MScon

MSCON Controller

Instruction Manual First Edition

IAI America, Inc.

MSCON

Please Read Before Use

Thank you for purchasing our product.

This Instruction Manual describes all necessary information items to operate this product safely such as the operation procedure, structure and maintenance procedure.

Before the operation, read this manual carefully and fully understand it to operate this product safely. The enclosed CD or DVD in this product package includes the Instruction Manual for this product. For the operation of this product, print out the necessary sections in the Instruction Manual or display them using the personal computer.

After reading through this manual, keep this Instruction Manual at hand so that the operator of this product can read it whenever necessary.

[Important]

- This Instruction Manual is original.
- The product cannot be operated in any way unless expressly specified in this Instruction Manual. IAI shall assume no responsibility for the outcome of any operation not specified herein.
- Information contained in this Instruction Manual is subject to change without notice for the purpose of product improvement.
- If you have any question or comment regarding the content of this manual, please contact the IAI sales office near you.
- Using or copying all or part of this Instruction Manual without permission is prohibited.
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Contents

Safety Guide

"Safety Guide" has been written to use the machine safely and so prevent personal injury or property damage beforehand. Make sure to read it before the operation of this product.

Safety Precautions for Our Products

The common safety precautions for the use of any of our robots in each operation.

No.	Operation Description	Description
1	Model Selection	● This product has not been planned and designed for the application where high level of safety is required, so the guarantee of the protection of human life is impossible. Accordingly, do not use it in any of the following applications. 1) Medical equipment used to maintain, control or otherwise affect human life or physical health. 2) Mechanisms and machinery designed for the purpose of moving or transporting people (For vehicle, railway facility or air navigation facility) 3) Important safety parts of machinery (Safety device, etc.) ● Do not use the product outside the specifications. Failure to do so may considerably shorten the life of the product. ● Do not use it in any of the following environments. 1) Location where there is any inflammable gas, inflammable object or explosive 2) Place with potential exposure to radiation 3) Location with the ambient temperature or relative humidity exceeding the specification range 4) Location where radiant heat is added from direct sunlight or other large heat source 5) Location where condensation occurs due to abrupt temperature changes 6) Location where there is any corrosive gas (sulfuric acid or hydrochloric acid) 7) Location exposed to significant amount of dust, salt or iron powder 8) Location subject to direct vibration or impact ● For an actuator used in vertical orientation, select a model which is equipped with a brake. If selecting a model with no brake, the moving part may drop when the power is turned OFF and may cause an accident such as an injury or damage on the work piece.

No.	Operation Description	Description
2	Transportation	● When carrying a heavy object, do the work with two or more persons or utilize equipment such as crane. ● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● When in transportation, consider well about the positions to hold, weight and weight balance and pay special attention to the carried object so it would not get hit or dropped. ● Transport it using an appropriate transportation measure. The actuators available for transportation with a crane have eyebolts attached or there are tapped holes to attach bolts. Follow the instructions in the instruction manual for each model. ● Do not step or sit on the package. ● Do not put any heavy thing that can deform the package, on it. ● When using a crane capable of 1t or more of weight, have an operator who has qualifications for crane operation and sling work. ● When using a crane or equivalent equipments, make sure not to hang a load that weighs more than the equipment's capability limit. ● Use a hook that is suitable for the load. Consider the safety factor of the hook in such factors as shear strength. ● Do not get on the load that is hung on a crane. ● Do not leave a load hung up with a crane. ● Do not stand under the load that is hung up with a crane.
3	Storage and Preservation	● The storage and preservation environment conforms to the installation environment. However, especially give consideration to the prevention of condensation. ● Store the products with a consideration not to fall them over or drop due to an act of God such as earthquake.
4	Installation and Start	(1) Installation of Robot Main Body and Controller, etc. ● Make sure to securely hold and fix the product (including the work part). A fall, drop or abnormal motion of the product may cause a damage or injury. Also, be equipped for a fall-over or drop due to an act of God such as earthquake. ● Do not get on or put anything on the product. Failure to do so may cause an accidental fall, injury or damage to the product due to a drop of anything, malfunction of the product, performance degradation, or shortening of its life. ● When using the product in any of the places specified below, provide a sufficient shield. 1) Location where electric noise is generated 2) Location where high electrical or magnetic field is present 3) Location with the mains or power lines passing nearby 4) Location where the product may come in contact with water, oil or chemical droplets

No.	Operation Description	Description
4	Installation and Start	(2) Cable Wiring ● Use our company's genuine cables for connecting between the actuator and controller, and for the teaching tool. ● Do not scratch on the cable. Do not bend it forcibly. Do not pull it. Do not coil it around. Do not insert it. Do not put any heavy thing on it. Failure to do so may cause a fire, electric shock or malfunction due to leakage or continuity error. ● Perform the wiring for the product, after turning OFF the power to the unit, so that there is no wiring error. ● When the direct current power (+24V) is connected, take the great care of the directions of positive and negative poles. If the connection direction is not correct, it might cause a fire, product breakdown or malfunction. ● Connect the cable connector securely so that there is no disconnection or looseness. Failure to do so may cause a fire, electric shock or malfunction of the product. ● Never cut and/or reconnect the cables supplied with the product for the purpose of extending or shortening the cable length. Failure to do so may cause the product to malfunction or cause fire.
		(3) Grounding ● The grounding operation should be performed to prevent an electric shock or electrostatic charge, enhance the noise-resistance ability and control the unnecessary electromagnetic radiation. ● For the ground terminal on the AC power cable of the controller and the grounding plate in the control panel, make sure to use a twisted pair cable with wire thickness $0.5mm^2$ (AWG20 or equivalent) or more for grounding work. For security grounding, it is necessary to select an appropriate wire thickness suitable for the load. Perform wiring that satisfies the specifications (electrical equipment technical standards). ● Perform Class D Grounding (former Class 3 Grounding with ground resistance 100Ω or below).

No.	Operation Description	Description
4	Installation and Start	(4) Safety Measures ● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● When the product is under operation or in the ready mode, take the safety measures (such as the installation of safety and protection fence) so that nobody can enter the area within the robot's movable range. When the robot under operation is touched, it may result in death or serious injury. ● Make sure to install the emergency stop circuit so that the unit can be stopped immediately in an emergency during the unit operation. ● Take the safety measure not to start up the unit only with the power turning ON. Failure to do so may start up the machine suddenly and cause an injury or damage to the product. ● Take the safety measure not to start up the machine only with the emergency stop cancellation or recovery after the power failure. Failure to do so may result in an electric shock or injury due to unexpected power input. ● When the installation or adjustment operation is to be performed, give clear warnings such as "Under Operation; Do not turn ON the power!" etc. Sudden power input may cause an electric shock or injury. ● Take the measure so that the work part is not dropped in power failure or emergency stop. ● Wear protection gloves, goggle or safety shoes, as necessary, to secure safety. ● Do not insert a finger or object in the openings in the product. Failure to do so may cause an injury, electric shock, damage to the product or fire. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity.
5	Teaching	● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● Perform the teaching operation from outside the safety protection fence, if possible. In the case that the operation is to be performed unavoidably inside the safety protection fence, prepare the "Stipulations for the Operation" and make sure that all the workers acknowledge and understand them well. ● When the operation is to be performed inside the safety protection fence, the worker should have an emergency stop switch at hand with him so that the unit can be stopped any time in an emergency. ● When the operation is to be performed inside the safety protection fence, in addition to the workers, arrange a watchman so that the machine can be stopped any time in an emergency. Also, keep watch on the operation so that any third person can not operate the switches carelessly. ● Place a sign "Under Operation" at the position easy to see. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity. * Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.

No.	Operation Description	Description
6	Trial Operation	● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● After the teaching or programming operation, perform the check operation one step by one step and then shift to the automatic operation. ● When the check operation is to be performed inside the safety protection fence, perform the check operation using the previously specified work procedure like the teaching operation. ● Make sure to perform the programmed operation check at the safety speed. Failure to do so may result in an accident due to unexpected motion caused by a program error, etc. ● Do not touch the terminal block or any of the various setting switches in the power ON mode. Failure to do so may result in an electric shock or malfunction.
7	Automatic Operation	● Check before starting the automatic operation or rebooting after operation stop that there is nobody in the safety protection fence. ● Before starting automatic operation, make sure that all peripheral equipment is in an automatic-operation-ready state and there is no alarm indication. ● Make sure to operate automatic operation start from outside of the safety protection fence. ● In the case that there is any abnormal heating, smoke, offensive smell, or abnormal noise in the product, immediately stop the machine and turn OFF the power switch. Failure to do so may result in a fire or damage to the product. ● When a power failure occurs, turn OFF the power switch. Failure to do so may cause an injury or damage to the product, due to a sudden motion of the product in the recovery operation from the power failure.

No.	Operation Description	Description
8	Maintenance and Inspection	● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● Perform the work out of the safety protection fence, if possible. In the case that the operation is to be performed unavoidably inside the safety protection fence, prepare the “Stipulations for the Operation” and make sure that all the workers acknowledge and understand them well. ● When the work is to be performed inside the safety protection fence, basically turn OFF the power switch. ● When the operation is to be performed inside the safety protection fence, the worker should have an emergency stop switch at hand with him so that the unit can be stopped any time in an emergency. ● When the operation is to be performed inside the safety protection fence, in addition to the workers, arrange a watchman so that the machine can be stopped any time in an emergency. Also, keep watch on the operation so that any third person can not operate the switches carelessly. ● Place a sign “Under Operation” at the position easy to see. ● For the grease for the guide or ball screw, use appropriate grease according to the Instruction Manual for each model. ● Do not perform the dielectric strength test. Failure to do so may result in a damage to the product. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity. ● The slider or rod may get misaligned OFF the stop position if the servo is turned OFF. Be careful not to get injured or damaged due to an unnecessary operation. ● Pay attention not to lose the cover or untightened screws, and make sure to put the product back to the original condition after maintenance and inspection works. Use in incomplete condition may cause damage to the product or an injury. * Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.
9	Modification and Dismantle	● Do not modify, disassemble, assemble or use of maintenance parts not specified based at your own discretion.
10	Disposal	● When the product becomes no longer usable or necessary, dispose of it properly as an industrial waste. ● When removing the actuator for disposal, pay attention to drop of components when detaching screws. ● Do not put the product in a fire when disposing of it. The product may burst or generate toxic gases.
11	Other	● Do not come close to the product or the harnesses if you are a person who requires a support of medical devices such as a pacemaker. Doing so may affect the performance of your medical device. ● See Overseas Specifications Compliance Manual to check whether complies if necessary. ● For the handling of actuators and controllers, follow the dedicated instruction manual of each unit to ensure the safety.

Alert Indication

The safety precautions are divided into "Danger", "Warning", "Caution" and "Notice" according to the warning level, as follows, and described in the Instruction Manual for each model.

Level	Degree of Danger and Damage	Symbol
Danger	This indicates an imminently hazardous situation which, if the product is not handled correctly, will result in death or serious injury.	⚠ Danger
Warning	This indicates a potentially hazardous situation which, if the product is not handled correctly, could result in death or serious injury.	⚠ Warning
Caution	This indicates a potentially hazardous situation which, if the product is not handled correctly, may result in minor injury or property damage.	⚠ Caution
Notice	This indicates lower possibility for the injury, but should be kept to use this product properly.	! Notice

Precautions in Operation

1. Make sure to follow the usage condition, environment and specification range of the product.

Not doing so may cause a drop of performance or malfunction of the product.

2. Use the following teaching tools.

Use the PC software and the teaching pendant stated in the next clause as applicable for this controller.
[Refer to 1.1.2 Teaching Tool.]

3. Backup the data to secure for breakdown.

A non-volatile memory is used as the backup memory for this controller. All the registered position data and parameters are written into this memory and backed-up at the same time. Therefore, you will not usually lose the data even if the power is shut down. However, make sure to save the latest data so a quick recovery action can be taken in case when the controller is broken and needs to be replaced with another one.

How to Save Data
(1) Save the data to CD-R or hard disk with using the PC software
(2) Hard-copy the information of position tables and parameters on paper

4. Set the operation patterns.

To be applied to variety ways of use, this controller corresponds to the control by each fieldbus and, in addition, it possesses multiple operation (PIO) patterns.
Setting can be established in the parameters. [Refer to Chapter 3 Operation and Chapter 7 Parameter.]
Set the operation pattern setting to the logic that suits to your use after the power is turned ON.

Warning: Please note it is very risky when the control sequence and PIO pattern setting do not match to each other. It may not only cause the normal operation disabled, but also may cause an unexpected operation.

5. The actuators listed below cannot be connected:

1) Actuator with its motor capacity more than 200W
2) Linear Actuator
3) NS-S Type (Nut rotary actuator)
4) RCS2-SRA7BD
5) Slim Small ROBO Cylinder
   (RCS2-RN5N/RP5N/GS5N/GD5N/SD5N/TCA5N/TWA5N/TFA5N)
6) When the total of the motor capacity of the connected actuators exceeds 900W for 200V motor power or 450W for 100V type

6. Clock setting in calendar function

There may be a case that Gateway Error Code 84A “Real Time Clock Vibration Stop Detect” is issued at the first time to turn the power ON after the product is delivered. In such a case, set the current time with a teaching tool.
If the battery is fully charged, the clock data is retained for approximately 10 days after the power is turned OFF.
Even though the time setting is conducted before the product is shipped out, the battery is not fully charged. Therefore, the clock data may be already lost even in 10 days after the product is shipped out.

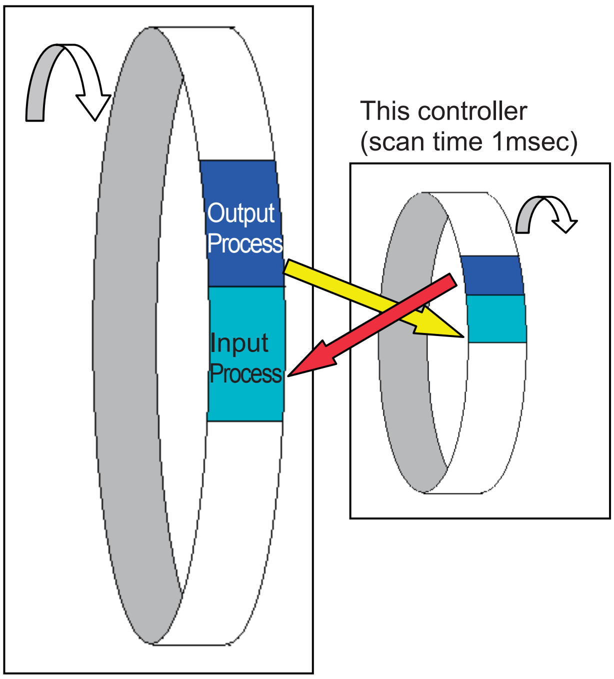
7. For the rotary actuator, it is necessary to pay attention to cable breakage due to twisting and other factors.
   Especially for the type with a through hole in the center of rotation, and when using it with cables going through the hole, and also for the actuator with 360° rotation, special care is required because there is no limit to the rotation in one direction.

8. Limitations on operation of rotary actuator in index mode
   Rotary actuators of 360° specification can select the normal mode for finite rotations or the index mode enabling multi-rotation control by using parameter No.79 “Rotational axis mode selection”.
   [Refer to Chapter 7 Parameter.]
   The following limitations are applied to the index mode:
   1) Index Mode cannot be selected in the absolute type controllers. It will issue Alarm Code 0A1 “Parameter Data Error”.
   2) In the JOG operation by PC software, a teaching pendant or PIO Signal, the indicated range in one time is from 0 to 360.00° and that makes one turn.
   3) Pressing is unavailable. The pressing torque can only be set to 0.
   4) Do not issue positioning command around 0° repeatedly during movement near 0°. Failure to follow this may cause the actuator to rotate in the direction reverse to the specified rotation direction or operate indefinitely.
   5) Soft stroke limit is invalid in the index mode.

9. According to sequence program creation
   Please note the following things when creating a sequence program.
   When data transfer is necessary between two devices that have a different scan time from each other, duration more than the longer scan time is required to certainly read the signal. (To have the loading process on PLC side safely, it is recommended to set the timer to at least twice longer than the long scanning time.)

● Operation Image

PLC (Programmable Logic Controller)
(example: scan time is 20msec)



As shown in the diagram, the input and output timings of two devices that have different scan time do not match, of course, when transferring a signal.
There is no guarantee that PLC would read the signal as soon as this controller signal turns ON.
In such a case, make the setting to read the signal after a certain time that is longer than the longer scan time to ensure the reading process to succeed on the PLC side.
It is the same in the case this controller side reads the signal.
In such a case, it is recommended to ensure 2 to 4 times of the scan time for the timer setting margin.
It is risky to have the setting below the scan time since the timer is also processed in the scan process.
In the diagram, PLC can only read the input once in 20msec even though this controller output once in 1msec.
Because PLC only conducts output process once in 20msec, this controller identifies the same output status for that while.

Also, if one tries to read the signal that is being re-written by the other, the signal may be read wrongly. Make sure to read the signal after the rewriting is complete. (It is recommended to have more than 2 scan periods to wait.) Make sure not to have the output side to change the output until the other side completes the reading. Also, a setting is made on the input area not to receive the signal less than a certain time to prevent a wrong reading of noise. This duration also needs to be considered.

10. PLC Timer Setting

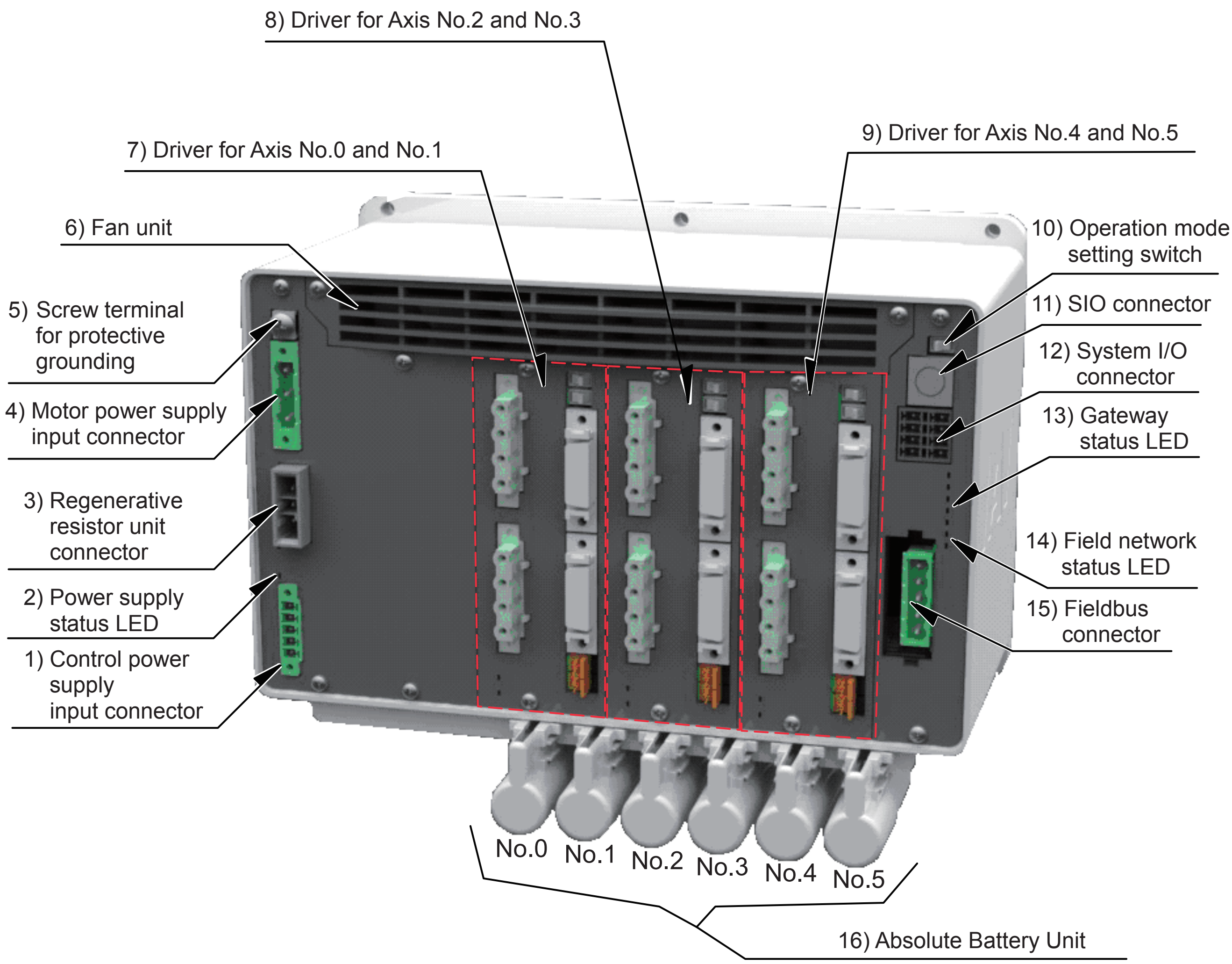
Do not have the PLC timer setting to be done with the minimum setting.
Setting to “1” for 100msec timer turns ON at the timing from 0 to 100msec while 10msec timer from 0 to 10msec for some PLC.
Therefore, the same process as when the timer is not set is held and may cause a failure such as the actuator cannot get positioned to the indicated position number in Positioner Mode.
Set “2” as the minimum value for the setting of 10msec timer and when setting to 100msec, use 10msec timer and set to “10”.

International Standards Compliances

MSCON comply with the following overseas standards.

RoHS Directive	CE Marking	UL
○	To be scheduled	Compliance not planned

Name for Each Parts and Their Functions



1) Control power supply input connector
[Refer to 2.2 [2] Power Supply Circuit and Brake Circuit]
Supply 24V DC power for control. For an actuator equipped with a brake, also supply 24V DC power for brake control. (Do not attempt to connect it when there is no actuator with a brake.)

2) Power supply status LED
It shows the status of control power source and driving source.
[Refer to 3.6 Power Supply and Cutoff for the details.]

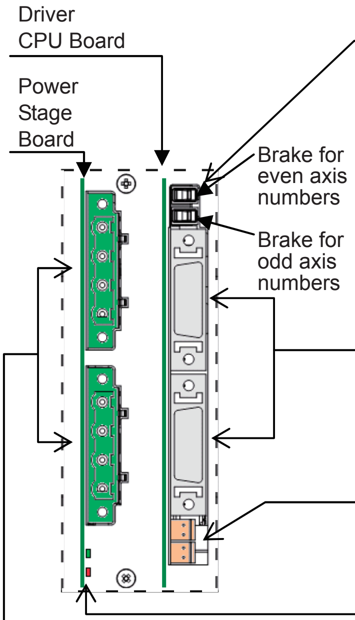
3) Regenerative resistor unit connector
[Refer to 2.2 [6] Regenerative Resistor Circuit]
This is a connector to plug in the external regenerative unit.

4) Motor power supply input connector
This is a connector to supply power to MSCON.

5) Screw terminal for protective grounding
It is the terminal for the connection of ground cable to prevent electric shock and noise.
It connects to the PE terminal on the motor power supply connector inside MSCON.

6) Fan unit
This is the fan unit to cool down the controller. This unit can be detached from the controller for maintenance by removing the two screw in the front of the controller.

7) Actuator driver for Axis No.0 and No.1
8) Actuator driver for Axis No.2 and No.3
9) Actuator driver for Axis No.4 and No.5
One piece of a driver CPU board and one piece of a power stage board make one pair. It is possible to control two axes with one set. Three classes are available to insert at the maximum.



- Brake Release Switch (BK RLS/NOM)
  This is a switch to compulsorily release the brake of the actuator equipped with a brake.

> ⚠ Warning: In normal operation, make sure to set this switch to NOM side. The brake would not work even with the servo OFF condition if the switch is on the RLS side. In the vertical type, the work may drop and cause an injury or the work to be damaged.

- Encoder Connector (PG)
  It is the connector to connect the actuator encoder cable.
  [Refer to Section 2.4.3 Actuator Connection for the details of how to connect.]

- Absolute Battery Connector
  Connect an absolute battery if absolute type.

- Driver Status LED
  These show the current condition of the drivers.
  Upper one shows the status of even axis numbers (0, 2 and 4), and lower shows the status of odd axis numbers (1, 3 and 5).
  Note: The axis number is determined by the slot the driver board is inserted.

○: Illuminating, ×: OFF, ☆: Flashing

LED (SV*/ALM*) *: Axis No. = 0 to 5		Driver status
Lamp status	Color	
○	Green	Servo ON
☆	Green	During automatic servo OFF
×	–	Servo OFF
○	Red	Alarm generated, Emergency-stop input, Motor driving power OFF

- Motor Cable Connector (M)
  It is the connector to connect the actuator motor cable.
  [Refer to Section 2.4.3 Actuator Connection for the details of how to connect.]

> ⚠ Caution: Do not attempt to insert the driver CPU board to position other than the one that the board was originally inserted to.
> The parameter dedicated for the indicated actuator is already written to the driver CPU board at the purchase order. Proper operation cannot be performed with it inserted in a wrong position. It is the same for the power stage board. Also, it may cause such malfunctions as the board being burned down.

10) Operation mode setting switch
This is a switch to change the operation mode between Automatic Operation (AUTO) and Manual Operation (MANU). The operation modes are provided to avoid the duplication of the operation using PC software or a teaching pendant (described as teaching tool from now on) and the operation with Fieldbus.
For the details of the mode selection, refer to 12) System I/O connector.

11) SIO connector
This is a connector dedicated for the teaching tool connection.

12) System I/O connector
This is a connector for additional devices for the input of all-axes external emergency stop and AUTO/MANU switchover.
It is connected in a series with the operation mode setting switch (AUTO/MANU) on the front panel. The controller can be in the following modes by the mode selection on each switch and teaching tool.

MSCON status	Condition	
	Switch on front panel	Operation mode switchover input Note 1
AUTO	AUTO	Short-circuit A/M- and A/M+
MANU	AUTO	Open A/M- and A/M+ terminals
	MANU	Short-circuit A/M- and A/M+

Note 1: Refer to Sections 2.2 [3] Emergency Circuit and 2.2 [7] Mode Switchover Circuit for the details.

⚠ Caution: When in MANU Mode of the teaching tool, select “PIO startup prohibited” for the operation mode.

13) Gateway status LED
Gateway condition (status) is displayed.
[Refer to 3.11 Gateway status LED for the details.]

14), 15) Field network connector and field network status LED
Connect the field network cable to connector. [Refer to 2.2 [8] Wiring for Field Network for details.]
Field network status LEDs show the status (condition) of the fieldbus.
[Refer to 3.10 Field network status LEDs for the details.]

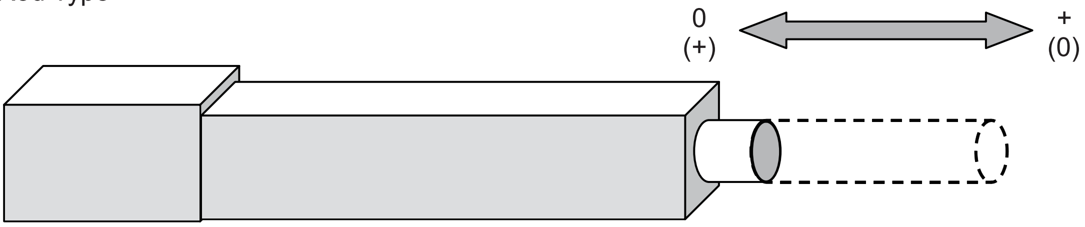
16) Absolute Battery Unit [Refer to Chapter 6.]
If the actuator is the absolute encoder type, set one unit of this battery unit per unit of actuator to the base frame on the bottom of MSCON, and connect it to the battery connector (Note) on the driver board.
Note : There is an indication of axis number to the battery connectors. Connect Absolute Battery Unit to the battery connector of the axis number that an absolute encoder type actuator is connected. [Refer to 2.4.4 Battery Connection.]

Actuator Axes

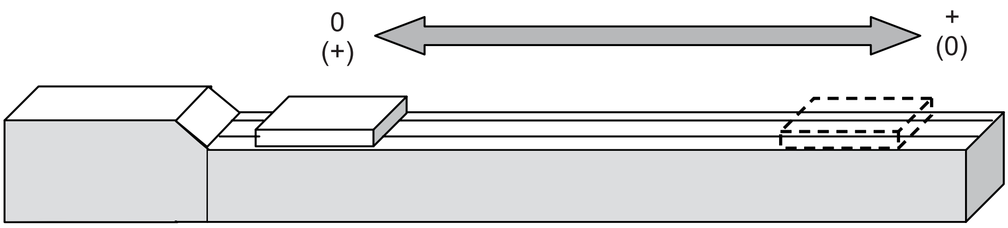
Refer to the pictures below for the actuator axes that can be controlled.
0 defines the home position, and items in ( ) are for the home-reversed type (option).

⚠ Caution:	There are some actuators that are not applicable to the origin reversed type. Check further on the catalog or the Instruction Manual of the actuator.

