axis.
In case relevant axis is in operation, it will be on. Since FLT command can't be executed during operation sets to be executed when axis is not in operation. In case FLT is executed during operation, "error 212" would be appeared.
(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.
(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 Floating Origin Setting. XBF-PD02a series supports for 2 axes. In the "execution of axis" from the configuration of Floating Origin Setting, you can set a value 0 or 1.

## Chapter 8 Program

(2) Jog Operation
(b) Operation state by axis

(d) Error state for each axis
(a) Condition of Jog operation
(a) Condition of Jog Operation

Condition of Jog Operation Command
(b) 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.
(c) 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.
(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.

## Chapter 8 Program

(e) 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.

## Chapter 8 Program

(3) Inching Operation

(b) 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.
(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 Inching Operation. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Inching Operation, you can set a value 0 or 1.
(f) Amount of Inching Operation Movement Measure the amount of moving range by Inching Operation.
(h) Reference for Inching Operation is from "Chapter 9.3.2."

## Chapter 8 Program

### 8.1.4 Parameter and Operation Data Setting

(1) Parameter Setting

(f) Axis of command execution
(a) Condition of basic parameter setting command

Condition of basic parameter setting command (TBP)
(b) Condition of home/manual parameter setting command Condition of home/manual parameter setting command (THP)
(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.
(f) Axis of command execution

You can set an axis for Parameter Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 or 1.

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(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."
(h) List of Changing Parameter

You need to set a list for parameter ( g ) changing from set command. Once operating is working, this value will change to parameter (g). For more information of list of changing parameter look for "Chapter 6. Command."

## Chapter 8 Program

## (2) Operating Data Teaching


(a) Condition of Operating Data Command

Condition of Operating Data Command (TMD)
(b) 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 Operating Data Setting while it is running, the "error 472" would be appeared.
(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.
(d) Address of Positioning Module In this example, Positioning Module installed at the slot no.3.
(e) Axis of command execution

You can set an axis for Parameter Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 or 1.
(f) Value of Changing Parameter

You can set a value of changing parameter.
(g) 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 1000 ms .

| Setting Value | Items |
| :---: | :---: |
| 1 | Goal Position |
| 2 | Circular interpolation auxiliary position |
| 3 | Operating speed |
| 4 | Dwell Time |
| 5 | M code No. |
| 6 | Circular interpolation turns |
| 7 | Operation method |
| 8 | Control method |

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| Setting Value | Items |
| :---: | :---: |
| 9 | Operting pattern |
| 10 | Coordinates |
| 11 | Size of Circular arc |
| 12 | Acc. No. |
| 13 | Dec. No. |
| 14 | Circular interpolation method |
| 15 | Circular interpolation direction |
| 16 | Repeat step number |

(h) Changing Operating Data Step

You can configure the changing operating data step number by using the operating data step command. XBF-PD02A supports 150 steps for each axis. This value supports from number 0 to 150 . The numbers are considered as a step meaning number $1 \sim 150$ are same as 1~150 steps. When you set this value as 0 means that you will stay put with current value.

## Chapter 8 Program

(3) Operation Data Teaching Array

(a) Condition of Teaching Array

Condition Write Teaching Array Data (TWR), Teaching Array Command (TEAA)
(b) 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. If you execute Teaching Array while it is running, the "error 461" would be appeared when it is Position Teaching or the "error 463" would be appeared when it is Speed Teaching.
(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.

## Chapter 8 Program

(e) 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 axis 1 through 4 axes.
(f) 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 |

(g) Amount of Saving Teaching data

Decide how many data will be saved by using TWR 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.
(h) 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 $X$ will be operate on 10 steps from $7^{\text {th }}$ step, hence it will be operate between $7^{\text {th }}$ step and $16^{\text {th }}$ step.
(i) 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. The frequency of ROM teaching is limited to 100,000.
(j) 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.

## Chapter 8 Program

(k) 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"
(I) Write Teaching Data (TWR) of above example also be operated, using command PUT.


For more information about each saving Teaching Data, look for reference from "Chapter 5.1.1." When you are using a command "PUT," you need to setup a type of data as a "WORD" not a "DINT" considered its size.

## Chapter 8 Program

(4) Saving Current Data

(a) Condition of Saving Current Data

Condition of Saving Current Data Command (WRT). When current saving data operated, those values of module parameter and operating data would be saved in Flash memory. Therefore configuration of Ram Teaching would be constantly saved whether power is on or not.
(b) Operation state \& error state

According to exercise from "Chapter 8.1.2 Current State Reading", it is a signal of "operation state and error state" for each axis. Since Saving Current Data command can't be executed, condition is set to be executed when both axes are not in operation. If you execute Saving Current Data command during operation, error 172 occurs.
(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 Parameter Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 or 1.
(e) 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 flash memory, which make constantly stable whether its power is on or not.

| $15 \sim 2$ Bit | 1Bit | 0Bit |
| :---: | :---: | :---: |
| N/A | axis $Y$ | axis $X$ |

## Chapter 8 Program

### 8.1.5 Positioning Operation

## (1) Homing


(a) Condition of Homing

Condition of Homing Command (ORG)
(b) 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.
(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 Inching Operation. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Manual Operation, you can set a value 0 or 1.
(f) For more information, reference for Homing is in the "Chapter 9.1."

## Chapter 8 Program

## (2) Direct Start


(a) Condition of Direct Start

Condition of Direct Start Command (DST)
(b) 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.
(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.
(e) Axis of command execution

Set the axis to execute direct start
(f) 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."
(g) 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."

## Chapter 8 Program

(h) 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"
(i) 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"
(j) 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.

| $15 \sim 12$ | $11 \sim 10$ | $9 \sim 8$ | $7 \sim 5$ | 4 | $3 \sim 2$ | $1 \sim 0$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | Dec. Time | Acc. Time | - | $0:$ Absolute <br> $1:$ Ralative | - | $0:$ Position <br> control <br> $1: S p e e d$ <br> control |

## Chapter 8 Program



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.
(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.
(e) 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 axis 1 through 4 axes.
(f) Operating step number by Indirect Start

Set the operating step number by indirect start for main command axis.
(g) Indirect start operates by appointing step of position data for each axis. For more information, reference for Setting of Operating Data is in the "Chapter4.6."
(4) Simultaneous Start

(a) Condition of Simultaneous Start

Condition of Simultaneous Start Command
(b) 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 Axis Simultaneous Start while it is running, the "error 291" would be appeared.
(c) Simultaneous start step per axis

These are step numbers to execute simultaneous start per axis. Since XBF-PD02A supports two axes, step number of axis $Z$ is meaningless.
(d) Address of Positioning Module In this example, Positioning Module installed at the slot no.3.
(e) Axis of command execution

You can set an axis for Parameter Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 or 1.
(g) 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.

| $15 \sim 2$ Bit | 1 Bit | OBit |
| :---: | :---: | :---: |
| Not use | Axis Y | Axis X |

## Chapter 8 Program

(5) Speed Synchronization

(a) Condition of Speed Synchronization

Condition of Speed Synchronization Command (SSS)
(b) 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.
(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 Parameter Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 or 1.
(f) Ratio of Main Axis

Set value for Ratio of Main Axis to execute a Speed Synchronization.
(g) 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 .
(h) 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.

## Chapter 8 Program

| Setting value | Main Axis |
| :---: | :---: |
| 0 | Axis X |
| 1 | Axis Y |
| 2 | Encoder |

(i) For more information, reference for Speed Synchronization is in the "Chapter 9.4.1."
(6) Position Synchronization

(a) Condition of Position Synchronization

Condition of Position Synchronization Command (SSP)
(b) 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 Synchronization while it is running, the "error 341" would be appeared.
(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 Parameter Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 or 1.
(g) Main axis position

You can set the position of main axis to execute position synchronization. Sub axis start when main axis reaches this position.
(h) Step number of sub axis

You can set the operating step number of sub axis which is executed by position synchronization.

## Chapter 8 Program

(i) Main Axis Setting

Setting of main axis to operate Position Synchronization. This setting is for main axis of Position Synchronization. This setting cannot be set as same value as command axis, and possible setting values are as below.

| Setting value | Main Axis |
| :---: | :---: |
| 0 | Axis X |
| 1 | Axis Y |

(j) For more detail on position synchronization, refer to "9.4.2 position synchronization"

## Chapter 8 Program



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 be configured while it is running hence configuration will only be configured when it is running.
(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.
(e) Axis of command execution

You can set an axis for Parameter Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 or 1.
(f) 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 "0~65,535." 1~65,535 means Deceleration Time set as $1 \mathrm{~ms} \sim 65,535 \mathrm{~ms}$. If it set as " 0 ," it will be operated with set deceleration value. (For example, in case of indirect start, it will stop with deceleration time set in operation data.). During speed synchronization operation, DEC. stop is used to stop speed synchronization operation.
(g) For more information, reference of Deceleration Stop is in the "Chapter 9.2.12."

## Chapter 8 Program

(8) Emergency Stop

(a) Condition of Emergency Stop

Condition of Emergency Stop Command (EMG)
(b) Address of Positioning Module

In this example, Positioning Module installed at the slot no.3.
(c) Axis of command execution

You can set an axis for Parameter Setting. XBF-PD02A supports for2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 or 1.
(d) Emergency Stop is operating by each axis.

Once Emergency Stop command executes the error "481" would be occurred and it stops immediately.
(e) For more information, refer to (3) Emergency Stop is in the "Chapter 9.2.12."

## Chapter 8 Program

(9) M code Cancellation

(a) Condition of M code Cancellation

Condition of $M$ code Cancellation (MOF). Once $M$ code Cancellation command executed, number of $M$ code would be change to "0," and signal of M code to "Off."
(b) 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 Cancellation command can only be valid once M code are generated. The condition for execution is operation possible when it is "On."
(c) Address of Positioning Module In this example, Positioning Module installed at the slot no.3.
(d) Axis of command execution

You can set an axis for Parameter Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 or 1.
(e) For more information, reference of $M$ code Cancellation is in the "Chapter 9.6.2."

## Chapter 8 Program

### 8.1.6 Operation Setting Change while Operating

(1) Speed Override

(a) Condition of Speed Override

Condition of Speed Override Command (SOR)
(b) 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.
(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.
(e) Axis of command execution

You can set an axis for Parameter Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 or 1.
(f) 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 Pulse/Second depends on Speed Command Unit from basic parameters. If a changing Operation Speed Value is "\%," then the unit would be [ $\times 10^{-2} \%$ ].
(g) For more information, reference of Speed Override is in the "Chapter 9.5.3."

## Chapter 8 Program

(2) Position Override

(a) Condition of Position Override

Condition of Position Override Command (POR)
(b) 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.
(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.
(e) Axis of command execution

You can set an axis for Parameter Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 or 1.
(f) 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.
(g) For more information, reference of Position Override is in the "Chapter 9.5.2."

## Chapter 8 Program

(d) Address of Positioning Module
(e) Axis of command execution
/

(a) Condition of Position Assign Speed Override Condition of Position Assign Speed Override Command (PSO)
(b) 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.
(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 Parameter Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 or 1.
(f) 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.
(g) 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 Pulse/Second depends on Speed Command Unit from basic parameters. If a changing Operation Speed Value is "\%," then the unit would be [ $\times 10^{-2} \%$ ].
(h) For more information, reference of Position Assign Speed Override is in the "Chapter 9.5.4."

## Chapter 8 Program

(4) Speed/Position Switching Control

(f) Axis of command execution
(a) Condition of Speed/Position Switching Control

Condition of Speed/Position Switching Control Command (VTP)
(b) 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.
(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) 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.
(e) Address of Positioning Module In this example, Positioning Module installed at the slot no.3.
(f) Axis of command execution

You can set an axis for Parameter Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 or 1.
(g) For more information, reference of Speed/Position Switching Control is in the "Chapter 9.2.9."

## Chapter 8 Program

(5) Position/ Speed Switching Control

(a) Condition of Position/ Speed Switching Control

Condition of Position/ Speed Switching Control Command (PTV)
(b) 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.
(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) 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.
(e) Address of Positioning Module

In this example, Positioning Module installed at the slot no.3.
(f) Axis of command execution

You can set an axis for Parameter Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 or 1.
(g) For more information, reference of Position/ Speed Switching Control is in the "Chapter 9.2.10."

## Chapter 8 Program

(6) Current Step Change (Start Step Number Change)

(a) Condition of Current Step Change

Condition of Current Step Change Command (SNS). Once Current Step Change is executed, current operation step will move set step.
(b) 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.
(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 Parameter Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value for axis 0 or 1.
(f) Change Step Number

Set change step number by Current Step Change. XBF-PD02A support 150 step operation data for each Axis. Therefore, the range of step number setting of Current Step Change is 1~150.
(g) For more information, reference of Current Step Change is in the "Chapter 9.5.7."

## Chapter 8 Program

## (7) Repeat Step No. Change


(a) Condition of Repeat Step No. Change
(a) Condition of Repeat Step No. Change

Condition of Repeat Step No. Change Command (SRS). Once Repeat Step No. Change is executed, repeat operation step will move set step. When current step is complete, the next start step will be the step set in repeat step.
(b) 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.
(c) Address of Positioning Module In this example, Positioning Module installed at the slot no.3.
(d) Axis of command execution

You can set an axis for Parameter Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 or 1.
(e) Change Step Number

Set change step number by Current Step Change. XBF-PD02A series support 150 step operation data for each Axis.
Therefore, the range of step number setting of Current Step Change is 1~150.
(f) For more information, reference of Repeat Step No. Change is in the "Chapter 9.5.8."
(8) Current Position Preset

(a) Condition of Current Position Preset

Condition of Current Position Preset Command (SNS). 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) 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.
(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.
(e) Axis of command execution

You can set an axis for Parameter Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 or 1.
(f) Change Current Position

Set change current position by Current Position Preset. Unit is pulse.
(g) For more information, reference of Current Position Preset is in the "Chapter 9.5.5."

## Chapter 8 Program

## (9) Encoder Preset


(a) Condition of Encoder Preset

Condition of Encoder Preset Command (EPRS). 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.
(c) Axis of command execution

You can set an axis for Encoder preset. You can input 0 (axis X) or 1 (axis Y). But in case of XBF-PD02A, it supports only one encoder. So any value doesn't affect the EPRS instruction.
(d) Changing Encoder Position

Set for Changing Encoder Position
(e) For more information, reference of Encoder Preset is in the "Chapter 9.5.6."

## Chapter 8 Program

### 8.1.7 Error

## (1) Error Reset

## (c) Address of Positioning Module


(a) Condition of Error Reset

Condition of Error Reset Command (CLR). Once Error Reset is executed, it erases errors of module form each axis.
(b) 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.
(c) Address of Positioning Module

In this example, Positioning Module installed at the slot no.3.
(d) Axis of command execution

You can set an axis for Parameter Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 or 1.
(e) Cancel output inhibition

In case of output inhibition, you can select whether to cancel output inhibition or not. If it is 0 , doesn't cancel output inhibition. If it is 1 , cancels output inhibition.

## Chapter 8 Program

### 8.2 Example of IEC type Programming

### 8.2.1 General description

Here we supposed the positioning Module is installed at the 3 slot. In the real usage, you need to change its value according to your actual set up. And we supposed the axis $X$ and axis $Y$ is used.

### 8.2.2 Current State Read

(1) Bit Information about Operation state Reading (APM_SRD)


## Chapter 8 Program

(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) Axis of operation

If you command each axis, need to set Axis of command execution. XBF-PD02A can control max. 2 axes and Axis of command execution 0~1 means axis $\mathrm{X} \sim$ axis Y .
(d) The position for saving bit information

Set the device to save bit state value of axis from the positioning module with APM_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.
(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 8 Program

(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.

## Chapter 8 Program

(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) Axis of operation

If you command each axis, need to set Axis of command execution. XBF-PD02A can control max. 2 axes, Axis of command execution 0~1 means axis $\mathrm{X} \sim$ axis Y .
(d) The position for saving operation information

Set the device to save operation state value of axis from the APM module with APM_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 \%MD6. For the detail description about the device saved, refer to "7.3.1 Operation Information Reading (APM_CRD)".
(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 8 Program

## (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 value

The current value of encoder is displayed.
(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.

## Chapter 8 Program

### 8.2.3 Operation Test

## (1) Floating Origin Setting

Decide origin of current motor's position without set a machinery origin.
(d) Address of Positioning Module

(a) This is the condition for running a Floating Origin Setting
(a) This is the condition for running a Floating Origin Setting
(b) Operating state by axis

According to exercise from "Chapter 8.2.2 Current State Reading," it is a signal of "Operating" for each axis.
This command can be executed when axis is not in operation. If you execute this command during operation, error code 211 occurs.
(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.
(e) Axis of command execution

You can set an axis for Floating Origin Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Floating Origin Setting, you can set a value 0 or 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.

## Chapter 8 Program

(2) Jog Operation
(c) State of driving control by axis

(b) Operating state by axis
(a) Condition for Jog Operation
(a) This is the condition for Jog Operation This is the condition for Jog Operation Command
(b) 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.
(c) 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.

## Chapter 8 Program

(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) JOG operation execution for each axis

JOG operation command is not executed by using instruction but by set or clear relevant bit of $U$ device. In the above example, if condition for JOG condition is on, $X$ axis JOG (CW) will be on, $X$ axis JOG (CCW) will be off and $X$ axis JOG LOW/HIGH SPEED will be on. So JOG CW HIGH SPEED operation will be exetuted. For $U$ device, refer to "5.2.1". U device is refreshed at scan end.

## Chapter 8 Program

(3) Inching Operation

(a) This is the condition for Inching Operation

This is the condition for Inching Operation Command (APM_INC)
(b) Operating state by axis

According to exercise from "Chapter 8.2.2 Current State Reading," it is a signal of "Operating" for each axis.
This command can be executed when axis is not in operation. If you execute this command during operation, error code 401 occurs.
(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.

## Chapter 8 Program

(e) Axis of command execution

You can set an axis for Inching Operation. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Inching Operation, you can set a value for axis X through axis Y .
(f) Amount of Inching Operation Movement

Measure the amount of moving range by Inching Operation.
(g) 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.
(h) Error Status

This is the area that output error no. if there are errors in operation of function block.
(i) Reference for Inching Operation is from "Chapter 7.6.1."

## Chapter 8 Program

### 8.2.4 Parameter and Operation Data Setting

(1) Parameter Setting
(a) Condition for Parameter Setting Command

(a) This is the condition for Parameter Setting Command

This is the condition for Basic Parameter Setting Command (APM_SBP)
(b) This is the condition for Home/Manual Parameter Setting Command

This is the condition for Home/Manual Parameter Setting Command (APM_SHP)

## Chapter 8 Program

(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. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 or 1.
(g) Value of Changing Parameter

You can set a value of changing parameter. For more information about Parameter Value Changing look for "Chapter 7. Function Block." 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 7. Function Block." In case of setting I/O parameter, the value would be parameter value itself. Therefore changing of list would not be necessary.
(i) Execution content of each function block is as follows.

APM_SBP: changes acc. time 2 of axis $X$ basic parameter into 200ms
APM_SBP: changes bias speed of axis $X$ basic parameter into 5
APM_SHP: changes home address of axis X home/manual parameter into 0 .
APM_SHP: changes JOG high speed of axis Y home/manual parameter into 10000.

## Chapter 8 Program

## (2) Operating Data Setting


(a) This is the condition for Operating Data Command This is the condition for Operating Data Command (SMD)
(b) 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 Operating Data Setting while it is running, the "error 472 " would be appeared.

## Chapter 8 Program

(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.
(e) Axis of command execution

You can set an axis for Parameter Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 or 1.
(f) Operation data step to change

Set the operation data step no. to change with operation data setting command. XBF-PD02A can set 150 step operation data per each axis and the data would be 0 to 150 . If the data is set as " 0 ", it means "Current step" of operation data of corresponding axis.
(g) 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 1000 ms .

| Setting <br> value | Operation Data |
| :---: | :--- |
| 1 | Goal position |
| 2 | Circular interpolation support position |
| 3 | Operation speed |
| 4 | Dwell time |
| 5 | M code No. |
| 6 | Circular interpolation turns |
| 7 | Operation method |
| 8 | Control method |
| 9 | Operation pattern |
| 10 | Coordinate |
| 11 | Arc size |
| 12 | Acceleration No. |
| 13 | Deceleration No. |
| 14 | Circle interpolation method |
| 15 | Circle interpolation direction |
| 16 | Repeat step number |

(h) Operation data value to change

Set the value of operation data to change.
(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.
(j) Error State

This is the area that output error no. if there are errors in operation of function block.