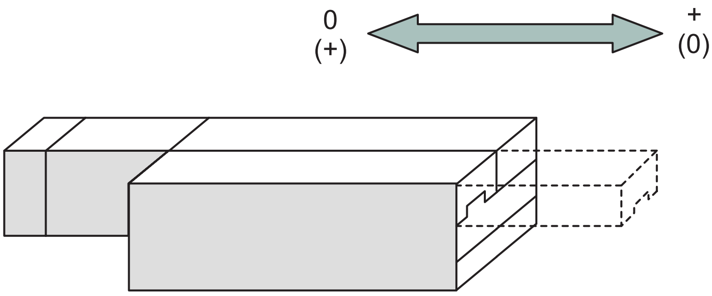
(1) Rod Type



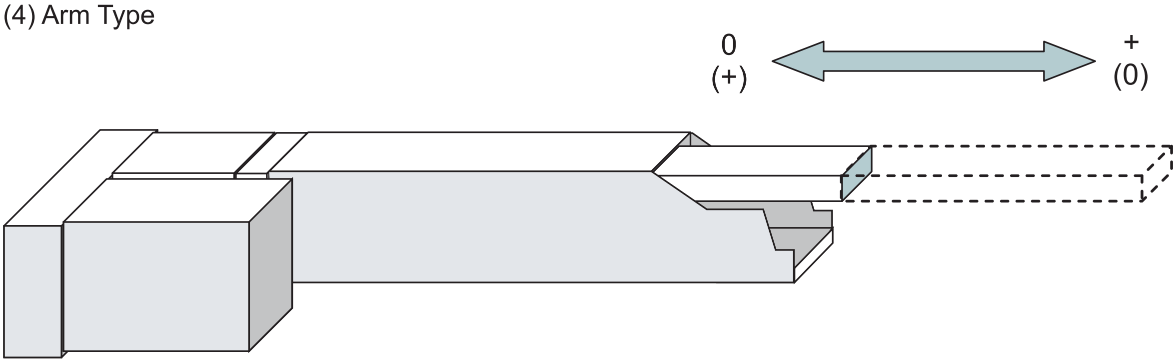
(2) Slider Type



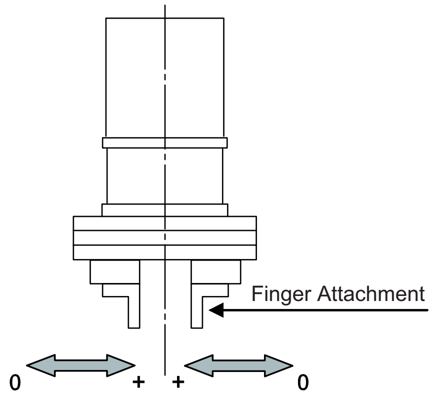
(3) Flat Type



(4) Arm Type

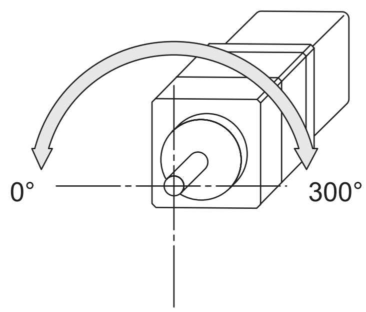


(5) Gripper Type

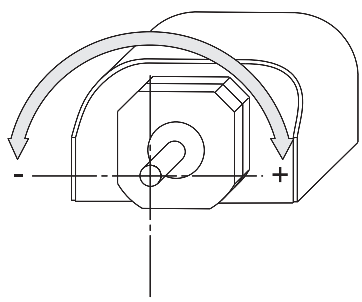


(6) Rotary Type

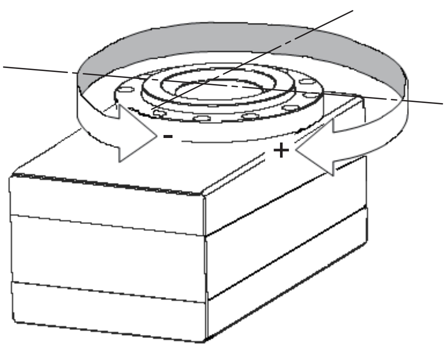
(300° Rotation Specification)



(360° Rotation Specification)



(360° Rotation Specification)



For Multiple Rotation Type with the origin reversed type, the directions of + and – are the other way around.

Starting Procedures

When using this product for the first time, work while making sure to avoid omission and incorrect wiring by referring to the procedure below. "PC" stated in this section means "PC software".

Check of Packed Items
Are all the delivered items present?

No → Contact your local IAI distributor.

↓ Yes

Installation and Wiring [Refer to 1. and 2.]
Install the controller and actuator and perform wiring according.

↓

Important Check Item
• Is frame ground (FG) connected?
• Has the noise countermeasure been taken?

↓

Power Supply and Alarm Check
Connect the PC software, set the operation mode setting switch to "MANU" side and turn the power ON.
Select [Teaching Mode 1 Safety Speed Activated / Prohibit PIO Startup] in the PC software.

↓

Check Item
Is RDY in Gateway Status LEDs turned ON in green?

No → Connect the PC software, confirm the alarm code, and remedy the indicated situation.

↓ Yes

Initial Setting and PIO Pattern Select［Refer to 3.2］
Conduct the initial selection for those such as PIO Patterns for each axis from the PC.
Register the operation mode to MSCON using Gateway Parameter Setting Tool.

↓

Servo ON
Turn the servo ON for all the connected axes by operating the PC.

⚠Caution
Please perform this process with the actuator away from the mechanical end or interfering objects as much as possible. Move the actuator away from interfering surroundings. It may generate an alarm if the actuator hit the mechanical end or interfering objects when the servo is turned ON.
The slider may get slightly dropped by self-weight if servo ON and OFF is repeatedly performed at the same position. Be careful not to pinch the hand or damage the work.

↓

Check Item
Is SV* on the status LED display for the driver on the axis number indicated for the servo-on turned ON in green?

No → If an alarm is generated, check the detail of the alarm on the PC and have an appropriate treatment.

↓ Yes

Check of Safety Circuit
Does the emergency stop circuit (drive cutoff circuit) work properly and turn the servo OFF?

No → Check the emergency stop circuit.

↓ Yes

Target Position Setting [Except for simple direct mode and direct numerical specification mode: Chapter 3]
Set a target position in the "Position" field for each position in the position table.

↓

Establish Link to Field Network
1) Assign MSCON as the host controller [Refer to the instruction manual of the master unit].
2) Put the operation mode setting switch on the front panel of MSCON to AUTO side, and reboot the power.
3) Once the link with the master unit is established, turn ON MON signal in the gateway control signals.
(While MON Signal is ON, control from field network is available.)

↓

Test Run Adjustment 1
1) Cancel the emergency stop, do not put a work piece on, set to low speed and check the operation with commands from the PC.
2) Check the operation (of communication) with commands from the host system (PLC, etc.).

↓

Check Item
Any vibration or abnormal noise?

No → Check if there is any problem with the installation of the actuator and the condition of the actuator use exceeds the ranges of the rated values. Adjust the servo if necessary.

↓ Yes

Test Run Adjustment 2
Check the system operation conducted.

Chapter 1 Specifications Check

1.1 Product Check

1.1.1 Parts

The standard configuration of this product is comprised of the following parts.
If you find any fault in the contained model or missing parts, contact us or our distributor.

No.	Part Name	Model	Quantity	Remarks
1	Controller	Refer to “How to read the model plate”, “How to read the model”	1	
		Accessories		
2	Control Power Supply Connector	MC1.5/5-STF-3.81 (Supplier: PHOENIX CONTACT)	1	
3	Motor Power Supply Connector	GMSTB2.5/3-STF-7.62 (Supplier: PHOENIX CONTACT)	1	
4	System I/O Connector	FMCD1.5/4-ST-3.5 (Supplier: PHOENIX CONTACT)	1	
5	CC-Link Connector (For CC-Link Type)	SMSTB2.5/5-ST-5.08 AU (Supplier: PHOENIX CONTACT)	1	
6	DeviceNet Connector (For DeviceNet Type)	SMSTB2.5/5-ST-5.08 AU (Supplier: PHOENIX CONTACT)	1	
7	Absolute Battery Unit (Absolute Type)	(Battery AB-5)	1	Number of batteries is determined by the number of axes to be connected.
8	First Step Guide		1	
9	Instruction Manual (DVD)		1	
10	Safety Guide		1	

1.1.2 Teaching Tool

For the setup operation such as position setting and parameter setting by a teaching, conduct it on PC software.
Prepare a teaching tool such as PC software and so on for the operations and tunings.

No.	Part Name	Model
1	PC Software (Includes RS232C Exchange Adapter + Peripheral Communication Cable)	RCM-101-MW
2	PC Software (Includes USB Exchange Adapter + USB Cable + Peripheral Communication Cable)	RCM-101-USB
3	Teaching Pendant (Touch panel teaching)	CON-PTA
4	Teaching Pendant (Touch panel teaching equipped with a deadman switch)	CON-PDA
5	Teaching Pendant (Touch panel teaching equipped with a deadman switch + TP adapter (RCB-LB-TG))	CON-PGA
6	Teaching Pendant	CON-T
7	Teaching Pendant (equipped with dead man’s switch + TP adapter (RCB-LB-TG))	CON-TG
8	Gateway Parameter Setting Tool	–

1.1.3 Instruction Manuals related to this product, which are contained in the DVD.

No.	Name	Manual No.
1	MSCON Controller Instruction Manual	ME0304
2	PC software RCM-101-MW/ RCM-101-USB Instruction Manual	ME0155
3	Touch panel teaching CON-PTA/PDA/PGA Instruction Manual	ME0295
4	Teaching Pendant CON-T/TG Instruction Manual	ME0178

1.1.4 How to read the model plate

Actuetor Type / SERIAL No.

Connected actuator type

No. 0	RCS3-SA6C-I-150-20-500-T2	
No. 1	RCS3-SA6C-I-150-20-500-T2	
No. 2	RCS2-SA6C-I-20-6-200-T2-B	
No. 3	RCS2-SA6C-I-20-6-200-T2-B	
No. 4	RCS2-SA6C-I-20-6-200-T2-B	
No. 5	RCS2-SA6C-I-20-6-200-T2-B	

Model → MODEL MSCON-C-6-150I -150I -20I -20I -20I -20I -DV-0-1

Serial number → SERIAL No. *********

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1.1.5 How to read the model

(Example) Consists of 5 axes : Axis No.0, 2, 3 : 60W actuators to be connected
Axis No.4, 5 : 100W actuators to be connected
Axis No.1 : Not connected

Axis No.
0 1 2 3 4 5

MSCON – C – 5 - 60I–N–60I–60I–100I–100IHA – DV - 0 – 2 –**

<Type Name>
C : Standard Type

<Connected Axes>
1 to 6 : Number of driver axes

<Detail of Connected Axis>
[Motor Type]
12 : 12W Servo Motor
20 : 20W Servo Motor
30D : 30W Servo Motor
30R : 30W Servo Motor (for RS Series)
60 : 60W Servo Motor
100 : 100W Servo Motor
150 : 150W Servo Motor
200 : 200W Servo Motor
N : Not connected (not equipped with motor driver)
[Encoder Type]
I : Incremental
A : Absolute
[Option]
HA : High Accel/Decel Type
L : Home Sensor/Limit Switch Type
C : Creep Sensor Type
B : Brake Type

<Identification for IAI use only>
*There is no identification in some cases

<Power-supply Voltage>
1 : 100V AC
2 : 200V AC

<I/Ocable Length>
0 : No cable

<I/O Type>
DV : DeviceNet Type
CC : CC-Link Type
PR : PROFIBUS-DP Type
CN : CompoNet Type
ML : MECHATROLINK Type
EP : EtherNet/IP Type
EC : EtherCAT Type

1.2 Basic Specifications

Number of Controlled Axes		Max. 6-axis
Control Power Voltage		24V DC ± 10%
Control Power Current Consumption		Max. 2.4A
Add the Control Power In Rush Current (Note1)		Max. 7A 5msec or less
Drive (Motor) Power Supply Voltage	Driving Source Voltage 100V AC Specification	AC100 to 115V ± 10%
	Driving Source Voltage 200V AC Specification	AC200 to 230V ± 10%
Drive (Motor) Power Supply In-Rush Current (Note1)	Driving Source Voltage 100V AC Specification	10A max. with 20A for 80msec (driving source voltage 100V in ambient temp. 25°C) 10A max. with 45A for 80msec (driving source voltage 115V × 10% in ambient temp. 40°C)
	Driving Source Voltage 200V AC Specification	10A max. with 45A for 40msec (driving source voltage 200V in ambient temp. 25°C) 10A max. with 95A for 40msec (driving source voltage 230V × 10% in ambient temp. 40°C)
Motor Capacity of Connectable Actuators	Driving Source Voltage 100V AC Specification	Max. 200W/axis (up to 450W in total for six axes)
	Driving Source Voltage 200V AC Specification	Max. 200W/axis (up to 900W in total for six axes)
Electromagnetic Brake Power Supply Voltage (when brake-equipped actuator connected)		24V DC ± 10%
Brake Power Supply Current		Max. 1A/axis (0.5A/axis at steady state)
Brake Power Supply In-Rush Current (Note1)		Max. 10A 10msec or less
Drive (Motor) Power Capacity		Refer to 1.3.1 Power Capacity and Heat Generation.
Leak Current		3.5mA (Motor power supply) ◎ There is no leak current of control power supply and brake power supply.
Heat Generation		Refer to 1.3.1 Power Capacity and Heat Generation.
Drive (Motor) Frequency		50/60Hz ± 5%
Transient Power Cutoff Durability		1msec (Control Power Supply), 20msec (Drive (Motor) Power Supply), 5msec (Brake Power Supply)
Motor Control System		Sinusoidal Wave PWM Vector Current Control
Applicable Encoder		Incremental Serial Encoder Absolute Serial Encoder
Actuator Cable Length		Max. 20m
Serial Communication (SIO Port: For Teaching)		RS485 1ch (complying with Modbus Protocol) Speed : 9.6 to 230.4kbps
External Interface		DeviceNet(Note), CC-Link, PROFIBUS-DP, CompoNet, MECHATROLINK II, EtherNet/IP, EtherCAT [Refer to Section 1.4. Fieldbus Type]
Data Setting and Input		PC software, Teaching pendant, Gateway parameter setting tool
Data Retention Memory		Position data and parameters are saved in the nonvolatile memory. (There is no limitation in number of writing)
Number of Positioning Points		Max. 256 points (There is no limit for simple direct and direct indication modes) Note: The number of positioning points differs depending on the operation mode select by the parameter setting.
LED Indication (Mounted on Front Panel)		LED lamp for driver status display 2 points Gateway Status LED 5 points Fieldbus Status LED 2 points Power Supply Status LED 2 points
Forcibly Releasing of Electromagnetic Brake (Mounted on Front Panel)		Switching NOM (standard)/RLS (compulsory release)
Protective Functions		Overload, overcurrent, overvoltage, etc.
Protection Function against Electric Shock		Class I
Insulation Resistance (Between secondary power source and FG)		500V DC 10MΩ or more

Withstanding Voltage (Between primary and secondary power sources, Between primary power source and PE)		1500V AC for 1 min. (for MSCON individually)
Cooling Method		Forced air-cooling
External Dimensions		225W × 154H × 115D
Weight (when drivers for 6 axes mounted)	Incremental Type	Approx. 1900g
	Absolute Type	Approx. 2000g (including batteries)
Environ-ment	Surrounding air temperature	0 to 40 °C
	Surrounding humidity	85%RH or less (non-condensing)
	Surrounding environment	[Refer to 1.7 Installation and Storage Environment.]
	Surrounding storage temperature	−20 to 70 °C Note: 0 to 40 °C for absolute battery.
	Surrounding storage humidity	85%RH or less (non-condensing)
	Usable Altitude	1000m or lower above sea level
	Vibration Durability	Frequency 10 to 57Hz/ Swing width: 0.075mm Frequency 57 to 150Hz/ Acceleration 9.8m/s^2 XYZ Each direction Sweep time: 10 min. Number of sweep: 10 times
	Package Drop	Dropping height 800mm, 1 corner, 3 edges and 6 surfaces
	Protection Class	IP20
	Pollution Degree	II
	Overvoltage Category	III

Note1: The rush current value varies depending on the impedance of the power line.

1.3 Selection of Power Source and Power Supply Supportive Devices

1.3.1 Power Capacity and Heat Generation

Shown in the table is the relation between the motor wattage and motor power capacity of an actuator that can be connected to MSCON.

Actuator Motor Wattage	Motor Power Capacity [VA]	Peek Max. Motor Power Capacity [VA]	Heat Generation [W]
12	41	123	1.7
20	50	150	2.0
30D (Excluding RS)	47	141	2.0
30R (for RS)	138	414	4.0
60	146	438	4.8
100	238	714	7.0
150	328	984	8.3
200	421	1263	9.2

RS : Rotary Shaft

1.3.2 Selection of Circuit Breaker

For the selection of the circuit breaker, perform it according to the following items.

- 3 times of the rated current flows to the controller during the acceleration/deceleration. Select an interrupter that does not trip with this value of current. If a trip occurs, select an interrupter that possesses the rated current of one grade higher. (Check the operation characteristics curves in the product catalog.)
- Select an interrupter that does not trip with the in-rush current. (Check the operation characteristics curves in the product catalog.)
- Consider the current that enables to cutoff the current even when a short circuit current is flown for the rated cutoff current.
  Rated Interrupting Current > Short Circuit Current = Circuit Breaker Primary Power Capacity / Power Voltage

Consider margin for the rated current on the circuit breaker.

Rated Current for Circuit Interrupter > Total capacity of motor power for all the connected actuators / AC input voltage × Safety margin (1.2 to 1.3 for reference)

1.3.3 Selection of Leak Current Breaker

- It may be mandatory by law to install a leakage breaker.
- A ground fault circuit interrupter needs to be selected carefully considering the purposes of prevention of fire and protection of human (Determined by law).
- Leak current varies depending on the capacity of connected motor, cable length and the surrounding environment. Measure the leak current at the point where a ground fault circuit interrupter is to be installed when leakage protection is conducted.
- Use the harmonic type (for inverter) for the ground fault circuit interrupter.

1.3.4 Control Power (24V DC) Capacity

Follow the description below for the calculation of 24V DC power capacity.

(1) Control Power Current Consumption :
Select from control power supply current in the table below ············ 1)

Number of Controlled Axes (Note1)	1 axis	2 axis	3 axis	4 axis	5 axis	6 axis
Control Power Unit Heating Value [W]	25.5	31.5	38.2	44.2	50.9	56.9
Control Power Capacity [A]	1.1	1.3	1.6	1.8	2.1	2.4

Note 1: See the line of max. number of controlled axes connectable to corresponding MSCON.
It can be defined on the manufacturing name plate.
MSCON-C-*-• • • •: “*” is the maximum number of connectable axes.

(2) Current Consumption of Brake Power Supply:
1A or 0.5A (Note 2) × number of brake-equipped actuators ············ 2)

Note 2: The maximum current of 1A per actuator runs for approximately 100ms when a brake is released. The current consumption after the release is 0.5A per unit.
Calculate the capacity with 0.5A per unit when a 24V DC power supply corresponding to transient load change such as peak load appliance is used and capable for the maximum current described above. For other cases, calculate with 1A per unit.

(3) Add the Control Power In Rush Current: 7A ············ 3)

[Selection of Power Supply]

Usually, the rated current is to be approximately 1.3 times higher than the total of Control Power 1) and Motor Power 2) above considering approximately 30% of margin to the load current. However, considering the inrush currents [excitation (3)], even though it is a short time, select a power supply with sufficient “peak load capacity”. If a power supply with insufficient peak capacity is utilized, a transient voltage drop or cutoff may occur. This may present issues with power supplies providing remote sensing functionality.

(Remark) Selection of Power Supply Protection Circuit Breaker

It is recommended that the power supply protection is conducted on the primary side (AC power side) of the 24V DC power supply unit.
If having 24V DC turned ON/OFF, keep the 0V connected and have the +24V ON/OFF (cut one side only).
Be careful to the in-rush current of the 24V DC power supply unit when making a selection. (Check it in the operation characteristics curve graph in a catalog provided by the supplier.)
Consider the current that enables to cutoff the current even when a short circuit current is flown for the rated cutoff current.

- Rated Interrupting Current > Short Circuit Current = Circuit Breaker Primary Power Capacity / Power Voltage
- (Remark) In-rush Current of IAI Power Supply Unit PS241 = 50 to 60A, 3msec

1.4 Specifications for each Fieldbus

1.4.1 Specifications of DeviceNet Interface

Item	Specification			
Communication Protocol	DeviceNet2.0			
	Group 2 Dedicated Server			
	Network-Powered Insulation Node			
Baud Rate	Automatically follows the master			
Communication System	Master-Slave System (Polling)			
Number of Occupied Channels	Refer to 3.4.1 PLC Address Construction by each Operation Mode			
Number of Occupied Nodes	1 Node			
Communication Cable Length (Note2)	Baud Rate	Max. Network Length	Total Branch Line Length	Max. Branch Line Length
	500kbps	100m	39m	6m
	250kbps	250m	78m	
	125kbps	500m	156m	
Communications Cable	Use the dedicated cable.			
Connector (Note1)	MSTBA2.5/5-G-5.08-ABGY AU (Manufactured by PHOENIX CONTACT or equivalent)			
Consumption Current of Communication Power Supply	60mA			
Communication Power Supply	24V DC (Supplied from DeviceNet)			

Note1: The cable-side connector is a standard accessory. (SMSTB2.5/5-ST-5.08 AU by PHOENIX CONTACT)

Note2: For T branch communication, refer to the Instruction Manuals for the master unit and programmable logic controller (stated as PLC from now on) to be mounted.

1.4.2 Specifications of CC-Link Interface

Item	Specification					
Communication Protocol	CC-Link Ver1.1 or Ver2					
Station Type	Remote device station (4 stations max. to occupy)					
Baud Rate	10M/5M/2.5M/625K/156kbps					
Communication System	Broadcast Polling System					
Number of Occupied Stations	Refer to 3.4.1 PLC Address Construction by each Operation Mode					
Communication Cable Length(Note2)	Baud Rate [bps]	10M	5M	2.5M	625k	156k
	Total Cable Length [m]	100	160	400	900	1200
Communications Cable	Use the dedicated cable.					
Connector (Note1)	MSTBA2.5/5-G-5.08 AU (Manufactured by PHOENIX CONTACT or equivalent)					

Note1: The cable-side connector is a standard accessory. (SMSTBA2.5/5-ST-5.08 AU by PHOENIX CONTACT)

Note2: For T branch communication, refer to the Instruction Manuals for the master unit and PLC to be mounted.

1.4.3 Specifications of PROFIBUS-DP Interface

Item	Specification		
Communication Protocol	PROFIBUS-DP		
Baud Rate	Automatically follows the master		
Communication System	Hybrid System (Master-Slave System or Token Passing System)		
Number of Occupied Stations	Refer to 3.4.1 PLC Address Construction by each Operation Mode		
Communication Cable Length	Max. Total Network Length	Baud Rate	Cable Type
	100m	12,000/6,000/3,000kbps	Type A Cable
	200m	1,500kbps	
	400m	500kbps	
	1000m	187.5kbps	
	1200m	9.6/19.2/93.75kbps	
Communications Cable	STP cable AWG18		
Connector (Note1)	9 pin female D-sub Connector		
Transmission Path Format	Bus/Tree/Star		

Note 1: Prepare the 9-pin male D-sub connector as the connector on the cable side.

1.4.4 Specifications of CompoNet Interface

Item	Specification
Communication System	CompoNet specialized protocol
Communication Type	Remote I/O Communication
Baud Rate	Automatically follows the master
Communication Cable Length	Follows CompoNet Type
Slave Type	Word Mixed Slave
Available Node Addresses for Setting	0 to 63 (Setting conducted on controller parameter)
Number of Occupied Channels	Refer to 3.4.1 PLC Address Construction by each Operation Mode
Communications cable (Note1)	Round-type cable (JIS C3306, VCTF2 conductors) Flat cable I (with no sheathed) Flat cable II (sheathed)
Connector (Controller side)	XW7D-PB4-R (manufactured by OMRON or equiv.)

Note1: Prepare a communication cable separately.

1.4.5 Specifications of MECHATROLINK II Interface

Item		Specification
Slave Type		Intelligent I/O
Baud Rate	MECHATROLINK II	10Mbps
Max. Transmittable Distance		50m
Min. Distance between Stations		0.5m
Number of Occupied Bytes		Refer to 3.4.1 PLC Address Construction by each Operation Mode
Transmission Frequency		1 to 8ms
Data Length	MECHATROLINK II	32 bytes
Settable Node Address Range		61 to 7F [hex.]
Communications Cable (Note1)		STP Cable (characteristic impedance 130Ω)
Connector	Controller Side	DUSB-ARB82-T11A-FA (Manufactured by DDK or equivalent)

Note1: Prepare the communication cable separately.

1.4.6 Specifications of EtherNet/IP Interface

Item	Specification
Communication Protocol	IEC61158 (IEEE802.3)
Baud Rate	10BASE-T/100BASE-T (Autonegotiation setting is recommended)
Communication Cable Length	EtherNet/IP Specifications (Distance between hub and each node: 100m or less)
Number of Connection	Master Unit
Available Node Addresses for Setting	0.0.0.0 to 255.255.255.255
Communications Cable (Note1)	Category 5e or higher (Double shielded cable braided with aluminum foil recommended)
Connector	RJ45 Connector × 1pc

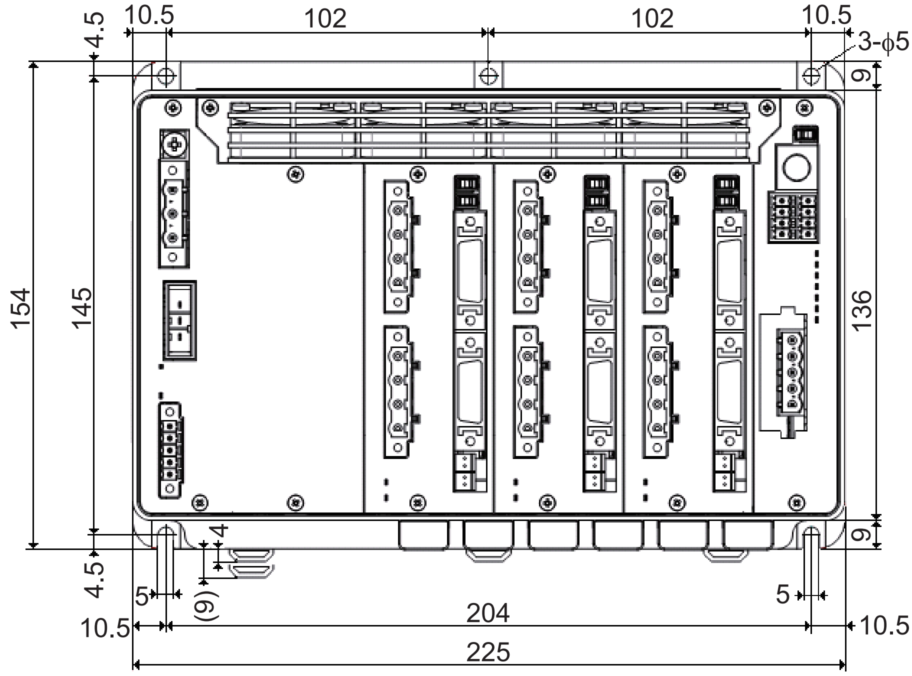
Note1: Please prepare a communication cable separately.

1.4.7 Specifications of EtherCAT Interface

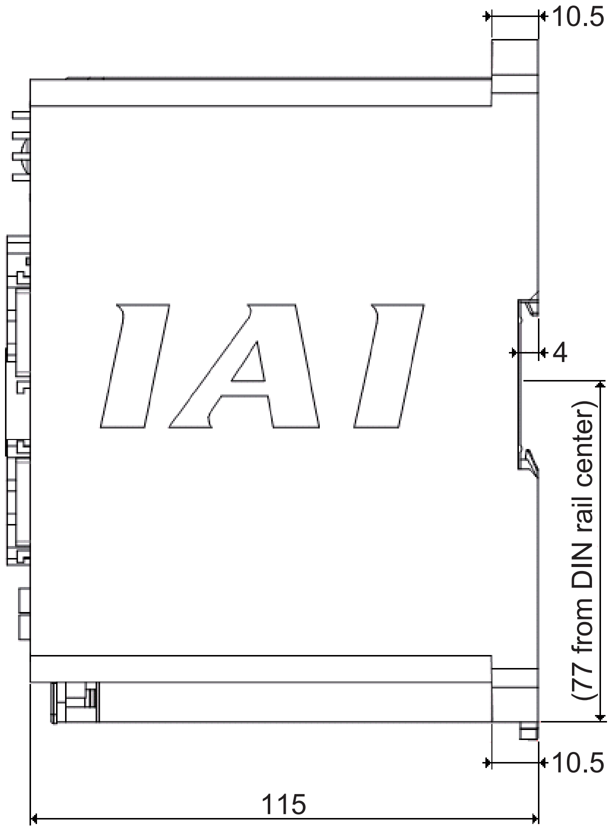
Item	Specification
Communication Protocol	IEC61158 type12
Physical Layer	100Base-TX (IEEE802.3)
Baud Rate	Automatically follows the master
Communication Cable Length	Depends on EtherCAT® Specification (Distance between each node: 100m or less)
Slave Type	I/O slave
Available Node Addresses for Setting	0 to 127 (17 to 80 : When connected to the master (CJ1W-NC*82) manufactured by OMRON)
Communications Cable (Note1)	Category 5e or more (Double shielded cable braided with aluminum foil recommended)
Connector	RJ45 Connector × 2pcs (Input×1, Output×1)
Connection	Daisy chain only

Note1: Please prepare a communication cable separately.

1.5 External Dimensions
1.5.1 Incremental Type

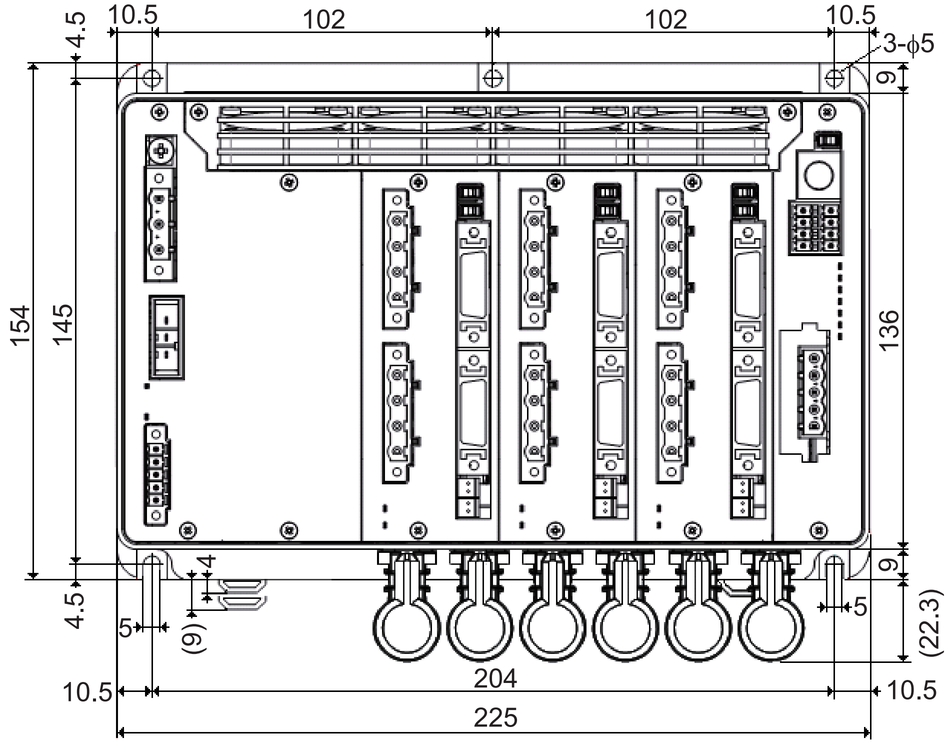


Front View

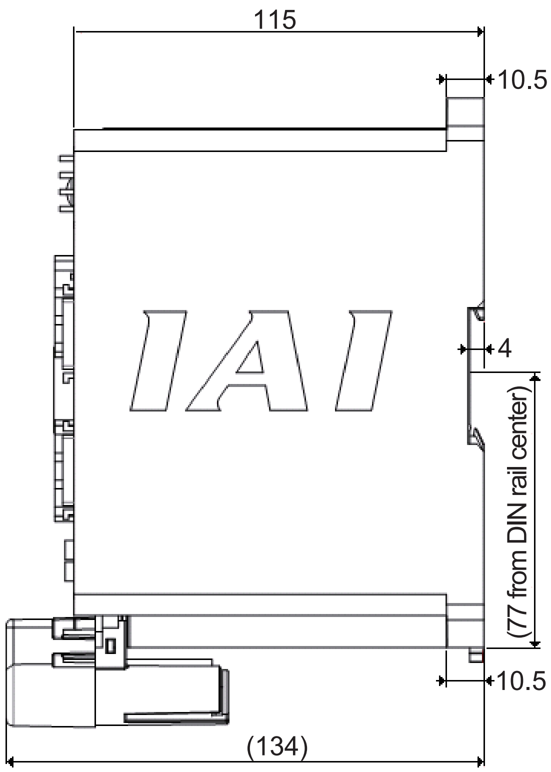


Side View

1.5.2 Absolute Type



Front View



Side View

1.6 Option
1.6.1 Regenerative Resistor Unit

This unit is necessary to be connected in the case that the regenerative energy cannot be consumed by the regenerative resistor built into the MSCON.

[Specification]

Item			Specifications
Model	First Unit	RESU-2 (Screw Attachment Type)	MSCON Connection Cable (Model CB-SC-REU010) 1m enclosed
		RESUD-2 (DIN Rail Attachment Type)	
	2nd unit or later	RESU-1 (Screw Attachment Type)	Regenerative unit connection cable (Model CB-ST-REU010) 1m enclosed
		RESUD-1 (DIN Rail Attachment Type)	
Dimensions			W35.6 × H136 × D115
Body Weight			Approx. 0.7kg
Built-in Regeneration Resistor			220Ω 80W

[Reference for connectable number of units]

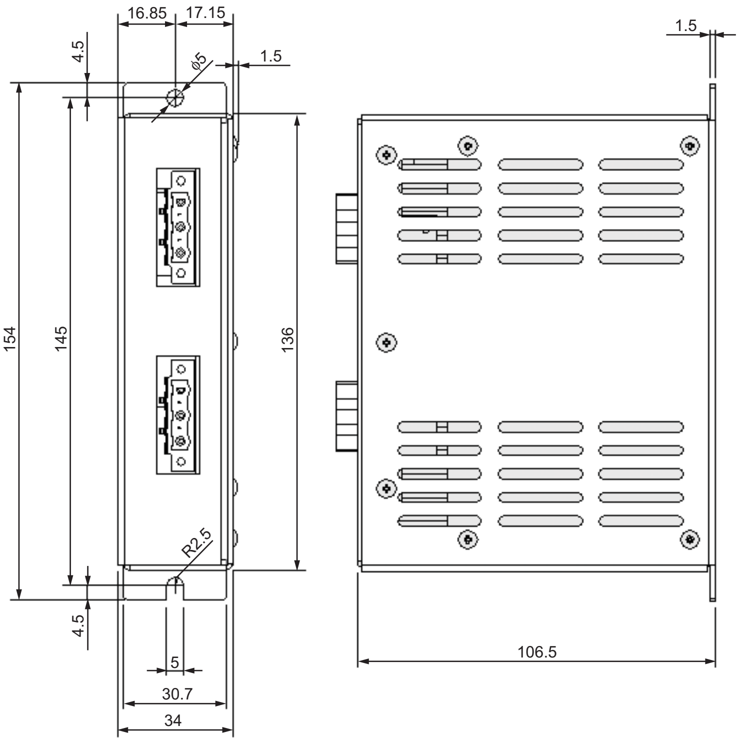
Total Wattage for Motors of 6 Axes		No. of Connected Regenerative Resistance Units
Actuator horizontally oriented	Actuator vertically oriented	
to 450	to 200	0
to 900	to 600	1
–	to 800	2
–	to 900	3

⚠ Caution : The number of connectable units is a reference for when operation is made under the following condition;

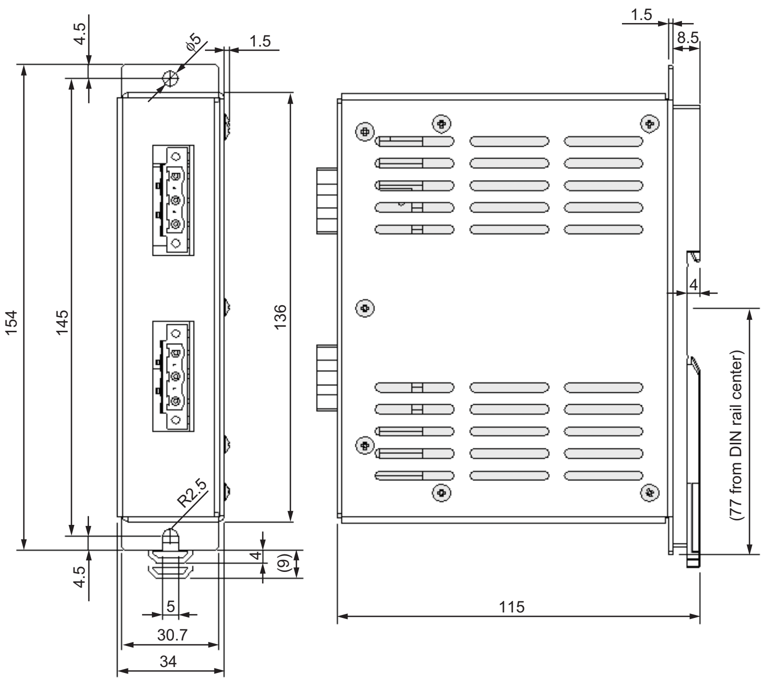
[Condition] When 1,000mm of back and forth operation is made under the actuator maximum speed, acceleration/deceleration 0.3G and rated load with the duty 50%.

In some operational conditions, gateway alarm “0A2 Motor Power Voltage Error” or “0AB Estimated Regenerative Discharge Power Excess” may be generated, and it may require more regenerative resistor that described in the table above. In such cases, add more regenerative resistance units. However, please note the number of maximum connectable regenerative resistance units is 4. It is not effective even with connection more than necessary. Consider to change the operational conditions (to reduce the load) or to use a higher specification actuator.

[RESU-*Type External Dimensions: Screw Attachment Type]



[RESUD-*Type External Dimensions: DIN Rail Attachment Type]



1.7 Installation and Storage Environment

This product is capable for use in the environment of pollution degree 2[*1] or equivalent.
*1 Pollution Degree 2: Environment that may cause non-conductive pollution or transient conductive pollution by frost (IEC60664-1)

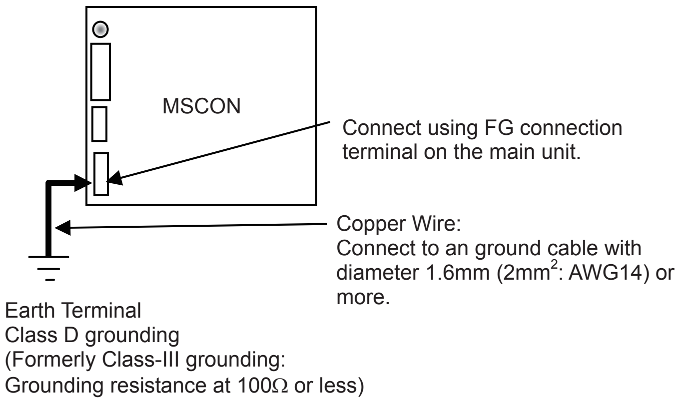
[1] Installation Environment
Do not use this product in the following environment.
- Location where the surrounding air temperature exceeds the range of 0 to 40°C
- Location where condensation occurs due to abrupt temperature changes
- Location where relative humidity exceeds 85%RH
- Location exposed to corrosive gases or combustible gases
- Location exposed to significant amount of dust, salt or iron powder
- Location subject to direct vibration or impact
- Location exposed to direct sunlight
- Location where the product may come in contact with water, oil or chemical droplets
- Environment that blocks the air vent [Refer to 1.8 Noise Elimination and Mounting Method]

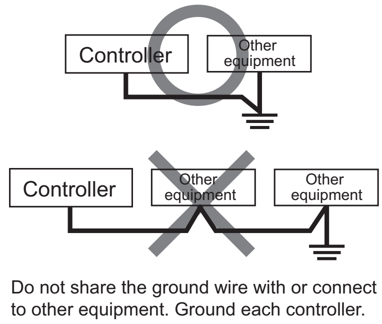
When using the product in any of the locations specified below, provide a sufficient shield.
- Location subject to electrostatic noise
- Location where high electrical or magnetic field is present
- Location with the mains or power lines passing nearby

[2] Storage Environment
- Storage environment follows the installation environment. Especially in a long-term storage, consider to avoid condensation of surrounding air.
  Unless specially specified, moisture absorbency protection is not included in the package when the machine is delivered. In the case that the machine is to be stored in an environment where dew condensation is anticipated, take the condensation preventive measures from outside of the entire package, or directly after opening the package.

1.8 Noise Elimination and Mounting Method

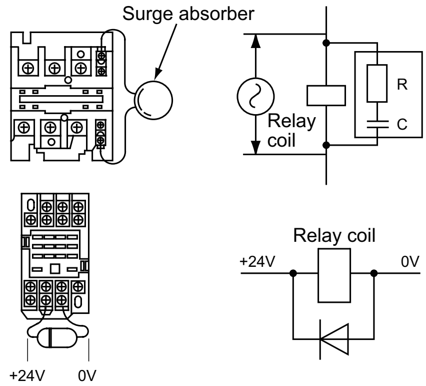
(1) Noise Elimination Grounding (Frame Ground)





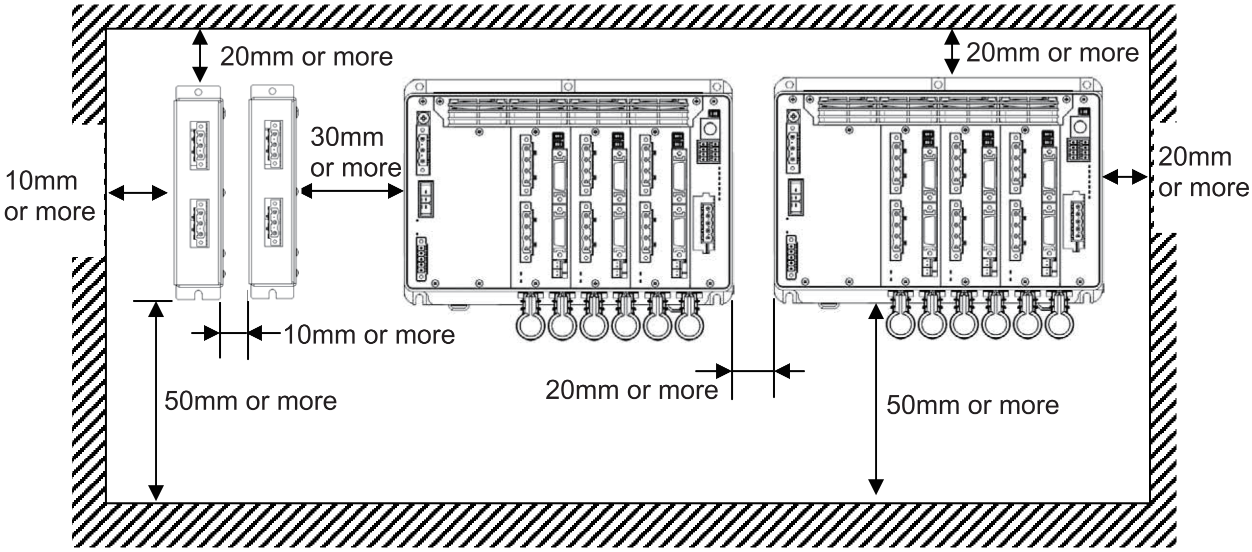
(2) Precautions regarding wiring method
1) Wire is to be twisted for the power supply.
2) Separate the signal and encoder lines from the power supply and power lines.

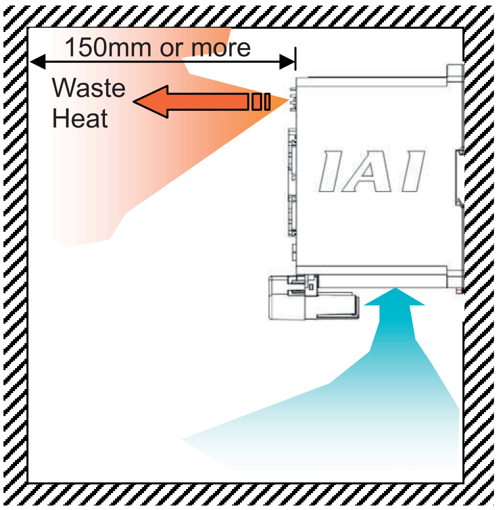
(3) Noise Sources and Elimination
Carry out noise elimination measures for electrical devices on the same power path and in the same equipment. The following are examples of measures to eliminate noise sources.
1) AC solenoid valves, magnet switches and relays
[Measure] Install a Surge absorber parallel with the coil.
2) DC solenoid valves, magnet switches and relays
[Measure] Mount the windings and diodes in parallel. Select a diode built-in type for the DC relay.



(4) Heat Radiation and Installation

Design and Build the system considering the size of the controller box, location of the controller and cooling factors to keep the ambient temperature around the controller below 40°C
Pay a special attention to the battery unit since the performance of it would drop both in the low and high temperatures. Keep it in a room temperature environment as much as possible. (Approximately 20°C is the recommended temperature.)

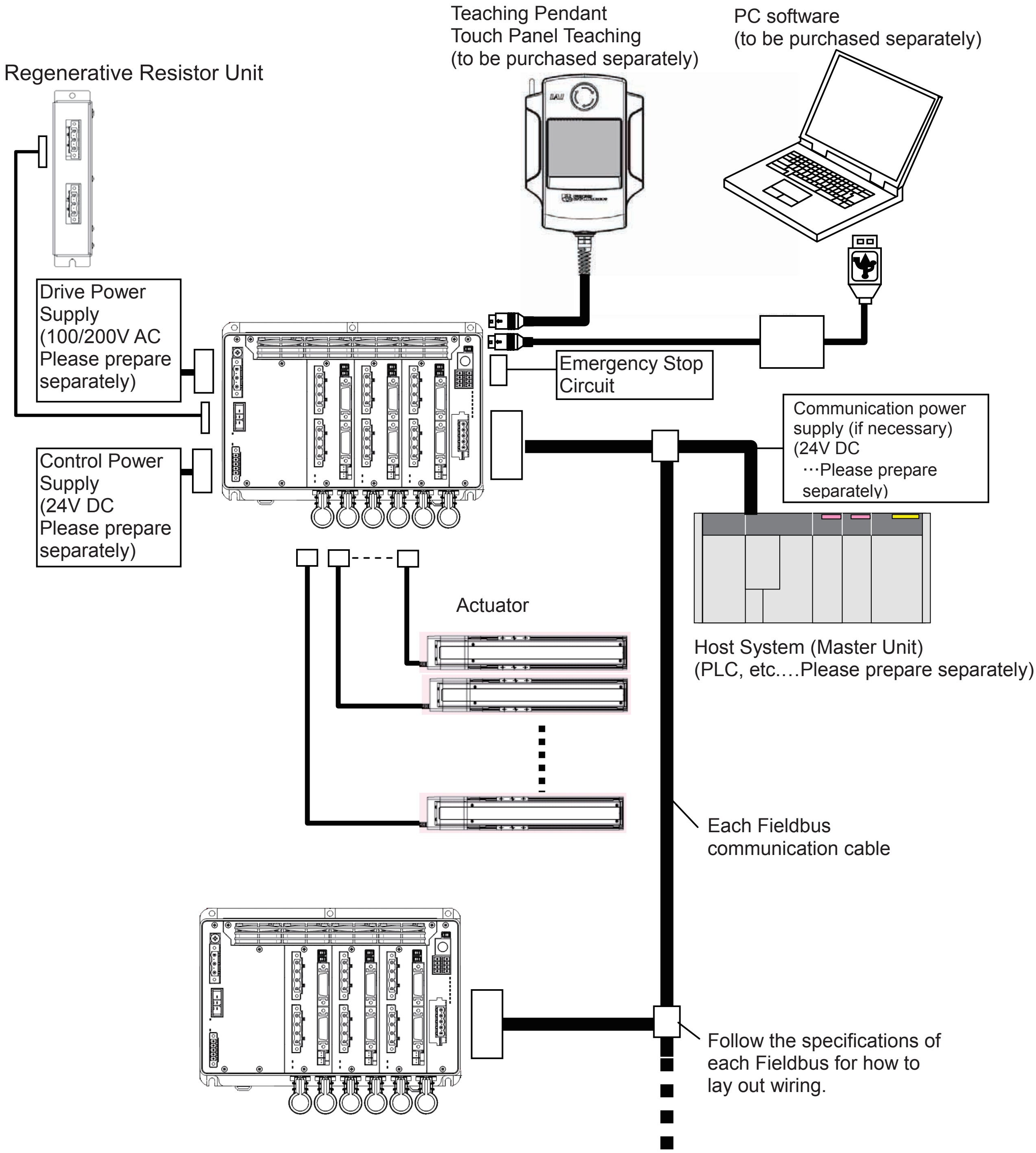




To install the unit, use the attachment holes on the top and bottom of the main body and affix with screws, or attach to DIN rails. (Regenerative resistance unit is separated to screw attachment type and DIN rail attachment type. Have an appropriate way to affix the unit for each type.)

Chapter 2 Wiring

2.1 Wiring Diagram (Connection of construction devices)

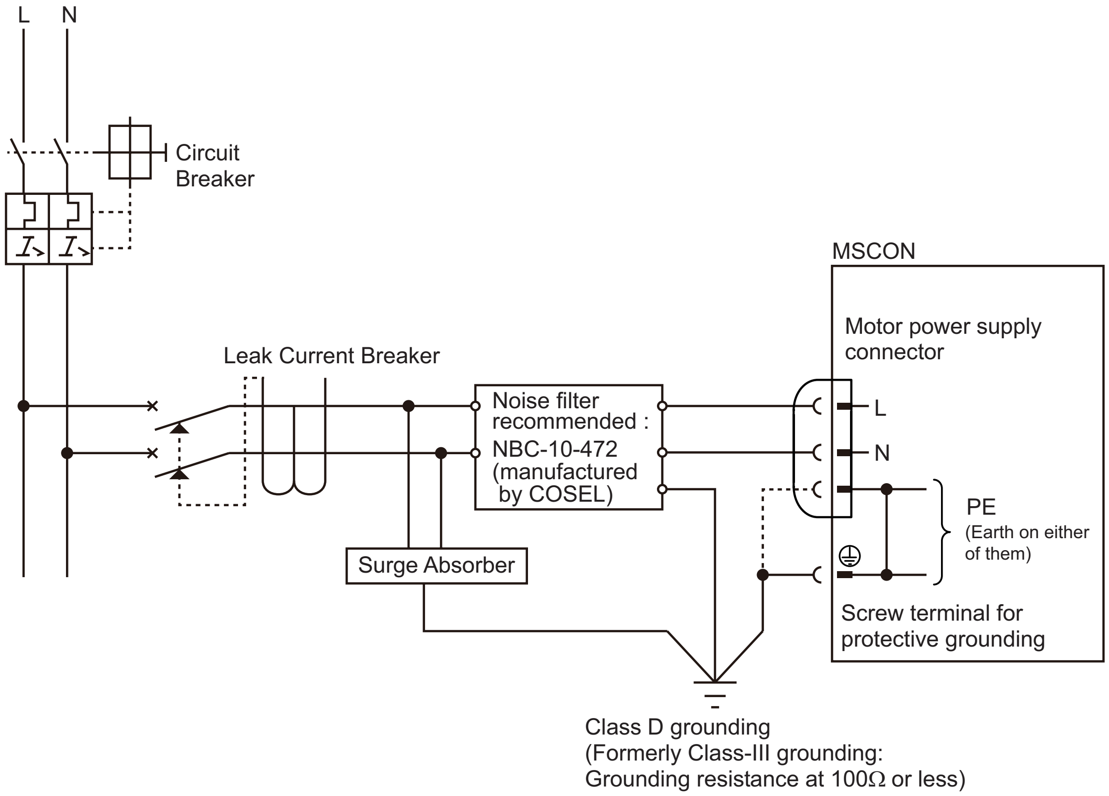


2.2 Circuit Diagram

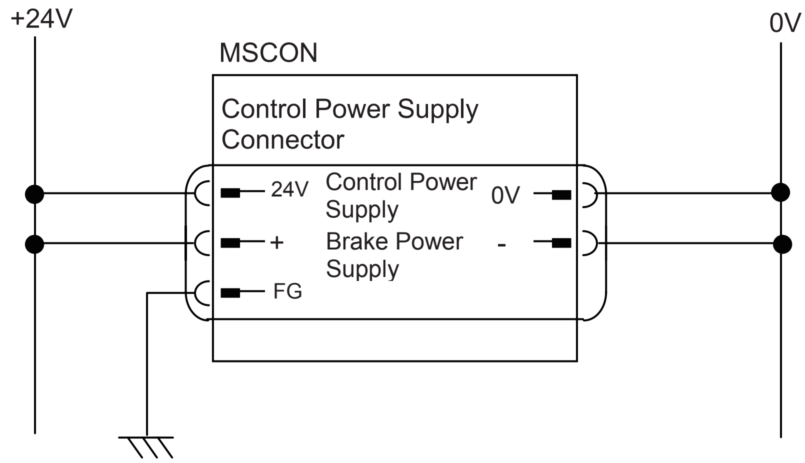
Sample circuit diagrams are shown below.

[1] Drive (Motor) Power Supply Circuit

Note: Drive power supply voltage (100V/200V AC) cannot be changed after the product is delivered.



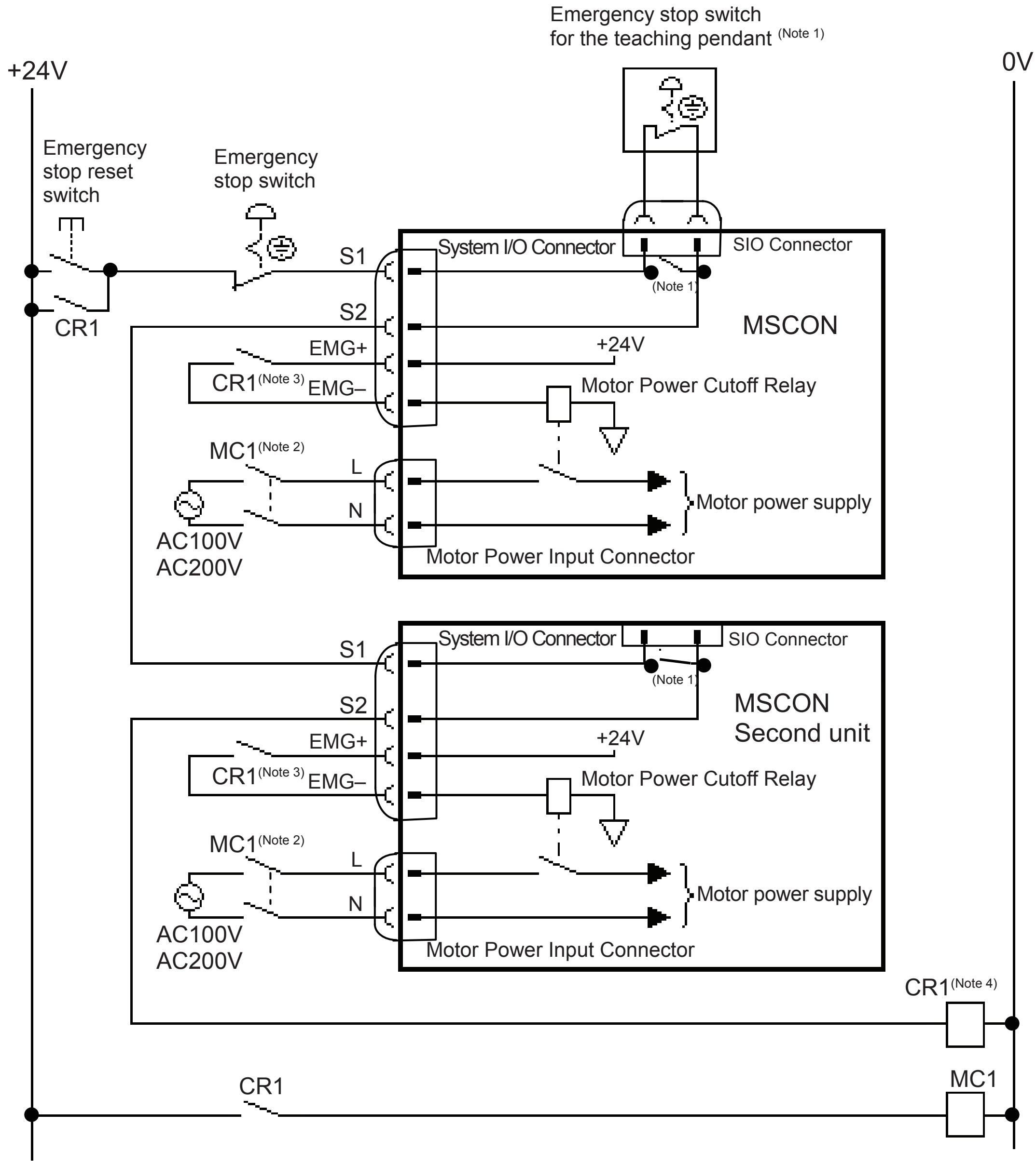
[2] Control Power Supply and Brake Power Supply Circuit



Caution:
- When using an actuator equipped with a brake, supply a brake power (24V DC). With the power not being supplied, 0A5 Electromagnetic Brake Non-Release Error will occur. Do not attempt to supply a brake power if there is no actuator with a brake.
- If having the control power supplied/cut on the 24V DC side, keep the 0V connected and have the +24V supplied/cut (cut one side only). If cut also on 0V side (cut both sides), it may damage the internal circuit.

[3] Emergency Stop Circuit

It is the example of circuit layout when an emergency switch of the teaching pendant is used to the emergency stop circuit of the equipment.