## Chapter 8 Program

(k) Execution content of each function block is as follows.

Operation data setting for axis X : sets the goal position on step no. 2 of axis X operation data as 10000
Operation data setting for axis Y : sets \%MB112 (Operation data item of axis Y) of axis Y operation data \%MW41 (Operation step of axis Y) step as \%MD27 (Operation data value of axis Y).

Chapter 8 Program
(3) Operation Data Teaching Array


## Chapter 8 Program

(a) This is the condition for Teaching Array

Condition Teaching Array Command (APM_ATEA)
(b) 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. If you execute Teaching Array while it is running, the "error 461" would be appeared when it is Position Teaching or the "error 463" would be appeared when it is Speed Teaching.
(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.
(e) Axis of command execution

You can set an axis for Parameter Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 or 1.
(f) 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 $X$ will be operate from $22^{\text {th }}$ step, which is $10^{\text {th }}$ step away from $13^{\text {th }}$ step, hence it will be operate between $13^{\text {th }}$ step and $22^{\text {th }}$ step.
(g) 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. Frequency of ROM teaching is limited to 100,000.
(h) 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.
(i) 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 7.4.7"
(j) 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. 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 +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 +17 | 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 |

(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.
(I) 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.
Axis X Teaching Array : Execute RAM Teaching the position value of 10 steps from no. 13 to no. 22 of axis X as the value saved in \%MD50 ~ \%MD59.

Axis $Y$ Teaching Array : Execute Teaching array based on the value in variable.

## Chapter 8 Program

## (4) Saving Current Data


(a) This is the condition for Saving Current Data

This is the condition for Saving Current Data Command (APM_WRT). When current saving data operated, those values of module parameter and operating data would be saved in flash memory. Therefore configuration of Ram or Ram Teaching would be constantly saved whether power is on or not.
(b) Operation state \& error state

According to exercise from "Chapter 8.1.2 Current State Reading", it is a signal of "operation state and error state" for each axis. Since Saving Current Data command can't be executed, condition is set to be executed when both axes are not in operation. If you execute Saving Current Data command during operation, error 172 occurs.
(c) Address of Positioning Module

In this example, Positioning Module is installed at the 3 slot.
(d) Axis of command execution

You can set an axis for Parameter Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 or 1.
(e) 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 flash memory, which make constantly stable whether its power is on or not.

| $15 \sim 2$ Bit | 1 Bit | OBit |
| :---: | :---: | :---: |
| N/A | axis $Y$ | axis $X$ |

(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.

### 8.2.5 Positioning Operation

(1) Homing
(e) Address of Positioning Module
$\begin{array}{ll} & \text { (e) State of Operation complete }\end{array}$
(a) Condition for Homing

(a) This is the condition for Homing This is the condition for Homing Command (APM_ORG)
(b) 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.
(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.

## Chapter 8 Program

(d) Address of Positioning Module

In this example, Positioning Module is installed at the 3 slot.
(e) Axis of command execution

You can set an axis for Inching Operation. XBF-PD02A supports for 2 axes. In the "execution of axis", you can set a value 0 (Axis X ) or 1 (Axis Y ).
(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 for Homing is in the "Chapter 9.1."

Chapter 8 Program
(2) Direct Start

(a) This is the condition for Direct Start This is the condition for Direct Start Command (APM_DST)
(b) 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.

## Chapter 8 Program

(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 Inching Operation. XGF series supports for 4 axes. In the "execution of axis" from the configuration of Manual Operation, you can set a value 0 (axis X ) or 1 (axis Y ).
(f) Address

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."
(g) Speed

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."
(h) Dwell Time

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"
(i) 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"
(j) Control method

Set direct start. Follows are executed depending on setting value.
0 : Position control
1 : Speed control
(K) Coordinates setting

Set the operating coordinates of direct start. Followings are executed depending on setting value.
0 : Absolute coordinates
1 : Relative coordinates
(I) ACC/DEC No.

Set the ACC/DEC No. used in positioning control. It operates by corresponding ACC/DEC Time of basic parameter depending on setting value. Data type is USINT.

Chapter 8 Program

| $7 \sim 4$ | $3 \sim 2$ | $1 \sim 0$ |
| :---: | :---: | :---: |
|  | $0:$ DEC no.1 | $0:$ ACC no.1 |
| - | $1:$ DEC no.2 | $1:$ ACC no.2 |
|  | $2:$ DEC no.3 | $2:$ ACC no.3 |
|  | $3:$ DEC no.4 | $3:$ ACC no.4 |

(m) 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.
(n) Error State

This is the area that output error no. if there are errors in operation of function block.
(o) The function block used in the example is as follows.

Axis $X$ Direct Start : Execute position control with Axis $X$ Goal Position \%MD80(axis $X$ goal position), Goal Speed \%MD81(axis Goal Speed), Dwell time 100ms, M code 0, Absolute coordinates, Acc. Time1, Dec Time 1

Axis Y Direct Start : Execute position control with Axis X Goal Position \%MD82(axis X Goal position), Goal Speed \%MD83(axis $X$ Goal Speed), Dwell time 500ms, M code 0, Relative coordinates, Acc. Time 2, Dec Time 2

## Chapter 8 Program

(3) Indirect Start
(c) Error state for each axis

(d) Address of Positioning Module
(a) This is the condition for Indirect Start This is the condition for Indirect Start Command (APM_IST)
(b) 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.
(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. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 (axis X ) or 1 (axis Y ).
(f) Operating step number by Indirect Start

Set the operating step number by indirect start for main Axis of command execution.

## Chapter 8 Program

(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) Indirect start operates by appointing step of position data for each axis. Therefore it could run those commands of Positioning control, Speed control, Linear circular interpolation depends on setting of positioning data. For more information, reference for Setting of Operating Data is in the "Chapter4.6."
(j) The operation of function block is as follows.

Axis1 Indirect Start : Execute step no. 1 of axis $X$ by indirect start
Axis2 Indirect Start : Execute \%MW168(Indirect start step) of axis Y by indirect start

## Chapter 8 Program

## (4) Synchronous Start


(a) This is the condition for Simultaneous Start

This is the condition for Simultaneous Start Command
(b) 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 Axis $X$ Simultaneous Start while it is running, the "error 291" would be appeared.
(c) 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.
(d) Address of Positioning Module In this example, Positioning Module is installed at the 3 slot of 0 bases.

## Chapter 8 Program

(e) 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. Since XBF-PD02A supports up to two axes, set this WORD as 3.

| $15 \sim 2$ Bit | 1 Bit | OBit |
| :---: | :---: | :---: |
| N/A | Axis X | Axis Y |

(f) Simultaneous start step no. per each axis

Set the step no. of each axis for Simultaneous start. XBF-PD02A can control 2 axes, it doesn't use Z_STEP input.
(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.
(j) The function block used in the example is as follows.

Simultaneous start: Execute no. 10 operation step of axis X and step of \%MW170 (axis Y Simultaneous start step) Simultaneously.

## Chapter 8 Program

## (5) Speed Synchronization


(a) This is the condition for Speed Synchronization

This is the condition for Speed Synchronization Command (APM_SSS)
(b) 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.
(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. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 (axis X ) or 1 (axis Y ).
(f) 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.

| Setting value | Main axis |
| :---: | :---: |
| 0 | X - axis |
| 1 | Y - axis |
| 2 | Encoder |

(g) Ratio of Main Axis

Set value for Ratio of Main Axis to execute a Speed Synchronization.
(h) 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.
(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) For more information, reference for Speed Synchronization is in the "Chapter 9.4.1."

## Chapter 8 Program

## (6) Position Synchronization


(a) This is the condition for Position Synchronization This is the condition for Position Synchronization (APM_SSP)
(b) 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 Synchronization while it is running, the "error 341 " would be appeared.
(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. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 (axis X ) or 1(axis Y ).
(f) Step of Subordinate Axis

Set step number for Subordinate Axis to execute a Position Synchronization.
(g) Value of Main Axis

Set value for Main Axis to execute Position Synchronization. Therefore main axis will be executed the command when the subordinate axis reaches this set value.
(h) Main Axis Setting

Set a main axis to operate Speed Synchronization. This setting is for main axis of Position 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 |
| :---: | :---: |
| 0 | Axis X |
| 1 | Axis Y |

(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.
(I) For more information, reference for Synchronous Start by Position is in the "Chapter 9.4.2."

## Chapter 8 Program

## (7) Deceleration Stop


(a) This is the condition for Deceleration Stop This is the condition for Deceleration Stop Command (APM_STP)
(b) 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.
(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. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 (axis X ) or 1 (axis Y ).

## Chapter 8 Program

(f) 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 "0~65,535." 1~65,535 means Deceleration Time set as 1 ms ~ $65,535 \mathrm{~ms}$. If it set as " 0 ," it will be operated with set deceleration value. Also it use to stop Speed Synchronization Operation while Speed Synchronization Operation.
(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 Deceleration Stop is in the "Chapter 9.2.12."
(j) Operation of each function block is as follows.

Axis1 Dec. Time : When axis $X$ is in operation, decelerate to \%MW96(axis $X$ Dec. stop Time), then stop.
Axis2 Dec. Time : When axis $Y$ is in operation, decelerate to 1000 ms , then stop.

## Chapter 8 Program

## (8) Emergency Stop


(b) Address of Positioning Module
(a) This is the condition for Emergency Stop

This is the condition for Emergency Stop Command (APM_EMG)
(b) Address of Positioning Module

In this example, Positioning Module is installed at the 3 slot of 0 bases.
(c) 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.
(d) Error State

This is the area that output error no. if there are errors in operation of function block.
(e) Emergency Stop is operating by each axis.

EMG stop command is applied to both axis X and axis Y . Once it is executed, both axes occurs error code 481 and stop without deceleration
(f) For more information, reference of Emergency Stop is in (3) EMG stop of "Chapter 9.2.1."

## Chapter 8 Program

## (9) M code Cancellation


(a) This is the condition for M code Cancellation

This is the condition for M code Cancellation (APM_MOF). Once M code Cancellation command executed, number of $M$ code would be change to " 0 ," and signal of $M$ code to "Off."
(b) 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."
(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. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 (axis X ) or 1 (axis Y ).
(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) For more information, reference of M code Cancellation is in the "Chapter 9.6.2."

## Chapter 8 Program

### 8.2.6 Operation Setting Change while Operating

(1) Speed Override

(a) This is the condition for Speed Override

This is the condition for Speed Override Command (APM_SOR)
(b) 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.
(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.

## Chapter 8 Program

(e) Axis of command execution

You can set an axis for Parameter Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 (axis X ) or 1 (axis Y ).
(f) 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 Pulse/Second. If a changing Operation Speed Value is " $\%$," then the unit would be [ $\times 10^{-2} \%$ ].
(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) The function block in the example above is as follows.

Axis $X$ Speed Override : The operating speed of axis $X$ will be changed to speed value saved in \%MD97 and then continue to operate.
Axis $Y$ Speed Override : The operating speed of axis $Y$ will be changed to 20000 and then continue to operate.
(j) For more information, reference of Speed Override is in the "Chapter 9.5.3."

## Chapter 8 Program

## (2) Position Override


(a) This is the condition for Position Override This is the condition for Position Override Command (APM_POR)
(b) 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.
(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.

## Chapter 8 Program

(e) Axis of command execution

You can set an axis for Parameter Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 (axis X ) or 1 (axis Y ).
(f) Change for Goal Position Value

Setting Value Change for Goal Position Value. Once Position Override commands are executed, the goal position of executed axis will be changed to set goal position.
(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) The function block in the example above is as follows.

Axis X Position Override : Goal position of axis $X$ is changed to the value saved in \%MD98.
Axis Y Position Override: Goal position of axis $Y$ is changed to the value saved in \%MD99.
(j) For more information, reference of Position Override is in the "Chapter 9.5.2."

## Chapter 8 Program

## (3) Position Assign Speed Override



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.
(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

## Chapter 8 Program

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. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 (axis X ) or 1 (axis Y ).
(f) 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.
(g) 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 Pulse/Second. If a changing Operation Speed Value is "\%," then the unit would be [ $\times 10^{-2} \%$ ].
(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.

Axis X Positioning Speed Override : When the current position of axis X become the same position as the position saved in \%MD100, the speed value will be changed to the speed saved in \%MD97.

Axis Y Positioning Speed Override : When the current position of axis $X$ become 50000, the speed will be changed to 100000.
(k) For more information, reference of Position Assign Speed Override is in the "Chapter 9.5.4."

## Chapter 8 Program

## (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 (APM_VTP)
(b) 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.
(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) 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.
(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. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 (axis X ) or 1 (axis Y ).
(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 Speed/Position Switching Control is in the "Chapter 9.2.9."

## Chapter 8 Program

## (5) Position/ Speed Switching Control


(a) This is the condition for Position/ Speed Switching Control This is the condition for Position/ Speed Switching Control Command (APM_PTV)
(b) 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.
(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) 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.
(e) Address of Positioning Module In this example, Positioning Module is installed at the 3 slot of 0 bases.

## Chapter 8 Program

(f) Axis of command execution

You can set an axis for Parameter Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 (axis X ) or 1 (axis Y ).
(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 Position/ Speed Switching Control is in the "Chapter 9.2.10".

## Chapter 8 Program

(6) Current Step Change (Start Step Number Change)

(a) Condition for Current Step Change
(a) This is the condition for Current Step Change

This is the condition for Current Step Change Command (APM_SNS). Once Current Step Change is executed, current operation step will move set step.
(b) 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.
(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.

## Chapter 8 Program

(e) Axis of command execution

You can set an axis for Parameter Setting. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 (axis X ) or 1 (axis Y ).
(f) Change Step Number

Set change step number by Current Step Change. XBF-PD02A supports 150 step operation data for each Axis. Therefore, the range of step number setting of Current Step Change is 1~150. In the above example, current step of axis $X$ changes into step no. 50 and that of axis $Y$ changes into step no. designated at \%MW202 (Axis Y start step)
(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 Current Step Change is in the "Chapter 9.5.7."

## Chapter 8 Program

## (7) Repeat Step No. Change

(b) Error state for each axis

(a) This is the condition for Repeat Step No. Change

This is the condition for Repeat Step No. Change Command (APM_SRS). 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) 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.
(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. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 (axis X ) or 1 (axis Y ).
(e) Change Step Number

Set change step number by Current Step Change. XBF-PD02A supports 150 step operation data for each Axis. Therefore, the range of step number setting of Current Step Change is 1~150. In the example, Axis $X$ and axis $Y$ are changed to step no. 11 and step no. saved in \%MW203 (axis Y repeat step).
(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 Repeat Step No. Change is in the "Chapter 9.5.8."

## Chapter 8 Program

(8) Current Position Preset

(a) This is the condition for Current Position Preset

This is the condition for Current Position Preset Command (APM_SNS). 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) 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.
(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.

## Chapter 8 Program

(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. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 (axis X ) or 1(axis Y ).
(f) Change Current Position

Set change current position by Current Position Preset. Unit follows the value from "Unit" of basic parameter. In the example, Axis X and axis Y are changed to 5000 and the position saved in \%MD102 respectively.
(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 Current Position Preset is in the "Chapter 9.5.7."

## Chapter 8 Program

## (9) Encoder Preset


(a) This is the condition for Encoder Preset

This is the condition for Encoder Preset Command (APM_EPRE). 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. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 (axis X ) or 1 (axis Y ).
(d) Changing Encoder Position

Set for Changing Encoder Position. In the example, the encoder position is changed to 2000.
(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) For more information, reference of Encoder Preset is in the "Chapter 9.5.6."

## Chapter 8 Program

### 8.2.7 Error

## (1) Error Reset


(a) This is the condition for Error Reset

This is the condition for Error Reset Command (APM_RST). Once Error Reset is executed, it erases errors of module form each axis.
(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) 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. XBF-PD02A supports for 2 axes. In the "execution of axis" from the configuration of Parameter Setting, you can set a value 0 or 1.
(e) Cancel output inhibition

You can select whether you cancel output inhibition or not. If 0 , doesn't cancel output inhibition. If 1, cancels output inhibition.
(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.

## Chapter 9 Functions

### 9.1 Homing

Homing is carried out to confirm the origin of the machine when applying the power. In case of homing, it is required to set homing parameter per axis. If the origin position is determined by homing, the origin detection signal is not recognized during positioning operation.

### 9.1.1 Homing method

(1) By DOG
(a) Origin detection after DOG "Off" (0: DOG/HOME (Off))
(b) Origin detection after deceleration when DOG "On" (1: DOG/HOME (On))
(c) Origin detection by DOG (2: DOG)
(2) By not using DOG
(a) Origin detection by origin and high/low limit (3: Upper/Lower limit/HOME)
(b) Origin detection by high/low limit (4: Upper/Lower limit)
※The items that effect to the homing from Software Package parameter are as follows.

### 9.1.2 Parameters for Homing

(1) Position of Origin
(2) Homing High Speed
(3) Homing Low Speed
(4) Homing acceleration time
(5) Homing deceleration time
(6) Homing dwell time
(7) Origin compensation amount
(8) Homing mode
(9) Homing Direction

- For further information about homing parameters and setting value, please refer to Chapter 4.


## Chapter 9 Functions

### 9.1.3 Origin Detection after DOG Off (0: DOG/HOME (Off))

This is the method using the DOG and origin signal and the action by homing command is as follows.
(1) Operation
(a) It accelerates to the setting homing direction and acts by homing high speed.
(b) In this case, if DOG signal is entered, it decelerates and acts by homing low speed.
(c) If origin signal is entered after the DOG signal has changed from "On" to "Off", the origin shall be determined and it stops.

- Operating Pattern



## NOTE

1. While DOG signal maintains "On", the origin will not be determined by origin signal.

That is, when DOG signal changes from "Off" to "On"(acceleration section -> homing high speed), from "On" to "Off" (deceleration section -> homing low speed) and then when the origin changes from "Off" to "On", the origin will be determined.

2. While the homing speed acts to the deceleration section by homing high speed after the DOG signal is changed from "Off" to "On", from "On" to "Off", the origin will not be determined even if encounters the origin input.

3. If the DOG signal is changed from "Off" to "On", from "On" to "Off" and encounters external high/low limit while waiting the origin input, the action is as follow.

4. If "On" time of the origin is short, the positioning module can not recognize it.

Origin


## Chapter 9 Functions

### 9.1.4 Origin Detection after Deceleration when DOG On (1: DOG/HOME (On))

This is the method using the DOG and origin signal and the action by homing command is as follows.
(1) Operation
(a) It accelerates to the setting homing direction and acts by homing high speed.
(b) In this case, if DOG signal is entered, it decelerates and acts by homing low speed.
(c) If encounters the origin signal as external input signal when the DOG is "On" while the homing low speed is active, the origin shall be determined and it stops.


## Note

1. Once the DOG signal is "On", when the homing speed acts from high speed to low speed via deceleration section, if the origin signal is entered in the state that the DOG signal is "ON", the origin will be determined promptly.
That is, when the homing speed decelerates, the origin will not be determined by the origin signal.
2. When encounters the external input high/low limit signal before origin after the DOG signal has changed from "Off" to "On", the action will be the same as the method of Article 9.1.3
3. If "On" time of origin signal is short, the positioning module can not recognize it.

## Chapter 9 Functions

### 9.1.5 Origin Detection by DOG (2: DOG)

This is used when determines the origin only by using the DOG.
(1) Operation
(a) It accelerates to the setting homing direction and acts by homing high speed.
(b) In this case, if DOG signal is entered, it decelerates and transferred to opposite direction acts by homing high speed.
(c) When it operates in opposite direction, if DOG is entered, it decelerates and transferred to opposite direction and acts by homing low speed.
(d) In this case, if encounters DOG origin signal, the origin would be determined and it stops.