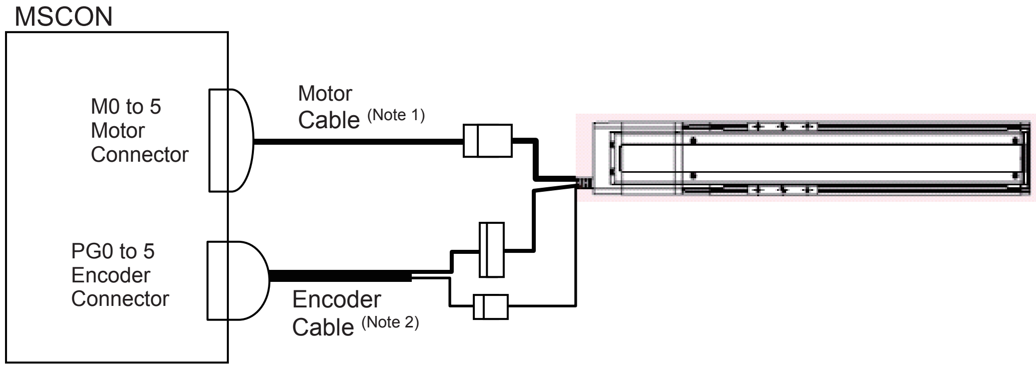
Note 1: When the teaching pendant is not connected, S1 and S2 become short-circuited inside the controller.

Note 2: When the motor power must be disconnected externally for safety category compliance, apply a safety rated contactor between L and N.

Note 3: The rating for the emergency stop signal (EMG-) to turn ON/OFF at contact CR1 is 24V DC and 30mA.

Note 4: For CR1, select the one with coil current 0.1A or less.

[4] Motor • Encoder Circuit



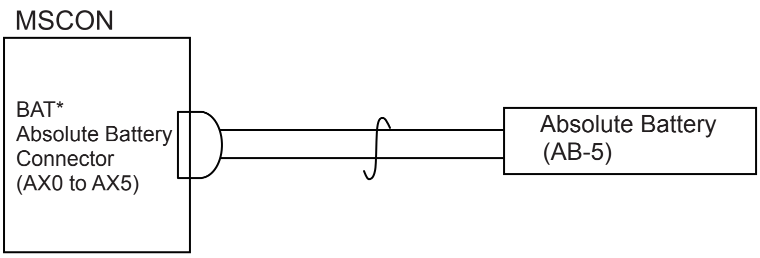
Note 1: Applicable Moter Cable types □□□: cable length Example) 030 = 3m

Model Name	Cable	Reference
For Single Axis Robot Connection	CB-RCC-MA□□□-RB	Robot cable from 0.5 to 20m
	CB-RCC-MA□□□	Standard cable from 0.5 to 20m
	CB-X-MA□□□-RB	Robot cable from 0.5 to 20m
	CB-X-MA□□□	Standard cable from 0.5 to 20m

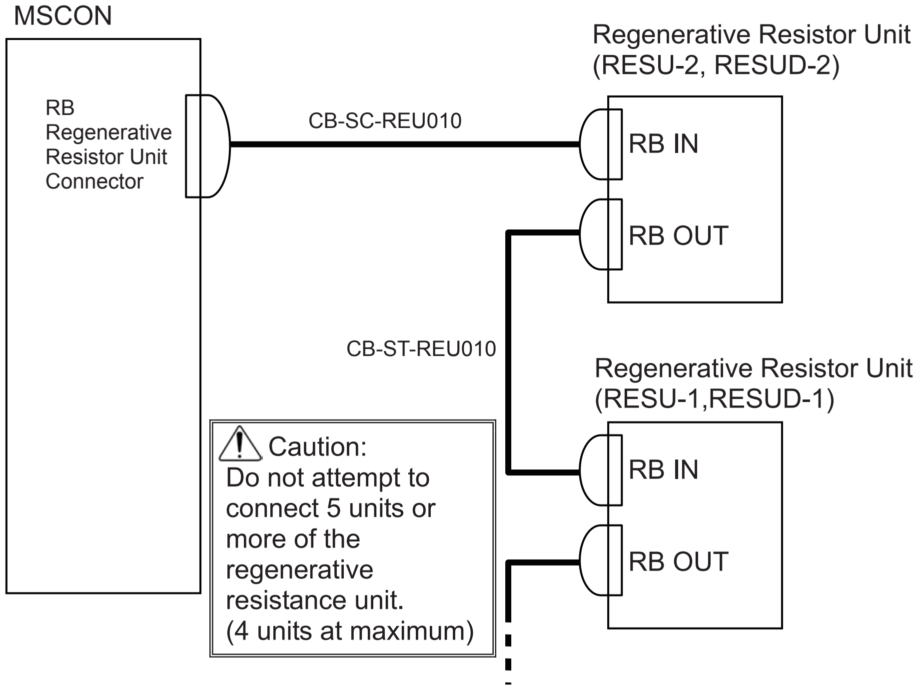
Note 2: Applicable Encoder Cable types □□□: cable length Example) 030 = 3m

Model Name	Cable	Reference
For Single Axis Robot Connection	CB-X1-PA□□□	Robot cable from 0.5 to 20m
For Connection of Single Axis Robot Equipped with LS (Option)	CB-X1-PLA□□□	Robot cable from 0.5 to 20m
For RCS2 [models equipped with LS and rotary models (RT*) are excluded]	CB-X3-PA□□□	Robot cable from 0.5 to 20m
	CB-RCS2-PA□□□	Standard cable from 0.5 to 20m
RCS2 [for models equipped with LS and rotary models (RT*)]	CB-X2-PLA□□□	Robot cable from 0.5 to 20m
	CB-RCS2-PLA□□□	Standard cable from 0.5 to 20m

[5] Absolute Battery Circuit (for Absolute Type Only)

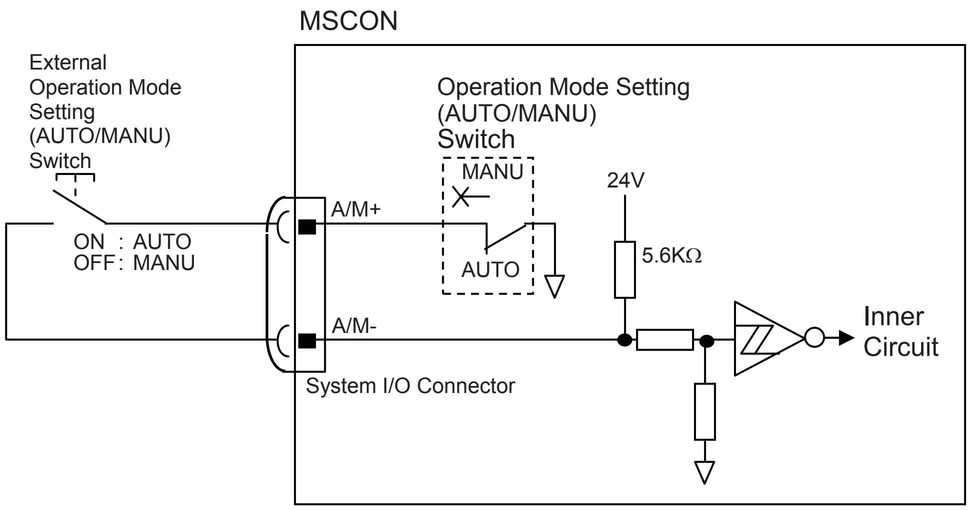


[6] Regenerative Resistance Circuit



[7] Mode Switchover (AUTO/MANU) Circuit

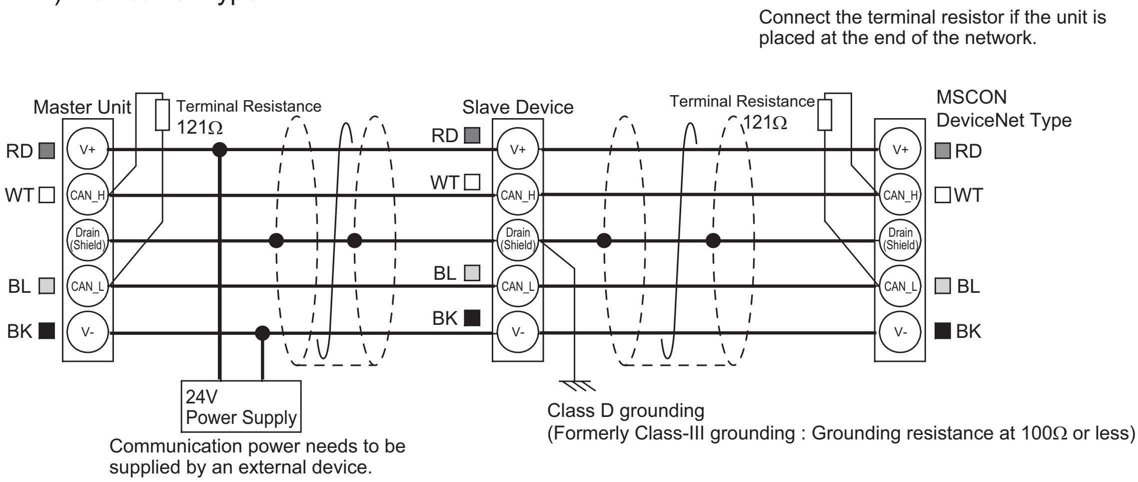
When a switchover of the operation modes (AUTO/MANU) is required with an external input, connect a device such as a switch between A/M + terminal and A/M – terminal.
If not switching externally, apply a jumper on A/M + terminal and A/M – terminal.



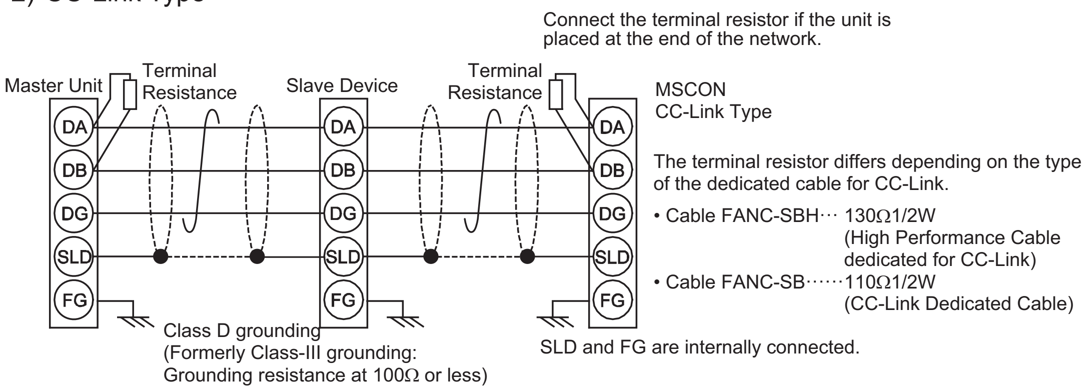
[8] Field Network Circuit (For Field Network Type)

Refer to the instruction manual of the master unit for each field network and constructed PLC for the details of the circuit.

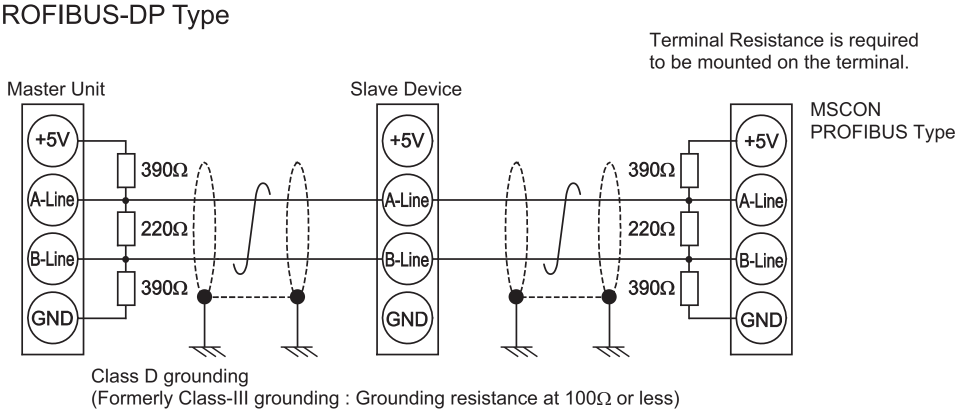
1) DeviceNet Type



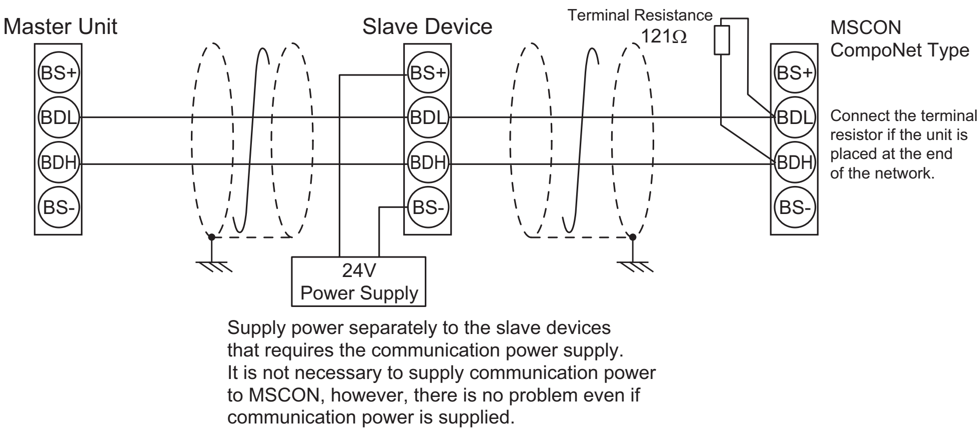
2) CC-Link Type



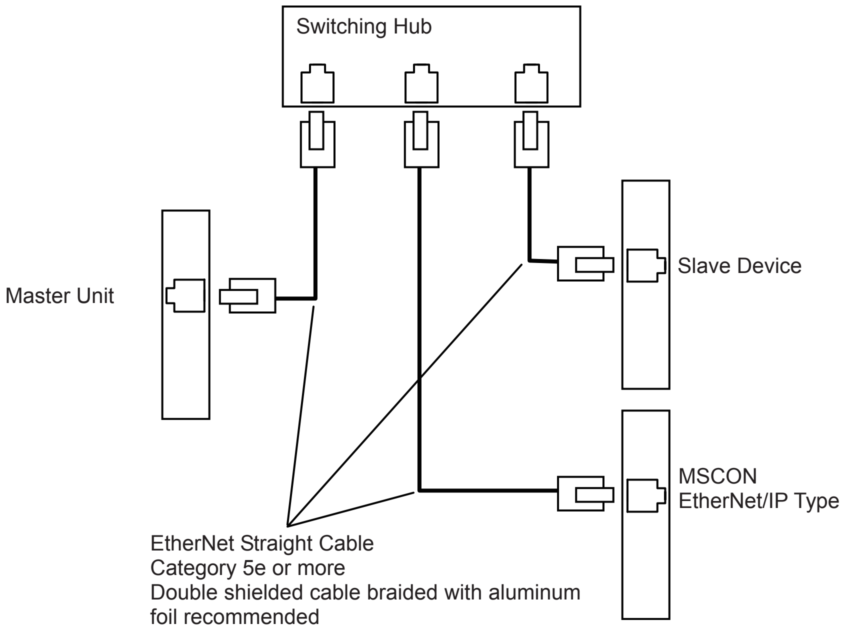
3) PROFIBUS-DP Type



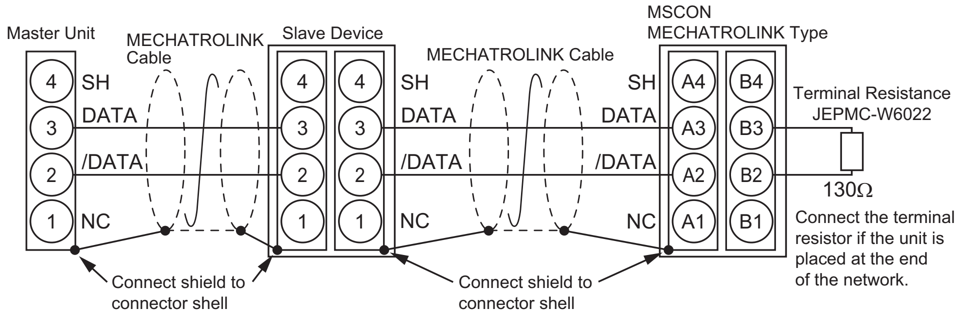
4) CompoNet Type



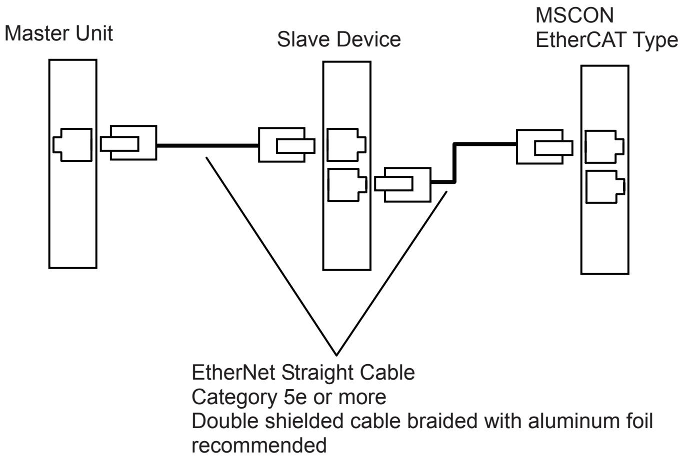
5) EtherNet/IP Type



6) MECHATROLINK Type



7) EtherCAT Type

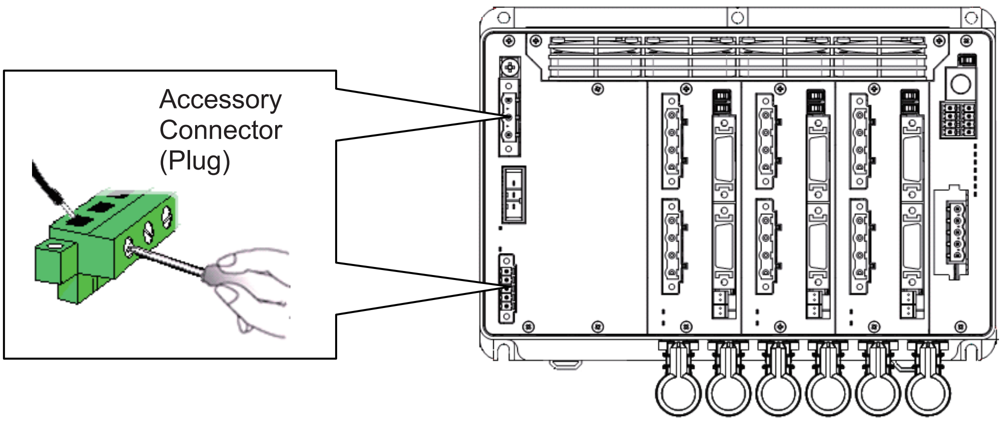


Note: Terminal resistor is not required.

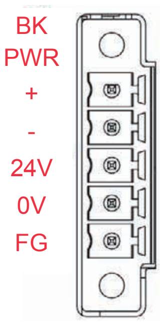
2.3 Wiring Method

2.3.1 Wiring of Control Power Supply and Drive Power Supply Input Connector

Insert the wires to the enclosed connector (plug).
Strip the sheath of the applicable wires for 7mm and insert them to the connector. When inserting, twist the affixing screw on the side of the inlets to the left with a slotted screw driver to open an inlet. After inserting a cable, twist the affixing screw to the right to hold the cable.



(1) Control Power Supply Input Connector

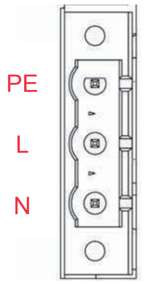


Front view of connector on controller side

Power Supply Input Connector	Model	Remarks
Cable Side	MC1.5/5-STF-3.81	Enclosed in standard package Manufactured by PHOENIX CONTACT
Controller Side	MC1.5/5-GF-3.81	

Pin No.	Signal Name	Contents	Applicable Cable
1	BK PWR+	Brake Power Input (24V DC ±10%)	KIV0.75mm^2 (AWG19)
2	BK PWR-		
3	24V	Control Power Input (24V DC ±10%)	KIV3.5 to 0.75mm^2 (AWG 12 to 19) Select the cable thickness allowable for the current figured out in the power capacity. If supplying power with using a 24V DC, having it turned ON/OFF, keep the 0V connected and have the +24V supplied/cut (cut one side only).
4	0V		
5	FG	Functional Ground Cable	It is connected to the shield of the encoder connector and fieldbus frame ground terminal inside the unit.

(2) Drive (Motor) Power Supply Input Connector



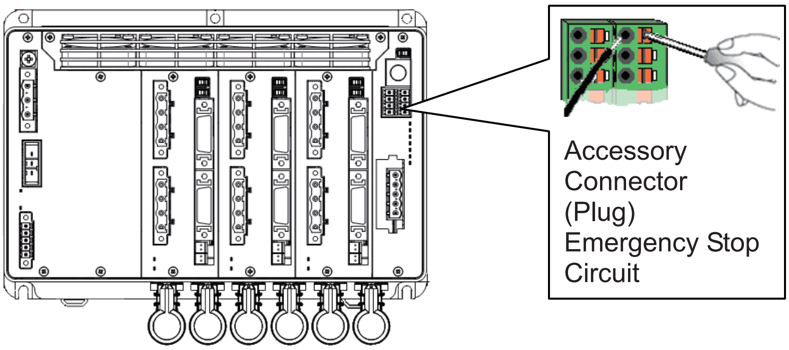
Front view of connector on controller side

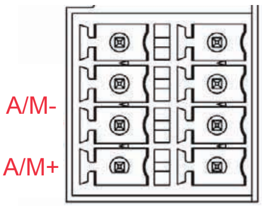
Power Supply Input Connector	Model	Remarks
Cable Side	MC2.5/3-STF-7.62	Enclosed in standard package Manufactured by PHOENIX CONTACT
Controller Side	MC2.5/3-GF-7.62	

Pin No.	Signal Name	Contents	Applicable Cable
1	N	Motor Power Input (100V AC or 200V AC … to be determined when ordered)	KIV3.5 to 1.25mm^2 (AWG12 to16) Select the cable thickness allowable for the current figured out in the power capacity.
2	L		
3	PE	Functional Ground Cable	It is connected to the shield of the encoder connector and fieldbus frame ground terminal inside the unit.

2.3.2 Wiring Layout of System I/O Connector

This consists of the emergency stop input and cable terminals for the operation mode (AUTO/MANU) switch.
Strip the sheath of the applicable wires for 10mm and insert them to the connector. Push a protrusion beside the cable inlet with a small slotted screwdriver to open the inlet. Once the cable is inserted, take the slotted screwdriver off the protrusion to fix the cable to the terminal.





Front view of connector on controller side

System I/O Connector	Model	Remarks
Cable Side	FMCD1.5/4-ST-3.5	Enclosed in standard package Manufactured by PHOENIX CONTACT
Controller Side	MCDN1.5/4-G1-3.5P26THR	

Pin No.	Signal Name	Contents	Applicable Cable
1	EMG+	+24V power output for emergency stop	KIV1.25 to 0.2mm (AWG16 to 24)
2	S2	For external emergency stop signal input	
3	S1	For external emergency stop signal output	
4	EMG-	Emergency-stop input	
5	A/M+	+24V output for operation mode (AUTO/MANU) switchover	
6	A/M-	Operation mode (AUTO/MANU) switchover signal input	
7	NC	Connection is not required	
8	NC		

2.3.3 Actuator Connection

To the encoder connector and motor connector on each actuator, connect the relay cables.
[Refer to the Note.]
Check in the instruction manual of each actuator for the details of the relay cables.

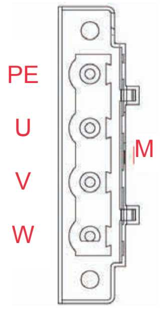
(1) Encoder Connector

Front view of connector on controller side

Encoder Connector	Model	Remarks
Cable Side	10126-3000PE	
Controller Side	10226-52A2PL	

Pin No.	Signal Name	Contents	Applicable Cable
1	NC	Unconnected	Cable dedicated for IAI products
2	NC		
3	NC		
4	NC		
5	NC		
6	NC		
7	SRD+	Serial Encoder Communication+	
8	SRD-	Serial Encoder Communication-	
9	LC_SD+	For future extension (Reserved)	
10	LC_SD-		
11	NC	Unconnected	
12	24VOUT	24V power supply for sensors	
13	0V		
14	BATT	Battery power supply for ABS	
15	BATTGND		
16	VCC	Encoder Power Supply	
17	GND		
18	LC_VCC	For future extension (Reserved)	
19	LC_GND		
20	BK-	Brake Power Supply	
21	BK+		
22	NC	Unconnected	
23	RSV	Sensor Input (Reserve)	
24	OT	Sensor Input (Over Travel)	
25	CREEP	Sensor Input (Creep Sensor)	
26	LS	Sensor Input (Limit Switch)	

(2) Motor Connector

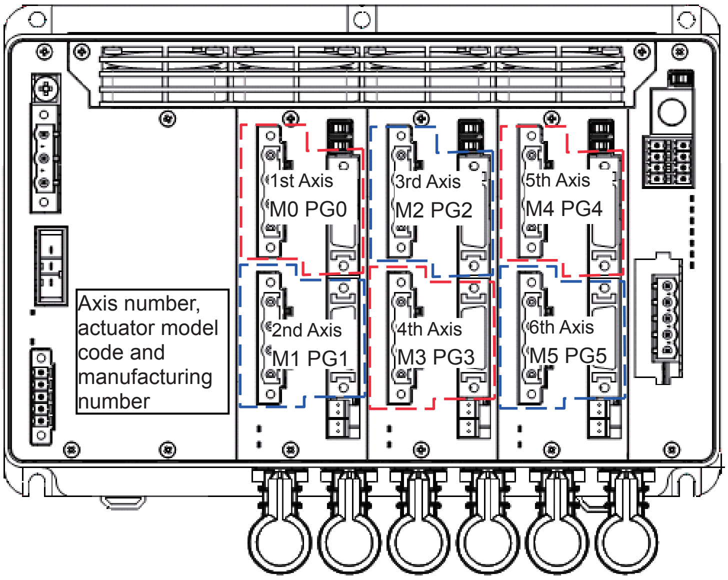


Front view of connector on controller side

Motor Connector	Model	Remarks
Cable Side	GIC2.5/4-STF-7.62	
Controller Side	GIC2.5/4-GF-7.62	

Pin No.	Signal Name	Contents	Applicable Cable
1	PE	Protective ground terminal	Cable dedicated for IAI products
2	U	Motor cable U-phase	
3	V	Motor cable V-phase	
4	W	Motor cable W-phase	

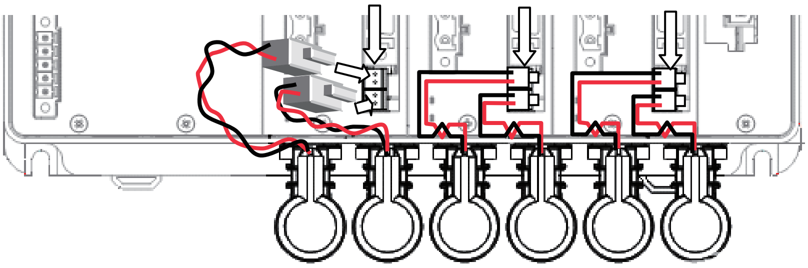
Caution: There is an axis number shown on the actuator cables (Encoder Cable: PG0 to 5, Motor Cable: M0 to 5). Refer to the figure below to plug the actuators correctly. Also, there are the model code and manufacturing number of the connected actuator printed on the front panel that you can refer to.
There is a risk of wrong operation or operation out of control of actuators if the connectors are plugged in to the wrong positions.
Check in the instruction manual of each actuator for the details (connection layout diagram) of each cable.



If an actuator is purchased individually, there is no axis number written on the connection cable. Check the actuator model code on the front panel and plug in the connector.

2.3.4 Battery Connection (For Absolute Type)

If the actuator is the absolute type, connect the harness of the absolute battery unit laid on the bottom of the main unit to the specified absolute battery connector.



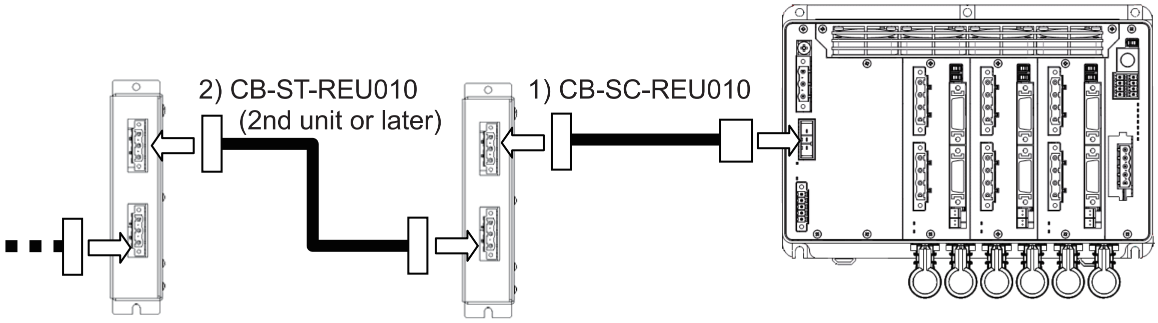
Front view of connector on controller side

Absolute Battery Connector	Model	Remarks
Cable Side	IL-2S-S3L-(N)	Already connected to battery
Controller Side	IL-2P-S3FP2-1	

Pin No.	Signal Name	Contents	Applicable Cable
1	BAT-	Battery Negative Side	Already connected to battery (AB-5)
2	BAT+	Battery Positive Side	

2.3.5 Connection of Regenerative Resistance Unit

Connect the regenerative resistance unit with a cable enclosed with it referring to the figure below. The cable to connect with MSCON and that to connect each regenerative resistance unit differ to each other in the model code.