- Operating Pattern



## Note

If "ON" time of DOG is longer than deceleration time, the action is as follows.


## Chapter 9 Functions

### 9.1.6 Origin Detection by Origin and Upper/Lower Limit (3: Upper/Lower Limit/Home)

This is the homing method using external input upper/lower signal and origin signal and is used in case of not using the DOG signal.
(1) Operation
(a) It accelerates to the setting homing direction and acts by homing high speed.
(b) In this case, if High/Low signal is entered, it transferred to opposite direction and acts by homing low speed.
(c) If encounters the origin signals while the homing low speed is active, the origin would be determined and it stops.

- Operating Pattern


Note
In case that origin signal is "ON" before entering the external input high/low limit signal, it carries out the homing low speed operation when the external input high/low limit signal is entered and when origin signal is "ON", the origin will be determined.


## Chapter 9 Functions

### 9.1.7 Origin Detection by Upper/Lower Limit (4: Upper/Lower Limit)

This is the homing method using the external input upper/lower limit signal and is used when not using the origin or DOG signal.
(1) Operation
(a) It accelerates to the setting homing direction and acts by homing high speed.
(b) In this case, if High/Low limit signal is entered, it transferred to opposite direction and acts by homing low speed.
(c) If encounters the origin signals while the homing low speed is active, the origin would be determined and it stops.

■ Operating Pattern


## Chapter 9 Functions

### 9.2 Positioning Control

Positioning control execute using data which set on the 「Operation Data」. Positioning Control includes Shortening Position control, Shortening Speed Control, Shortening Feed Control, Interpolation control, Speed/Position Switching control, Position/Speed Switching control and Position/Torque Switching control.

| Positioning Control |  | Control Method | Operation |
| :---: | :---: | :---: | :---: |
| Positioning Control | Position Control | Absolute, Position Control Incremental, Position Control | Specified axis executes positioning control from the beginning (current stop position) to the goal position. |
|  | Linear Interpolation | Absolute, Linear Interpolation Incremental, Linear Interpolation | Executing linear interpolation control by using starting address (current stop position) from the axis (2 axes or more) to the target position. |
|  | Circular Interpolation | Absolute, Circular Interpolation Incremental, Circular Interpolation | Execute positioning control until goal position by the trajectory of arc and control sub-axis as using axis-2 according to data of main axis. |
| Speed Control |  | Absolute, Speed Control Incremental, Speed Control | Execute Speed control as setting speed until deceleration stop command is entered. |
| Speed/Position Switching Control |  | Absolute, <br> Speed Control <br> Incremental, Speed <br> Control | Speed controlling and then speed / position switching command or speed / position control switching input signal is entered, speed control switch to position control and execute positioning control as much as target position. |
| Position/Speed Switching Control |  | Absolute, Position Control Incremental, Position Control | Position controlling and then position / speed switching command is executed, position control switch to speed control and execute speed control as setting speed 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 | Set the Type of control and Standard coordinates of Positioning control. |
| Operation pattern | Select one among END, KEEP, CONT |
| Control method | Select one among position control and speed control |
| Operation Method | Set the control method of continuous operation data. |
| Repeat step | In case of Repeat operation, sets the step to repeat. |
| Goal Position | Set the absolute target position or distance of positioning control. |
| Operation Speed | Set the value of operation speed during operation control. |
| Cir. Int. aux. point | Set the value of auxiliary point (MID, CENTER, RADIUS) in case of circular <br> interpolation |
| Cir. Int. mode | Set how to create circular arc (MID, CENTER, RADIUS). |
| M Code | Set the M Code when using the code number for sub operation of positioning control. |
| Acceleration Number | Set the operation number of operation control during acceleration time. <br> Acceleration Number is selected from basic parameters which are Acceleration <br> Number1, 2, 3, and 4. |
| Deceleration | Set the operation number of operation control during deceleration time. <br> Deceleration Number is selected from basic parameters which are Deceleration <br> Number1, 2, 3, and 4. |
| Dumber | After complete the positioning control, set the time until servo drive complete <br> positioning control. |
| Swell Time | Set the number of arcs to draw during circular interpolation. |
| Cir. Int. Turns | Set the direction in case of circular interpolation |
| Cir. Int. directionCirt. Size Set the size of circular arc in case of circular interpolation middle point method |  |

## Note

It is available to set the operation data each of 1~150 steps for each axis.

## Chapter 9 Functions

### 9.2.2 Operation mode of Positioning Control

Operation mode describes various configurations for how to operate the positioning data using several operation step no. and how to determine the speed of position data.
Operation mode types are as follows.

| Control Method | Operation Method | Operation Pattern |  | Operation |
| :---: | :---: | :---: | :---: | :---: |
| Positio ning Control | Single | End | $\bigcirc$ | Terminated after the completion of the current step position control |
|  |  | Keep | $\bigcirc$ | Continue to the next step after the completion of the current step position control |
|  |  | Continuous | $\bigcirc$ | The current step and the next step in a continuous drive speed |
|  | Repeat | End | $\bigcirc$ | Repeat the step after the completion of the current step position control to change the step number |
|  |  | Keep | $\bigcirc$ | Repeat the step after the completion of the current step position control continues to drive |
|  |  | Continuous | $\bigcirc$ | Repeat the step and the successive steps in the current driving speed |
| Speed Control | Single | End | $\bigcirc$ | Speed control drive of the driving data to the current step |
|  |  | Keep | $\bigcirc$ | Speed control drive of the driving data to the current step After completing the following steps VTP control orders continue to drive location |
|  |  | Continuous | X | Errors |
|  | Repeat | End | $\bigcirc$ | Speed control drive of the driving data to the current step |
|  |  | Keep | $\bigcirc$ | Speed control drive of the driving data to the current step Repeat the step after the completion of location control, VTP orders continue to drive |
|  |  | Continuous | X | Errors |
| Linear Interpol ation | Single | End | $\bigcirc$ | Terminated after the completion of the current step-linear interpolation |
|  |  | Keep | $\bigcirc$ | The next step after the completion of the staff continue to drive a straight line interpolation |
|  |  | Continuous | X | Errors |
|  | Repeat | End | $\bigcirc$ | Repeat the step after the completion of the current staff, continue to drive a straight line interpolation |
|  |  | Keep | $\bigcirc$ | Repeat the current step and the successive steps to speed linear interpolation driving |
|  |  | Continuous | X | Errors |
| Circular Interpol ation | Single | End | $\bigcirc$ | After completing the current step termination arc interpolation |
|  |  | Keep | $\bigcirc$ | The next step after the completion of the staff continue to drive the arc interpolation |
|  |  | Continuous | X | Errors |
|  | Single | End | $\bigcirc$ | Repeat the step after the completion of the current staff, continue to drive the arc interpolation |
|  |  | Keep | $\bigcirc$ | Repeat the step and the successive steps in the current arc interpolation drive speed |
|  |  | Continuous | X | Errors |

## Note

1, Operation mode shall be set from PLC Program or Operation data.
2. Operation data can be set up to 150 from operation step no. $1 \sim 150$ at each axis.
3. With one time start command, positioning operation method by one operation step positioning data and positioning operation method by several operation step in order shall be determined by operation mode of each positioning data set by the operator.

## Chapter 9 Functions

(1) End Operation (Single)
(a) With one time start command, the positioning to the goal position is executed and the positioning shall be completed at the same time as the dwell time proceeds.
(b) The positioning completion of this operation mode can be used as operation mode of last positioning data of Go-on operation mode and Continuous operation mode.
(c) Operation direction shall be determined by the value of address.
(d) Operation action is trapezoid type operation that has acceleration, constant, deceleration section according to the setting speed and position data but the operation pattern according to the setting value is as follows.

1) Normal Operation Patterns


## Chapter 9 Functions

2) Abnormal Operation Patterns

[ Example ] - When operating only by Start Command [when setting the step no. as "0" by indirect start

- Starting command execute total four times.
- Setting of XG5000

| Step NO. | Coord. | Control | Method | Pattern | Goal Position <br> $[\mathrm{pls}]$ | Operation Speed <br> $[\mathrm{pls} / \mathrm{s}]$ | Accel NO. | Decel <br> NO. | M Code | Dwell <br> Time |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | ABS | POS | SIN | END | 10000 | 1000 | No.1 | No.1 | 0 | 0 |
| 2 | ABS | POS | SIN | END | 15000 | 500 | No.1 | No.1 | 0 | 0 |
| 3 | ABS | POS | SIN | END | 25000 | 1000 | No.1 | No.1 | 0 | 0 |
| 4 | ABS | POS | SIN | END | 30000 | 500 | No.1 | No.1 | 0 | 0 |

- Operation Pattern


Operating step that execute according to starting command order will be [1] $\rightarrow[2] \rightarrow[3] \rightarrow[4]$.

## Chapter 9 Functions

(2) End Operation (Repeat)
(a) With one time start command, the positioning to the goal position is executed and the positioning shall be completed at the same time as the dwell time proceeds.
(b) The operation type of Repeat operation mode is same as that of Single operation but the different thing is to determine next operation by operation step no. assigned by repeat step no. change command after positioning completion of Repeat operation mode.
(c) Therefore, if Repeat step no. change command was not executed, the step no."1" shall 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 " (1~150) for Indirect Start, the positioning operation shall be done with the setting step no. regardless of the current operation step no. But, if the step no. is set as " 0 ", the positioning operation shall be done with the current step no. changed by Repeat operation mode.
(e) Operation direction shall be determined by position address.
(f) Repeat operation step no. change command is available to execute during operation.
[ Example 1] - When operating only by Start Command [when setting the step no. as "0" by indirect start

- Starting command execute total four times.
- Setting of XG5000

| Step <br> NO. | Coord. | Control | Method | Pattern | Rep. <br> step | Goal Position <br> $[\mathrm{pls}]$ | Operation Speed <br> $[\mathrm{pls} / \mathrm{s}]$ | Accel <br> NO. | Decel <br> NO. | M <br> Code | Dwell <br> Time |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | ABS | POS | SIN | END | 0 | 10000 | 1000 | No. 1 | No. 1 | 0 | 0 |
| 2 | ABS | POS | REP | END | 1 | 15000 | 500 | No. 1 | No. 1 | 0 | 0 |
| 3 | ABS | POS | SIN | END | 0 | 25000 | 1000 | No. 1 | No. 1 | 0 | 0 |
| 4 | ABS | POS | REP | END | 1 | 30000 | 500 | No. 1 | No. 1 | 0 | 0 |



Operating step that execute according to starting command will be [1] $\rightarrow[2] \rightarrow[1] \rightarrow[2]$.
Operating step 3,4 will not execute.

## (3) Keep Operation

(a) With one time Start command, the positioning to the goal position of operation step is executed and the positioning shall be completed at the same time as dwell time proceeds and without additional start command, the positioning of operation step for (current operation step no. +1) shall be done.
(b) Go-on operation mode is available to execute several operation steps in order.
(c) Set the operation pattern by 'End' when executing the last step of Go-on operation.
(d) When operation pattern is Go-on (or continuous), continue operation until operation pattern come out as 'End'. Therefore, if there is no 'End' operation pattern, execute the operation data 400 times. When 400 times operation pattern is not the end, error occurs and operation will be stop. When 400 times operation steps is 'Go-on' and 'Continuous', execute operation data of Repeat Step Number.
(e) Operation direction shall be determined by setting value of goal position.
[Example] - When operating only by Start Command [when setting the step no. as "0" by indirect start

- Starting command execute total two times.
- Setting of XG5000

| Step <br> NO. | Coord. | Control | Method | Pattern | Goal Position <br> $[\mathrm{pls}]$ | Operation Speed <br> $[\mathrm{pls} / \mathrm{s}]$ | Accel <br> NO. | Decel <br> NO. | M Code | Dwell <br> Time |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | ABS | POS | SIN | Keep | 10000 | 1000 | N0.1 | N0.1 | 0 | 0 |
| 2 | ABS | POS | SIN | Keep | 15000 | 500 | N0.1 | N0.1 | 0 | 0 |
| 3 | ABS | POS | SIN | END | 25000 | 1000 | N0.1 | N0.1 | 0 | 0 |
| 4 | ABS | POS | SIN | END | 30000 | 500 | N0.1 | N0.1 | 0 | 0 |



Operating step that execute according to starting command order will be $[1 \rightarrow 2 \rightarrow 3] \rightarrow[4]$.
(4) Continuous Operation
(a) With one time Start command, the positioning for operation step set by continuous operation mode is executed to

## Chapter 9 Functions

the goal position without stop and the positioning shall be completed at the same time as dwell time proceeds.
(b) Steps of dwell time set as 'Continuous' operation mode is ignored, steps of dwell time set as 'End' operation pattern is valid.
(c) When you execute 'Continuous' operation mode, always set as 'End' for the very last operation step.
(d) In case direction changes during 'Continuous Operation', error code 511 occurs and positioning stops. In case of changing direction, use END, KEEP Operation.
[Example] - When operating only by Start Command [when setting the step no. as "0" by indirect start

- Starting command execute once.
- Setting of XG5000

| Step <br> NO. | Coord. | Control | Method | Pattern | Goal Position <br> [pIs] | Operation Speed <br> $[\mathrm{pls} / \mathrm{s}]$ | Accel <br> NO. | Decel <br> NO. | M Code | Dwell <br> Time |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | ABS | POS | SIN | CONT | 10000 | 500 | Once | Once | 0 | 0 |
| 2 | ABS | POS | SIN | CONT | 15000 | 1000 | Once | Once | 0 | 0 |
| 3 | ABS | POS | SIN | END | 25000 | 300 | Once | Once | 0 | 0 |

- Operation Pattern


Operating step that execute according to starting command order will be [1 $\rightarrow 2 \rightarrow 3$ ].

## Chapter 9 Functions

## 9．2．3 Positioning Control

After executed by the start positioning operation command（「Direct start」，「Indirect start」，「Simultaneous start」），positioning control from specified axis（the current stop position）to goal position（the position to move）．
（1）Control by Absolute method（Absolute coordinate）
（a）Positioning control from start position to goal position（the position assigned by positioning data）．Positioning control is carried out based on the position assigned（origin position）by homing．
（b）Transfer direction shall be determined by start position and goal position．
－Start position＜Goal position：forward direction positioning
－Start position＞Goal position：reverse direction positioning
［Example］Set the Incremental Coordinates as follow，Operate shortening positioning control．
$\triangleright$ Start position：1000，
$\triangleright$ Goal position： 8000
The transfer amount to forward direction shall be 7000 （7000＝8000－1000）．

－Setting of XG5000

| Step <br> NO． | Coord． | Control | Method | Pattern | Goal Position <br> ［pIs］ | Operation Speed <br> ［pls／s］ | Accel NO． | Decel <br> NO． | M Code | Dwell <br> Time |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | ABS | POS | SIN | END | 8000 | 1000 | No．1 | No．1 | 0 | 100 |

－Operation Pattern


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(2) Control by Incremental method (Incremental coordinate)
(a) Positioning control as much as the goal transfer amount from start position. Unlike the absolute coordinates of goal position, it is not a value of specified on goal position; it is a moving amount of current position.
(b) Transfer direction shall be determined by the sign of transfer amount.
$\triangleright$ Transfer direction (+) or no sign: forward direction (current position increase) positioning
$\triangleright$ Transfer direction (-) : reverse direction (current position decrease) positioning


## [ Example ] Set the Incremental Coordinates as follow, Operate shortening positioning control.

- Start address : 5000,
$\triangleright$ Goal address : -7000
This will be reverse direction and positioning will be at the point of -2000 .


■ Setting of XG5000

| Step <br> NO. | Coord. | Control | Method | Pattern | Goal Position <br> [pls] | Operation Speed <br> $[\mathrm{pls} / \mathrm{s}]$ | Accel <br> NO. | Decel <br> NO. | M Code | Dwell <br> Time |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | INC | POS | SIN | END | -7000 | 1000 | N0.1 | NO.1 | 0 | 100 |

- Operation Pattern



## Chapter 9 Functions

## 9．2．4 Speed Control

After executed by the start positioning operation command（ $\ulcorner$ Direct start」，「Indirect start」，Simultaneous start $\lrcorner$ ），this controls the speed by the setting 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．
$\triangleright$ Forward direction ：when position value is positive number（＋）（＂0＂included）
$\triangleright$ Reverse direction ：when position value is negative number（－）
（b）In case of using speed control，the following items of operation data do not affect．
$\triangleright$ Coordinates，Operation method，Dwell time
$\triangleright$＂Absolute，shortening speed control＂，＂Incremental，shortening speed control＂execute same operation．
（c）Accelerating operation of speed control operate with acceleration number and time on setting data，decelerating operation operate with deceleration number and time of a command 「deceleration stop」．
（2）Operation Timing

（3）Restrictions
（a）Set the operation pattern of speed control as＇End＇or＇Go－On＇．When it is set on＂Continuous＂，error occurs（error code：236）and can not execute speed control．
（b）Using as speed control，only when「 M code mode」of extended parameter is＂with＂， M code signal is＂On＂． （Using＂After mode＂，M code signal is not＂On＂．）

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(c) Speed control of software upper/lower limit checking change according to the setting of the speed control of software upper/lower limit check.

| Item | Setting Value | Contents |
| :--- | :--- | :--- |
| During Speed Control <br> Soft Upper/Lower <br> limit | $0:$ Not Detected | During Speed Control, do not operate to check the range of <br> upper/lower limit of software |
|  | $1:$ Detected | During Speed Control, operate to check the range of upper/lower <br> limit of software |

(4) Setting of XG5000

| Step <br> NO. | Coord. | Control | Method | Pattern | Goal Position <br> [pls] | Operation Speed <br> [pls/s] | Accel NO. | Decel <br> NO. | M Code | Dwell <br> Time |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | ABS | SPD | SIN | END | 100 | 1000 | N0.1 | No.1 | 0 | 0 |

## Chapter 9 Functions

### 9.2.5 Linear Interpolation Control

Executes interpolation control from starting position to the goal position with interpolation axis set as the main axis and sub axis
(1) Linear interpolation control with absolute coordinates
(a) Execute linear interpolation from starting position to the goal position designated on positioning data. Positioning control is on basis of the designated position from homing.
(b) The direction of movement depends on the starting position and the goal position for each axis.

■ Starting position < Goal position : Positioning operation in forward

- Starting position > Goal position : Positioning operation in reverse



## Note

Because more than 2 axes are in action, so need user to pay attention

1. Available pattern is END, KEEP and available method is SIN, REP. In case of using CONT, it operates as KEEP.
2. The available auxiliary commands are as follows.

- DEC. stop, EMG. stop

3. The commands unavailable in linear interpolation are as follows.

- Position/Speed switching control, Position override, Speed override, Position specified speed override

4. Main and sub axis are determined depending on movement amount.
(1) main axis: movement amount is larger between axis $X$ and axis $Y$
(2) sub axis: movement amount is smaller between axis $X$ and axis $Y$
5. The parameter items which work depending on the value of each axis are as follows.

- Backlash compensation, Software high/low limit


## Chapter 9 Functions

(c) Setting example of operating data

| Setting items | Main-axis setting | Sub-axis setting | Description |
| :---: | :---: | :---: | :--- |
| Control method | ABS | ABS | Sets the coordinate method |
| Pattern | END | $-* 1$ | Sets the pattern of main axis |
| Control | POS | - | Sets the control method of main axis |
| Method | SIN | SIN | Sets the operation method of linear interpolation |
| Goal position <br> [pls] | 10000 | 5000 | Set the goal position to position on main-axis and sub- <br> axis |
| Operating <br> speed <br> [pls/s] | 1000 | - | Use speed-designated method of main axis for linear <br> interpolation |
| Acc. no. | No.1 | - | Set acc. no. for acceleration <br> (no.1 ~no.4) |
| Dec. no. | No.2 | Set dec. no. for deceleration. <br> (no.1 ~no.4) |  |
| M code | 0 | When need to execute auxiliary work synchronizing <br> with linear interpolation |  |
| Dwell time | - | Set dwell time(ms) to outputting the signal positioning <br> completion |  |

- $^{* 1}$ : It does not need to be set. Whatever value is set as, it does not affect linear interpolation.
[Example] axis $X$ and axis $Y$ are main and sub axis each. Execute linear interpolation by the setting as follows.
- Starting position $(1000,4000)$, Goal position $(10000,1000)$

In this condition, the operation is as follows.