Front view of connector on controller side

Regenerative Resistance Unit Connector	Model	Remarks
Cable Side	1-178128-3	
Controller Side	1-178138-5	

Pin No.	Signal Name	Contents	Applicable Cable
1	RB+	Regenerative Resistance +	Dedicate cable enclosed with regenerative resistance unit
2	RB-	Regenerative Resistance -	
3	PE	Protective Ground Terminal	

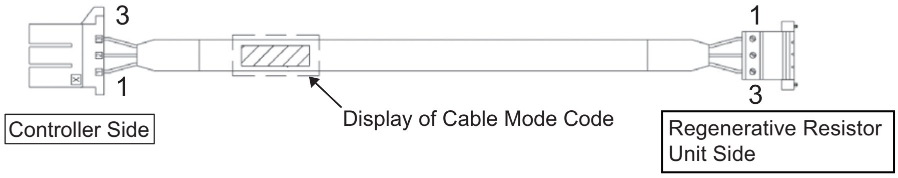
Refer to the table below to connect the necessary number of units.

Total Wattage for Motors of 6 Axes		No. of Connected Regenerative Resistance Units
Actuator horizontally oriented	Actuator vertically oriented	
to 450	to 200	0
to 900	to 600	1
-	to 800	2
-	to 900	3

⚠ Caution : The number of connectable units is a reference for when operation is made under the following condition;
[Condition] When 1,000mm of back and forth operation is made under the actuator maximum speed, acceleration/deceleration 0.3G and rated load with the duty 50%.
In some operational conditions, gateway alarm "0A2 Motor Power Voltage Error" or "0AB Estimated Regenerative Discharge Power Excess" may be generated, and it may require more regenerative resistor that described in the table above. In such cases, add more regenerative resistance units. However, please note the number of maximum connectable regenerative resistance units is 4. It is not effective even with connection more than necessary. Consider to change the operational conditions (to reduce the load) or to use a higher specification actuator.

Connection Cable

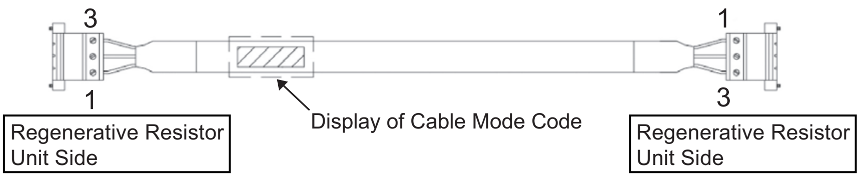
1) Regenerative resistance connection cable for SCON (CB-SC-REU010)
   Cable length : 1m



Wiring	Color	Signal	No.
KIV 1.0mm^2 (AWG17)	Light Blue	RB+	1
	Brown	RB-	2
	Green/Yellow	PE	3

No.	Signal	Coler	Wiring
1	RB+	Light Blue	KIV 1.0mm^2 (AWG17)
2	RB-	Brown	
3	PE	Green/Yellow	

2) Regenerative resistance connection cable for XSEL (CB-ST-REU010)
   Cable length : 1m

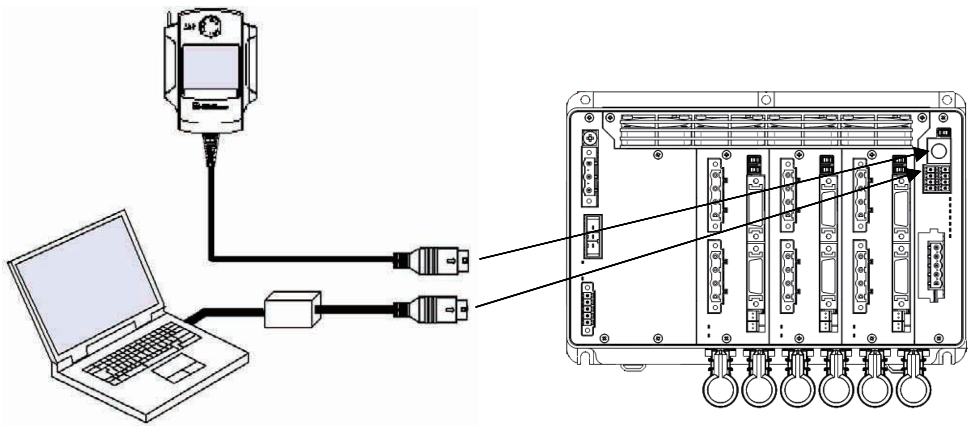


Wiring	Color	Signal	No.
KIV 1.0mm^2 (AWG17)	Light Blue	RB+	1
	Brown	RB-	2
	Green/Yellow	PE	3

No.	Signal	Coler	Wiring
1	RB+	Light Blue	KIV 1.0mm^2 (AWG17)
2	RB-	Brown	
3	PE	Green/Yellow	

2.3.6 Connection of SIO Connector

Connect an applicable teaching tool such as the PC software.



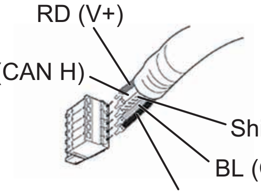
SIO connector	Model	Remarks
Cable Side	miniDIN 8 Pin	
Controller Side	TCS7587-0121077	

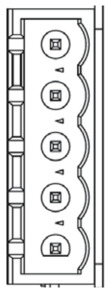
Pin No.	Signal Name	Contents	Applicable Cable
1	SGA	Teaching Tool Signal +	Cable dedicated for IAI products
2	SGB	Teaching Tool Signal -	
3	5V	Power Supply for Teaching Tool	
4	ENB	Enable Signal Input	
5	EMGA	Emergency Stop Signal A	
6	24V	Power Supply for Teaching Tool	
7	0V	0V	
8	EMGB	Emergency Stop Signal B	
Shell	0V	0V	

2.3.7 Wiring Layout of Field Network Connector

Check the instruction manuals for each Field Network master unit and mounted PLC for the details.

1) DeviceNet Type





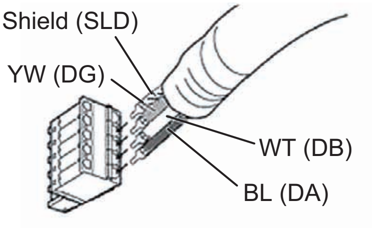
Front view of connector on controller side

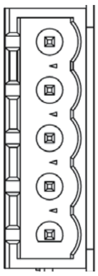
DeviceNet Connector	Model	Remarks
Cable Side	SMSTB2.5/5-ST-5.08 AU	Enclosed in standard package Manufactured by PHOENIX CONTACT
Controller Side	MSTBA2.5/5-G-5.08 ABGY AU	

Pin No.	Signal Name	Contents	Applicable Cable
1	V- (BK)	Power Supply Cable Negative Side	
2	CAN L (BL)	Communication Data Low Side	
3	Shield (None)	Shield	DeviceNet Dedicated Cable
4	CAN H (WT)	Communication Data High Side	
5	V+ (RD)	Power Supply Cable Positive Side	

(Note): Connect a terminal resistor (121Ω) between CAN L and CAN H to the end of the network. [Refer to 2.2 [8] Field Network Circuit (For Field network Type)]

2) CC-Link Type





Front view of connector on controller side

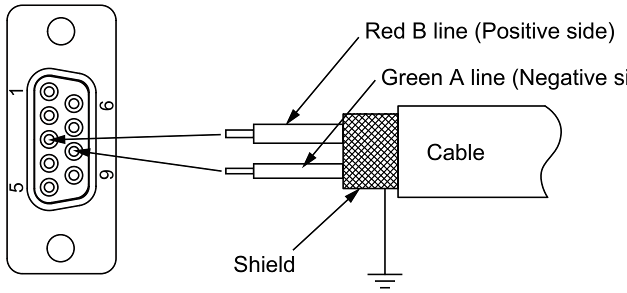
CC-Link Connector	Model	Remarks
Cable Side	SMSTB2.5/5-ST-5.08 AU	Enclosed in standard package Manufactured by PHOENIX CONTACT
Controller Side	MSTBA2.5/5-G-5.08 AU	

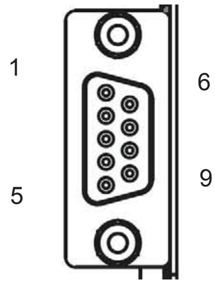
Pin No.	Signal Name (Color)	Contents	Applicable Cable
1	DA (BL)	Communications Line A	CC-Link Dedicated Cable
2	DB (WT)	Communications Line B	
3	DG (YW)	Digital GND	
4	SLD	Connect the shield of the shielded cable (Connect the FG of the 5 pins and controller FG internally)	
5	FG	Frame Ground (Connect the SLD of the 4 pins and controller FG internally)	

(Note): Connect a terminal resistor (121Ω) between DA and DB to the end of the network. [Refer to 2.2 [8] Field network Circuit (For Field network Type)]

3) PROFIBUS-DP Type

Use the type A cable for PROFIBUS-DP (EN5017).





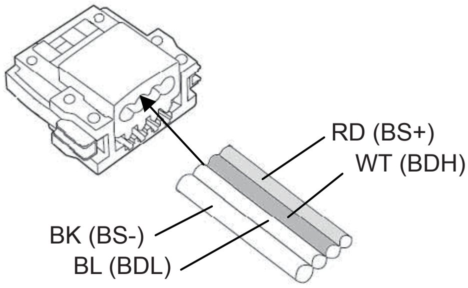
Front view of connector on controller side

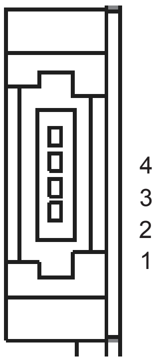
PROFIBUS-DP Connector	Model	Remarks
Cable Side	D-sub 9-pin connector (Male)	Please prepare separately
Controller Side	D-sub 9-pin connector (Female)	

Pin No.	Signal Name	Contents	Applicable Cable
1	NC	Unconnected	PROFIBUS-DP Dedicated Cable
2	NC	Unconnected	
3	B-Line	Communications Line B (RS485)	
4	RTS	Request for Sending	
5	GND	Signal GND (Insulated)	
6	+5V	+5V Output (Insulated)	
7	NC	Unconnected	
8	A-Line	Communications Line A (RS485)	
9	NC	Unconnected	

(Note): Connect a terminal resistor (220Ω) between A-Line and B-Line to the end of the network. [Refer to 2.2 [8] Field network Circuit (For Field network Type)]

4) CompoNet Type





Front view of connector on controller side

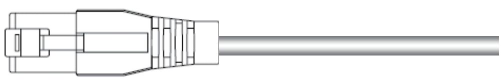
CompoNet Connector	Model	Remarks
Cable Side	Connector that complies with CompoNet standards	Please prepare separately
Controller Side	XW7D-PB4-R	Manufactured by OMRON

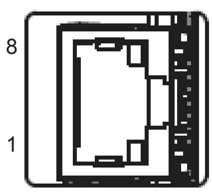
Pin No.	Signal Name (Color)	Contents	Applicable Cable
1	BS+ (RD)	Communication Power Supply +(Note 1)	CompoNet Dedicated Cable
2	BDH (WT)	Signal Cable H Side	
3	BDL (BL)	Signal Cable L Side	
4	BS- (BK)	Communication Power Supply -(Note 1)	

Note 1: It is unnecessary to supply the communication power. (Internal power source is used.)
If conducting multi power supply to other slave devices via communication cables, there is no problem with connecting the power supply to BS+ and BS- terminals.

(Note): Connect a terminal resistor (121Ω) between BDH and BDL to the end of the network. [Refer to 2.2 [8] Field network Circuit (For Field network Type)]

5) EtherNet/IP Type



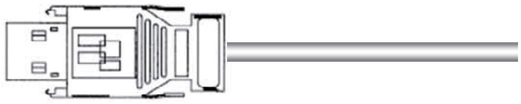


Front view of connector on controller side

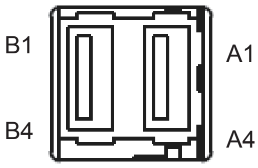
EtherNet/IP Connector	Model	Remarks
Cable Side	8P8C Modular Plug	
Controller Side	8P8C Modular Jack	

Pin No.	Signal Name (Color)	Contents	Applicable Cable
1	TD+	Sent data +	For EtherNet cable, use a straight STP cable that possesses the performance of Category 5e or more.
2	TD-	Sent data -	
3	RD+	Received data +	
4	—	Not used	
5	—	Not used	
6	RD-	Received data -	
7	—	Not used	
8	—	Not used	

6) MECHATROLINK Type



MECHATROLINK Connector	Model	Remarks
Cable Side	Connector that complies with MECHATROLINK standards	
Controller Side	DUSB-ARB82-T11A-FA	Manufactured by DDK

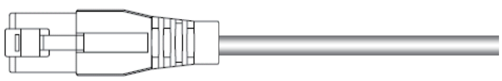


Front view of connector on controller side

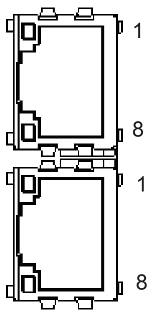
Pin No.	Signal Name (Color)	Contents	Applicable Cable
A1/B1	NC	Unconnected	MECHATROLINK Dedicated Cable
A2/B2	/DATA	Signal Cable - Side	
A3/B3	DATA	Signal Cable + Side	
A4/B4	SH	Shield	

(Note): Connect a terminal resistor (JEPMC-W6022) between DATA and DATA if the unit comes to the end of the network. [Refer to 2.2 [8] Field network Circuit (For Field network Type)]

7) EtherCAT Type



EtherCAT Connector	Model	Remarks
Cable Side	8P8C Modular Plug	
Controller Side	8P8C Modular Jack	



Front view of connector on controller side

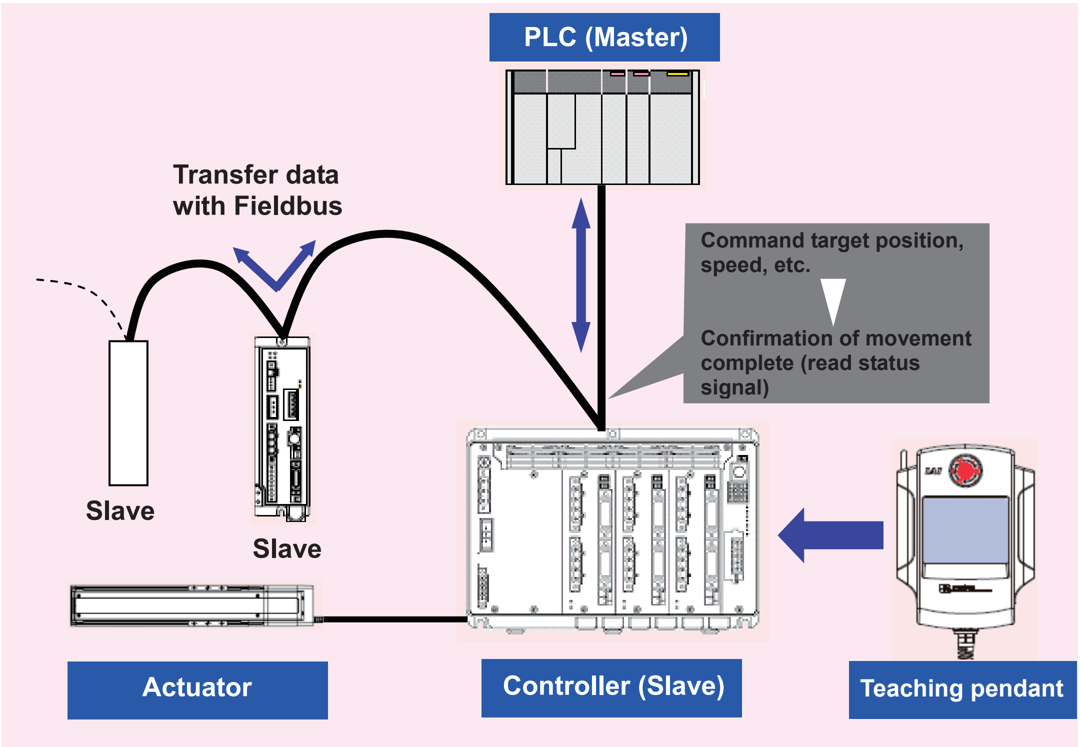
Pin No.	Signal Name (Color)	Contents	Applicable Cable
1	TD+	Sent data +	For EtherNet cable, use a straight STP cable that possesses the performance of Category 5e or more.
2	TD-	Sent data -	
3	RD+	Received data +	
4	—	Not used	
5	—	Not used	
6	RD-	Received data -	
7	—	Not used	
8	—	Not used	

Chapter 3 Operation

3.1 Basic Operation

3.1.1 Basic Operation Methods

This controller is to be controlled with fieldbus. Even though there are several types for an actuator, such as slider type, rod type, rotary type, gripper type, etc., the method to control the operation is the same unless otherwise specified in this manual.



[Basic Operation Procedures]

[1] Establish the parameter settings on all the connected axes by using a teaching tool such as the PC software.
1) When using an operation pattern in those described in the next page except for Remote I/O Mode, set the Parameter No. 25 PIO Pattern to 8. When using Remote I/O Mode (Note 1), establish the setting in Parameter No. 25 PIO Pattern considering the suitable operation mode to be used.
[Refer to 3.4.10 Control Signals in Remote I/O Mode.]
Note 1: It is necessary to set all the axes of MSCON to Remote I/O Mode.
2) Set the zone (Parameters No.1 and 2) and soft limit (Parameter No.3 and 4) that suit to the system.
[Refer to Chapter 7 Parameter Setting]

⇩

[2] Initial Setting [Refer to Sections 3.2 and 3.9]
Establish the settings for those such as the slave addresses in the field network using Gateway Parameter Setting Tool. Establish the settings of the motions for all the axes.
1) Establish the setting following the procedure described in Section 3.2.
2) Set the gateway parameters to suit the system to be used.
Establish such settings as the calendar function (clock setting) use or the speed unit change in Direct Indication Mode.

⇩

[3] Setting of Position Data [Refer to Sections 3.3]
(Note) Setting of Direct Indication Mode is not necessary.
Set the data for those to be used such as target position, speed, etc. to the position data.

⇩

[4] Field Network Settings [Refer to Sections 3.4.1 and 3.4.2]
Assign MSCON to PLC (master unit).
[Refer to the instruction manuals for the master unit and PLC]

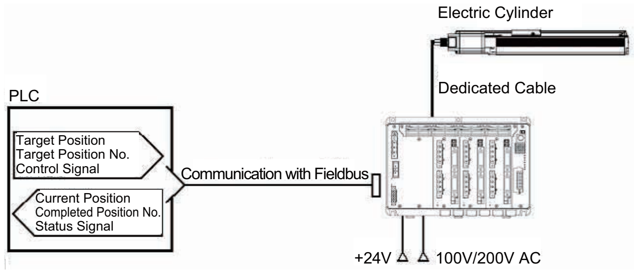
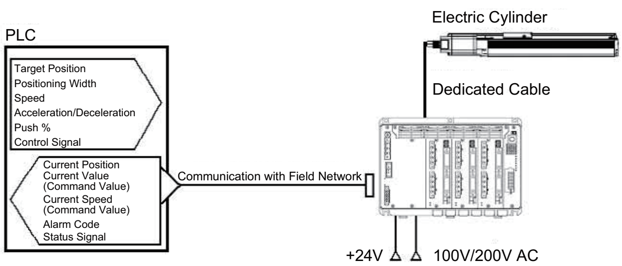
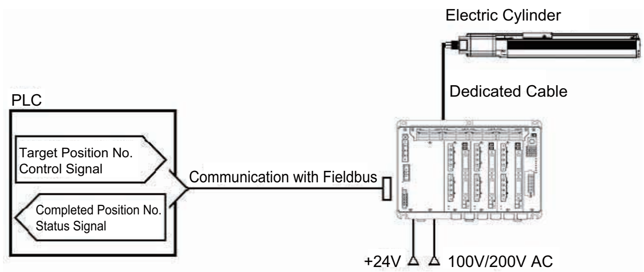
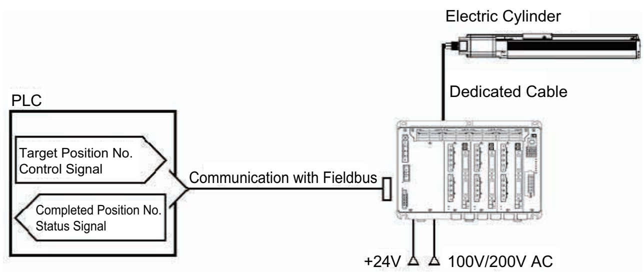
⇩

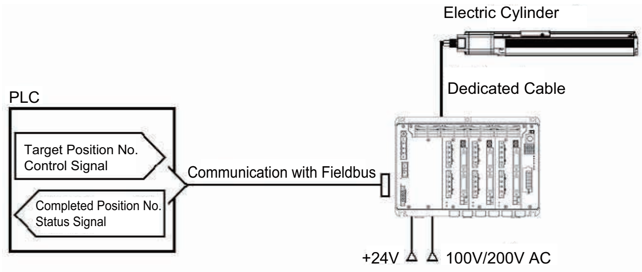
[5] Link to Network
1) Put the operation mode setting switch on the front panel of MSCON to AUTO side and reboot the power. (By putting to AUTO, field network line activates.)
2) Once the link to PLC (master unit) is established (Note 2), turn ON MON Signal of the gateway control signals (Note 3). <u>While MON Signal is ON, control from field network is available.</u>
Note 2: By referring to 3.10 Field network status LEDs display, confirm that the communication is established in the normal condition.
Note 3: Refer to 3.4.3 Control Signals of Gateway.

⇩

[6] Operation Control in Each Operation Mode [Refer to Sections 3.4.4 to 3.4.10]
1) Send the information of the target position, speed, acceleration/deceleration, etc. from PLC (master unit) to the MSCON.
2) The actuator follows the received information of the target position, speed, acceleration/deceleration, etc. to perform a positioning at the specific coordinates.
3) Confirm the status of positioning complete.

- Operation Mode Available
  7 types of operation modes are available to select from. The settings are to be established with Gateway Parameter Setting Tool.
  Shown below are the outline.

Operation Pattern	Contents	Overview
Positioner 1	In Positioner 1 Mode, 256 points of position data can be registered at the maximum and is able to stop at the registered positions. Monitoring of the current position is also available.	
Simple Direct Mode	In Simple Direct Mode, the target position can be indicated directly by inputting a value. Monitoring of the current position is also available. Those other than the target position are to be indicated in the position table, and the setting can be done for 256 points at maximum.	
Direct Indication Mode	The target position, speed acceleration/deceleration and pressing current limit can be indicated with inputting a number. Monitoring of not only the current position, but also the current speed and indicated current are available. In Direct Indication 2 Mode, anti-vibration control is available instead of JOG operation.	
Direct Indication 2 Mode		
Position 2 Mode	This is the operation mode of the position data of 256 points at maximum set in the position table. The monitoring of the current position is not available This mode is that the transferred data is reduced from Positioner 1 Mode.	
Position 3 Mode	This is the operation mode of the position data of 256 points at maximum set in the position table. The monitoring of the current position is not available This is the mode to control with the minimized number of signals to perform the positioning operation by reducing the amount of sent and received data from Positioner 2 Mode.	

Operation Pattern	Contents	Overview
Remote I/O	Five types (Note 1) of control same for PIO are available. Note : It is to be switched with PIO patterns (driver board parameters)	

Note 1: Available PIO pattern numbers: 0, 1, 2, 4 and 5
[See 3.4.10 Control Signal for Remote I/O Mode.]

3.1.2 Parameter Settings

Parameter data should be set appropriately according to the applicaiton requirements.
Parameters are variables to be set to meet the use of the controller in the similar way as settings of the ringtone and silent mode of a cell phone and settings of clocks and calendars.

(Example)

Software Stroke Limit	:	Set a proper operation range for definition of the stroke end, prevention of interferences with peripherals and safety.
Zone Output	:	Set to require signal outputs in an arbitrary position zone within the operation zone.

Parameters should be set to meet the use of the controller prior to operation. Once set, they may not set every operation.
Refer to Chapter 7 for the parameter types and the details.

3.2 Initial Setting

The operation mode is to be set using Gateway Parameter Setting Tool (Ver. 1.2.0.0 or later). Registration of positions and setting of parameters are to be conducted on RC PC Software (Note1).

Note1: See the instruction manual of the PC software for the applicable version.

Shown below is the process for the setup. Follow the instruction to conduct the setting properly.

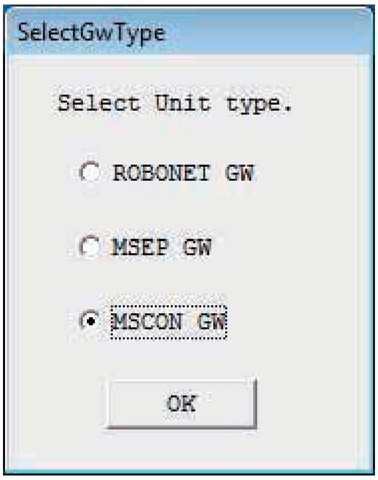
(Preparation) Install RC PC Software and Gateway Parameter Setting. For Gateway Parameter Setting Tool, install the file stored in the CD-ROM for PC software, or download from our website, intelligentactuator.com.
[Refer to the instruction manual of the PC software for the details of the PC software.]

Make sure the system I/O connector wires and operation mode setting switch are in MANU condition when having the setting done.

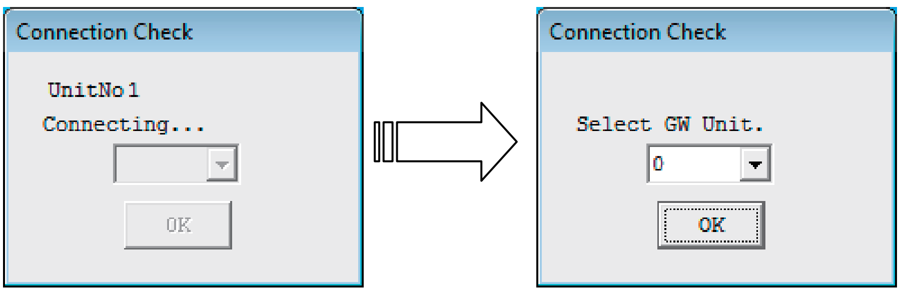
[Step 1] Join the PC and SIO connector of MSCON with using the cable enclosed in RC PC Software, and start up RC PC Software. Establish the setting in Parameter No. 25 PIO Pattern. [Refer to 3.1.1 Selectable Operation Patterns.]

Operation Pattern	PIO Pattern Setting
Types other than Remote I/O Mode	8
Remote I/O Mode	0, 1, 2, 4, 5 (select number referring to Section 3.4.10)

[Step 2] Close RC PC Software and open Gateway Parameter Setting Tool.
The following window appears. Select “MSCON” GW and click OK.

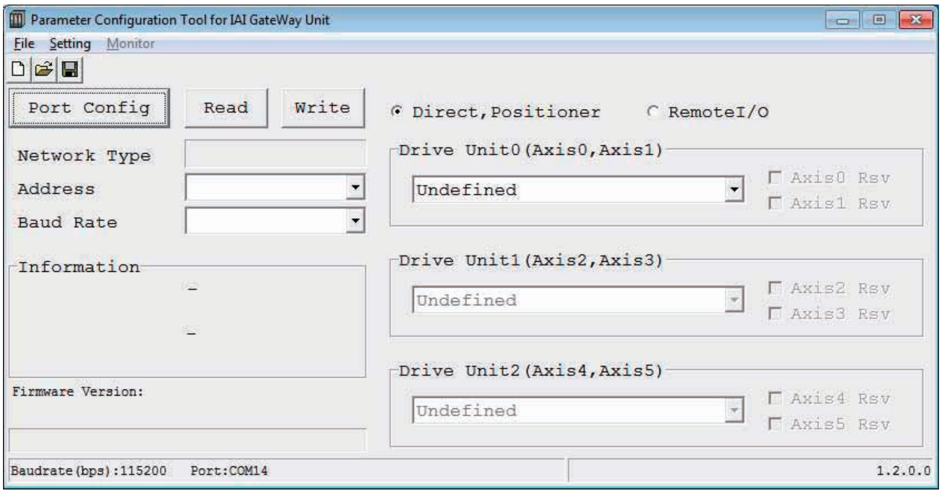


[Step 3] Once MSCON is detected the detected unit numbers become available to select. Select the unit number to be connected and click the OK button.