- Setting example of XG5000
- Operating data of main-axis (axis $X$ )

| Step no. | Coord. | Control | Method | Pattern | Goal position <br> [pls] | Operating speed <br> [pls/s] | Acc. no. | Dec. no. | M code | Dwell time |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | ABS | POS | SIN | END | 10000 | 3000 | No.1 | No. 1 | 0 | 100 |

- Operating data of sub-axis (axis Y)

| Step no. | Coord. | Control | Method | Pattern | Goal position <br> [pls] | Operating speed <br> [pls/s] | Acc. no. | Dec. no. | M code | Dwell time |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | ABS | POS | SIN | END | 1000 | 3000 | No.1 | No.1 | 0 | 100 |

## Operating pattern



## Chapter 9 Functions

(2) Linear interpolation control with Incremental coordinates
(a) Execute 2 axes linear interpolation from starting position to the goal position. Positioning control is on basis of the current stop position.
(b) Moving direction depends on the sign of the goal position (Moving amount)

- The sign is positive (+ or nothing) : Positioning operation in forward
- The sign is negative (-) : Positioning operation in reverse

[Example] axis $X$ and axis $Y$ are main and sub axis each. Execute linear interpolation by the setting as follows.
■ Starting position (1000, 4000), Goal position (9000, -3000) In this condition, the operation is as follows.
- Setting example of XG5000
- Operating data of main-axis (axis X)

| Step <br> no. | Coord. | Control | Method | Pattern | Goal position <br> [pls] | Operating speed <br> [pls/s] | Acc. no. | Dec. no. | M code | Dwell time |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | INC | POS | SIN | END | 9000 | 3000 | No. 1 | No. 1 | 0 | 100 |

- Operating data of sub-axis (axis Y)

| Step <br> no. | Coord. | Control | Method | Pattern | Goal position <br> $[\mathrm{pls}]$ | Operating speed <br> $[\mathrm{pls} / \mathrm{s}]$ | Acc. no. | Dec. no. | M code | Dwell time |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | INC | POS | SIN | END | -3000 | 0 | No.1 | No. 1 | 0 | 0 |

- Operating pattern


Interpolating speed $(F)=\sqrt{V_{x}^{2}+V_{y}^{2}}$

## Chapter 9 Functions

### 9.2.6 Designate Midpoint of Circular Interpolation

Operates interpolation following the path of circular which is through midpoint that is set by 2 axes
And, available to execute circular interpolation of over 360 degrees by the set circular interpolation turns
(1) Control of circular interpolation by absolute coordinate, designate midpoint
(a) Operate circular interpolation from starting point and pass the midpoint that is set operation data to target point.
(b) To be made path of circular interpolation with start position, midpoint and a crossing which is perpendicular divide equally position of midpoint and target position.
(c) Movement direction is decided automatically depends on set target position and auxiliary point of circular interpolation.
Forward of the
axis of ordinates
Reverse of midpoint
main axis
Reverse of
main axis
(d) Restriction

- User can't draw circle which is starting point same with last point on the circular interpolation of midpoint designation method. If you want to draw circle, please use method of midpoint.
- User cannot progress circular interpolation of midpoint designation method with following cases.
- Midpoint that is designated as auxiliary point same with start position or target position. (Error code : 284)
- In case of start position same with target position (Error code : 285)
- In case of calculated radius of circular arc exceed 2,147,483,647pls (Error code : 286)
- In case of auxiliary position and target position in a straight line from start position, (Error code : 287)


## Chapter 9 Functions

## Note

Because more than 2 axes are in action, so need user to pay attention

1. Available pattern is END, KEEP and available method is SIN, REP. In case of using CONT, it operates as KEEP.
2. The available auxiliary commands are as follows.

- DEC. stop, EMG. stop

3. The commands unavailable in linear interpolation are as follows.

- Position/Speed switching control, Position override, Speed override, Position specified speed override

4. Main and sub axis are determined depending on movement amount.
(1) main axis: movement amount is larger between axis $X$ and axis $Y$
(2) sub axis: movement amount is smaller between axis $X$ and axis $Y$
5. The parameter items which work depending on the value of each axis are as follows.

- Backlash compensation, Software high/low limit


## Chapter 9 Functions

（e）Example of setting operation data

| Setting item | Main axis <br> setting | Sub axis setting | Contents |
| :--- | :---: | :---: | :--- |
| Coord． | ABS | $-\star 1$ | Set the coordinate method of main axis |
| Pattern | END | - | Set the operation pattern of main axis |
| Control | SIN | - | Set control method of main axis |
| Method | 10000 | - | Set operation method for circular interpolation． |
| Target position <br> ［pls］ | No．1 | - | Set the target position for positioning on the main <br> axis and sub axis． |
| Operation speed <br> ［pls／s］ | No．2 | - | Circular interpolation use method of designating <br> composition speed |
| Acceleration speed | － | Set the acceleration time No．for acceleration． <br> （No．1 -4$)$ |  |
| Deceleration speed | － | Set the deceleration time No．for deceleration． <br> （No．1 -4$)$ |  |
| M code | 500 | Set it for progressing auxiliary operation depends <br> on circular interpolation operation． |  |
| Dwell time | － | set the dwell time taken until plc outputs the signal <br> which informs users of finishing the position <br> decision |  |
| Circular <br> interpolation <br> Auxiliary point | 5000 | Set midpoint for passing circular arc on the method <br> of the designating midpoint． |  |
| Circular <br> interpolation mode | MID | - | In case of using the method of designating <br> midpoint，set 「midpoint on the main axis． |
| Circular interpolation <br> Turns | 0 | When user want to draw circle which is over 360 <br> degrees，set the number of rotations of circular arc． |  |

${ }^{-{ }^{*}}$ ：Do not need setting．Whatever you set，there is no effect to circular interpolation．

## Note

The circular interpolation control of the method of designating midpoint operate by standards of set item on the operation data of main axis（command axis）．
When circular interpolation operation of the method of designating midpoint，there is no effect except for 「Target position」，「Auxiliary point of circular interpolation」on the axis of setting．What ever you take for the value，there is no effect to operate，there is no error．
[Example] Operate circular interpolation of designating midpoint and absolute coordinate (main axis; axis $X$, sub axis; axis $Y$ )

- In case of Start position ( 0,0 ), Target position (10000, 6000), Auxiliary point (2000, 6000), operation is as follows;
- Example of setting in the XG5000
- Main axis (axis X) operation data

| Step |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| No. | Coord. | Control | Method | Pattern | Target <br> position <br> [pls] | Operation <br> Speed <br> [pls/s] | Acc. <br> Speed | Dec. <br> Speed | M <br> code | Dwell <br> time | Circular <br> interpolation <br> Auxiliary <br> point | Circular <br> interpolat <br> ion mode | The number <br> of rotations <br> of Circular <br> interpolation |
| 1 | ABS | POS | SIN | END | 10000 | 3000 | No. 1 | No. 1 | 0 | 100 | 2000 | Midpoint | 0 |

- Sub axis (axis Y) operation data

| Step <br> No. | Coord. | Control | Method | Pattern | Target position [pls] | Operation <br> Speed <br> [pls/s] | Acc. <br> Speed | Dec. Speed | $\begin{gathered} \mathrm{M} \\ \text { code } \end{gathered}$ | Dwell time | Circular interpolation Auxiliary point | Circular interpolat ion mode | The number of rotations of Circular interpolation |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | ABS | POS | SIN | END | 6000 | 0 | No. 1 | No. 1 | 0 | 100 | 6000 | Midpoint | 0 |

- Operation pattern



## Chapter 9 Functions

(2) Circular interpolation by Incremental coordinates, the method of designating midpoint
(a) Operate circular interpolation from start position and go through midpoint to target position as amount of set movement.
(b) Midpoint position is the incremented position as set value on 「the circular interpolation auxiliary point」 from current stop position.
(c) The intersection of perpendicular bisectors of starting position and midpoint, the current stop position and the goal position will be the center-point of the arc.
(d) Movement direction is decided by set target position and circular interpolation auxiliary point.

(e) Restriction

- Can not draw circle which starting point is the same with last point on the circular interpolation of the method of designating midpoint. When want to draw circle, should use midpoint method.
- In this following case, it will be error and can not working circular interpolation of method of designating midpoint.
- In case of midpoint which is designated as auxiliary point is same with start position and target position. (Error code : 284)
- In case of start position same with target position. (Error code : 285)
- Radius of calculated circle exceed 2147483647pls (Error code : 286)
- Start position is in alignment with auxiliary position and target position. (Error code : 287)
（f）Example of operation data setting

| Setting item | Main axis setting | Sub axis setting | Contents |
| :---: | :---: | :---: | :---: |
| Coord． | INC | －＊1 | Set coordinate method of main axis |
| Pattern | END | － | Set pattern of main axis |
| Control | POS | － | Set control method of main axis |
| Method | SIN | － | Set operation method for circular interpolation |
| Target position ［pls］ | 10000 | 0 | Set target position as a amount of increment of stop position for positioning on the main axis，sub axis． |
| Operation speed ［pls／s］ | 1000 | － | Circular interpolation use method of designating composition speed．Set composition speed on the main axis． |
| Acceleration speed | No． 1 | － | Set acceleration time No．for acceleration． （No． 1 ～No．4） |
| Deceleration speed | No． 2 | － | Set deceleration time No．for deceleration． $\text { (No. } 1 \text { ~No.4) }$ |
| M code | 0 | － | Set it when user wants to progress other auxiliary action with circular interpolation operation． |
| Dwell time | 500 | － | set the dwell time taken until plc outputs the signal which informs users of finishing the position decision |
| Circular interpolation auxiliary point | 5000 | 5000 | Set the middle point that the arc with mid－point designating method would pass by as an increment from the current stop position |
| Circular interpolation mode | Mid | － | Set＂midpoint＂，when use method of designating midpoint． |
| The number of rotations of circular interpolation | 0 | － | Set the number of rotations for drawing circle that it is over 360 degrees． |

$-^{{ }^{\star}}$ ：Do not need setting．Whatever user set，there is no effect to circular interpolation．

## Note

Circular interpolation of method of designating midpoint is depends on item that it is set on operation data of main axis（command axis）．
There is no effect to circular interpolation operation except for 「Target position」 and 「Circular interpolation auxiliary point $\lrcorner$ ，when operate circular interpolation of method of designating midpoint． Whatever user set，there is no effect and no error．

## Chapter 9 Functions

[ Example ] Operate circular interpolation of method of designating Incremental coordinate midpoint with axis X (main axis), with axis Y (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 XG5000
- Main axis (axis X) Operation data

| Step |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| No. | Coord. | Control | Method | Pattern | Target <br> position <br> [pIs] | Operation <br> Speed <br> [pls/s] | Acc. <br> Speed | Dec. <br> Speed | $M$ <br> code | Dwell <br> time | Circular <br> interpolation <br> Auxiliary <br> point | Circular <br> interpolation <br> mode | The number of <br> rotations of <br> Circular <br> interpolation |
| 1 | INC | POS | SIN | END | 8000 | 1000 | No. 1 | No. 1 | 0 | 100 | 5000 | Midpoint | 0 |

- Sub axis (axis Y) Operation data

| Step |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| No. | Coord. | Control | Method | Pattern | Target <br> position <br> $[p / s]$ | Operation <br> Speed <br> [pls/s] | Acc. <br> Speed | Dec. <br> Speed | $M$ <br> code | Dwell <br> time | Circular <br> interpolation <br> Auxiliary <br> point | Circular <br> interpolation <br> mode | The number of <br> rotations of <br> Circular <br> interpolation |
| 1 | INC | POS | SIN | END | 4000 | 0 | No. 1 | No. 1 | 0 | 100 | 5000 | Midpoint | 0 |

- Operation pattern



## Chapter 9 Functions

## 9．2．7 Circular interpolation control of designating center point

Operate interpolation up to trace of the circle after operate by starting command of positioning operation．And then， Center point is center of circle and it is move to rotation direction of circular interpolation．
「The number of rotations of circular interpolation」can operate circular interpolation which is over 360 degrees with setting value．
There is no limit for composition of axis 2 that it needs to use circular interpolation control．
（1）Circular interpolation by method of absolute coordinate，designating center point
（a）Operate from start position and circular interpolate to target position with the trace of circle．And the circle has radius which distance is to set midpoint position．「Circular interpolation auxiliary point」 is midpoint of this circle．
（b）Moving direction depends on set direction on＂circular interpolation mode＂of operation data．

- 「Center，CW」－Circular interpolation go clockwise from current position．
- 「Center，CCW」－Circular interpolation go counterclockwise from current position．

（c）If target position is same with start position，can progress circular interpolation．And the circle radius is distance from midpoint to starting position（＝target position）



## Chapter 9 Functions

(d) Restriction

- In this following case, to be error and can not progress circular interpolation control of method of designating midpoint.
- In case of midpoint which is set as auxiliary point is same with starting/target position, (Error code : 284)
- In case of calculated radius of circle exceed 2,147,483,647pls, (Error code : 286)


## Note

If executing circular interpolation start, 2 axes will operate at the same time. Need user to pay attention.

1. Available pattern is END, KEEP and available method is SIN, REP. In case of using CONT, it operates as KEEP.
2. The available auxiliary commands are as follows.

- DEC. stop, EMG. stop

3. The commands unavailable in linear interpolation are as follows.

- Position/Speed switching control, Position override, Speed override, Position specified speed override

4. Main and sub axis are determined depending on movement amount.
(1) main axis: movement amount is larger between axis $X$ and axis $Y$
(2) sub axis: movement amount is smaller between axis $X$ and axis $Y$
5. The parameter items which work depending on the value of each axis are as follows.

- Backlash compensation, Software high/low limit
(e) Example of operation data setting

| Setting item | Main axis setting | Sub axis setting | Contents |
| :---: | :---: | :---: | :---: |
| Coord. | ABS | -*1 | Set coordinate method of main axis |
| Pattern | END | - | Set pattern of main axis |
| Control | POS | - | Set control method of main axis |
| Method | SIN | - | Set operation method for circular interpolation. |
| Target position [pls] | 10000 | 0 | Set target position as a amount of increment of stop position for positioning on the main axis, sub axis. |
| Operation <br> speed <br> [pls/s] | 1000 | - | Circular interpolation use method of designating composition speed. Set composition speed on the main axis. |
| Acceleration speed | No. 1 | - | Set acceleration time No. for acceleration. $\text { (No. } 1 \text { ~ No.4) }$ |
| Deceleratio n speed | No. 2 | - | Set deceleration time No. for deceleration. $\text { (No. } 1 \text { ~ No.4) }$ |
| M code | 0 | - | Set it when user wants to progress other auxiliary action with circular interpolation operation. |
| Dwell time | 500 | - | set the dwell time taken until plc outputs the signal which informs users of finishing the position decision |
| Circular interpolation auxiliary point | 5000 | 5000 | Set the center-point on the method of designating center-point. |
| Circular interpolation mode | Center | - | Set the center-point on the method of designating center-point. |
| Circular interpolation direction | CW | - | Set the moving direction of circular arc |
| The number of rotations of circular interpolation | 0 | - | Set the number of rotations for drawing circle that it is over 360 degrees. |

- $^{* 1}$ : Do not need setting. Whatever user set, there is no effect to circular interpolation.


## Note

Circular interpolation of method of designating midpoint is depends on item that it is set on operation data of main axis (command axis).
There is no effect to circular interpolation operation except for $\ulcorner$ Target position」 and $\ulcorner$ Circular interpolation auxiliary point」, when operate circular interpolation of method of designating midpoint. Whatever user set, there is no effect and no error.

## Chapter 9 Functions

[Example] Operate circular interpolation of designating midpoint and absolute coordinate (main axis; axis

## 1, sub axis; axis 2)

■ In case of Start position (0, 0), Target position (0, 0), Auxiliary point (1000, 1000), direction of rotation :CW operation is as follows;

- Example of setting in the XG5000
- Main axis (axis X) operation data

| Step |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| No. | Coord | Control | Method | Pattern | Target <br> position <br> [pls] | Operation <br> Speed <br> [pls/s] | Acc. <br> Speed | Dec. <br> Speed | M <br> code | Dwell <br> time | Circular <br> interpolation <br> Auxiliary <br> point | Circular <br> interpolation <br> mode | Cir. <br> Int. <br> dir. | The number of <br> rotations of <br> Circular <br> interpolation |
| 1 | ABS | POS | SIN | END | 0 | 1000 | No. 1 | No. 1 | 0 | 100 | 1000 | Center | CW | 0 |

- Sub axis (axis Y) operation data

| Step <br> No. | Coord | Control | Method | Pattern | Target position [pls] | Operation <br> Speed <br> [pls/s] | Acc. <br> Speed | Dec. <br> Speed | $\begin{gathered} \mathrm{M} \\ \text { code } \end{gathered}$ | Dwell time | Circular interpolation Auxiliary point | Circular interpolation mode | Cir. <br> Int. <br> dir. | The number of rotations of Circular interpolation |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | ABS | POS | SIN | END | 0 | 0 | No. 1 | No. 1 | 0 | 100 | 1000 | Center | CW | 0 |

- Operation pattern



## Chapter 9 Functions

（2）Circular interpolation control by the method of Incremental coordinate，designating center－point
（a）Start operating at starting position and then execute circular interpolation by moving amount already set，along the trace of the arc which has a distance between starting position and designated mid－point as radius．「Circular interpolation auxiliary point」 means the moving amount between the current position and mid－point．
（b）Moving direction is decided to set direction on＂circular interpolation mode＂of operation data．

- 「Center－point，CW」－Circular interpolation go clockwise from current position．．
- 「Center－point，CCW」－Circular interpolation go counterclockwise from current position．

（c）If set target position of main axis and sub axis as＂ 0 ＂，than starting position will be same with target position and can progress circular interpolation that it is drawing circle．The radius of the circle is distance from starting position to center－point．



## Chapter 9 Functions

(d) Restriction

- User cannot progress circular interpolation of midpoint designation method with following cases.
- Midpoint that is designated as auxiliary point same with start position or target position.
(Error code: 284)
- In case of calculated radius of circular arc exceed 2,147,483,647pls (Error code: 286)
(e) Example of operation data setting

| Setting item | Main axis setting | Sub axis <br> setting | Contents |
| :---: | :---: | :---: | :--- |
| Coord. | INC | $-{ }^{*}$ | Set coordinate method o main axis |
| Pattern | END | - | Set pattern of main axis |
| Control | POS | - | Set control method of main axis |
| Method | SIN | - | Set operation method for circular interpolation. |
| Target <br> position [pls] | 10000 | - | Set target position as the amount of increment of stop <br> position for positioning on the main axis, sub axis. |
| Operation <br> speed <br> [pls/s] | 1000 | Circular interpolation use method of designating <br> composition speed. Set composition speed on the <br> main axis. |  |
| Acceleration <br> speed | No.1 | - | Set acceleration time No. for acceleration. <br> (No.1 ~No.4) |
| Deceleration <br> speed | No.2 | - | Set deceleration time No. for deceleration. <br> (No.1 ~No.4) |
| M code | 0 | Set it when users want to progress other auxiliary <br> action with circular interpolation operation. |  |
| Dwell time | 500 | set the dwell time taken until plc outputs the signal <br> which informs users of finishing the position decision |  |
| Circular <br> interpolation <br> auxiliary <br> point | 5000 | -5000 | Set the center-point position by amount of increment of <br> current stop position on the method of designating <br> center-point. |
| Circular <br> interpolation <br> mode | Center | CW | In case of using the method of designating center- |
| point, set the center-point |  |  |  |

$-^{*}$ : Do not need setting. Whatever user set, there is no effect to circular interpolation.

## Note

Circular interpolation of method of designating midpoint is depends on item that it is set on operation data of main axis command axis）．
There is no effect to circular interpolation operation except for 「Target position」 and 「Circular interpolation auxiliary point」，when operate circular interpolation of method of designating midpoint． Whatever user set，there is no effect and no error．
［ Example ］Operate circular interpolation of the method of designating Incremental coordinate center point with axis $X$（main axis），with axis $Y$（sub axis）
－Start position：$(0,0)$
Target position（amount of movement）setting：$(2000,0)$
Auxiliary point（amount of movement）setting：$(1000,0)$
Direction of rotations：CW
In this case operation is as follows：
－Example of setting XG5000
－Main axis（axis X）Operation data

| $\begin{array}{\|l} \text { Step } \\ \text { No. } \end{array}$ | Coord． | Control | Method | Pattern | Target position ［pls］ | Operation Speed ［pls／s］ | Acc． Speed | Dec． Speed | $\begin{gathered} \mathrm{M} \\ \text { code } \end{gathered}$ | Dwell time | Circular interpolation Auxiliary point | Circular Interpolation mode | Circular int． Dir． | The number of rotations of Circular interpolation |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | ABS | POS | SIN | KEEP | 2000 | 1000 | No． 1 | No． 1 | 0 | 100 | 1000 | Center－point | CW | 0 |
| 2 | ABS | POS | SIN | END | 2000 | 1000 | No． 1 | No． 1 | 0 | 100 | 1000 | Center－point | CW | 0 |

－Sub axis（axis Y）Operation data

| $\begin{aligned} & \text { Step } \\ & \text { No. } \end{aligned}$ | Coord． | Control | Method | Pattern | Target position ［pls］ | Operation <br> Speed <br> ［pls／s］ | Acc． Speed | Dec． Speed | $\begin{gathered} \mathrm{M} \\ \text { code } \end{gathered}$ | Dwell time | Circular interpolation Auxiliary point | Circular Interpolation mode | Circular int． Dir． | The number of rotations of Circular interpolation |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | ABS | POS | SIN | KEEP | 0 | 0 | No． 1 | No． 1 | 0 | 100 | 1000 | Center－point | CW | 0 |
| 2 | ABS | POS | SIN | END | 0 | 0 | No． 1 | No． 1 | 0 | 100 | 1000 | Center－point | CW | 0 |

－Operation pattern


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（3）Circular interpolation control which 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 is different with distance B which it is distance from target position to center point（End point，Radius）on circular interpolation control of the method of designating center point．Sometimes do not operate normally．

When starting point radius have difference with end point radius，calculate each speed on the set operation speed， and operate circular interpolation control with compensating radius．
（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．

| Starting point radius＞Ending point radius | Midpoint starting point radius＜Ending point radius |
| :---: | :---: |
|  |  |
|  |  |

Note
In case of＂Starting point radius＜Ending point radius＂，the more operate circular interpolation，the faster． Sometimes exceed 「Speed limit」 of parameter．When operate circular interpolation，in case of starting point radius shorter than ending point radius，lower speed for never exceeding $\ulcorner$ Speed limit $\rfloor$ ．
Can operate no exceed 「Speed limit」，even if it is near to target position．


## 9．2．8 Circular interpolation control with designated radius

After being executed by circular interpolation command，then it operates along the trace of the circle made by circular interpolation with 2 axes．According to「The turn no．of circular interpolation」，circular interpolation which is bigger than $360^{\circ}$ is available to be executed．
（1）Circular interpolation by method of absolute and designating radius
（a）Start operating at starting position and execute circular interpolation along the trace of the circle which has radius set on circular interpolation auxiliary point of main－axis operating 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 ${ }^{\circ}$ ， Circular arc＞＝180 ${ }^{\circ}$ ）．

| Circular interpolation mode | Description |
| :--- | :--- |
| Radius， $\mathrm{CW}, \mathrm{Arc}<180^{\circ}$ | Execute circular interpolation in clockwise and the arc is smaller than $180^{\circ}$ |
| Radius， $\mathrm{CW}, \mathrm{Arc}>=180^{\circ}$ | Execute circular interpolation in clockwise and the arc is bigger than $10^{\circ}$ |
| Radius， CCW, Arc $<180^{\circ}$ | Execute circular interpolation in counterclockwise and the arc is smaller <br> than $180^{\circ}$ or same． |
| Radius，CCW，Arc $>=180^{\circ}$ | Execute circular interpolation in counterclockwise and the arc is bigger <br> than $180^{\circ}$ or same． |


| CW，Arc＜180 ${ }^{\circ} \mathrm{CW}, \mathrm{Arc}>=180^{\circ}$ | CCW， $\operatorname{Arc}<180^{\circ} \mathrm{CCW}, \mathrm{Arc}>=180^{\circ}$ |
| :---: | :---: |
|  |  |

（b）Restrictions
－Circular interpolation with designating radius method may not draw an exact circle that the starting position and

## Chapter 9 Functions

ending position are same. If user wants to draw an exact circle, use circular interpolation with center point method.

- In the cases below, error would arise and circular interpolation may not be executed.
- 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 goal position
- Radius < (R x 0.8) : Error (error code:270)
- ( $\mathrm{R} \times 0.8$ ) <= Radius < R
: Execute circular interpolation after reset the radius to R. In other words, execute circular interpolation by setting the center of the line from starting position to goal position as center point.


## Note

If executing circular interpolation start, 2 axes will operate at the same time. Need user to pay attention.

1. Available pattern is END, KEEP and available method is SIN, REP. In case of using CONT, it operates as KEEP.
2. The available auxiliary commands are as follows.

- DEC. stop, EMG. stop

3. The commands unavailable in linear interpolation are as follows.

- Position/Speed switching control, Position override, Speed override, Position specified speed override

4. Main and sub axis are determined depending on movement amount.
(1) main axis: movement amount is larger between axis $X$ and axis $Y$
(2) sub axis: movement amount is smaller between axis $X$ and axis $Y$
5. The parameter items which work depending on the value of each axis are as follows.

- Backlash compensation, Software high/low limit
（c）Setting example of Operating data

| Items | Main－axis setting | Sub－axis setting | Description |
| :---: | :---: | :---: | :---: |
| Coord． | ABS | －＊1 | Set the coordinate method of main axis |
| Pattern | END | － | Set the operation pattern of main axis |
| Control | POS |  | Set the control method of main axis |
| Method | SIN | － | Set the operation method for circular interpolation |
| $\begin{gathered} \text { Goal } \\ \text { position[pls] } \end{gathered}$ | 10000 | 0 | Set the goal position to execute on Main，Sub，Helical axis |
| Operating speed［pls／s］ | 1000 | － | Use connecting speed designation method for circular interpolation．Set connecting speed on main－axis |
| Acc．no． | No． 1 | － | Set no．of acc．time to use in acceleration（no1～4） |
| Dec．no． | No． 2 | － | Set no．of dec．time to use in deceleration（no1～4） |
| M code | 0 | － | Set it when executing another auxiliary operation synchronizing with circular interpolation |
| Dwell time | 500 | － | Set dwell time for outputting positioning complete |
| Auxiliary point | 5000 | － | Set the radius on main－axis |
| $\begin{gathered} \text { Circular } \\ \text { interpolation } \end{gathered}$ Mode | Radius | － | If use radius designation method，set ${ }^{〔}$ Radius」 on main－ axis and |
| $\begin{gathered} \text { Circular } \\ \text { interpolation } \\ \text { direction } \\ \hline \end{gathered}$ | CW |  | Set moving direction of arc and |
| Arc size | Arc＜180 ${ }^{\circ}$ | － | Set size of arc |
| The No．of Turns | － |  | Set the no．of turns of arc for making a circle bigger than $360^{\circ}$ |

－${ }^{*}$ ：It means that no need to be set．Whatever value it is，it dose not affect circular interpolation．

## Note

1．Circular interpolation control of Radius designation method is executed on the basis of the items set on operating data．When it is executed，only「Goal position」 can affect circular interpolation．In other words， whatever value is set as，it does not affect the action and no errors arise．
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 goal position．If it is smaller than the half（ $R$ ）and 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．If it is smaller than the half $(R)$ and the value is lower than $80 \%$ of $R$ ，error（error code：270）arises and circular interpolation is not executed．

## Chapter 9 Functions

[Example] Axis $X$ is main-axis and Axis $Y$ is sub-axis. Execute circular interpolation with absolute coordinates and designated radius.

- Starting position (1000, 1000), Goal position (9000, 1000), Auxiliary point (5000, 0)

Moving direction of arc : CW, Size of arc : Arc >= $180^{\circ}$
The action is as follows in the condition above

- Setting example in XG5000
- Main-axis (Axis X) Operating data

| Step <br> No. | Coord. | Control | Method | Pattern | Goal <br> position <br> $[\mathrm{pls}]$ | Operating <br> speed <br> $[\mathrm{pls} / \mathrm{s}]$ | Acc. <br> No, | Dec. <br> No, | Dwell <br> Time | Auxiliary <br> Point | Circular <br> interpolation <br> mode | Cir. <br> Int. <br> Dir. | Arc <br> size | The no. <br> of <br> turns |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | ABS | POS | SIN | KEEP | 9000 | 1000 | No.1 | No.1 | 100 | 5000 | Radius, | CW | 0 | Arc<180 |

- Sub-axis (Axis Y) Operating data

| Step <br> No. | Coord. | Control | Method | Pattern | Goal <br> position <br> $[\mathrm{pls}]$ | Operating <br> speed <br> $[\mathrm{pls} / \mathrm{s}]$ | Acc. <br> No, | Dec. <br> No, | Dwell <br> Time | Auxiliary <br> Point | Circular <br> interpolation <br> mode | Cir. <br> Int. <br> Dir. | Arc <br> size | The no. <br> of <br> turns |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | ABS | POS | SIN | KEEP | 9000 | 1000 | No.1 | No.1 | 100 | 5000 | Radius, | CW | 0 | Arc< $<180$ |

- Operation pattern

(2) Circular interpolation by method of Incremental and designating radius
(a) Start operating from starting position and then execute circular interpolation by increment set on goal 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 ${ }^{\circ}$, $\operatorname{Arc}>=180^{\circ}$ )

| Circular interpolation mode | Description |
| :--- | :--- |
| Radius, CW, Arc $<180^{\circ}$ | Execute circular interpolation with center-point of arc which smaller than <br> $180^{\circ}$ in direction of CW |
| Radius, CW, Arc $>=180^{\circ}$ | Execute circular interpolation with center-point of arc which bigger than $180^{\circ}$ in <br> direction of CW |
| Radius, CCW, Arc $<180^{\circ}$ | Execute circular interpolation with center-point of arc which smaller than <br> $180^{\circ}$ in direction of CCW |
| Radius, CCW, Arc $>=180^{\circ}$ | Execute circular interpolation with center-point of arc which bigger than $180^{\circ}$ in <br> direction of CWW |



## Chapter 9 Functions

(b) Restrictions

- Circular interpolation with designating radius method may not draw an exact circle that the starting position and ending position are same. If user wants to draw an exact circle, use circular interpolation with center point method.
- In the cases below, error would arise and circular interpolation may not be executed.
- 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 goal position
- Radius < ( $\mathrm{R} \times 0.8$ ) : Error (error code: 270)
- ( $\mathrm{R} \times 0.8$ ) <= Radius < R
: Execute circular interpolation after reset the radius to R. In other words, execute circular interpolation by setting the center of the line from starting position to goal position as center point.
（c）Setting example of Operating data

| Items | Main－axis setting | Sub－axis setting | Description |
| :---: | :---: | :---: | :---: |
| Coord． | INC | －${ }^{*}$ | Set the coordinate method of main axis |
| Pattern | END | － | Set the operation pattern of main axis |
| Control | POS | － | Set the control method of main axis |
| Method | SIN | － | Set the method to execute circular interpolation |
| Goal position［pls］ | 10000 | 0 | Set the goal position to execute on Main，Sub，Helical axis |
| Operating speed［pls／s］ | 1000 | － | Use connecting speed designation method for circular interpolation．Set connecting speed on main－axis |
| Acc．no． | No． 1 | － | Set no．of acc．time to use in acceleration（no1～4） |
| Dec．no． | No． 2 | － | Set no．of dec．time to use in deceleration（no1～4） |
| M code | 0 | － | Set it when executing another auxiliary operation synchronizing with circular interpolation |
| Dwell time | 500 | － | Set dwell time for outputting positioning complete |
| Auxiliary point | 5000 | － | Set the radius on main－axis |
| Circular interpolation Mode | Radius | － | If use middle－point－designation method，set「Middle－ point」on main－axis |
| Cir．Int．Dir | CW | － | Set moving direction |
| Arc size | Arc $<180^{\circ}$ | － | Set arc size |
| The No．of Turns | 0 | － | Set the no．of turns of arc for making a circle bigger than $360^{\circ}$ |

－${ }^{* 1}$ ：It means that no need to be set．Whatever value it is，it dose not affect circular interpolation．

## Note

1．Circular interpolation control of Radius designation method is executed on the basis of the items set on operating data．When it is executed，only「Goal position」 can affect circular interpolation．In other words， whatever value is set as，it does not affect the action and no errors arise．
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 goal position．If it is smaller than the half（ $R$ ）and 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．If it is smaller than the half（ $R$ ）and the value is lower than $80 \%$ of $R$ ，error（error code：270）arises and circular interpolation is not executed．

## Chapter 9 Functions

[Example] Axis $X$ is main-axis and Axis $Y$ is sub-axis. Execute circular interpolation with Incremental coordinates and designated radius.

- Starting position (1000, 1000), Goal position (8000, 0), Auxiliary point (5000, 0)

Moving direction of arc : CCW, Size of arc : Arc >= $180^{\circ}$
The action is as follows in the condition above
■ Setting example in XG5000

- Main-axis (Axis X) Operating data

| Step <br> No. | Coord. | Control | Method | Pattern | Goal <br> position <br> $[\mathrm{pls}]$ | Operating <br> speed <br> [pls/s] | Acc. <br> No, | Dec. <br> No, | Dwell <br> Time | Auxiliary <br> Point | Circular <br> interpolation <br> mode | Cir. Int. <br> dir | Arc size | The no. <br> of <br> turns |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | ABS | POS | SIN | END | 8000 | 1000 | No.1 | No.1 | 100 | 5000 | Radius | CW | Arc>=180 | 0 |

- Sub-axis (Axis Y) Operating data

| Step <br> No. | Coord. | Control | Method | Pattern | Goal <br> position <br> $[\mathrm{pls}]$ | Operating <br> speed <br> $[\mathrm{pls} / \mathrm{s}]$ | Acc. <br> No, | Dec. <br> No, | Dwell <br> Time | Auxiliary <br> Point | Circular <br> interpolation <br> mode | Cir. Int. <br> dir | Arc size | The no. <br> of <br> turns |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | ABS | POS | SIN | END | 8000 | 1000 | No.1 | No.1 | 100 | 5000 | Radius | CW | Arc> $=180$ | 0 |

Operation pattern


## Chapter 9 Functions

### 9.2.9 Speed/Position Switching Control

The setting axis by positioning start 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 as much as goal transfer amount.

## (1) Characteristics of Control

(a) Set control method of operating data as "Shortcut speed control" and executing positioning with「Speed/Position Switching」in 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(-)
(2)

Operation timing

(3) Restrictions
(a) Operation pattern of speed control has to be set as "End" or "Go on". If "Continuous" is set as, error (error code:236) arises and speed control may not be executed.
(b) If the value of goal position is 0 , speed/position switching command may not be executed. In this case, it continues to operate with speed control and error code 304 occurs.

## Chapter 9 Functions

(4) Setting example of operation data

| Items | Setting value | Description |
| :---: | :---: | :--- |
| Coord. | ABS | Set the coordinate method of main axis |
| Pattern | END | Set the pattern of main axis |
| Control | SPD | Set the control of main axis as SPD when starting |
| Method | SIN | Set the operation method |
| Goal position <br> [pls] | 10000 | After inputting speed/position switching control, set moving amount to <br> position. |
| Operating speed <br> $[p l s / s]$ | 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 | 500 | Set it when user needs to execute another auxiliary work synchronizing <br> with speed/position switching control |
| Dwell time | Set dwell time(ms) between switching command's inputting and <br> positioning completion's outputting |  |

## Chapter 9 Functions

## 9．2．10 Position／Speed Switching Control

The setting axis by positioning start 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 deceleration stop or SKIP operation or continues next operation．

## （1）Characteristics of Control

（a）Set control method of operating data as＂Shortcut position control＂and user may change position control to speed control with「Speed／Position Switching」
（b）Direction of movement depends on the sign of value and coordinates
－「Absolute，position control」
－Starting position＜Goal position ：Positioning in forward direction
－Starting position＞Goal position ：Positioning in reverse direction
－「Incremental，position control」
－The value of goal position has positive sign（＋）：Positioning in forward direction
－The value of goal position has negative sign（－）：Positioning in reverse direction
（2）Operating timing


## Chapter 9 Functions

## (3) Restrictions

(a) Position/speed switching command is not inputted before positioning to the goal position, it stops by deceleration and finishes the positioning.
(b) After position/speed switching, software high/low limit check depends on "Soft high/low limit in speed control" of extended parameter

| Items | Setting value | Description |
| :---: | :--- | :--- |
| Soft high/low <br> in speed control | $0:$ Not detect | Not to execute checking for software high/low limit in speed control |
|  | 1 : Detect | Execute checking for software high/low limit in speed control |

(4) Setting example of operation data

| Items | Setting value | Description |
| :---: | :---: | :--- |
| Coord. | ABS | Set the coordinate method of main axis |
| Pattern | END | Set the operation pattern of main axis |
| Control | POS | Set the control method as POS when starting |
| Method | SIN | Set the operation method |
| Goal position <br> $[\mathrm{pls}]$ | 10000 | Set the value of goal position for position control |
| Operating speed <br> $[\mathrm{pls} / \mathrm{s}]$ | 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 | 500 | Set it when user needs to execute another auxiliary work synchronizing <br> with speed/position switching control |
| Dwell time | When it is executed with position control and without position/speed <br> switching command, set dwell time between positioning and complete <br> signal's outputting. |  |

### 9.2.11 Start of Positioning

In case of stop in action of dynamic positioning, can positioning by restart. Three Starting types are general start, Simultaneous start, point operation. Operating signal is have to "OFF", when it start.
(1) Direct start
(a) Do not use operating data, directly input positioning data by auxiliary data and perform positioning control.
(b) Setting auxiliary data of direct start.

| Setting item |  |
| :---: | :--- |
| Target position | Set target position of control. |
| Operating speed | Set operating speed of control. |
| Dwell time | Set dwell time (ms) that it is from positioning to outputting signal of positioning. <br> $(0 \sim 65535)$ |
| M code | Set for performing auxiliary action which is depending on set control.(0~65535) |
| Acc. time | Set acceleration time number for acceleration. (No.1 ~ No.4) |
| No. | Set reduction time number for reduction. (No.1 ~ No.4) |
| No. | Set coordinate about target position of set control.(absolute, Incremental) |
| Coordinate | Select one between position control and speed control |
| Control method |  |

(2) Indirect Start
(a) Start control of positioning by designating step number of operation data which was saved in positioning module.
(b) Setting auxiliary data of indirect start

| Setting item | Contents |
| :---: | :---: |
| Operation step | Set step number of operation data what you need operating.(0 or $1 \sim 400$ ) |

Note
Set ' 0 ' operation step of Indirect start and carry out command of indirect start. And then start operation data which was saved in step number.

## Chapter 9 Functions

(3) Simultaneous start
(a) According to axis information and setting step, executes Simultaneous start
(b) Restriction

In these cases can not operate all of the axes which were set simultaneous start by error.

- When occurred error in over an axis among setting axes of simultaneous start. (Output error code in its axis.)
- When command axis of simultaneous start was wrong. (Error code : 296)
- Only set command axis (Set over 2 axes is necessary.)