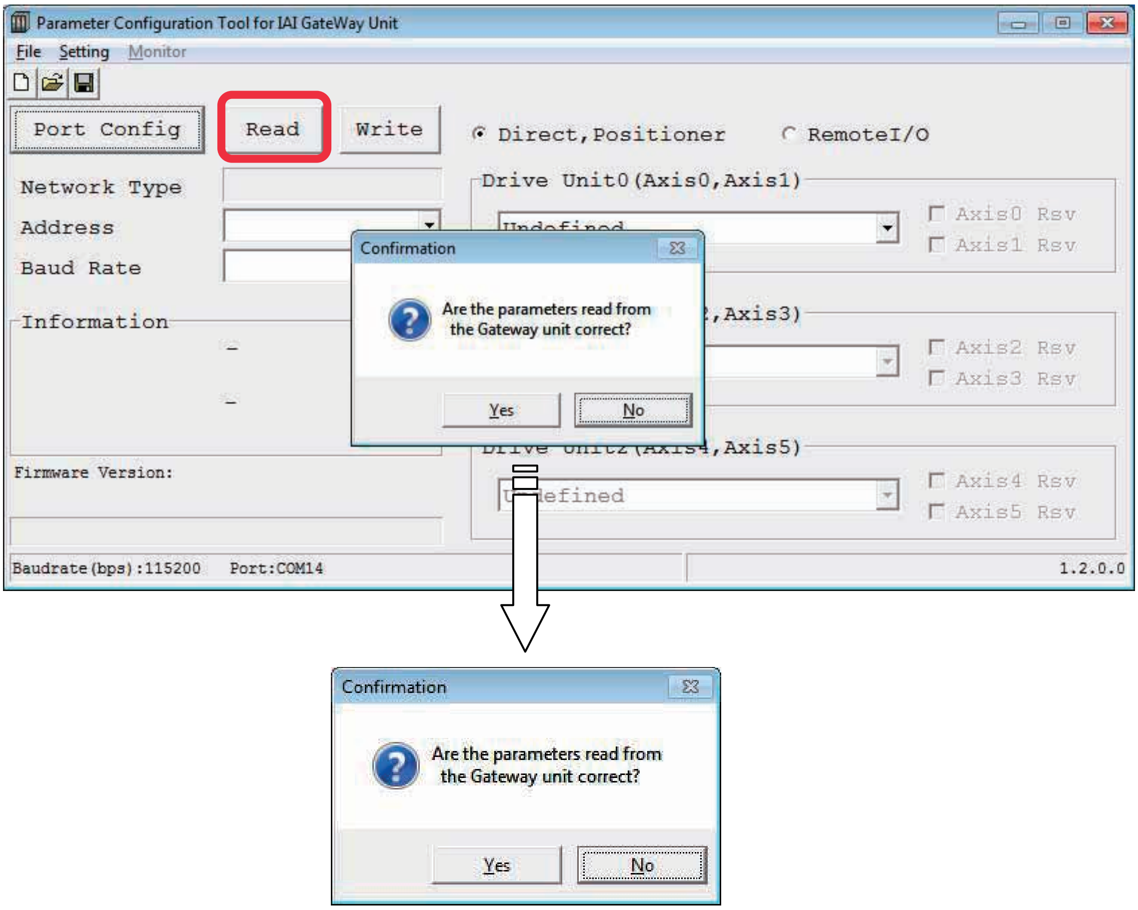
MSCON being detected   Select the unit number to be connected

[Step 4] The main window opens. The main window opens even when MSCON could not be detected.

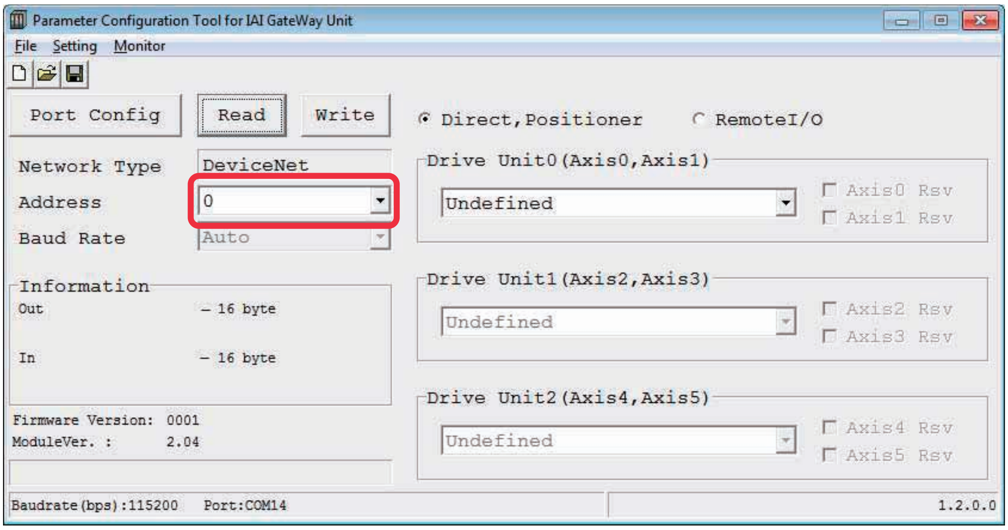


Main windows (Initial condition)

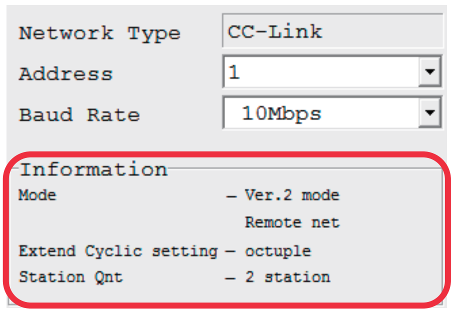
[Step 5] Reading is started from MSCON to PC. Click on the Read button and a confirmation window appears. Click on the “Yes” button.
If the writing is finished in normal condition, writing complete window appears. Click OK.



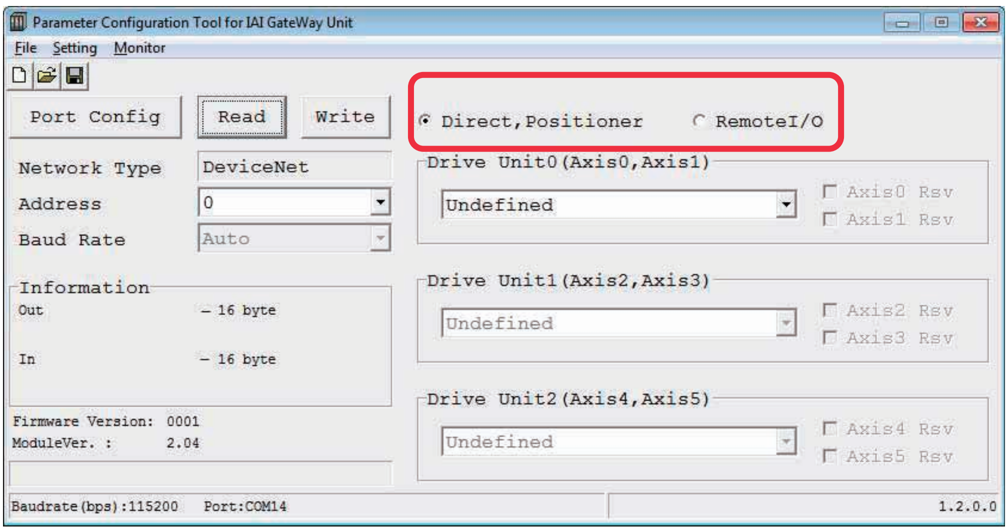
[Step 6] The parameters input to MSCON are listed as shown below. Indicate the Field Network node addresses in Address.



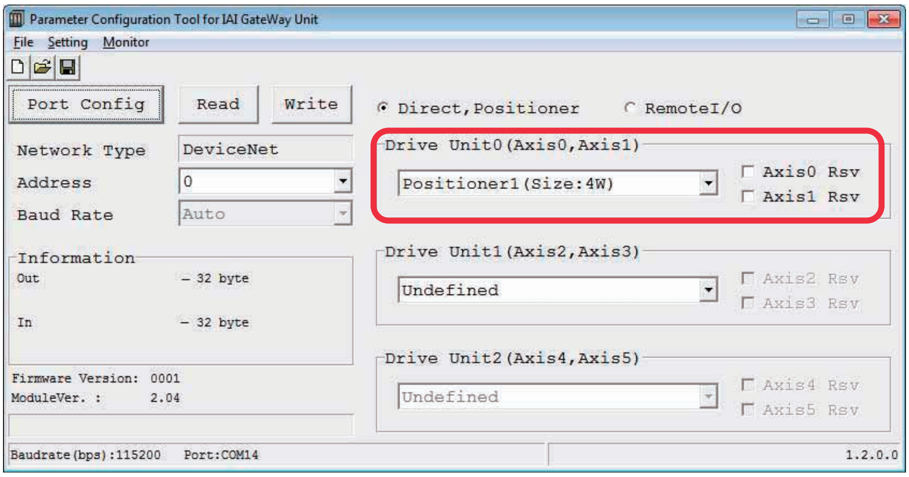
Caution
In the following slave, set the value the number of occupied station is added to the current station number.



[Step 7] Select whether to use Remote I/O Mode or any other mode (such as Positioner Mode). When Remote I/O Mode is selected, any other mode except for Remote I/O Mode cannot be selected for all the axes on MSCON.



[Step 8] Select an operation mode for each drive unit (in 2 axes unit).
Select an operation mode for Drive Unit 0 (AX0: 1st axis, AX1: 2nd axis) first. (Only Remote I/O Mode can be selected if Remote I/O Mode was selected in Step 7.)



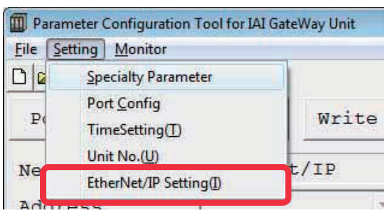
[Step 9] For MSCON with the number of driver axes 3 or more, select the operation mode of Drive Unit 1 (AX2: 3rd axis, AX3: 4th axis).
(Note) By selecting the operation mode for Drive Unit 0 [Refer to Step 8], the operation mode for Drive Unit 1 becomes available to be selected.

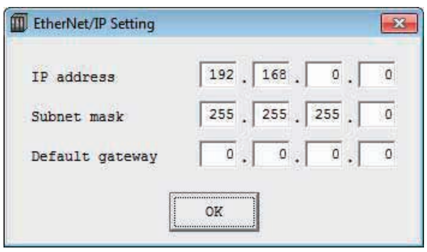
[Step 10] For MSCON with the number of driver axes 5 or more, select the operation mode of Drive Unit 2 (AX4: 5th axis, AX5: 6th axis).
(Note) By selecting the operation mode for Drive Unit 1 [Refer to Step 9], the operation mode for Drive Unit 2 becomes available to be selected.

[Step 11] In case there is an actuator that is connected but not to be activated (reserved axis), tick on “Axis n Reserved” beside the operation mode setting box for each drive unit. (n indicate the axis number)
(Note) An error will be issued if an actuator is not connected.

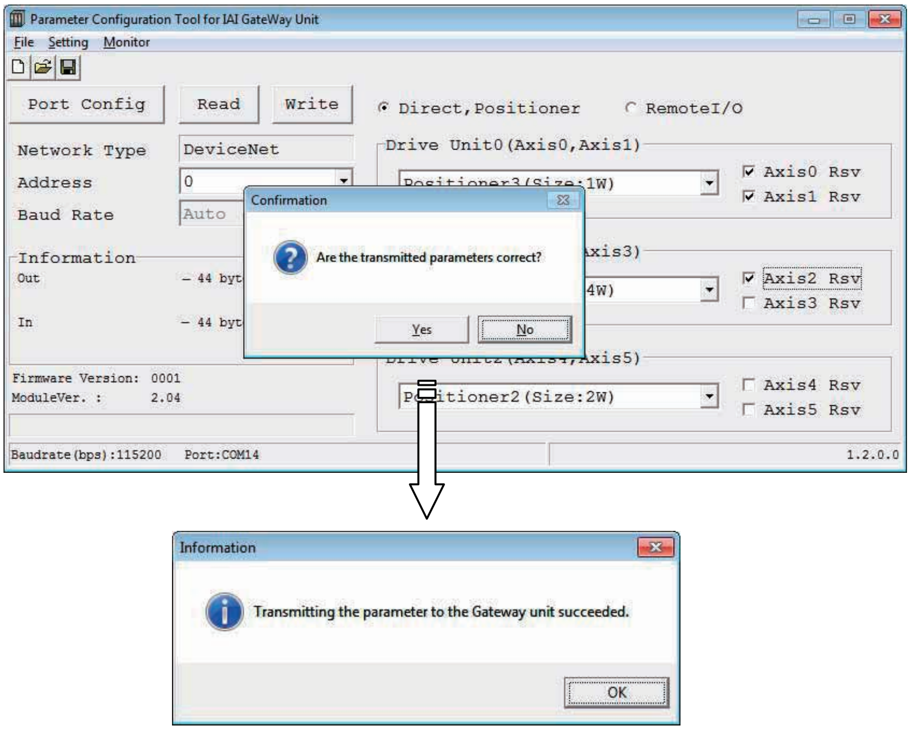
> ⚠ Caution: If set as the reserved axis, but an actuator not to be connected, set as the invalid axis in Parameter No. 158 Invalid Axis Setting.
> Even if the total number of the used axes is an odd number, make the last axis in reservation to get an even number. It is necessary to secure as much area as when not set as reserved even if set as the reserved axis.

[Step 12] Conduct only for EtherNet/IP Type (move onto Step 13 if not applied)
Click on Setting in the menu and select EtherNet/IP Setting, and the setting window for the IP address, subnet mask and default gateway opens. Establish the settings to suit your system.





[Step 13] Write the edited operation mode setting parameters to MSCON. Click on the "Transfer" button shown below and a confirmation window pops up. Click on the "Yes" button.
If the writing is finished in normal condition, writing complete window appears. Click OK.



[Step 14] A confirmation window for Gateway Unit reboot opens. Click "Yes" to accept the reboot.

[Step 15] After rebooting, a confirmation window for parameter reading appears for confirmation of the written contents. Click "Yes" to accept the reading.
Once the reading process is complete, confirm that the written contents are reflected.
If not written properly, do the process again from Step 2.

> (!) Reference: The settings are conducted in the special parameters for the process of communication error, change in pressing method for Fieldbus Type and speed unit change for Direct Indication Mode. Refer to 3.9. About Gateway Parameter Setting Tool for the details.

3.3 Setting of Position Data

The values in the position table can be set as shown below. In the case that only positioning is necessary, all you have to do is to input the position data, and nothing else is required as long as the indication of acceleration and deceleration is needed. For the speed and acceleration/deceleration, the data set to the parameters is automatically reflected to the setting. Therefore, the work can be simple if you put the speed and acceleration/deceleration data to the parameter setting.

1) No.	2) Position [mm]	3) Velocity [mm/s]	4) Accele-ration [G]	5) Decele-ration [G]	6) Pressing [%]	7) Thresh-old [%]	8) Positioning width [mm]	9) Zone+ [mm]	10) Zone- [mm]	11) Acceleration/ Deceleration mode	12) Incre-mental	13) Gain set	14) Stop mode	15) Vibration suppress No.	Comment
0	0.00	100.00	0.30	0.30	0.00	0.00	0.10	0.00	0.00	0	0	0	0	0	
1	100.00	100.00	0.30	0.30	0.00	0.00	0.10	0.00	0.00	0	0	0	0	0	
2	150.00	200.00	0.30	0.30	50.00	0.00	30.00	0.00	0.00	0	0	0	0	0	
3	200.00	400.00	1.00	1.00	0.00	0.00	0.10	0.00	0.00	0	0	0	0	1	
4	200.00	200.00	0.30	0.30	0.00	0.00	0.10	250.00	230.00	0	0	0	0	2	
5	500.00	50.00	0.10	0.10	0.00	0.00	0.10	0.00	0.00	0	0	0	0	0	
6															
7															

> ⚠ Caution: The input value is treated as the angle for the rotary actuator.
> Therefore;
> [mm]→[deg] ············ 1.2=1.2deg
> [mm/s]→[deg/s]········ 100=100deg/s
> They are treated as above.
> Please note that the display on the screen of a teaching tool such as the PC software is in [mm].

1) Position No.········· It is the number commanded by PLC in operation command.

> ⚠ Caution: Do not use position No.0 if available positions remains enough.
> At the first servo ON after power ON, the completed position No. output is 0 even if the actuator is not located at position No.0. The actuator enters into the same state as that at positioning to position No.0. The completed position No. output is 0 during movement of the actuator. To use position No.0, get the command history by using the sequence program to check completed position No.0 based on the history.

2) Position [mm] ······ Positioning coordinate value. Enter it as the distance from the home position.
For pitch feed (relative movement = incremental feed), enter the pitch width.
A value with – indicates that the actuator moves toward the home position. A value without – indicates that the actuator moves to be away from the home position.

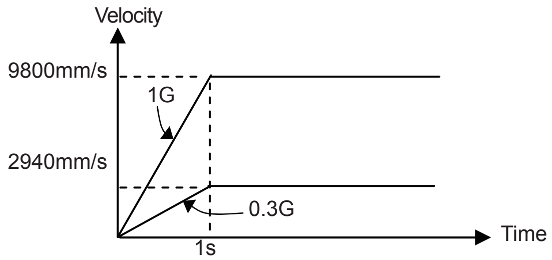
> ⚠ Caution: (1) In the case of a Gripper Type:
> Set the coordinate value on the single finger basis. Set the value for the movement of one finger from the home position. Stroke information in the specification is shown in the total value of movement distance of the two fingers.
> Therefore, the stroke is 1/2 of what is described in the specifications.
> (2) In the case of a Rotary Type
> Set the coordinate value by an angle from the home.

3) Velocity [mm/s]···· Set the velocity in the operation.
Do not attempt to input a value more than the maximum velocity or less than the minimum velocity *1.
*1 Minimum velocity [mm/sec] =
Lead length [mm] / Number of encoder pulse / 0.001 [sec]

4) Acceleration [G] ·· Set the acceleration at start.

5) Deceleration [G] ·· Set the deceleration at stop.

(Reference) How to set the acceleration is described below The same idea can be applied to the deceleration.
$1G=9800mm/s^2$: Acceleration capable to accelerate up to 9800mm/s per second
0.3G : Acceleration capable to accelerate up to 9800mm/s × 0.3 = 2940mm/s per second



⚠Caution: (1) Set the velocity, acceleration and deceleration so that they do not exceed the rating values described in the brochure or the catalog or instruction manual of the actuator. The setting that exceeds the rated acceleration/deceleration speed may shorten the actuator life remarkably.
(2) Consider to lower the acceleration/deceleration speed when a shock or vibration is applied to the actuator or work. In such cases, do not continue the use of the actuator, otherwise the product life may be shortened extremely fast.
(3) If the payload is extremely lighter than the rated payload, increase acceleration/deceleration to larger than their rated values to shorten the tact time. Contact our company. Inform us of the weight, shape and mounting method of the work and the installation conditions of the actuator.
(4) For the gripper type, have the setting done for the speed and acceleration/deceleration in the basis of one finger. Therefore, note that the relative speed and acceleration/deceleration speed become twice as it is set for the two fingers.

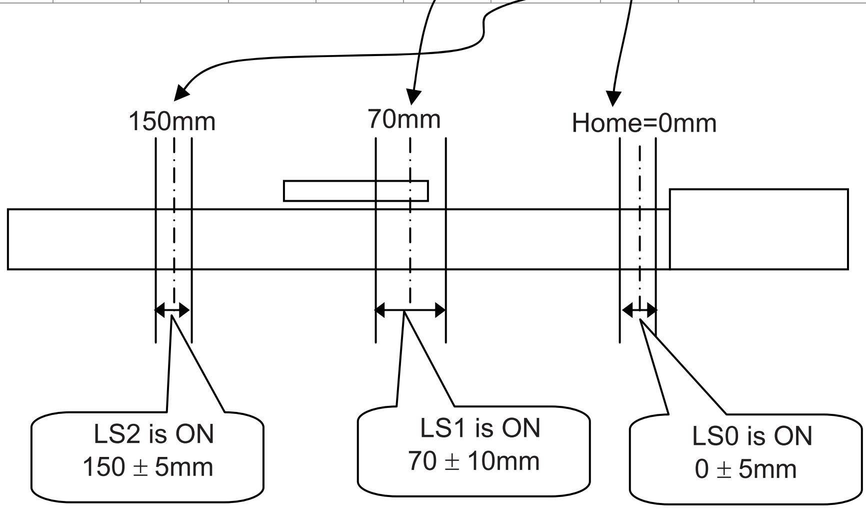
6) Pressing [%] ······· Setting proper data here allows pressing to be done.
Set a pressing torque (limit current value) in %. If the value is set to 0, the normal positioning operation is performed.
The speed for the pressing operation is set in Parameter No.34.
If the setting done in 3) is less than the pressing speed setting value, the pressing operation is performed at this setting value.

7) Threshold [%] ····· Set the threshold value of the pressing torque in %.
If the torque (load current) becomes larger than this setting value during pressing, the detection signal is output. This feature is used to monitor the load current and judge whether the operation is good or not in such an operation as press fitting in pressing.

8) Positioning width [mm] ·· In Positioner * Mode, Simple Direct Mode and PIO patterns*1 0 to 2 and 4 in Remote I/O Mode, the positioning complete signal is output if the remaining moving distance is entered within the zone set here when positioning is performed.
For pressing, the actuator is moved at the setup velocity and acceleration/deceleration in the same way as normal positioning to the position of the coordinate value set in 2) and then performs pressing movement by the data set here. For PIO pattern 5, the positioning band is not the complete signal output range against positioning command. Despite the specified position number, the relevant output signal (LS*) is turned ON when the actuator reaches the setting range. The operation is accomplished as if a sensor were installed to detect the actuator. PIO pattern 5 does not correspond to the pressing operation.
Set the positioning band more than the minimum unit of the movement amount (movement amount for one pulse of an encoder) of the used actuator.
*1 PIO pattern: This is the operation pattern of Remote I/O Mode.
[Refer to 3.8 Control and functions of Input and output signals of Remote I/O Mode]

[Example of PIO pattern 5]
The figure below shows the position table and the position at which each of the LS signals is turned ON. If the actuator passes any of the positioning bands in the operation by another position number or manual operation in the servo-off state, the relevant LS signal is always turned ON.

No.	Position [mm]	Velocity [mm/s]	Accele-ration [G]	Decele-ration [G]	Pressing [%]	Thresh-old [%]	Positioning width [mm]	Zone+ [mm]	Zone- [mm]	Acceleration/ Deceleration mode	Incre-mental	Gain set	Stop mode
0	0.00	250.00	0.20	0.20	0	0	5.00	0.00	0.00	0	0	0	0
1	70.00	250.00	0.20	0.20	0	0	10.00	0.00	0.00	0	0	0	0
2	150.00	250.00	0.20	0.20	0	0	5.00	0.00	0.00	0	0	0	0

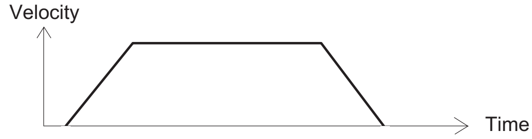
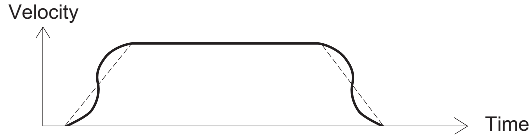
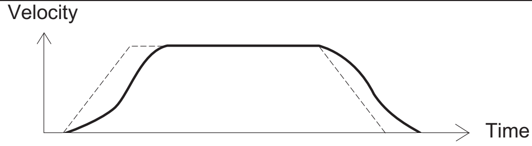


9) Zone + [mm] (Note) ········· Set the coordinate value on the positive side at which position zone output signal PZONE is turned ON. PZONE is set to ON in the zone between this value and the coordinate value on the negative side set in 10).
The feature follows the specified position number. It is valid only when the position is specified but invalid in another position operation.

10)Zone - [mm] (Note) .... Set the coordinate value on the negative side at which position zone output signal PZONE is turned ON.

Note: If set to Zone + < Zone -, PZONE Signal turns ON out of the ranges of Zone + and Zone -.

11) Acceleration/deceleration mode .... Select a proper acceleration/deceleration pattern depending on the load.

Set value	Acceleration/Deceleration Pattern	Operation
0	Trapezoid	
1	S-shaped Motion (Refer to Caution at S-shaped Motion)	 Set the S-motion rate with parameter No.56.
2	First-Order Delay Filter (Refer to Caution at First-order Delay Filter)	 Set the delay time constant with parameter No.55.

Caution at S-shaped Motion

1) Since it requires a speed change during the operation, even if having the position command or direct command that S-shaped motion is set while the actuator is moving, S-shaped motion control cannot be performed and will be the trapezoid control.
   Make sure to make a command while the actuator is stopped.
2) S-shaped motion control is invalid in the index mode of the rotary actuator.
   It will be the trapezoid control even if S-shaped acceleration/deceleration control is indicated.
3) Do not use S-shaped acceleration/deceleration control if the setting of the acceleration time or the deceleration time exceeds 2 seconds. It will be the trapezoid control.
4) Do not pause on the move during acceleration or deceleration. It will change the speed (acceleration) and may cause a danger.

Caution at First-order Delay Filter:

1) Since it requires a speed change during the operation, even if having the position command or direct command that first-order delay filter is set while the actuator is moving, first-order delay filter control cannot be performed and will be the trapezoid control.
   Make sure to make a command while the actuator is stopped.
2) First-order delay filter control is invalid in the index mode of the rotary actuator.
   It will be the trapezoid control even if first-order delay filter control is indicated

12) Incremental········ Set to 1 for pitch feed (relative movement = incremental feed).
The value set for the position in 1) indicates the pitch feed distance.
With the value set to 0, positioning is defined to the position in 1) based on the absolute coordinate system.

> ⚠ Caution: In the pitch feed, do not perform a command with a pitch smaller than the minimum encoder resolution (lead/encoder pulse number) or that less than positioning accuracy repeatability.
> There would be no deviation to occur even with the command because it is an operation command to the same position as the positioning complete condition, but the positioning control cannot be performed properly.
> When solenoid valve mode 2 is selected, set this to 0. Setting this to 1 causes the position data error to occur.

13) Gain set ············· Six parameters required for servo gain adjustment are collected to be a single set. 4 types of settings are able to be registered and the servo gains can be switched over for each positioning operation. By utilizing Smart Tuning Function (Note) in the PC software, the setting close to the optimum can be obtained.

(Note) Refer to Chapter 9 Appendix Connectable Actuators for the applicable models.
It may require the setting of the gain set dedicated for the home-return operation in the case this function is used to have the high-speed setting or the setting to apply a transported weight more than the ratings.
For how to set up and the caution items, refer to the instruction manual for RC PC Software.

[Parameters constructed in 1 set]

- Servo Gain Number (Position Gain)
- Position Feed Forward Gain
- Speed Loop Proportional Gain
- Speed Loop Integral Gain
- Torque Filter Time Constant
- Current Control Band Number

It is able to establish the gain set that corresponds to the position number to be operated to the indicated gain set.

[Refer to “Servo Adjustment” in Section 7.3 for each gain parameter details.]

Setting	Parameter Set Select	Parameter No.
0	Gain Set 0	7, 71, 31 to 33, 54
1	Gain Set 1	120 to 125
2	Gain Set 2	126 to 131
3	Gain Set 3	132 to 137

14) Stop mode ········· Automatic servo OFF is enabled after a certain period from the completion of positioning for power saving.
A proper period can be selected from three parameters.

Setting	Operation after Positioning Complete	Parameter No.
0	Keep the servo ON	—
1	Automatic servo-off in a certain time	36
2	Automatic servo-off in a certain time	37
3	Automatic servo-off in a certain time	38

⚠ Caution:
- No retaining torque is provided in automatic servo OFF. Pay sufficient attention to the setting because the actuator may be moved by external force applied to it.
- Do not use the automatic servo OFF if the next moving command is relative distance specification (pitch feed). Failure to follow it may cause position shift to occur.
- Do not use the automatic servo OFF in pressing. If used, the pressing force is lost.
- Automatic Servo OFF would not function in the operation with teaching mode of PC software.

15) Vibration suppress No.····· Suppresses vibration (sympathetic vibration) of the load installed on the actuator.
It possesses a capacity to deal with 3 types of vibration.
There are 4 parameters corresponds to 1 type of vibration and they are compiled in 1 set.
Set the parameter set corresponds to the position number necessary for the vibration control in the position table.
[Refer to Chapter 5 Vibration Suppress Control Function.

Setting	Vibration Control Frequency (Specific Frequency)	Parameter No.
0	Vibration suppress frequency (Natural frequency)	—
1	Vibration Control Parameter Set 1	97 to 100
2	Vibration Control Parameter Set 2	101 to 104
3	Vibration Control Parameter Set 3	105 to 108

⚠ Caution:
(1) The vibration frequency that can be controlled (applicable specific frequency) is from 0.5 to 30Hz.
(2) The vibration control is applicable only for the vibration generated by the load of the actuator connected to this controller.
Other vibrations cannot be controlled.
(3) The vibration control is applicable only for the vibration in the direction of the actuator operation. Vibration in other directions cannot be controlled.
(4) The vibration control is not applicable for home-return and pressing operations.
(5) If the vibration frequency setting is low, the takt time may become long. The value below approximately 6Hz makes the positioning finishing to take more than 150ms.

3.4 Fieldbus Type Address Map

3.4.1 PLC Address Construction by each Operation Mode

The address domain to be occupied differs depending on the operation mode.
Refer to the example in Section 3.4.2 for the assignment.