## [ Example ] Set Simultaneous start of axis X , axis Y as follows;

- Current position of axis 1: 0, Operation step: 1

Current position of axis 2: 0, Operation step: 3

- Example of setting XG5000
- Operation data of axis X

| Step No. | Coord. | Control | Method | Pattern | Target position <br> [pls] | Operation <br> speed [pls/s] | Acceleratio <br> n No. | Deceleratio <br> n No. | M code | Dwell time |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | ABS | POS | SIN | CONT | 1000 | 1000 | 1 | 1 | 0 | 0 |
| 2 | ABS | POS | SIN | END | 1800 | 800 | 1 | 1 | 0 | 0 |

- Operation data of axis $Y$

| Step No. | Coord. | Control | Method | Pattern | Target position <br> $[\mathrm{pls}]$ | Operation <br> speed [pls/s] | Acceleratio <br> n No. | Deceleratio <br> n No. | M code | Dwell time |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 3 | ABS | POS | SIN | END | 900 | 500 | 2 | 2 | 0 | 0 |

- Operation pattern



### 9.2.12 Positioning stop

Here describes factor which are stop axis during operation.
(1) Stop command and Stop factor

Command \& Stop factor of stop positioning operating is as follows;
(a) It will stop, when stop command is "On" or there are some stop factors at each axis. But, interpolation control (linear interpolation, Circular interpolation, helical interpolation, elliptic interpolation)
In case of there is stop command or stop factor on main axis, operation axes of interpolation control will stop.

| Status Stop factor |  | $\underset{{ }_{1}}{\text { Positioning }}$ | Homing ${ }^{*}$ | Jog Operation | Speed synchronous | Status of Axis after stop | M code On Status of signal |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & \text { Parameter } \\ & \text { setting } \end{aligned}$ | Exceed soft high-limit | Prompt stop | No Detection | Prompt stop ${ }^{*}$ |  | Error (Error501) | No change |
|  | Exceed soft low-limit | Prompt stop | No Detection | Prompt stop |  | Error (Error502) | No change |
| Sequence program | $\begin{aligned} & \text { Deceleration } \\ & \text { stop } \\ & \text { command } \\ & \hline \end{aligned}$ | Deceleration stop | $\begin{aligned} & \text { Deceleration } \\ & \text { stop } \end{aligned}$ | $\begin{gathered} \text { Error } 322 \\ \text { (Go-on } \\ \text { operation) } \\ \hline \end{gathered}$ | $\begin{aligned} & \text { Deceleration } \\ & \text { stop }^{\text {5 }} \end{aligned}$ | Stop On | No change |
|  | $\begin{aligned} & \text { Emergency } \\ & \text { stop } \\ & \text { command } \\ & \hline \end{aligned}$ | Sudden stop |  |  |  | Error (Error481) | "Off" |
| External signal | External highlimit "On" | Sudden stop |  | When operate to forward, sudden stop | Sudden stop | Error (Error492) | No change |
|  | $\begin{aligned} & \text { External low- } \\ & \text { limit "On" } \end{aligned}$ | Sudden stop |  | When operate to reverse, sudden stop | Sudden stop | Error (Error493) | No change |
| XG5000 monitor window | $\begin{aligned} & \hline \text { Deceleration } \\ & \text { stop } \\ & \text { command } \end{aligned}$ | Deceleration stop | $\begin{aligned} & \text { Deceleration } \\ & \text { stop } \end{aligned}$ | Error322 (Go-on operation) | Deceleration stop | Stop "On" | No change |
|  | Emergency stop command | Sudden stop |  |  |  | Stop "On" | "Off" |

## Note

*1 : Positioning means position control, speed control, interpolation control, speed/position switching control, position/speed switching control.
*2 : When complete homing, DOG and origin signal do not effect to positioning control.
*3 : Only work while software high/low limit on the speed control of expansion parameter at the speed control operation mode is set " 1 :detection"
*4: Output speed become " 0 ", when it has factor of stop.
*5 : Speed goes to "0", according to DEC stop time, auxiliary data of DEC stop command
(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.


## Chapter 9 Functions

- Positioning of Incremental coordinate method: Operate as set movement at the target position.
(e) It decelerate and stop by XG5000 and「deceleration stop」command of sequence program as set support data.
(f) Restriction
- 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.
(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.


## Chapter 9 Functions

(3) Emergency Stop
(a) If EMG stop command occurs during indirect operation, direct operation, simultaneous start operation, synchronization operation, Home return operation, Jog operation and inching operation, it will stop immediately without deceleration.
(b) In case of emergency stop, error 481 will occur.
(c) M code signal will be "Off" after Emergency stop.
(d) 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 stopped immediately 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.
(c) Motion timing

(5) Stop by software upper/lower limit

## Chapter 9 Functions

（a）When positioning control，if value of current command position out of set value of expansion parameter in「software upper limit」 and「software lower limit」，it will promptly be stopped without outputting value of command position．
（b）If value of command position to be out of software upper limit range，will occur error 501，and if it to be out of software lower limit range，will occur error 502.
－Setting related parameter（expansion parameter）

| Item | Setting value | Contents |
| :---: | :---: | :---: |
| Software upper <br> limit | $-2147483648 \sim 2147483647$ | Set position of software upper limit． |
| Software lower limit | $-2147483648 \sim 2147483647$ | Set position of software lower limit． |

（c）Condition
Software upper／lower 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 upper limit＝Software lower limit＂
（d）Motion timing


## Chapter 9 Functions

(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.

Note
Process is as follows, when factor of sudden stop is occurred during deceleration stop.


## Chapter 9 Functions

(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 Incremental coordinate.
(c) 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 (MOF)」command.
(b) Restart after 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 XG5000 manual operation parameter setting.
Set the Jog speed on Jog high/low speed of XG5000 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 | $1 \sim$ Speed limit | Set Jog speed. Jog high speed must be set below limit |
| Jog Low Speed | $1 \sim$ Jog High Speed | Set Jog speed. Jog low speed must be set below Jog high speed |
| Jog Acc. Time | $0 \sim 65,535$ | Set the acc. Time used in acceleration of Jog operation |
| Jog Dec. Time | $0 \sim 65,535$ | Set the dec. time used in deceleration of Jog operation |

## Note

If "Jog Acc. Time" is 0 , it operates at a goal speed immediately
If "Jog Dec. Time" is 0 , it stops immediately without deceleration.

## Chapter 9 Functions

## (2) Operation Timing



## Note

Notices for setting Jog speed are as follows.
Jog Low Speed $\leq$ Jog High Speed $\leq$ 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 XG5000 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 |
|  | XBC Type | XEC Type |  |
| X - axis | UXX.01.0 | \%UXx.y. 16 | Axis X Forward Jog |
|  | UXX.01.1 | \%UXx.y. 17 | Axis X Reverse Jog |
|  | UXX.01.2 | \%UXx.y. 18 | Axis X Jog Low/High Speed |
|  | UXX.01.3 | \%UXx.y. 19 | Clear positioning complete signal |
| Y - axis | UXX.01.4 | \%UXx.y. 20 | Axis Y Forward Jog |
|  | UXX.01.5 | \%UXx.y. 21 | Axis Y Reverse Jog |
|  | UXX.01.6 | \%UXx.y. 22 | Axis Y Jog Low/High Speed |
|  | UXX.01.7 | \%UXx.y. 23 | -Clear positioning complete signal |

[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

## Chapter 9 Functions



## 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.

## Chapter 9 Functions

### 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 $-2147483648 \sim 2147483647$ 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 XG5000.
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 | $0 \sim 65,535$ | Set the accelerating time for acceleration of Inching operation |
| Jog dec. Time | $0 \sim 65,535$ | Set the decelerating time for deceleration of Inching operation |
| Inching Speed | $1 \sim 65,535$ | Set the speed of Inching operation |

## Chapter 9 Functions

(2) Operation Timing


## Chapter 9 Functions

### 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) 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.
(c) Auxiliary data of speed sync. command

The auxiliary data used in speed sync. command is as follows.

| Item | Setting value | Description |
| :---: | :---: | :--- |
| Main Axis | 0 (X-axis), 1(Y-axis), 2(encoder) | Set the main axis of speed sync. |
| Ratio of Main axis | $1 \sim 65,535$ | Set the ratio of main axis at speed sync. ratio. |
| Ratio of Sub axis | $1 \sim 65,535$ | Set the ratio of sub axis at speed sync. ratio.. |

Ratio of Speed sync. is calculated as follows.
Ratio $=\frac{\text { SubAxis }}{\text { MainAxis }}$
Operating speed of sub axis is calculated as follows.

$$
\begin{aligned}
\hline \text { Operaing speed of SubAxis } & =\text { Operating Speed of MainAxis } \times \text { Ratio of speed sync. } \\
& =\text { Operating Speed of MianAxis } \times \frac{\text { Ratio of SubAxis }}{\text { Ratio of MainAxis }}
\end{aligned}
$$

## Chapter 9 Functions

## (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 (MOF) 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".

## Chapter 9 Functions

[Example] axis $X$ is main axis, axis $Y$ is sub axis. Operate at "ratio of main axis : ratio of sub axis = $2: 1$ "

- Example of setting in XG5000
-Operation data of main axis (axis X )

| Step no. | Coord. | Control | Method | Pattern | Goal Position <br> [pls] | Operating speed <br> [pls/s] | Acc. no. | Dec. no. | M code | Dwell <br> Time |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | INC | POS | SIN | 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 In case of origin fix
(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,

- Encoder direction in PHASE A/B 4 multiplication
- 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


## Chapter 9 Functions


(g) Related parameter (Common Parameter)

Set parameter related to encoder on common parameter.

| Item | Setting Value | Description |
| :---: | :---: | :---: |
| Encoder Pulse <br> Input | 0: CW/CCW 1 multiplying <br> $1:$ PULSE/DIR 1 multiplying <br> $2:$ PHASE A/B 4 multiplying | Set the encoder to use in input of encoder |
| Maximum of <br> encoder | $-2147483647 \sim 2147483647$ | Set the count range with max./min. of |
| Minimum of <br> encoder | $-2147483647 \sim$ Max. of Encoder |  |

## Chapter 9 Functions

[Example] Execute speed sync. control with encoder (main axis), axis2(sub axis) at "the ratio of main axis : the ratio of sub axis =1: $\mathbf{2 "}^{\prime \prime}$.
(Hypothesize that the input speed of encoder is 1 Kpps )
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



## Chapter 9 Functions

### 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 <br> position sync. | $-2147483648 \sim 2147483647$ | Set the position of main axis in position sync. control |
| Operation step | $1 \sim 150$ | Set the step no. to be executed when the main axis <br> arrives at the position for position sync. |
| Main axis | 0 (axis X ) $\sim 1$ (axis Y ) | 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 (MOF).
(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.

## Chapter 9 Functions

[Example] Axis $X$ is main axis, axis $X$ is sub axis. The position of main axis for position sync. is 1300, execute position sync. with operation data no. 10 of axis $Y$.

- The current position of axis $X$ : 0

The current position of axis $Y: 0$

- Example in XG5000
- Main axis (axis X) Operation data

| Step no. | Coord. | Control | Method | Pattern | Goal position <br> [pls] | Operating speed <br> [pls/s] | Acc. no. | Dec. no. | M code | Dwell <br> time |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | INC | POS | SIN | END | 2000 | 1000 | No. 1 | No. 1 | 0 | 0 |

- Sub axis (axis Y) Operation data

| Step no. | Coord. | Control | Method | Pattern | Goal position <br> [pls] | Operating speed <br> [pls/s] | Acc. no. | Dec. no. | M code | Dwell <br> time |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 10 | INC | POS | SIN | END | 2000 | 2000 | No. 2 | No. 2 | 0 | 0 |

## - Operating pattern



## Chapter 9 Functions

### 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 "The position of homing completion" of homing parameter.
(c) Related parameter (Homing Parameter)

| Items | Setting value | Description |
| :---: | :---: | :--- |
| Position of homing <br> completion | $-2147483648 \sim 2147483647$ | Set the position after homing completion or floating <br> origin setting |

## 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


## Chapter 9 Functions

### 9.5.2 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 $-2,147,483,648 \sim 2,147,483,647$ 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.


## Chapter 9 Functions



## (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 axis X operating by absolute, position control.

- Current position of axis X : 0
- Setting example in XG5000
- Operation data of axis $X$

| Step no. | Coord. | Control | Method | Pattern | Goal position <br> $[\mathrm{pls}]$ | Operation speed <br> $[\mathrm{pls} / \mathrm{s}]$ | Acc.no. | Dec.no. | M code | Dwell time |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | ABS | POS | SIN | CONT | 1000 | 1000 | No. 1 | No. 1 | 0 | 0 |
| 2 | ABS | POS | SIN | 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.

## Chapter 9 Functions

### 9.5.3 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 |
| :---: | :---: | :--- |
|  | $0.01 \sim 65,535$ <br> $(1=0.01 \%)$ | Set the speed override setting value with percentage <br> (If it is $100 \%$, set 1000) |
|  | $1 \sim$ 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)
[Example] Execute speed override $(50 \% \rightarrow \mathbf{1 0 0 \%} \rightarrow \mathbf{2 0 0 \%} \rightarrow \mathbf{1 5 0 \%})$ on axis $X$ operating by absolute, position control.

- Current position of axis X : 0
"Speed override" of common parameter : Set \%
"Speed limit" of basic parameter : 3000 [pls/s]
- Setting example of XG5000
- Operation data of axis X

| Step no. | Coord. | Control | Method | Pattern | Goal position <br> [pls] | Operation speed <br> [pls/s] | Acc.no. | Dec.no. | M code | Dwell time |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | ABS | POS | SIN | END | 1000 | 2000 | No.1 | No.1 | 0 | 0 |

- Operation pattern



## Chapter 9 Functions

### 9.5.4 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 $-2147483648 \sim 2147483647$ 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 Incremental 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 |

(g) Auxiliary data setting of positioning speed override command

| Items | Setting value | Description |
| :---: | :--- | :--- |
| Postion | -2147483648 <br> 2147483647 | $\sim$ |
| Speed | $0.01 \sim 655.35(1=0.01 \%)$ | Sf the position to start speed override <br> $(100 \%$ is 10000 $)$ |
|  | $1 \sim$ Speed limit | If speed override is "Exact number", set the speed with <br> exect 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.
(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) If execute positioning speed override in dec. area., error code 377 arise and speed overrid is not executed.

## Chapter 9 Functions

［Example］Execute positioning speed override at 4000 ［pls／s］at 2000（position of speed override）on axis $X$ operating by absolute，position control．
－Current position of axis X： 0
「Speed override」 of common parameter：Speed setting
「Speed limit」 of basic parameter ： 5000 ［pls／s］
－Setting example in XG5000
－Operation data of axis X

| Step no． | Coord． | Control | Method | Pattern | Goal position <br> $[p l s]$ | Operation speed <br> $[p l s / s]$ | Acc．no． | Dec．no． | M code | Dwell time |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | ABS | POS | SIN | END | 5000 | 2000 | No．1 | No．1 | 0 | 0 |

－Operation pattern


## Chapter 9 Functions

### 9.5.5 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 | $-2147483648 \sim 2147483647$ | 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)

## Chapter 9 Functions

### 9.5.6 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 | $-2147483648 \sim$ <br> 2147483647 | Set the encoder position to change on selected <br> encoder |  |  |

(2) Operation timing

(3) Restrictions

In the cases below, encoder preset command may not be executed and error arises.
(a) There is an encoder as a main axis (error code: 532)
(b) Position value of encoder preset exceeds the max./min. value of encoder of common parameter. (error code:534)

## Chapter 9 Functions

### 9.5.7 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 | $1 \sim 150$ | 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 $0 \sim 400$. (error code:442)

If step no. is 0 , keep the current step no.

## Chapter 9 Functions

### 9.5.8 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 | $1 \sim 150$ | Set the repeat operation step no. to change |

(2) Operation timing


## (3) Restrictions

In the case below, repeat operation step no. change command is not executed.
(a) Step no. to change is out of $0 \sim 150$. (error code:442)

If the step no. is 0 , keep the previous step no.

## Chapter 9 Functions

[Example] Execute repeat operation step no. change command on axis1 operating by absolute, shortcut position control.

- Current position of axis X : 0
- Setting example in XG5000
- Operation data of axis X

| Step <br> no. | Coord. | Control | Method | Pattern | Repeat <br> step | Goal <br> position <br> [pls] | Operation <br> speed <br> [pls/s] | Acc. no. | Dec. no. | M code | Dwell time |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | ABS | POS | SIN | KEEP | - | 1000 | 1000 | No.1 | No.1 | 0 | 0 |
| 2 | ABS | POS | SIN | CONT | - | 2000 | 2000 | No.1 | No.1 | 0 | 0 |
| 3 | ABS | POS | SIN | CONT | - | 4000 | 3000 | No.1 | No.1 | 0 | 0 |
| 4 | ABS | POS | REP | KEEP | 10 | 2000 | 3000 | No.1 | No.1 | 0 | 0 |
| 5 | ABS | POS | SIN | END | - | 5000 | 2000 | No.1 | No.1 | 0 | 0 |

- Operation pattern



## Chapter 9 Functions

### 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 immediately.

## Chapter 9 Functions

## (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 | $-2147483648 \sim$ | Set the position of soft high limit |
| Soft Low Limit | -2147483647 |  |
|  | $214783648 \sim$ | Set the position of soft low limit |

(f) Software high/low limit is shown as follows.

(g) 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)


## Chapter 9 Functions

### 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 : $0 \sim 65535$ )
(b) If M code is set as " 0 ", M code signal will not occur.
(c) If $M$ code occurs, $M$ code no. $(1 \sim 65535)$ and $M$ code signal ( $O n$ ) 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 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 |
| :---: | :--- | :--- |
|  | $0:$ None | Not to output $M$ code signal and $M$ code no. |
|  | $1:$ With | Start and turn $M$ code signal on at the same time, <br> then output $M$ code no. set in operation data. |
|  | 2 : After | After finishing positioning by start command, turn $M$ <br> code signal on and then output $M$ code no. set in <br> operation data. |

(2) Operation timing

[Example] Set M code no. in operation data as follows and execute absolute, positioning control.

- Current position of axis X : 0
$M$ code mode of basic parameter : With
- Setting example in XG5000
- Operation data of axis X

| Step <br> no. | Coord. | Control | Method | Pattern | Goal position <br> $[\mathrm{pls}]$ | Operation speed <br> $[\mathrm{pls} / \mathrm{s}]$ | Acc. no. | Dec. no. | M code | Dwell time |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | ABS | POS | SIN | KEEP | 1000 | 2000 | No.1 | No.1 | 100 | 0 |
| 2 | ABS | POS | SIN | KEEP | 3000 | 2000 | No.1 | No.1 | 200 | 0 |
| 3 | ABS | POS | SIN | END | 5000 | 2000 | No.1 | No.1 | 300 | 0 |

- Operation pattern



## Chapter 9 Functions

### 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 XG5000.

## (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

- Single teaching

| Items | Setting value | Description |
| :---: | :--- | :--- |
| Step | $0 \sim 150$ | Set the step no. for teaching |
| Position | $0:$ RAM teaching |  |
| $1:$ ROM teaching |  |  | Set the method of teaching | Data |
| :---: |
| 0: Position |
| $1:$ Speed |$\quad$ Set the data items for teaching |  |
| :--- |

- Teaching array

| Items | Setting value | Description |
| :---: | :--- | :--- |
| Step | $0 \sim 150$ | Set the step no. for teaching |
| Position | $0:$ RAM teaching <br> $1:$ ROM teaching | Set the method of teaching |
| Data | $0:$ Position <br> $1:$ Speed | Set the data items for teaching |
| Number | $1 \sim 16$ | Set the number of step |

## Chapter 9 Functions

## 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 TWR.

## (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 (1~150). (Error code: 465)

Total number (Teaching step no. + The number of Teaching) must be below 150.

### 9.7.2 Parameter Change from Program

User may modify the operation parameter set on XG5000 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) Parameter is saved in RAM. If you want to save the parameter permanently, use WRT instruction.

## Chapter 9 Functions

## (2) Basic Parameter Teaching

(a) Change the setting value of designated item from basic parameter of APM module into teaching data.
(b) Auxiliary data setting of basic parameter teaching command

| Setting value | Items | Setting range |
| :---: | :---: | :---: |
| 1 | Speed limit | 1 ~ 2,000,000 [pulse/s] |
| 2 | Bias speed | 1 ~ 2,000,000 [pulse/s] |
| 3 | Acc.time 1 |  |
| 4 | Acc.time 2 |  |
| 5 | Acc.time 3 |  |
| 6 | Acc.time 4 |  |
| 7 | Dec.time 1 |  |
| 8 | Dec.time 2 |  |
| 9 | Dec.time 3 |  |
| 10 | Dec.time 4 |  |
| 11 | SW upper limit | -2,147,483,648 ~ 2,147,483,647 [pulse] |
| 12 | SW lower limit | -2,147,483,648 ~ 2,147,483,647 [pulse] |
| 13 | Backlash compensation amount | 0 ~ 65,535 [pulse] |
| 14 | SW limit detect | 0: not detect, 1: detect |
| 15 | Pos. Comp. Condition | 0: Dwell, 1: Inposition <br> 2: Dwell and Inposition 3: Dwell or Inposition |
| 16 | Upper/Lower limit | 0 : not use, 1: use |
| 17 | Pulse output level | 0: Low Active, 1: High Active |
| 18 | Pulse output mode | 0: CW/CCW, 1: PLS/DIR |
| 19 | M code output mode | 0: None, 1: With, 2: After |

For the details about basic parameter items and setting value, refer to "Chapter 4 parameter and operation data".

## (3) Homing/Manual Parameter Teaching

(a) Change the setting value of designated item from homing/manual parameter into teaching data.
(b) Auxiliary data setting of homing parameter teaching command

| Setting value | Item | Setting range |
| :---: | :---: | :---: |
| 1 | Home address | -2,147,483,648 ~ 2,147,483,647 [pulse] |
| 2 | Home high speed | 1 ~ 2,000,000 [pulse/s] |
| 3 | Home low speed |  |
| 4 | Home compensation | -32,768 $\sim 32,767$ [pulse] |
| 5 | Homing ACC time | 0 ~ 65,535 [ms] |
| 6 | Homing Dec time |  |
| 7 | Dwell time |  |
| 8 | Home method | 0:DOG/HOME(Off), 1:DOG/HOME(On), 2:DOG, <br> 3: U.L.Limit/HOME, 4:U.L.Limit |
| 9 | Home direction | 0:CW, 1:CCW |
| 10 | JOG high speed | 1 ~ 2,000,000 [pulse/s] |
| 11 | JOG low speed |  |
| 12 | JOG ACC Time (ms) | 0 ~ 65,535[ms] |
| 13 | JOG DEC Time (ms) | $0 \sim 65,535[\mathrm{~ms}]$ |
| 14 | Inching speed | $1 \sim 65,535[p u l s e / s]$ |

For the details about basic parameter items and setting value, refer to "Chapter 4 parameter and operation data".
(4) I/O Signal Parameter Teaching
(a) Change the setting value of designated item from I/O signal parameter of into teaching data.
(b) Auxiliary data setting of I/O signal parameter teaching command

| Bit | Signal |
| :---: | :---: |
| 0 | Upper limit signal |
| 1 | Lower limit signal |
| 2 | DOG signal |
| 3 | HOME signal |
| 4 | INPOSITION signal |
| 5 | Deviation counter clear output signal |
| $6 \sim 15$ | Not used |

For the details about basic parameter items and setting value, refer to "Chapter 4 parameter and operation data".

## Chapter 9 Functions

## (5) Common Parameter Teaching

(a) Change the setting value of designated item from common parameter into teaching data.
(b) Auxiliary data setting of common parameter teaching command

| Setting <br> value | Item | Setting range |
| :---: | :---: | :--- |
| 1 | Encoder max. value | $-2147483648 \sim 2147283647$ |
| 2 | Encoder min. value |  |
| 3 | Speed override | $0:$ CW/CCW, $1:$ PLS/DIR, 2: PHASE |
| 4 | Encoder input | 0 |

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 XG5000 with operation data teaching command.

## (1) Characteristics of Control

(a) Change setting value of designated step and item from positioning module's operation data into teaching data.
(b) Parameter teaching is not available in operation.
(c) The changed parameter is saved in RAM. If you want to save parameter permanently, use WRT instruction.
(d) Auxiliary data setting of operation data teaching command

| Setting value | Item | Setting range |
| :---: | :---: | :---: |
| 1 | Goal address |  |
| 2 | Cir. int. aux. point | -2,147,483,648 ~ 2,147,483,647 [pulse] |
| 3 | Speed | 1 ~ 2,000,000 [pulse/s] |
| 4 | Dwell time | 0 - 65,535[ms] |
| 5 | M code number | 0 ~ 65,535 |
| 6 | Cir. int. turns | 0~65,535 |
| 7 | Method | 0: SIN, 1: REP |
| 8 | Control | $0:$ POS, 1: SPD |
| 9 | Pattern | 0: END, 1: KEEP, 2: CONT |
| 10 | Coord. | 0: ABS, 1: INC |
| 11 | Cir. int. size | $0: \operatorname{Arc}<180$ 1: $\operatorname{Arc}>=180$ |
| 12 | ACC. no. | 0-3 |
| 13 | DEC. no. | 0~3 |
| 14 | Cir. int. mode | 0:MID, 1: CENTER, 2: RADIUS |
| 15 | Cir. int. direction | $0: C W, 1: C C W$ |
| 16 | Repeat step no. | 1~150 |

For the details about basic parameter items and setting value, refer to "Chapter 4 parameter and operation data".

## Chapter 10 Positioning Monitoring Package

### 10.1 Positioning Monitoring Package

You can monitor the status of XGB PLC positioning module and carry out test operation without the program by changing the parameters and operation data if you use the XGB monitoring package.

### 10.1.1 Introduction of Positioning Monitoring Package

- You can easily and conveniently monitor the current positioning operation or change the parameter or operation data by using the following positioning monitoring package with XGB PLC connected to XG5000.
- If you use the positioning monitoring package, you can easily carry out test operation without the program, adjust the parameter and operation data, and permanently save it in PLC after the adjustment.
- XGB positioning monitoring package for XGB positioning module is available with over XG5000 V3.1 and it is carried out in the following sequence.
(1) Opening the Monitoring Package
- Select 'Monitoring' $\rightarrow$ 'Special Module Monitoring' with XGB PLC connected to XG5000, the special module monitoring display is invoked as follows.
(If XGB is not connected to XG5000, 'Special Module Monitoring' is inactivated in the 'Monitoring' menu. Thus make sure that XGB is connected to XG5000 before using positioning monitoring.)

- When you want to carry out the positioning monitoring package, double click on the positioning module or select the positioning module, and then click on the 'Monitoring' button at the bottom. And the positioning monitoring package is started as follows.

- The menu and function of the positioning monitoring package are as follows.

| Items | Functions | Remark |
| :---: | :--- | :---: |
| Monitoring | Monitors the positioning of the axis or gives commands. |  |
| Teaching Command | Executes teaching for each axis |  |
| Position Parameter | Checks and modifies the positioning parameter of each axis. |  |
| X-axis data | Checks and modifies the operation data of axis X. |  |
| Y-axis data | Checks and modifies the operation data of axis Y. |  |
| Start Monitor | Carries out positioning monitoring. | WRT |
| Stop Monitor | Stops positioning monitoring. |  |
| Write | Permanently saves the changed parameter and operation data in <br> PLC. | Read |
| Reads parameter and operation data saved in module |  |  |
| Save Project | Saves the changed parameter and operation data in XG5000 project. |  |

Chapter 10 Positioning Monitoring Package

### 10.2 Menus and Functions of Positioning Monitoring

The following is the function and use of the menus of the XGB monitoring package.

### 10.2.1 Monitoring and Command

- The positioning monitoring package consists of the command window for positioning test operation, teaching command window and positioning monitoring window as shown above.
- If you click on the 'Start Monitor' button at the left bottom of the package, the monitoring and command function is activated to make various commands and current status monitoring functions available.
- If you start the command on the left, the corresponding functions are activated without the program and the status is displayed on the monitoring window on the right.



## Chapter 10 Positioning Monitoring Package

（1）Positioning Command
－The commands available in the positioning monitoring package are as follows．
－To execute an command，enter the setting of the command，and click on the＇Run’ button（ $「 \ll 」, 「<\lrcorner, 「 \|\lrcorner$ ，「 $>\perp,\ulcorner\gg \perp$ during jog operation）．

| Item | Description |  |  |  |  | Command |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Indirect start | Direct start with the operation step set in the monitoring window |  |  |  |  | IST，APM＿IST |
| Error reset | Resets the error code and output inhibition in case of an error |  |  |  |  | CLR，APM＿RST |
| Direct start | Directly starts with the position，speed，dwell，M code，acc．／dec． number，coordinates and control method set in the monitoring window |  |  |  |  | DST，APM＿DST |
| M code OFF | Cancels the M code On signal and M code number |  |  |  |  | MOF，APM＿MOF |
| Dec．stop | Carries out deceleration stop in the set deceleration time |  |  |  |  | STP，APM＿STP |
| EMG stop | Stops the operation of the axis and inhibits pulse output |  |  |  |  | EMG，APM＿EMG |
| Spd override | Overrides the speed at the set speed value |  |  |  |  | SOR，APM＿SOR |
| Pos override | Overrides the position at the set position value |  |  |  |  | POR，APM＿POR |
| Spd override with position | Changes the operation speed at the speed value set in the set position |  |  |  |  | PSO，APM＿PSO． |
| Home return | Conducts home return as the home return method set in the positioning parameter |  |  |  |  | ORG，APM＿ORG |
| FLT | Sets the current position as the fixed home |  |  |  |  | FLT，APM＿FLT |
| Position preset | Presets the current position with the set value |  |  |  |  | PRS，APM＿PRS |
| Start step No． | Changes the start step with the set step |  |  |  |  | SNS，APM＿SNS |
| Inching | Conducts inching operation to the set position（inching amount）at the inching speed set in the positioning parameter |  |  |  |  | INCH，APM＿INC |
| Jog | Conducts jog operation at the jog speed set in the parameter |  |  |  |  |  |
|  | －＜ | $\square$ | 11 | $>$ | 》＞ |  |
|  | Reverse high speed | Reverse low speed | Jog stop | Normal low speed | Normal high speed |  |
| Spd position conversion | Changes from speed control to position control |  |  |  |  | VTP，APM＿VTP |
| Position spd conversion | Changes from position control to speed control |  |  |  |  | PTV，APM＿PTV |
| Spd synchronous operation | Speed synchronous operation at the set main axis，speed ration and delay time |  |  |  |  | SSS，APM＿SSS |

Chapter 10 Positioning Monitoring Package

| Item | Description | Command |
| :--- | :--- | :---: |
| Position <br> synchronous <br> operation | Speed synchronous operation at the set main axis, step and position | SSP, APM_SSP |
| Simultaneous start | Simultaneous start with the operation step set for each axis | SST, APM_SST |
| Linear interpolation <br> operation | Linear interpolation operation for axes $X$ and $Y$ with the set operation <br> step | LIN, APM_LIN |
| Circular <br> interpolation <br> operation | Circular interpolation operation for axes $X$ and $Y$ with the set <br> operation step | CIN, APM_CIN |

## Chapter 10 Positioning Monitoring Package

(2) Teaching command

- You can execute goal speed/position teaching for each step at positioning monitoring package

Positioning Module: XBF-PD02A (Line-Driver, 2-Axis)
? $\times$



| Command <br> item | Aux. data |  |
| :--- | :--- | :--- |
| Single <br> teaching | Step | Inputs operation step for single teaching (1~150) |
|  | Target | Inputs position to save teaching data (0:RAM, 1:ROM) |
|  | Data | Inputs type of teaching data .(0:position, 1:speed) |
|  | Value | Input value for teaching |
|  | Step | Inputs head operation step for multiple teaching (1~150) |
|  | Data | Inputs position to save teaching data (0:RAM, 1:ROM) |
|  | No. | Inputs type of teaching data .(0:position, 1:speed) |
|  | Inputs the number of step for multiple teaching (1~16) |  |

Chapter 10 Positioning Monitoring Package
(3) Positioning Monitoring Window

- The monitoring window on the right of the monitoring package displays the current status according to the positioning command.
- The information displayed in the positioning monitoring window is as follows.

| Item | Displays |
| :---: | :---: |
| Current position | Current position of each axis |
| Current speed | Current speed of each axis |
| Step No. | Currently operating step of each axis |
| Error code | Error code in case of an error of the axis |
| M code | M code of the currently operating step |
| Busy | Whether the axis is operating |
| Positioning complete | Whether the positioning has been completed for the axis |
| M code On | M code On/Off of the currently operating step |
| Origin fix | Whether the origin has been fixed |
| Output inhibit | Whether output is inhibited |
| Upper limit detection | Whether the upper limit is detected |
| Lower limit detection | Whether the lower limit is detected |
| EMG stop | Emergency stop |
| Normal/reverse rotation | Normal and reverse rotation |
| Operation status | The operation status of each axis (acc., dec., constant speed, and dwell) |
| Control pattern | Operation control pattern of each axis (position, speed, interpolation) |
| Home return | Whether home return is being conducted |
| Position Sync | Whether position synchronization is being conducted |
| Speed Sync | Whether position synchronous operation is being conducted |
| Jog high speed | Whether jog high speed operation is being conducted |
| Jog low speed | Whether jog low speed operation is being conducted |
| Inching | Whether inching operation is being conducted |
| Encoder | Current encoder count |
| Upper limit signal | External upper limit signal status of the axes |
| Lower limit signal | External lower limit signal status of the axes |

## Chapter 10 Positioning Monitoring Package

| Item |  |
| :---: | :--- |
| DOG | DOG signal status of the axes |
| HOME | Origin signal status of the axes |
| INPOSITION | INPOSITION signal status of the axes |

### 10.3 Parameter/Operation Data Setting Using Monitoring Package

You can change the positioning parameter and operation data of XGB PLC and do test operation by using the XGB monitoring package.

### 10.3.1 Changing the Position Parameter

(1) How to Change the Parameter

- You can change the position parameter by using the position monitoring package. Note that you can't change the parameter during output because PLC can't save parameter in flash memory.
- If you select 'Position Parameter' tab in the positioning monitoring package, the window appears where you can change the positioning basic parameter and the origin/manual parameter and the parameter saved in XG5000 is displayed as well.

| Positioning Module: XBF-PD02A (Line-Driver, 2-Axis) |  |  |  |  | ? | $x$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Item | X Axis |  |  | Y Axis | A |
| BasicParameter | Pulse Output Mode | 0: CW/CCW |  |  | 0: CWICCW |  |
|  | MCode Output Mode | $0:$ None |  |  | $0:$ None |  |
|  | Bias Speed | $1 \mathrm{pls} / \mathrm{s}$ |  |  | $1 \mathrm{pls} / \mathrm{s}$ |  |
|  | Speed Limit | $2000000 \mathrm{pls} / \mathrm{s}$ |  | $2000000 \mathrm{pls} / \mathrm{s}$ |  |  |
|  | ACC No. 1 | 500 ms |  | 500 ms |  |  |
|  | DEC No. 1 | 500 ms |  | 500 ms |  |  |
|  | ACC No. 2 | 1000 ms |  | 1000 ms |  |  |
|  | DEC No. 2 | 1000 ms |  | 1000 ms |  |  |
|  | ACC No. 3 | 1500 ms |  | 1500 ms |  |  |
|  | DEC No. 3 | 1500 ms |  | 1500 ms |  |  |
|  | ACC No. 4 | 2000 ms |  | 2000 ms |  |  |
|  | DEC No. 4 | 2000 ms |  | 2000 ms |  |  |
|  | SNW Upper Limit | 2147483647 pls |  | 2147483647 pls |  |  |
|  | SWW Lower Limit | -2147483648 pls |  | -2147483648 pls |  |  |
|  | Backlash Compensation | 0 pls |  | 0 pls |  |  |
|  | SNW Limit Detect | 0 : No Detect |  | 0 : No Detect |  |  |
|  | Pos. Comp. Condition | $0:$ Dwell |  | 0: Dwell |  |  |
|  | Upper/Lower Limit | 1: Use |  | 1: Use |  |  |
| Home/ <br> Manual Parameter | Home Method | O: DOG/HOME(OFF) |  | O: DOG/HOME(OFF) |  |  |
|  | Home Direction | 1: CCW |  | 1: CCW |  |  |
|  | Home Address | 0 pls |  | 0 pls |  |  |
|  | Home High Speed | $5000 \mathrm{pls} / \mathrm{s}$ |  | $5000 \mathrm{pls} / \mathrm{s}$ |  |  |
|  | Home Low Speed | $500 \mathrm{pls} / \mathrm{s}$ |  | $500 \mathrm{pls} / \mathrm{s}$ |  |  |
|  | Home compensation | $0 \mathrm{pls} / \mathrm{s}$ |  | $0 \mathrm{pls} / \mathrm{s}$ |  |  |
|  | Homing ACC Time | 1000 ms |  | 1000 ms |  |  |
|  | Homing DEC Time | 1000 ms |  | 1000 ms |  |  |
|  | DWELL Time | 0 ms |  | 0 ms |  |  |
|  | 10 H Hinh Sneed | Position ParameterX-Axis Data |  | Y-Axis Data | $5000 \mathrm{nds} / \mathrm{s}$ | $\checkmark$ |
| Monitoring | Teaching Command |  |  | Close |  |
| Start Monit | Stop Monitor | Write Read | Save Project |  |

- To change the parameter, first of all, change the parameter value to change, and select 'Write PLC'. Then the changed parameter is transferred to PLC, the position parameter saved in PLC is changed.


## Remark

- If you execute 'Write PLC,' the position parameter set in the positioning monitoring package and the operation data of each axis are all transferred to XGB.
- The parameter and operation data displayed when the positioning monitoring package is executed are not the data read from XGB but the parameter and operation data currently saved in XG5000. Therefore if you change the parameter or operation data in the positioning monitoring package, change the data after reading the data from XGB.
- Be sure to press the 'Save Project' button to save them in the XG5000 project. Otherwise the settings of XG5000 I/O parameter might be different from XGB.


## Chapter 10 Positioning Monitoring Package

### 10.3.2 Change of Position Operation Data

## (1) How to Change the Position Operation Data

- You can change the operation data of each axis by using the positioning monitoring package. Note that you can't change the operation data during operation because PLC can't save the operation data in flash memory.
- If you select the 'axis $X$ data' or 'axis $Y$ data' tabs in the positioning monitoring package, the window is invoked where you can set the operation data of each axis as follows along with the operation data saved in XG5000.

- To change the operation data, first of all, change the operation data value to change, and select 'Write PLC'. Then the changed operation data is transferred to PLC, the operation data saved in PLC is changed.


## Remark

- If you execute 'Write PLC,' the position parameter set in the positioning monitoring package and the operation data of each axis are all transferred to XGB.
- The parameter and operation data displayed when the positioning monitoring package is executed are not the data read from XGB but the parameter and operation data currently saved in XG5000. Therefore if you change the parameter or operation data in the positioning monitoring package, change the data after reading the data from XGB.
- Be sure to press the 'Save Project' button to save them in the XG5000 project. Otherwise the settings of XG5000 I/O parameter might be different from XGB.