• PLC Output → MSCON Input (n is PLC output top word address to MSCON) (Note 1)

PLC output Area		Simple Direct Mode	Positioner 1 Mode	Direct Indication Mode	Direct Indication Mode 2	Positioner 2 Mode	Positioner 3 Mode	Remote I/O Mode	Details
MSCON Gateway Control Area	n	Gateway Control 0							3.4.3
	n+1	Gateway Control 1							
	n+2	Demand Command							3.4.11
	n+3	Data 0							
	n+4	Data 1							
	n+5	Data 2							
	n+6	Data 3							
	n+7	Occupied Area (Note 2)							
Connected Axes Control Area	n+8	Target Position (Axis No.0)	Occupied Area (Note 2)	Target Position (Axis No.0)	Target Position (Axis No.0)	Specified Position No. (Axis No.0)	Control Signal/ Position No. (Axis No.0)	Assignment Area for Axis No.0	3.4.4 to 3.4.10
	n+9					Control Signal (Axis No.0)	Assignment Area for Axis No.1	Assignment Area for Axis No.1	
	n+10	Specified Position No. (Axis No.0)	Specified Position No. (Axis No.0)	Positioning Width (Axis No.0)	Positioning Width (Axis No.0)	Assignment Area for Axis No.1	Assignment Area for Axis No.2	Assignment Area for Axis No.2	
	n+11	Control Signal (Axis No.0)	Control Signal (Axis No.0)				Assignment Area for Axis No.3	Assignment Area for Axis No.3	
	n+12	Assignment Area for Axis No.1	Occupied Area (Note 2)	Velocity (Axis No.0)	Velocity (Axis No.0)	Assignment Area for Axis No.2 and later	Assignment Area for Axis No.4	Assignment Area for Axis No.4	
	n+13			Acceleration/ Deceleration (Axis No.0)	Acceleration/ Deceleration (Axis No.0)		Assignment Area for Axis No.5	Assignment Area for Axis No.5	
	n+14		Assignment Area for Axis No.1	Current Limitation Value (Axis No.0)	Current Limitation Value (Axis No.0)				
	n+15			Control Signal (Axis No.0)	Control Signal (Axis No.0)				
	n+16 to n+23	Assignment Area for Axis No.2 and later	Assignment Area for Axis No.2 and later	Assignment Area for Axis No.1	Assignment Area for Axis No.1				
	n+24 to n+71			Assignment Area for Axis No.2 and later	Assignment Area for Axis No.2 and later				

Note1: For CC-Link, n and n+1 are for input and output bit addresses, and n+8 is for the top address of data register.
Note2: This is the domain occupied unconditionally. Therefore, this domain cannot be used for any other purpose.

⚠ Caution:
- Remote I/O Mode cannot be used together with other modes.
- Only Positioner 3 Mode and Remote I/O Mode are available to be selected in MECHATROLINK and CompoNet. (CompoNet occupies 32 bytes no matter of the number of axes.)

◎ In the case of CC-Link
Station Type: Ver.2 Remote device station
Extended Cyclic Setting/Occupied Station Number Setting:
Register the information of the occupations displayed on Gateway Parameter Setting Tool to the master unit. Connection cannot be established if information other than occupation is set.
[Refer to 3.2 Initial Setting.]

• MSCON Output → PLC Input (n is PLC input top word address from MSCON) (Note 1)

<table>
<tr><th colspan="2">PLC Input Area</th><th>Simple Direct Mode</th><th>Positioner 1 Mode</th><th>Direct Indication Mode</th><th>Direct Indication Mode 2</th><th>Positioner 2 Mode</th><th>Positioner 3 Mode</th><th>Remote I/O Mode</th><th>Details</th></tr>
<tr><td rowspan="8">MSCON Gateway Response Area</td><td>n</td><td colspan="7">Gateway Status 0</td><td rowspan="2">3.4.3</td></tr>
<tr><td>n+1</td><td colspan="7">Gateway Status 1</td></tr>
<tr><td>n+2</td><td colspan="7">Response Command</td><td rowspan="6">3.4.11</td></tr>
<tr><td>n+3</td><td colspan="7">Data 0</td></tr>
<tr><td>n+4</td><td colspan="7">Data 1</td></tr>
<tr><td>n+5</td><td colspan="7">Data 2</td></tr>
<tr><td>n+6</td><td colspan="7">Data 3</td></tr>
<tr><td>n+7</td><td colspan="7">Occupied Area (Note 2)</td></tr>
<tr><td rowspan="10">Connected Axes Response Area</td><td>n+8</td><td colspan="2" rowspan="2">Current Position (Axis No.0)</td><td rowspan="2">Current Position (Axis No.0)</td><td rowspan="2">Current Position (Axis No.0)</td><td>Completed Position No./ Simple Alarm ID (Axis No.0)</td><td>Status Signal/ Completed Position (Axis No.0)</td><td>Assignment Area for Axis No.0</td><td rowspan="10">3.4.4 to 3.4.10</td></tr>
<tr><td>n+9</td><td>Status Signal (Axis No.0)</td><td>Assignment Area for Axis No.1</td><td>Assignment Area for Axis No.1</td></tr>
<tr><td>n+10</td><td colspan="2">Completed Position No./ Simple Alarm ID (Axis No.0)</td><td rowspan="2">Command Current (Axis No.0)</td><td rowspan="2">Command Current (Axis No.0)</td><td rowspan="2">Assignment Area for Axis No.1</td><td>Assignment Area for Axis No.2</td><td>Assignment Area for Axis No.2</td></tr>
<tr><td>n+11</td><td colspan="2">Status Signal (Axis No.0)</td><td>Assignment Area for Axis No.3</td><td>Assignment Area for Axis No.3</td></tr>
<tr><td>n+12</td><td colspan="2" rowspan="4">Assignment Area for Axis No.1</td><td>Current Speed (Axis No.0)</td><td>Current Speed (Axis No.0)</td><td rowspan="6">Assignment Area for Axis No.2 and later</td><td>Assignment Area for Axis No.4</td><td>Assignment Area for Axis No.4</td></tr>
<tr><td>n+13</td><td>Occupied Area (axis No.0)</td><td>Occupied Area (Axis No.0)</td><td>Assignment Area for Axis No.5</td><td>Assignment Area for Axis No.5</td></tr>
<tr><td>n+14</td><td>Alarm Code (Axis No.0)</td><td>Alarm Code (Axis No.0)</td><td rowspan="4"></td><td rowspan="4"></td></tr>
<tr><td>n+15</td><td>Status Signal (Axis No.0)</td><td>Status Signal (Axis No.0)</td></tr>
<tr><td>n+16 to n+23</td><td colspan="2" rowspan="2">Assignment Area for Axis No.2</td><td>Assignment Area for Axis No.1</td><td>Assignment Area for Axis No.1</td></tr>
<tr><td>n+24 to n+71</td><td>Assignment Area for Axis No.2 and later</td><td>Assignment Area for Axis No.2 and later</td></tr>
</table>

Note1: For CC-Link, n and n+1 are for input and output bit addresses, and n+8 is for the top address of data register.

Note2: This is the domain occupied unconditionally. Therefore, this domain cannot be used for any other purpose.

⚠ Caution:
- Remote I/O Mode cannot be used together with other modes.
- Only Positioner 3 Mode and Remote I/O Mode are available to be selected in MECHATROLINK and CompoNet. (CompoNet occupies 32 bytes no matter of the number of axes.)

◎ In the case of CC-Link
Station Type: Ver.2 Remote device station
Extended Cyclic Setting/Occupied Station Number Setting:
Register the information of the occupations displayed on Gateway Parameter Setting Tool to the master unit. Connection cannot be established if information other than occupation is set.
[Refer to 3.2 Initial Setting.]

3.4.2 Example for Address Map Construction for each Field Network

Shown below is an example for the address map by the combination of operation modes for each Fieldnetwork. Refer to it for the address assignment.
The example for the address map shown below is provided for each field network, however is described together for the networks of the same address assignment.
Note In the order of each field network address map description
1) DeviceNet and CompoNet
2) CC-Link
3) PROFIBUS, EtherNet/IP, MECHATROLINK, EtherCAT

◎ In the case of CC-Link
Station Type: Ver.2 Remote device station
Extended Cyclic Setting/Occupied Station Number Setting:
Register the information of the occupations displayed on Gateway Parameter Setting Tool to the master unit. Connection cannot be established if information other than occupation is set.
[Refer to 3.2 Initial Setting.]

⚠ Caution:
- Remote I/O Mode is selected, all the axes connected to MSCON are involved in Remote I/O Mode.
- Only Positioner 3 Mode and Remote I/O Mode are available to be selected in MECHATROLINK and CompoNet. (CompoNet occupies 32 bytes no matter of the number of axes.)

[1] Address Map with Combination of Positioner 1/Simple Direct Modes and Direct Indication Mode

3 types of examples are shown below for the contraction of the address maps when operation is made with the combination of Simple Direct Mode and Direct Indication Mode for six axes for each field network.

Example of Combinations	Number of Simple Direct Mode Axes	Number of Direct Indication Mode Axes
1	6	0
2	4	2
3	0	6

1) DeviceNet (CompoNet is not applicable for this mode)
[Combination Example 1] When number of Simple Direct Mode axes is 6 and number of Direct Indication Mode 0
(n is the top channel number for each PLC input and output between MSCON and PLC)

PLC→MSCON		MSCON→PLC	
CH No.	Contents	CH No.	Contents
n to n+1	Gateway Control	n to n+1	Gateway Status
n+2 to n+7	Demand Command	n+2 to n+7	Response Command
n+8 to n+11	Axis No.0 Control Information	n+8 to n+11	Axis No.0 Status Information
n+12 to n+15	Axis No.1 Control Information	n+12 to n+15	Axis No.1 Status Information
n+16 to n+19	Axis No.2 Control Information	n+16 to n+19	Axis No.2 Status Information
n+20 to n+23	Axis No.3 Control Information	n+20 to n+23	Axis No.3 Status Information
n+24 to n+27	Axis No.4 Control Information	n+24 to n+27	Axis No.4 Status Information
n+28 to n+31	Axis No.5 Control Information	n+28 to n+31	Axis No.5 Status Information

[Combination Example 2] When number of Simple Direct Mode axes is 4 (axis No.0 to No.3) and number of Direct Indication Mode 2 (axis No.4, No.5)
(n is the top channel number for each PLC input and output between MSCON and PLC)

PLC→MSCON		MSCON→PLC	
CH No.	Contents	CH No.	Contents
n to n+1	Gateway Control	n to n+1	Gateway Status
n+2 to n+7	Demand Command	n+2 to n+7	Response Command
n+8 to n+11	Axis No.0 Control Information	n+8 to n+11	Axis No.0 Status Information
n+12 to n+15	Axis No.1 Control Information	n+12 to n+15	Axis No.1 Status Information
n+16 to n+19	Axis No.2 Control Information	n+16 to n+19	Axis No.2 Status Information
n+20 to n+23	Axis No.3 Control Information	n+20 to n+23	Axis No.3 Status Information
n+24 to n+27	Axis No.4 Control Information	n+24 to n+27	Axis No.4 Status Information
n+28 to n+31		n+28 to n+31	
n+32 to n+35	Axis No.5 Control Information	n+32 to n+35	Axis No.5 Status Information
n+36 to n+39		n+36 to n+39	

[Combination Example 3] When number of Simple Direct Mode axes is 0 and number of Direct Indication Mode 6
(n is the top channel number for each PLC input and output between MSCON and PLC)

PLC→MSCON		MSCON→PLC	
CH No.	Contents	CH No.	Contents
n to n+1	Gateway Control	n to n+1	Gateway Status 0
n+2 to n+7	Demand Command	n+2 to n+7	Response Command
n+8 to n+11	Axis No.0 Control Information	n+8 to n+11	Axis No.0 Status Information
n+12 to n+15		n+12 to n+15	
n+16 to n+19	Axis No.1 Control Information	n+16 to n+19	Axis No.1 Status Information
n+20 to n+23		n+20 to n+23	
n+24 to n+27	Axis No.2 Control Information	n+24 to n+27	Axis No.2 Status Information
n+28 to n+31		n+28 to n+31	
n+32 to n+35	Axis No.3 Control Information	n+32 to n+35	Axis No.3 Status Information
n+36 to n+39		n+36 to n+39	
n+40 to n+43	Axis No.4 Control Information	n+40 to n+43	Axis No.4 Status Information
n+44 to n+47		n+44 to n+47	
n+48 to n+51	Axis No.5 Control Information	n+48 to n+51	Axis No.5 Status Information
n+52 to n+55		n+52 to n+55	

2) CC-Link

[Combination Example 1] When number of Simple Direct Mode axes is 6 and number of Direct Indication Mode 0
(Extended Cyclic Setting/Number of Occupied Stations 4 times/2 stations)

PLC→MSCON		MSCON→PLC	
Address	Contents	Address	Contents
RY 00 to 1F	Gateway Control	RX 00 to 1F	Gateway Status
RY 20 to 6F	Demand Command	RX 20 to 6F	Response Command
RY 70 to 7F	Unavailable	RX 70 to 7F	Unavailable
RY 80 to BF	Unavailable	RX 80 to BF	Unavailable
RWw 00 to 03	Axis No.0 Control Information	RWr 00 to 03	Axis No.0 Status Information
RWw 04 to 07	Axis No.1 Control Information	RWr 04 to 07	Axis No.1 Status Information
RWw 08 to 0B	Axis No.2 Control Information	RWr 08 to 0B	Axis No.2 Status Information
RWw 0C to 0F	Axis No.3 Control Information	RWr 0C to 0F	Axis No.3 Status Information
RWw 10 to 13	Axis No.4 Control Information	RWr 10 to 13	Axis No.4 Status Information
RWw 14 to 17	Axis No.5 Control Information	RWr 14 to 17	Axis No.5 Status Information

[Combination Example 2] When number of Simple Direct Mode axes is 2 (axis No.0 to No.3) and number of Direct Indication Mode 2 (axis No.4, No.5)
(Extended Cyclic Setting/Number of Occupied Stations: 4 times/2 stations)

PLC→MSCON		MSCON→PLC	
Address	Contents	Address	Contents
RY 000 to 01F	Gateway Control	RX 000 to 01F	Gateway Status
RY 020 to 06F	Demand Command	RX 020 to 06F	Response Command
RY 070 to 07F	Unavailable	RX 070 to 07F	Unavailable
RY 080 to 0BF	Unavailable	RX 080 to 0BF	Unavailable
RWw 00 to 03	Axis No.0 Control Information	RWr 00 to 03	Axis No.0 Status Information
RWw 04 to 07	Axis No.1 Control Information	RWr 04 to 07	Axis No.1 Status Information
RWw 08 to 0B	Axis No.2 Control Information	RWr 08 to 0B	Axis No.2 Status Information
RWw 0C to 0F	Axis No.3 Control Information	RWr 0C to 0F	Axis No.3 Status Information
RWw 10 to 13	Axis No.4 Control Information	RWr 10 to 13	Axis No.4 Status Information
RWw 14 to 17		RWr 14 to 17	
RWw 18 to 1B	Axis No.5 Control Information	RWr 18 to 1B	Axis No.5 Status Information
RWw 1C to 1F		RWr 1C to 1F	

[Combination Example 3] When number of Simple Direct Mode axes is 0 and number of Direct Indication Mode 6
(Extended Cyclic Setting/Number of Occupied Stations: 8 times/2 stations)

PLC→MSCON		MSCON→PLC	
Address	Contents	Address	Contents
RY 000 to 01F	Gateway Control	RX 000 to 01F	Gateway Status
RY 020 to 06F	Demand Command	RX 020 to 06F	Response Command
RY 070 to 07F	Unavailable	RX 070 to 07F	Unavailable
RY 080 to 17F	Unavailable	RX 080 to 17F	Unavailable
RWw 00 to 03	Axis No.0 Control Information	RWr 00 to 03	Axis No.0 Status Information
RWw 04 to 07		RWr 04 to 07	
RWw 08 to 0B	Axis No.1 Control Information	RWr 08 to 0B	Axis No.1 Status Information
RWw 0C to 0F		RWr 0C to 0F	
RWw 10 to 13	Axis No.2 Control Information	RWr 10 to 13	Axis No.2 Status Information
RWw 14 to 17		RWr 14 to 17	
RWw 18 to 1B	Axis No.3 Control Information	RWr 18 to 1B	Axis No.3 Status Information
RWw 1C to 1F		RWr 1C to 1F	
RWw 20 to 23	Axis No.4 Control Information	RWr 20 to 23	Axis No.4 Status Information
RWw 24 to 27		RWr 24 to 27	
RWw 28 to 2B	Axis No.5 Control Information	RWr 28 to 2B	Axis No.5 Status Information
RWw 2C to 2F		RWr 2C to 2F	

3) PROFIBUS-DP, EtherNet/IP, EtherCAT
(MECHATROLINK is not applicable for this mode)

[Combination Example 1] When number of Simple Direct Mode axes is 4 and number of Direct Indication Mode 0
(n is the top channel number for each PLC input and output between MSCON and PLC)

PLC→MSCON		MSCON→PLC	
Node address (Byte Address)	Contents	Node address (Byte Address)	Contents
n to n+3	Gateway Control	n to n+3	Gateway Status
n+4 to n+15	Demand Command	n+4 to n+15	Response Command
n+16 to n+23	Axis No.0 Control Information	n+16 to n+23	Axis No.0 Status Information
n+24 to n+31	Axis No.1 Control Information	n+24 to n+31	Axis No.1 Status Information
n+32 to n+39	Axis No.2 Control Information	n+32 to n+39	Axis No.2 Status Information
n+40 to n+47	Axis No.3 Control Information	n+40 to n+47	Axis No.3 Status Information

[Combination Example 2] When number of Simple Direct Mode axes is 4 (axis No.0 to No.3) and number of Direct Indication Mode 2 (axis No.4, No.5)
(n is the top channel number for each PLC input and output between MSCON and PLC)

PLC→MSCON		MSCON→PLC	
Node address (Byte Address)	Contents	Node address (Byte Address)	Contents
n to n+3	Gateway Control	n to n+3	Gateway Status
n+4 to n+15	Demand Command	n+4 to n+15	Response Command
n+16 to n+23	Axis No.0 Control Information	n+16 to n+23	Axis No.0 Status Information
n+24 to n+31	Axis No.1 Control Information	n+24 to n+31	Axis No.1 Status Information
n+32 to n+39	Axis No.2 Control Information	n+32 to n+39	Axis No.2 Status Information
n+40 to n+47	Axis No.3 Control Information	n+40 to n+47	Axis No.3 Status Information
n+48 to n+55	Axis No.4 Control Information	n+48 to n+55	Axis No.4 Status Information
n+56 to n+63		n+56 to n+63	
n+64 to n+71	Axis No.5 Control Information	n+64 to n+71	Axis No.5 Status Information
n+72 to n+79		n+72 to n+79	

[Combination Example 3] When number of Simple Direct Mode axes is 0 and number of Direct Indication Mode 6
(n is the top channel number for each PLC input and output between MSCON and PLC)

PLC→MSCON		MSCON→PLC	
Node address (Byte Address)	Contents	Node address (Byte Address)	Contents
n to n+3	Gateway Control	n to n+3	Gateway Status
n+4 to n+15	Demand Command	n+4 to n+15	Response Command
n+16 to n+23	Axis No.0 Control Information	n+16 to n+23	Axis No.0 Status Information
n+24 to n+31		n+24 to n+31	
n+32 to n+39	Axis No.1 Control Information	n+32 to n+39	Axis No.1 Status Information
n+40 to n+47		n+40 to n+47	
n+48 to n+55	Axis No.2 Control Information	n+48 to n+55	Axis No.2 Status Information
n+56 to n+63		n+56 to n+63	
n+64 to n+71	Axis No.3 Control Information	n+64 to n+71	Axis No.3 Status Information
n+72 to n+79		n+72 to n+79	
n+80 to n+87	Axis No.4 Control Information	n+80 to n+87	Axis No.4 Status Information
n+88 to n+95		n+88 to n+95	
n+96 to n+103	Axis No.5 Control Information	n+96 to n+103	Axis No.5 Status Information
n+104 to n+111		n+104 to n+111	

[2] Address Map for Positioner 2 Mode

Shown below is the address map for each Field network when six axes of MSCON are operated in Positioner 2 Mode.

1) DeviceNet (CompoNet is not applicable for this mode)
(n is the top channel number for each PLC input and output between MSCON and PLC)

PLC→MSCON		MSCON→PLC	
CH No.	Contents	CH No.	Contents
n to n+1	Gateway Control	n to n+1	Gateway Status
n+2 to n+7	Demand Command	n+2 to n+7	Response Command
n+8 to n+9	Axis No.0 Control Information	n+8 to n+9	Axis No.0 Status Information
n+10 to n+11	Axis No.1 Control Information	n+10 to n+11	Axis No.1 Status Information
n+12 to n+13	Axis No.2 Control Information	n+12 to n+13	Axis No.2 Status Information
n+14 to n+15	Axis No.3 Control Information	n+14 to n+15	Axis No.3 Status Information
n+16 to n+17	Axis No.4 Control Information	n+16 to n+17	Axis No.4 Status Information
n+18 to n+19	Axis No.5 Control Information	n+18 to n+19	Axis No.5 Status Information

2) CC-Link
(Extended Cyclic Setting/Number of Occupied Stations: 1 times/4 stations)

PLC→MSCON		MSCON→PLC	
Address	Contents	Address	Contents
RY 00 to 1F	Gateway Control	RX 00 to 1F	Gateway Status
RY 20 to 6F	Demand Command	RX 20 to 6F	Response Command
RY 70 to 7F	Unavailable	RX 70 to 7F	Unavailable
RWw 00 to 01	Axis No.0 Control Information	RWr 00 to 01	Axis No.0 Status Information
RWw 02 to 03	Axis No.1 Control Information	RWr 02 to 03	Axis No.1 Status Information
RWw 04 to 05	Axis No.2 Control Information	RWr 04 to 05	Axis No.2 Status Information
RWw 06 to 07	Axis No.3 Control Information	RWr 06 to 07	Axis No.3 Status Information
RWw 08 to 09	Axis No.4 Control Information	RWr 08 to 09	Axis No.4 Status Information
RWw 0A to 0B	Axis No.5 Control Information	RWr 0A to 0B	Axis No.5 Status Information

3) PROFIBUS-DP, EtherNet/IP, EtherCAT
(MECHATROLINK is not applicable for this mode)
(n is the top node address for each PLC input and output between MSCON and PLC)

PLC→MSCON		MSCON→PLC	
Node address (Byte Address)	Contents	Node address (Byte Address)	Contents
n to n+3	Gateway Control	n to n+3	Gateway Status
n+4 to n+15	Demand Command	n+4 to n+15	Response Command
n+16 to n+19	Axis No.0 Control Information	n+16 to n+19	Axis No.0 Status Information
n+20 to n+23	Axis No.1 Control Information	n+20 to n+23	Axis No.1 Status Information
n+24 to n+27	Axis No.2 Control Information	n+24 to n+27	Axis No.2 Status Information
n+28 to n+31	Axis No.3 Control Information	n+28 to n+31	Axis No.3 Status Information
n+32 to n+35	Axis No.4 Control Information	n+32 to n+35	Axis No.4 Status Information
n+36 to n+39	Axis No.5 Control Information	n+36 to n+39	Axis No.5 Status Information

[3] Address Map for Positioner 3 Mode

Shown below is the address map for each Field network when six axes of MSCON are operated in Positioner 3 Mode.

1) DeviceNet, CompoNet
(n is the top channel number for each PLC input and output between MSCON and PLC)

PLC→MSCON		MSCON→PLC	
CH No.	Contents	CH No.	Contents
n to n+1	Gateway Control	n to n+1	Gateway Status
n+2 to n+7	Demand Command	n+2 to n+7	Response Command
n+8	Axis No.0 Control Information	n+8	Axis No.0 Status Information
n+9	Axis No.1 Control Information	n+9	Axis No.1 Status Information
n+10	Axis No.2 Control Information	n+10	Axis No.2 Status Information
n+11	Axis No.3 Control Information	n+11	Axis No.3 Status Information
n+12	Axis No.4 Control Information	n+12	Axis No.4 Status Information
n+13	Axis No.5 Control Information	n+13	Axis No.5 Status Information

2) CC-Link

(Extended Cyclic Setting/Number of Occupied Stations: 1 times/4 stations)

PLC→MSCON		MSCON→PLC	
Address	Contents	Address	Contents
RY 00 to 1F	Gateway Control	RX 00 to 1F	Gateway Status
RY 20 to 6F	Demand Command	RX 20 to 6F	Response Command
RY 70 to 7F	Unavailable	RX 70 to 7F	Unavailable
RWw 00	Axis No.0 Control Information	RWr 00	Axis No.0 Status Information
RWw 01	Axis No.1 Control Information	RWr 01	Axis No.1 Status Information
RWw 02	Axis No.2 Control Information	RWr 02	Axis No.2 Status Information
RWw 03	Axis No.3 Control Information	RWr 03	Axis No.3 Status Information
RWw 04	Axis No.4 Control Information	RWr 04	Axis No.4 Status Information
RWw 05	Axis No.5 Control Information	RWr 05	Axis No.5 Status Information

3) PROFIBUS-DP, EtherNet/IP, MECHATROLINK, EtherCAT

(n is the top node address for each PLC input and output between MSCON and PLC)

PLC→MSCON		MSCON→PLC	
Node address (Byte Address)	Contents	Node address (Byte Address)	Contents
n to n+3	Gateway Control	n to n+3	Gateway Status
n+4 to n+15	Demand Command	n+4 to n+15	Response Command
n+16, n+17	Axis No.0 Control Information	n+16, n+17	Axis No.0 Status Information
n+18, n+19	Axis No.1 Control Information	n+18, n+19	Axis No.1 Status Information
n+20, n+21	Axis No.2 Control Information	n+20, n+21	Axis No.2 Status Information
n+22, n+23	Axis No.3 Control Information	n+22, n+23	Axis No.3 Status Information
n+24, n+25	Axis No.4 Control Information	n+24, n+25	Axis No.4 Status Information
n+26, n+27	Axis No.5 Control Information	n+26, n+27	Axis No.5 Status Information

[4] Address Maps in Remote I/O Mode

Shown below are the address maps when operation of 6-axis MSCON is made with Remote I/O Mode.

1) DeviceNet, CompoNet
(n is the top channel number for each PLC input and output between MSCON and PLC)

PLC→MSCON		MSCON→PLC	
CH No.	Contents	CH No.	Contents
n to n+1	Gateway Control	n to n+1	Gateway Status
n+2 to n+7	Demand Command	n+2 to n+7	Response Command
n+8	Axis No.0 Control Information	n+8	Axis No.0 Status Information
n+9	Axis No.1 Control Information	n+9	Axis No.1 Status Information
n+10	Axis No.2 Control Information	n+10	Axis No.2 Status Information
n+11	Axis No.3 Control Information	n+11	Axis No.3 Status Information
n+12	Axis No.4 Control Information	n+12	Axis No.4 Status Information
n+13	Axis No.5 Control Information	n+13	Axis No.5 Status Information

2) CC-Link
(Extended Cyclic Setting/Number of Occupied Stations: 1 times/4 stations)

PLC→MSCON		MSCON→PLC	
Address	Contents	Address	Contents
RY 00 to 1F	Gateway Control	RX 00 to 1F	Gateway Status
RY 20 to 6F	Demand Command	RX 20 to 6F	Response Command
RY 70 to 7F	Unavailable	RX 70 to 7F	Unavailable
RWw 00	Axis No.0 Control Information	RWr 00	Axis No.0 Status Information
RWw 01	Axis No.1 Control Information	RWr 01	Axis No.1 Status Information
RWw 02	Axis No.2 Control Information	RWr 02	Axis No.2 Status Information
RWw 03	Axis No.3 Control Information	RWr 03	Axis No.3 Status Information
RWw 04	Axis No.4 Control Information	RWr 04	Axis No.4 Status Information
RWw 05	Axis No.5 Control Information	RWr 05	Axis No.5 Status Information

3) PROFIBUS-DP, EtherNet/IP, MECHATROLINK, EtherCAT
(n is the top node address for each PLC input and output between MSCON and PLC)

PLC→MSCON		MSCON→PLC	
Node address (Byte Address)	Contents	Node address (Byte Address)	Contents
n to n+3	Gateway Control	n to n+3	Gateway Status
n+4 to n+15	Demand Command	n+4 to n+15	Response Command
n+16, n+17	Axis No.0 Control Information	n+16, n+17	Axis No.0 Status Information
n+18, n+19	Axis No.1 Control Information	n+18, n+19	Axis No.1 Status Information
n+20, n+21	Axis No.2 Control Information	n+20, n+21	Axis No.2 Status Information
n+22, n+23	Axis No.3 Control Information	n+22, n+23	Axis No.3 Status Information
n+24, n+25	Axis No.4 Control Information	n+24, n+25	Axis No.4 Status Information
n+26, n+27	Axis No.5 Control Information	n+26, n+27	Axis No.5 Status Information

3.4.3 Gateway Control Signals (in common for all operation modes)

When operating the system with Fieldbus, the axes are controlled via MSCON. The top 2 words of input and output in each operation mode are the signals Gateway control and status monitoring.