## Appendix 1 Positioning Error Information \& Solutions

Here describes the positioning error types and its solutions.
(1) Error Information of Basic Parameter

| Error <br> Code | Error Description | Solutions |
| :---: | :--- | :--- |
| 101 | Invalid speed limit setting f basic parameter | Speed limit of basic parameter should be bias <br> speed $\sim 2,000,000$. |
| 102 | Bias speed value of Basic Parameter exceeds <br> the range. | Bias speed of Basic Parameter should be 1~bias <br> speed. |
| 103 | Pulse output mode value of Basic Parameter <br> exceeds the range. | Pulse output mode of Basic Parameter is 0: <br> CW/CCW 1: Pulse/Dir. Select one among two. |
| 104 | Speed limit of basic parameter by degree is <br> bigger than 180 out of range, so circular <br> interpolation can not be executed. | Operate with lower speed limit of Circular <br> Interpolation |
| 111 | Extended Parameter software upper/lower limit <br> range error | S/W upper limit of Extended Parameter should be <br> greater than or equal to S/W lower limit of Extended <br> Parameter. |
| 112 | M Code Mode value of Extended Parameter <br> exceeds the range. | M Code output of Extended Parameter is 0: None, 1: <br> With, 2: After. Select one among three. |

(2) Error Information of Home/Manual Operation Parameter

| Error <br> Code | Error Description | Solutions |
| :---: | :--- | :--- |
| 121 | Jog high speed value of Manual operation <br> parameter exceeds the range. | Set Jog high speed of Manual operation <br> parameter to be greater than or equal to Jog low <br> speed of Basic Parameter and less than or equal to <br> max. speed of Basic Parameter. |
| 122 | Jog low speed value of Manual operation <br> parameter exceeds the range. | Set Jog low speed of Manual operation <br> parameter to be more than bias speed and less than <br> Jog high speed of Manual operation parameter. |
| 123 | Inching speed value of Manual operation <br> parameter exceeds the range. | Set Inching speed of Manual operation <br> parameter to be greater than or equal to bias speed <br> of Basic Parameter and less than or equal to max. <br> speed of Basic parameter. |
| 132 | Homing mode value of Homing parameter <br> exceeds the range. | Homing method of Homing parameter is <br> DOG/HOME(Off), 1: DOG/HOME(On), 2: DOG, 3: <br> U.L.limit/HOME, 4: U.L.limit. Select one among five. |
| 133 | Homing address of Homing parameter <br> exceeds the range. | Set Homing address of Homing parameter to be <br> greater than S/W lower limit of Extended parameter <br> and less than S/W upper limit of Extended <br> Parameter. |
| parameter exceeds the range. |  |  |

## Appendix 1 Positioning Error Information \& Solutions

(3) Error Information of Common Parameter

| Error <br> Code | Error Description | Solutions |
| :---: | :--- | :--- |
| 141 | Encoder type value of Common parameter <br> exceeds the range. | Set Encoder input signal of Common parameter to <br> be between 0 and 2. |
| 148 | Encoder max/min value of common parameter <br> Exceeds the range. | Set Encoder max value smaller than min value, also <br> set encoder max/min value contains current position. |

(4) Error Information of Operating Data

| Error <br> Code | Error Description | Solutions |
| :---: | :--- | :--- |
| 151 | Not available to set operation speed value of <br> Operation data as "0". | Set operation speed to be greater than "0". |
| 152 | Operation speed of Operation data exceeds <br> max. speed value. | Set operation speed to be less than or equal to <br> max. speed set in the Basic Parameter. |
| 153 | Operation speed of Operation data is set less <br> than bias speed. | Set operation speed to be greater than or equal <br> to bias speed set in Basic Parameter. |
| 155 | Exceeds End/Keep/Continuous operation <br> setting range of Operation data. | Set one from operation pattern (0:End, 1:Go on, <br> 2: Continuous) of operation data to operate |
| 159 | Goal position of operation data exceeds the <br> range. | Goal position should be -2147483648 <br> 2147483647. |

(5) Error Information of Data Writing

| Error <br> Code | Error Description | Solutions |
| :---: | :--- | :--- |
| 172 | Can't execute writing parameter because <br> writing parameter is executed while operating | Once current operation is done, eliminate error with <br> error-reset command, and then execute writing <br> command again. Do not execute start operation <br> while parameter sending. |
| 175 | Start command cannot be executed while <br> writing sending-parameters or operating-data <br> from XG5000. | Execute again once writing of parameter or <br> operating data are done. |
| 176 | Can't execute instruction writing data in flash <br> memory because PLC is writing in flash <br> memory by WRT instruction or Write <br> Parameter of XG5000. | Execute again after finishing writing in flash memory |

(6) Error Information of Positioning command and Step control

| Error <br> Code | Error Description | Solutions |
| :---: | :--- | :--- |
| 201 | Not possible to carry out Homing command in <br> the state of in operation. | Check if command axis is in operation when the <br> Homing command is executed. |
| 202 | Not possible to carry out Homing command in <br> the state of output inhibition. | Check if axis is in the state of output inhibition when <br> Homing command is executed. |
| 211 | Not possible to carry out Floating origin setting <br> command in the state of in operation. | Check if command axis is in operation when <br> Floating origin setting command is executed. |
| 221 | Not possible to carry out Direct Start command <br> in the state of in operation. | Check if command axis is in operation when <br> Direct Start command is executed. |
| A1-2 | LSis |  |


| Error Code | Error Description | Solutions |
| :---: | :---: | :---: |
| 222 | Not possible to carry out Direct Start command in the state of output inhibition. | Check if axis is in the state of output inhibition when Direct Start command is executed. |
| 223 | Not possible to carry out Direct Start command in the state of M Code ON. | Check if $M$ code signal of command axis is $O N$ when Direct Start command is executed. MOF command can make M Code OFF. |
| 224 | Not possible to carry out Direct Start command at the absolute coordinate in the origin unsettled state. | Not possible to carry out absolute coordinate operation in the origin unsettled state. Check the coordinate of operation data to operate and the current origin determination. Available to carry out absolute coordinate operation after origin determination by Homing command or floating origin setting command. |
| 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. |
| 232 | Not possible to carry out Indirect Start command in the state of output inhibition. | Check if axis is in the state of output inhibition when Indirect Start command is executed. |
| 233 | Not possible to carry out Indirect Start command in the state of M Code ON. | Check if $M$ code signal of command axis is ON when Indirect Start command is executed Available to make M Code OFF by MOF command. |
| 234 | Not possible to carry out Indirect Start command at the absolute coordinate in the origin unsettled state. | 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. |
| 236 | Not possible to carry out Continuous operation of Indirect Start at speed control. | Check if there is no step that control method is set as speed control in the middle of Continuous operation of position control among Operation data and operation pattern is set as Continuous. |
| 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. |
| 244 | Not possible to carry out Linear Interpolation Start command when main axis is in the state of output inhibition. | Check if main axis is in the state of output inhibition when Linear Interpolation Start command is executed. |
| 245 | Not possible to carry out Linear Interpolation Start command when sub axis is in the state of output inhibition. | Check if sub axis is in the state of output inhibition when Linear Interpolation Start 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. | Check if M Code signal of main axis is ON when Linear interpolation command is executed. Available to make M Code OFF by MOF command. |
| 248 | Not possible to carry out Linear interpolation Start in the state that $M$ Code signal of subordinate axis 1 of Linear interpolation is ON. | Check if M Code signal of subordinate axis 1 is ON when Linear interpolation command is executed. Available to make M Code OFF by MOF command. |
| 250 | Not possible to carry out positioning operation of absolute coordinate in the state that main axis of Linear interpolation is 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. |

## Appendix 1 Positioning Error Information \& Solutions

| Error Code | Error Description | Solutions |
| :---: | :---: | :---: |
| 251 | Not possible to carry out positioning operation of absolute coordinate in the state that subordinate axis of Linear interpolation is 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. |
| 253 | In case that main axis and subordinate axis is set wrong in Linear interpolation. | Check if the subordinate axis is not assigned, or only one axis is assigned, or no axis is assigned when Linear interpolation command is executed. |
| 257 | Moving amount of main and sub axes are set as 0 | Check if moving amount of main and sub axes are set as 0 |
| 258 | Main axis of linear interpolation is set as speed control | Check if main axis of linear interpolation is set as speed control |
| 259 | Sub axis of linear interpolation is set as speed control | Check if sub axis of linear interpolation is set as speed control |
| 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. |
| 273 | Not possible to carry out Circular Interpolation Start command when main axis is in the state of output inhibition. | Check if main axis is in the state of output inhibition when Circular Interpolation Start command is executed. |
| 274 | Not possible to carry out Circular Interpolation Start command when sub axis is in the state of output inhibition. | Check if sub axis is in the state of output inhibition when Circular Interpolation Start 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. | Check if M Code signal of main axis is ON when circular interpolation command is executed. Available to make M Code OFF by 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 . | Check if M Code signal of subordinate axis is ON when circular interpolation command is executed. Available to make M Code OFF by MOF command. |
| 277 | Not possible to carry positioning operation of absolute coordinate in the state that main axis of circular interpolation is 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. |
| 278 | Not possible to carry positioning operation of absolute coordinate in the state that subordinate axis of circular interpolation is 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. |
| 279 | Incorrect setting of main and sub axis from circular Interpolation. | Check setting of main and sub axis of circular interpolation. |
| 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. |


| Error Code | Error Description | Solutions |
| :---: | :---: | :---: |
| 285 | The start point and end point is Not possible to be same in the middle point 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 $1 \sim 2147483647$. Check if radius is in the range. |
| 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 $90^{\circ}$, correct circle cannot be drawn. | Set operation speed lower than $90^{\circ}$ for circular Interpolation angular velocity. |
| 291 | Not possible to carry out Simultaneous Start command in the state of in operation. | Check if the Error occurred axis is included in Simultaneous Start command and if there is no axis in operation when the command is executed. |
| 292 | Not possible to carry out Simultaneous Start command in the state of output inhibition. | Check if axis is in the state of output inhibition when Simultaneous Start command is executed. |
| 293 | Not possible to carry out Simultaneous Start command in the state of M Code ON. | Check if the Error occurred axis is included in Simultaneous 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 incremental coordinate. |
| 296 | In case that Simultaneous Start command axis setting is wrong. | Check if only one axis of Simultaneous Start command is assigned. The axis assignment address means 0 bit: X axis, 1 bit: Y axis and each bit is set as " 1 " for axis assignment. |
| 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 goal position is 0 . | Check if the goal position is 0 when speed /position control switching command is executed. |
| 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. |
| 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 |

## Appendix 1 Positioning Error Information \& Solutions

| Error Code | Error Description | Solutions |
| :---: | :---: | :---: |
| 322 | Not possible to carry out deceleration stop command in the state of Jog operation. | Not possible to carry out deceleration stop command in the state of Jog operation. |
| 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. |
| 342 | Not possible to carry out Position Sync. command in the state of output inhibition. | Check if axis is in the state of output inhibition when Position Sync. command is executed. |
| 343 | Not possible to carry out Position Sync. command in the state of M Code ON. | Check if the M Code signal of the axis is ON when Position Sync. command is executed. Available to make M Code OFF by MOF command. |
| 344 | Not possible to carry out Position Sync. 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. |
| 346 | Not possible to carry out Position Sync. command in the state that the origin of main axis is not settled. | Check if main axis is in the origin unsettled state when Position Sync. command is executed. |
| 347 | There is error in setting main axis/subordinate axis of Position Sync. command. | Check if main axis of Position Sync. command is set as the same as command axis. Main axis is set by writing 0 ( X axis), 1 (Y axis) to the setting address. |
| 349 | Can't execute Position Sync. Command when main axis of command is already operating as sub axis of Position Sync. command | Check if main axis of command is already operating as sub axis of Position Sync. command |
| 350 | Not possible to carry out Speed Sync. command in the state of in operation of main axis. | Execute Speed Sync. command while main axis Is not operating when it is state of stop. |
| 351 | Not possible to carry out Speed Sync. command in the state of in operation. | Check if the axis is in operation when Speed Sync. command is executed. |
| 352 | Not possible to carry out Speed Sync. command in the state of output inhibition. | Check if axis is in the state of output inhibition when Speed Sync. command is executed. |
| 353 | Not possible to carry out Speed Sync. command in the state of M Code ON. | Check if the M Code signal of the axis is ON when Speed Sync. command is executed. Available to make M Code OFF by MOF command. |
| 355 | There is error in setting main axis/subordinate axis of Speed Sync. command. | Check if main axis of Speed Sync. command is set as the same as command axis. Main axis is set by writing $0(X$ axis $), 1(Y$ axis) to the setting address. |
| 356 | There is error in main axis ratio/second axis ratio value | Check if main axis ratio or sub axis ratio is set as 0 . |
| 357 | The speed of Speed Sync. Command cannot exceed its speed limit. | Set low for main axis ratio/second axis ratio values so that 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. |
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| Error Code | Error Description | Solutions |
| :---: | :---: | :---: |
| 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. |
| 374 | Not possible to carry out Speed Override command for the sub 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. |
| 381 | Not possible to carry out position speed override command not in the state of in operation. | Check if the axis is 'stop' state when position speed override command is executed. |
| 382 | Not possible to carry out position speed override command not in positioning operation. | Check if the axis is in speed control operation when position speed override command is executed. |
| 383 | Exceeds the speed override value range of position speed override command. | Speed value of 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 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 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 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. |
| 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. |
| 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. |
| 441 | Not possible to carry out Start step no. Change command in the state of in operation. | Check if the axis is in operation when Start step no. change 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 150. |
| 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 upper/lower 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. |

## Appendix 1 Positioning Error Information \& Solutions

| Error Code | Error Description | Solutions |
| :---: | :---: | :---: |
| 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. |
| 464 | Not possible to carry out ROM teaching in the state of in operation | Check if the axis is in operation when ROM 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 150 or same as 150. |
| 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: RAM or 1: ROM |
| 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. |
| 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. |
| 481 | Internal emergency stop | Eliminate reason of emergency stop and execute CLR command to delete the error. |
| 492 | Hard upper limit error | Be out of limited external upper signal range by using counter direct jog command. Then execute CLR command to delete the error. |
| 493 | Hard lower limit error | Be out of limited external lower signal range by using direct jog command. Then execute CLR command to delete the error. |
| 501 | Soft upper limit error | Be out of limited soft upper range by using counter direct jog command. Then execute CLR command to delete the error. |
| 502 | Soft lower limit error | Be out of limited soft upper range by using direct jog command. Then execute CLR 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 150. Set it Between 1 and 150. |
| 513 | Not possible to change direction in the state of continuous operation | If you want change the direction, use Keep operation. |
| 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 encoder as a main axis | Execute Encoder preset when the encoder using axis is not operating |
| 534 | The position of Encoder preset exceeds from Max or Min value of encoder. | Execute Encoder preset command after set the value of encoder position preset as bigger than Min value and smaller than Max value. |

## Appendix 2 Positioning System Current consumption

(1) Module Current consumption (DC 5V)
(Unit: mA)

| Item | Model | Current consumption |
| :---: | :---: | :---: |
| XGB Modular type Main Unit(XBMS) | XBM-DR16S | 400 |
|  | XBM-DN16S | 250 |
|  | XBM-DN32S | 280 |
| XGB Compact "S" type Main Unit(XBCS) | XBC-DN20S | 240 |
|  | XBC-DN30S | 255 |
|  | XBC-DN20SU | 252 |
|  | XBC-DN30SU | 270 |
|  | XBC-DN40SU | 288 |
|  | XBC-DN60SU | 340 |
|  | XBC-DP20SU | 305 |
|  | XBC-DP30SU | 352 |
|  | XBC-DP40SU | 355 |
|  | XBC-DP60SU | 394 |
|  | XBC-DR20SU | 478 |
|  | XBC-DR30SU | 626 |
|  | XBC-DR40SU | 684 |
|  | XBC-DR60SU | 942 |
| XGB Compact "H" type Main Unit(XBCH) | XBC-DR32H | 660 |
|  | XBC-DR64H | 1,040 |
|  | XBC-DN32H | 260 |
|  | XBC-DN64H | 330 |
| XGB IEC "H" type Main Unit(XECH) | XEC-DR32H | 660 |
|  | XEC-DR64H | 1,040 |
|  | XEC-DN32H | 260 |
|  | XEC-DN64H | 330 |
|  | XEC-DP32H | 300 |
|  | XEC-DP64H | 380 |
| XGB IEC "S" type Main Unit (XECS) | XEC-DR20SU | 478 |
|  | XEC-DR30SU | 626 |
|  | XEC-DR40SU | 684 |
|  | XEC-DR60SU | 942 |
|  | XEC-DN20SU | 252 |
|  | XEC-DN30SU | 270 |
|  | XEC-DN40SU | 288 |
|  | XEC-DN60SU | 340 |
|  | XEC-DP20SU | 305 |
|  | XEC-DP30SU | 352 |
|  | XEC-DP40SU | 355 |
|  | XEC-DP60SU | 394 |

Appendix 2 Positioning System Current consumption

| Item | Model | Current consumption |
| :---: | :---: | :---: |
| I/O Module | XBE-DC32A | 50 |
|  | XBE-DC16A/B | 40 |
|  | XBE-DC08A | 20 |
|  | XBE-RY16A | 440 |
|  | XBE-RY08A/B | 240 |
|  | XBE-TN32A | 80 |
|  | XBE-TN16A | 50 |
|  | XBE-TN08A | 40 |
|  | XBE-DR16A | 250 |
| Special Module | XBF-AD04A | 120 |
|  | XBF-AD08A | 105 |
|  | XBF-AD04C | 105 |
|  | XBF-AH04A | 120 |
|  | XBF-DV04A | 110 |
|  | XBF-DV04C | 70 |
|  | XBF-DC04A | 110 |
|  | XBF-DC04B | 110 |
|  | XBF-DC04C | 70 |
|  | XBF-RD04A | 100 |
|  | XBF-TC04S | 100 |
|  | XBF-PD02A | 500 |
|  | XBF-HO02A | 270 |
|  | XBF-HD02A | 330 |
| Communication Module | XBL-C21A | 110 |
|  | XBL-C41A | 110 |
|  | XBL-EMTA | 190 |
|  | XBL-EIMT/F/H | 280/670/480 |
|  | XBL-EIPT | 400 |
|  | XBL-CMEA | 150 |
|  | XBL-CSEA | 150 |
| Option Module | XBO-DC04A | 50 |
|  | XBO-TN04A | 80 |
|  | XBO-AD02A | 50 |
|  | XBO-DA02A | 150 |
|  | XBO-AH02A | 150 |
|  | XBO-RD01A | 30 |
|  | XBO-TC02A | 50 |
|  | XBO-RTCA | 30 |
|  | XBO-M2MB | 70 |

## (2) Calculation Example of Consumption CurrentVoltage

Calculate the consumption current and configure the XGB PLC system not to exceed the output current capacity of basic unit
(1) XGB PLC configuration example 1

- Consumption of current/voltage is calculated as follows.

| Type | Model | Unit No. | Internal 5V consumption <br> current <br> (Unit: mA) | Remark |
| :--- | :--- | :--- | :--- | :--- |
| Main unit | XBC-DN20SU | 1 | 252 | In case all contact points are On. <br> (Maximum consumption current) |
| Expansion <br> module | XBE-DC32A | 1 | 50 | All channel is used. <br> (Maximum consumption current) |
|  | XBE-TN32A | 1 | 80 | - |
|  | XBF-PD02A | 2 | 500 | $1.112 \mathrm{~A} \times 5 \mathrm{~V}=6.91 \mathrm{~W}$ |
| Consumption <br> current | $1,382 \mathrm{~mA}$ |  |  |  |
| Consumption <br> voltage | 6.91 W |  |  |  |

In case system is configured as above, since 5 V consumption current is total $1,382 \mathrm{~mA}$ and 5 V output of XGB standard type main unit is maximum 1.5 A , normal system configuration is available.
(2) XGB PLC configuration example 2

| Type | Model | Unit No. | Internal 5V consumption <br> current <br> (Unit: mA) | Remark |
| :--- | :--- | :--- | :--- | :--- |
| Main unit | XBC-DN30SU | 1 | 270 | In case all contact points are On. |
| Expansion <br> module <br> Consumption <br> current | XBE-DR16A | 2 | 250 | (Maximum consumption current) |
|  | XBE-RY16A | 2 | 440 | All channel is used. |
|  | XBF-PD02A | 2 | 500 | (Maximum consumption current) |

If system is configured as above, total 5 V current consumption is exceeded $2,260 \mathrm{~mA}$ and it exceeds the 5 V output of XGB standard type main unit. Normal system configuration is not available. Although we assume the above example that all contact points are on, please use high-end type main unit which 5 V output capacity is higher than standard type main unit.

## 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

LSIS Co., Ltd supports and observes the environmental policy as below.



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[^0]:    ※ The number of User's manual is indicated right part of the back cover.
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[^1]:    That is, if set h0003, axis $X$, axis $Y$ will be set to execute parameter/operation data save.