(n is the top word address for each PLC input and output between MSCON and PLC)

PLC→MSCON (PLC Output)		MSCON→PLC (PLC Input)	
Control Signal 0	n	Status Signal 0	n
Control Signal 1	n+1	Status Signal 1	n+1

(1) PLC I/O Signal

PLC Output

1 word=16 bit

Address n

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control Signal 0	MON	–	RTE	–	–	–	–	–	–	–	–	–	–	–	–	–

RTE: Signal to cancel the remained condition of communication error (ERR-T/ERR-C) during an operation

MON: Signal to activate operation control by communication

Address n+1

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control Signal 1 (to be fixed to 0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PLC Input

1 word=16 bit

Address n

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Status Signal 0	RUN	LERC	ERRT	MOD	ALMH	ALML	–	EMG	ALMC128	ALMC64	ALMC32	ALMC16	ALMC8	ALMC4	ALMC2	ALMC1

b15 to b0: Each type of control status monitoring output signals

Address n+1

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Status Signal 1	–	–	MNT5	MNT4	MNT3	MNT2	MNT1	MNT0	–	–	LNK5	LNK4	LNK3	LNK2	LNK1	LNK0

b15 to b8: Output of alarm-issued axis number

b7 to b0: Output of communication available axis number

(2) List for Input and Output Signal

(ON = Applicable bit is "1", OFF = Applicable bit is "0")

Signal Type		Bit	Symbol	Contents	Details
PLC Output	Control Signal 0	b15	MON	Operation control with communication is available while it is ON	–
		b14	–	Unavailable	–
		b13	RTE	Retained condition of ERR-T or ERR-C during an operation is cancelled if it is ON It is the cancel signal when ERR-T or ERR-C occurrence is set to latch in Gateway Parameter Setting Tool	–
		b12	–	Unavailable	–
		b11			
		b10			
		b9			
		b8			
		b7			
		b6			
		b5			
		b4			
		b3			
		b2			
		b1			
		b0			
	Control Signal 1	b15	–	Unavailable (Make it to all.)	–
		b14			
		b13			
		b12			
		b11			
		b10			
		b9			
		b8			
		b7			
		b6			
		b5			
		b4			
		b3			
		b2			
		b1			
		b0			

(ON = Applicable bit is "1", OFF = Applicable bit is "0")

Signal Type		Bit	Symbol	Contents	Details
PLC Input	Status Signal 0	b15	RUN	This signal turns ON when Gateway is in normal operation.	–
		b14	LERC	This signal turns ON if the ERR-T or ERR-C occurred during an operation is retained and turns OFF if cancel signal RTE is turn ON. It is effective when ERR-T or ERR-C occurrence is set to latch in Gateway Parameter Setting Tool.	–
		b13	ERRT	This signal turns ON when a communication error is detected between the Gateway and each axis.	–
		b12	MOD	This signal turns ON if the operation mode switch on the front of the unit is selected to be on MANU side, and turns OFF if on AUTO side.	–
		b11	ALMH	This signal turns ON when an error (Note 1) caused by the Gateway that requires a reboot is occurred. (A wrong setting in the parameters can be considered. Check the parameters settings.)	–
		b10	ALML	This signal turns ON when a light error (Note 1) caused by the Gateway is occurred. (It is considered that there shall be a loss of the calendar data. Check the parameters settings.)	–
		b9	–	Unavailable	–
		b8	EMG	This signal turns ON when EMG- input of the system I/O connector is OFF (emergency stop). In case this bit turns ON, all the connected axes perform an emergency stop.	–
		b7	ALMC1 to 128	It is an output of an alarm code caused by the Gateway. [Refer to Gateway alarm codes in Chapter 8. Troubleshooting for details.]	–
		b6			
		b5			
		b4			
		b3			
		b2			
		b1			
		b0			
	Status Signal 1	b15	–	The bit of an axis number that a light malfunction alarm is generated turns ON. Axis No.0=MNT0 to Axis No.5=MNT5	–
		b14	–		
		b13	MNT5		
		b12	MNT4		
		b11	MNT3		
		b10	MNT2		
		b9	MNT1		
		b8	MNT0		
		b7	–	The bit of an axis number that is identified as effective by Gateway turns ON. Axis No.0=LNK0 to Axis No.5=LNK5	–
		b6	–		
		b5	LNK5		
		b4	LNK4		
		b3	LNK3		
		b2	LNK2		
		b1	LNK1		
		b0	LNK0		

Note 1: Refer to Chapter 8. Troubleshooting for the details of the errors.

3.4.4 Control Signals for Direct Simple Direct

This mode is not applicable for CompNet and MECHATROLINK specifications.

To select the mode, use Gateway Parameter Setting Tool. This is the operation method to indicate the target position by directly inputting a value, and indicate a position number for other operational conditions.
The settable No. of position data items is max 256 points.
The main functions of MSCON capable to control in this mode are as described in the following table.

ROBO cylinder function	○: Direct control △: Indirect control ×: Disable Simple Direct Mode	Remarks
Home-return operation	○	
Positioning operation	○	For those other than the target position, it is necessary to set the position data
Speed and acceleration/deceleration setting	△	These items must be set in the position data table.
Pitch feeding (Incremental)	△	
Pressing operation	△	
Speed change during movement	△	
Operation at different acceleration and deceleration	△	
Pause	○	
Zone signal output	○	
PIO pattern selection	×	

(1) PLC Address Composition
(m is PLC input and output top word address for each axis number)

PLC→MSCON (PLC Output)		MSCON→PLC (PLC Input)	
Target Position	m to m+1	Current Position	m to m+1
Specified Position No.	m+2	Completed Position No. (Simple Alarm Code)	m+2
Control Signal	m+3	Status Signal	m+3

[Refer to Section 3.4.2 for the address maps for each Fieldbus.]

(2) Input and Output Signal Assignment for each Axis

The I/O signals for each axis consists of 4 words for each I/O bit register.

- The control signals and status signals are ON/OFF signals in units of bit.
- For the target position and current position, 2-word (32-bit) binary data is available and values from -999999 to +999999 (unit: 0.01mm) can be used. Negative numbers are to be dealt with two's complement.

> ⚠ Caution: Set the position data in the range of the soft stroke (0 to effective stroke length) of the actuator.

- For the indicated position number and complete position number, 1-word (16-bit) binary data is available and values from 0 to 255 can be used.

> ⚠ Caution: Set the operational condition in advance with using a teaching tool such as PC software in the position number to be used. Selecting a position number with no setting conducted will generate the alarm code 0A2 "Position Data Error".

PLC Output (m is PLC output top word address for each axis number)

1 word=16 bit

Address m

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position (Lower word)																

Address m+1

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position (Upper word)																

(Note) If the target position is a negative value, it is indicated by a two's complement.

Address m+2

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Specified Position No.	–	–	–	–	–	–	–	–	PC128	PC64	PC32	PC16	PC8	PC4	PC2	PC1

Address m+3

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control Signal	BKRL	–	–	–	–	–	–	JOG+	JOG-	JVEL	JISL	SON	RES	STP	HOME	CSTR

PLC Input (m is PLC input top word address for each axis number).

1 word=16 bit

Address m	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (Lower word)																

Address m+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (Upper word)																

(Note) If the target position is a negative value, it is indicated by a two's complement.

Address m+2	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Completed Position No.	–	–	–	–	–	–	–	–	PM128	PM64	PM32	PM16	PM8	PM4	PM2	PM1

Address m+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Status Signal	EMGS	CRDY	ZONE2	ZONE1	PZONE	–	–	MEND	BALM	–	PSFL	SV	ALM	MOVE	HEND	PEND

(3) I/O signal assignment

(ON = Applicable bit is "1", OFF = Applicable bit is "0")

Signal Type		Bit	Symbol	Contents	Details
PLC Output	Target Position	32 bits Data	–	32-bit signed integer indicating the current position Unit 0.01mm Available range for Setting: -999999 to 999999 Set the target position with the value from the home position. (Example) If +25.40mm, input 000009EC$_H$ (2540 in decimal system). (Note) Input the negative value using a compliment of 2.	3.7 (27)
	Specified Position No.	16 bits Data	PC1 to PC128	16-bit integer Available range for Setting: 0 to 255 To operate, it is necessary to have the position data that the operation conditions are already set in advance with a teaching tool such as the PC software. An operation is made with data except for the target position in Simple Direct Mode. In this register, indicate the position number the data is input with a binary number. Indicating a value out of the range or operating with a position number with no setting conducted will generate the alarm code 0A2 "Position Data Error".	3.7 (27)
	Control Signal	b15	BKRL	Brake release ON: Brake release, OFF: Brake activated	3.7 (17)
		b14	–	Unavailable	–
		b13			
		b12			
		b11			
		b10			
		b9			
		b8	JOG+	+Jog ON: Movement against home position, OFF: Stop	3.7 (12)
		b7	JOG-	-Jog ON: Movement toward home position, OFF: Stop	
		b6	JVEL	Jog-speed/inch-distance switching OFF : Use the setting values of Parameter No.26 JOG Speed and No.48 Inching Distance in MSCON ON : Use the setting values of Parameter No.47 JOG Speed 2 and No.49 Inching Distance in MSCON	3.7 (13)
		b5	JISL	Jog/inching switching ON: Inching, OFF: Jog	3.7 (14)
		b4	SON	Servo ON Command ON: Servo ON, OFF: Servo OFF	3.7 (5)
		b3	RES	Reset A reset is performed when this signal turns ON.	3.7 (4)
		b2	STP	Pause ON: Pause, OFF: Pause Release	3.7 (10)
		b1	HOME	Home return Home-return command with this signal ON, command carried on till complete even if the signal is turned OFF on the way	3.7 (6)
		b0	CSTR	Positioning start Movement command executed with this signal ON, command carried on till complete even if the signal is turned OFF on the way	3.7 (7)

(ON = Applicable bit is "1", OFF = Applicable bit is "0")

Signal Type		Bit	Symbol	Contents	Details
PLC Output	Current Position	32 bits	–	32-bit signed integer indicating the current position Unit: 0.01mm (Example) If +10.23mm, input 000003FFH (1023mm in decimal system). (Note) Negative numbers are two's implement.	3.7 (27)
	Completed Position No. (Simple Alarm Code)	16 bits	PM1 to M128	16-bit integer The positioning complete position number is output in a binary number once getting into the positioning width after moving to the target position. In the case that the position movement has not been performed at all, or during the movement, "0" is output. Read it by turning PEND Signal ON after movement. The simple alarm code (refer to Chapter 8 Troubleshooting) is output while an alarm is issued (ALM of Status Signal is ON).	3.7 (27)
	Status Signal	b15	EMGS	This signal turns ON during an emergency stop	3.7 (2)
		b14	CRDY	This signal turns ON when the controller is standing by.	3.7 (1)
		b13	ZONE2	"ON" for the current position within the zone set range The zone range setting is necessary for the parameter.	3.7 (11)
		b12	ZONE1	"ON" for the current position within the zone set range The zone range setting is necessary for the parameter.	
		b11	PZONE	Position zone This signal turns ON when the current position is inside the specified position zone.	3.7 (11)
		b10	–	Unavailable	–
		b9			
		b8	MEND	This signal turns ON when movement command is complete, stopping with servo-on and pressing is missed, and turns OFF when in emergency stop with servo is OFF and while CSTR Signal isON	3.7 (21)
		b7	BALM	Warning for absolute battery voltage drop This signal turns ON with battery voltage drop	3.7 (22)
		b6	-	Unavailable	–
		b5	PSFL	This signal turns ON when the actuator missed the load in push-motion operation.	3.7 (20)
		b4	SV	This signal turns ON when operation standby is complete (Servo is ON).	3.7 (5)
		b3	ALM	This signal is ON while an alarm is generated.	3.7 (3)
		b2	MOVE	This signal is ON while in movement.	3.7 (8)
		b1	HEND	This signal turns ON at home return complete and is kept unless the home position is lost due to a fact such as an alarm.	3.7 (6)
		b0	PEND	This signal turns ON when positioning is complete and stopping with servo-on, and turns OFF when pressing is missed and while CSTR Signal is ON	3.7 (9)

3.4.5 Control Signals for Positioner 1 Mode

This mode is not applicable for CompNet and MECHATROLINK specifications.

To select the mode, use Gateway Parameter Setting Tool. This is the method to operate with the operational condition of the indicated position number.
The settable No. of position data items is max 256 points.
The main functions of MSCON capable to control in this mode are as described in the following table.

ROBO cylinder function	○: Direct control △: Indirect control ×: Disable Positioner 1 Mode	Remarks
Home-return operation	○	
Positioning operation	△	
Speed and acceleration/deceleration setting	△	These items must be set in the position data table.
Pitch feeding (Incremental)	△	
Pressing operation	△	
Speed change during Movement	△	
Operation at different acceleration and deceleration	△	
Pause	○	
Zone signal output	○	
PIO pattern selection	×	

(1) PLC Address Composition

(m is PLC input and output top word address for each axis number)

PLC→MSCON (PLC Output)		MSCON→PLC (PLC Input)	
Unavailable	m to m+1	Current Position	m to m+1
Specified Position No.	m+2	Completed Position No. (Simple Alarm Code)	m+2
Control Signal	m+3	Status Signal	m+3

[Refer to Section 3.4.2 for the address maps for each Fieldbus.]

(2) Input and Output Signal Assignment for each Axis

The I/O signals for each axis consists of 4 words for each I/O bit register.

- The control signals and status signals are ON/OFF signals in units of bit.
- For the current position, 2-word (32-bit) binary data is available and values from -999999 to +999999 (unit: 0.01mm) can be used. Negative numbers are to be dealt with two's complement.
- For the indicated position number and complete position number, 1-word (16-bit) binary data is available and values from 0 to 255 can be used.

> ⚠ Caution : Set the operational condition in advance with using a teaching tool such as PC software in the position number to be used. Selecting a position number with no setting conducted will generate the alarm code 0A2 "Position Data Error".

PLC Output (m is PLC output top word address for each axis number)

1 word=16 bit

Address m	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Unavailable																

Address m+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Unavailable																

Address m+2	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Specified Position No.	–	–	–	–	–	–	–	–	PC128	PC64	PC32	PC16	PC8	PC4	PC2	PC1

Address m+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control Signal	BKRL	–	–	–	–	MODE	PWRT	JOG+	JOG-	JVEL	JISL	SON	RES	STP	HOME	CSTR

PLC Input (m is PLC input top word address for each axis number).

1 word=16 bit

Address m	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position Lower word																

Address m+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position Upper word																

(Note) If the target position is a negative value, it is indicated by a two's complement.

Address m+2	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Completed Position No.	–	–	–	–	–	–	–	–	PM128	PM64	PM32	PM16	PM8	PM4	PM2	PM1

Address m+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Status Signal	EMGS	CRDY	ZONE2	ZONE1	PZONE	MODES	WEND	MEND	BALM	–	PSFL	SV	ALM	MOVE	HEND	PEND

(3) I/O signal assignment

(ON = Applicable bit is “1”, OFF = Applicable bit is “0”)

Signal Type		Bit	Symbol	Contents	Details
	Specified Position No.	16 bits Data	PC1 to PC128	16-bit integer Available range for Setting: 0 to 255 To operate, it is necessary to have the position data that the operation conditions are already set in advance with a teaching tool such as the PC software. An operation is made with data except for the target position in Simple Direct Mode. In this register, indicate the position number the data is input with a binary number. Indicating a value out of the range or operating with a position number with no setting conducted will generate the alarm code 0A2 “Position Data Error”.	3.7 (27)
	Control Signal	b15	BKRL	Brake release ON: Brake release, OFF: Brake activated	3.7 (17)
		b14	–	Unavailable	–
		b13			
		b12			
		b11			
		b10	MODE	Teaching mode command (Invalid in Simple Direct Mode) OFF: Standard mode, ON : Teaching mode	3.7 (15)
		b9	PWRT	Position import command (Invalid in Simple Direct Mode) ON: Position Data Import	3.7 (16)
		b8	JOG+	+Jog ON: Movement against home position, OFF: Stop	3.7 (12)
		b7	JOG-	-Jog ON: Movement toward home position, OFF: Stop	
		b6	JVEL	Jog-speed/inch-distance switching OFF : Use the setting values of Parameter No.26 JOG Speed and No.48 Inching Distance in MSCON ON : Use the setting values of Parameter No.47 JOG Speed 2 and No.49 Inching Distance in MSCON	3.7 (13)
		b5	JISL	Jog/inching switching ON: Inching, OFF: Jog	3.7 (14)
		b4	SON	Servo ON command ON: Servo ON, OFF: Servo OFF	3.7 (5)
		b3	RES	Reset A reset is performed when this signal turns ON.	3.7 (4)
		b2	STP	Pause ON: Pause, OFF: Pause Release	3.7 (10)
		b1	HOME	Home return Home-return command with this signal ON, command carried on till complete even if the signal is turned OFF on the way	3.7 (6)
		b0	CSTR	Positioning start Movement command executed with this signal ON, command carried on till complete even if the signal is turned OFF on the way	3.7 (7)

(ON = Applicable bit is “1”, OFF = Applicable bit is “0”)

Signal Type		Bit	Symbol	Contents	Details
PLC Input	Current Position	32 bits	–	32-bit signed integer indicating the current position Unit: 0.01mm (Example) If +10.23mm, input $000003FF_H$ (1023mm in decimal system). (Note) Negative numbers are two’s implement.	3.7 (27)
	Completed Position No. (Simple Alarm Code)	16 bits	PM1 to PM128	16-bit integer The positioning complete position number is output in a binary number once getting into the positioning band after moving to the target position. In the case that the position movement has not been performed at all, or during the movement, “0” is output. Read it by turning PEND Signal ON after movement. The simple alarm code (refer to Chapter 8 Troubleshooting) is output while an alarm is issued (ALM of Status Signal is ON).	3.7 (27)
	Status Signal	b15	EMGS	This signal turns ON during an emergency stop	3.7 (2)
		b14	CRDY	This signal turns ON when the controller is standing by.	3.7 (1)
		b13	ZONE2	“ON” for the current position within the zone set range The zone range setting is necessary for the parameter.	3.7 (11)
		b12	ZONE1	“ON” for the current position within the zone set range The zone range setting is necessary for the parameter.	
		b11	PZONE	Position zone This signal turns ON when the current position is inside the specified position zone.	3.7 (11)
		b10	MODES	Teaching mode signal (Invalid in Simple Direct Mode) This signal is ON while the teaching mode is selected.	3.7 (15)
		b9	WEND	Position data import complete (Invalid in Simple Direct Mode) This signal turns ON when reading is complete.	3.7 (16)
		b8	MEND	This signal turns ON when movement command is complete, stopping with servo-on and pressing is missed, and turns OFF when in emergency stop with servo is OFF and while CSTR Signal is ON	3.7 (21)
		b7	BALM	Warning for absolute battery voltage drop This signal turns ON with battery voltage drop	3.7 (22)
		b6	–	Unavailable	–
		b5	PSFL	This signal turns ON when the actuator missed the load in push-motion operation.	3.7 (20)
		b4	SV	This signal turns ON when operation standby is complete (Servo is ON).	3.7 (5)
		b3	ALM	This signal is ON while an alarm is generated.	3.7 (3)
		b2	MOVE	This signal is ON while in movement.	3.7 (8)
		b1	HEND	This signal turns ON at home return complete and is kept unless the home position is lost due to a fact such as an alarm.	3.7 (6)
		b0	PEND	This signal turns ON when positioning is complete and stopping with servo-on, and turns OFF when pressing is missed and while CSTR Signal is ON	3.7 (9)

3.4.6 Control Signals for Direct Indication Mode

This mode is not applicable for CompNet and MECHATROLINK specifications.

This is an operation mode to indicate directly with values for the target position, positioning width, speed, acceleration/deceleration and pressing current.
Set a value to each input and output data register. Set to the parameters when using the zone signals.
The main functions of MSCON capable to control in this mode are as described in the following

ROBO cylinder function	○: Direct control △: Indirect control ×: Disable	Remarks
Home-return operation	○	
Positioning operation	○	
Speed and acceleration/deceleration setting	○	
Pitch feeding (Incremental)	○	
Pressing operation	○	
Speed change during movement	○	
Operation at different acceleration and deceleration	×	
Pause	○	
Zone signal output	△	Parameters must be set.
PIO pattern selection	×	

(1) PLC Address Composition

(m is PLC input and output top word address for each axis number)

PLC→MSCON (PLC Output)		MSCON→PLC (PLC Input)	
Target Position	m to m+1	Current Position	m to m+1
Positioning Width	m+2 to m+3	Command Current	m+2 to m+3
Command Speed	m+4	Current Speed	m+4
Acceleration/Deceleration	m+5	Unavailable	m+5
Current limitation value while pressing	m+6	Alarm Code	m+6
Control Signal	m+7	Status Signal	m+7

[Refer to Section 3.4.2 for the address maps for each Fieldbus.]

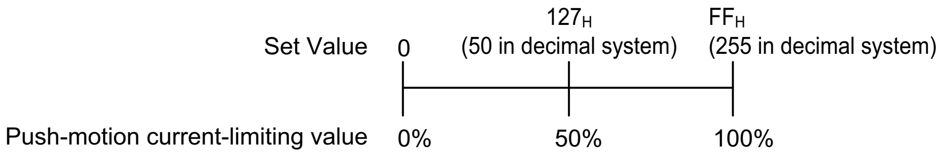
(2) I/O Signal Allocation for each Axis

The I/O signals for each axis consists of 8 words for each I/O bit register.

- The control signals and status signals are ON/OFF signals in units of bit.
- For the target position and current position, 2-word (32-bit) binary data is available and values from -999999 to +999999 (unit: 0.01mm) can be used. Negative numbers are to be dealt with two's complement.

⚠ Caution: Set the position data in the range of the soft stroke (0 to effective stroke length) of the actuator.

- Set the positioning width. The positioning width is expressed using 2-word (32 bits) binary data. The figures from 0 to +999999 (Unit: 0.01mm) can be set in PLC.
- The command speed is expressed using 1-word (16 bits) binary data. The figures from 1 to +65535 (Unit: 1.0mm/sec or 0.1mm/sec) can be set in PLC. A change of the unit is to be conducted on Gateway Parameter Setting Tool.
- The Acceleration/Deceleration is expressed using 1-word (16 bits) binary data. The figures from 1 to 300 (Unit: 0.01G) can be set in PLC.
- The pressing current limit value is expressed using 1-word (16 bits) binary data. The figures from 0 to 100% (0 to FF_H) can be set in PLC.



⚠ Caution: Have the setting with values available in the range of for speed, acceleration/deceleration and pressing current of the actuator. (Refer to the catalog or instruction manual of the actuator.) Otherwise, it may cause an abnormal condition of the servo or a malfunction of the actuator such as the alarm codes 0A3 "Position Command Information Data Error", 0C0 "Excess Actual Speed", 0C8 "Overcurrent", 0CA "Overheated" or 0E0 "Overloaded".

- The command current is expressed using 2-word (32 bits) binary data (Unit: 1mA).
- The current speed is expressed using 1-word (16 bits) binary data (Unit: 1.0mm/sec or 0.1mm/sec).
  The unit is the one set in the command speed. A positive number is output when the revolution of the driving motor is in CCW, while a negative number when CW. Negative numbers are output with two's complement.
  For Rotary Type, a positive number is output when rotating clockwise.
- The alarm code is expressed using 1-word (16 bits) binary data.

PLC Output (m is PLC output top word address for each axis number)

1 word=16 bit

Address m	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position (Lower word)																

Address m+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position (Upper word)																

(Note) If the target position is a negative value, it is indicated by a two' s complement. If the target position is a negative value, make an input with two's implement.

Address m+2	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Positioning Width (Lower word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1

Address m+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Positioning Width (Upper word)	–	–	–	–	–	–	–	–	–	–	–	–	524,288	262,144	131,072	65,536

Address m+4	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Velocity	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1

Address m+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Acceleration/ Deceleration	–	–	–	–	–	–	–	256	128	64	32	16	8	4	2	1

Address m+6	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current limitation value while pressing	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1

Address m+7	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control Signal	BKRL	INC	DIR	PUSH	GSL1	GSL0	–	JOG+	JOG-	JVEL	JISL	SON	RES	STP	HOME	CSTR

PLC Input (m is PLC input top word address for each axis number).

1 word=16 bit

Address m

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (Lower word)																

Address m+1

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (Upper word)																

(Note) If the target position is a negative value, the output is made with two's implement.

Address m+2

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Command Current (Lower word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1

Address m+3

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Command Current (Upper word)	–	–	–	–	–	–	–	–	–	–	–	–	524,288	262,144	131,072	65,536

Address m+4

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Speed																

(Note) It will be expressed with two's implement for a negative value.

Address m+5

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Unavailable																

Address m+6

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Alarm Code																

Address m+7

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Status Signal	EMGS	CRDY	ZONE2	ZONE1	–	–	–	MEND	BALM	–	PSFL	SV	ALM	MOVE	HEND	PEND

(3) I/O signal assignment

(ON = Applicable bit is “1”, OFF = Applicable bit is “0”)

Signal Type		Bit	Symbol	Contents	Details
PLC Output	Target Position	32 Bit data	–	32-bit signed integer indicating the current position Unit: 0.01mm Available range for Setting: -999999 to 999999 Set the target position with the value from the home position. (Example) If +25.40mm, input 000009EC$_H$ (2540 in decimal system). (Note) Input the negative value using a compliment of 2.	3.7 (28)
	Positioning Width	32 Bit data	–	32-bit integer Unit: 0.01mm Available range for Setting: 0 to 999999 (Example) If +25.40mm, input 000009EC$_H$ (2540 in decimal system). This register value has two meanings depending on the operation type. 1) Positioning operation ⇒ Range for positioning complete against the target position 2) Pressing operation ⇒ Pressing width (Pressing operation distance) A pressing operation is performed when PUSH Signal in the control signals is ON.	3.7 (28)
	Command Speed	16 Bit data	–	16-bit integer Unit: 1.0mm/sec or 0.1mm/sec (It is set to 1.0mm/sec in the initial setting.) A change of the unit is to be conducted on Gateway Parameter Setting Tool. Available range for Setting: 1 to 65535 Specify the speed at which to move the actuator. (Example) If 254.0mm/sec (1.0mm/s unit), input 09EC$_H$ (2540 in decimal system). It may cause an alarm or a malfunction if executing a movement command with 0 or a value more than the maximum speed of the actuator.	3.7 (28)
	Acceleration/Deceleration	16 Bit data	–	16-bit integer Unit: 0.01G Available range for Setting: 1 to 300 Specify the speed at which to move the actuator. The acceleration and deceleration will be the same value. (Example) If 0.30G, input 001E$_H$ (30 in decimal system). It may cause an alarm or a malfunction if executing a movement command with 0 or a value exceeding the maximum acceleration/deceleration of the actuator.	3.7 (28)
	Pressing Current Limit	16 Bit data	–	16-bit integer Unit : % Available range for Setting: 0 to 100 Indicate the current value for pressing operation. (Example) If “50%”, input “007F$_H$”. The pressing range available for indication differs depending on the actuator (Refer to the catalog or instruction manual for the actuator). It may cause an alarm or a malfunction if executing a movement command with a value more than the maximum pressing current.	3.7 (28)

<table>
<tr><th colspan="2">Signal Type</th><th>Bit</th><th>Symbol</th><th colspan="2">Contents</th><th>Details</th></tr>
<tr><td rowspan="17">PLC Output</td><td rowspan="17">Control Signal</td><td>b15</td><td>BKRL</td><td colspan="2">Brake release
ON: Brake release, OFF: Brake activated</td><td>3.7 (17)</td></tr>
<tr><td>b14</td><td>INC</td><td colspan="2">Incremental Command
ON: Relative position movement command,
OFF: Absolute position movement command</td><td>3.7 (26)</td></tr>
<tr><td>b13</td><td>DIR</td><td colspan="2">Push direction specification
ON: Movement against home position,
OFF:Movement toward home position</td><td>3.7 (19)</td></tr>
<tr><td>b12</td><td>PUSH</td><td colspan="2">Push-motion specification
ON: Pressing operation, OFF: Positioning operation</td><td>3.7 (18)</td></tr>
<tr><td>b11</td><td>GSL1</td><td>Servo Gain Parameter Set Select 1</td><td rowspan="2">Select the servo gain parameter set number to be used<table><tr><th>GSL1</th><th>GSL0</th><th>Gain Set</th></tr><tr><td>OFF</td><td>OFF</td><td>Gain Parameter Set 0 Select</td></tr><tr><td>OFF</td><td>ON</td><td>Gain Parameter Set 1 Select</td></tr><tr><td>ON</td><td>OFF</td><td>Gain Parameter Set 2 Select</td></tr><tr><td>ON</td><td>ON</td><td>Gain Parameter Set 3 Select</td></tr></table></td><td rowspan="2">3.7 (25)</td></tr>
<tr><td>b10</td><td>GSL0</td><td>Servo Gain Parameter Set Select 0</td></tr>
<tr><td>b9</td><td>–</td><td colspan="2">Unavailable</td><td>–</td></tr>
<tr><td>b8</td><td>JOG+</td><td colspan="2">+Jog
ON: Movement against home position, OFF: Stop</td><td>3.7 (12)</td></tr>
<tr><td>b7</td><td>JOG-</td><td colspan="2">-Jog
ON: Movement toward home position, OFF: Stop</td><td>3.7 (12)</td></tr>
<tr><td>b6</td><td>JVEL</td><td colspan="2">Jog-speed/inch-distance switching
OFF : Use the setting values of Parameter No.26 JOG Speed and No.48 Inching Distance in MSCON
ON : Use the setting values of Parameter No.47 JOG Speed 2 and No.49 Inching Distance in MSCON</td><td>3.7 (13)</td></tr>
<tr><td>b5</td><td>JISL</td><td colspan="2">Jog/inching switching
ON: Inching, OFF: Jog</td><td>3.7 (14)</td></tr>
<tr><td>b4</td><td>SON</td><td colspan="2">Servo ON command
ON: Servo ON, OFF: Servo OFF</td><td>3.7 (5)</td></tr>
<tr><td>b3</td><td>RES</td><td colspan="2">Reset
A reset is performed when this signal turns ON.</td><td>3.7 (4)</td></tr>
<tr><td>b2</td><td>STP</td><td colspan="2">Pause
ON: Pause, OFF: Pause Release</td><td>3.7 (10)</td></tr>
<tr><td>b1</td><td>HOME</td><td colspan="2">Home return
Home-return command with this signal ON, command carried on till complete even if the signal is turned OFF on the way</td><td>3.7 (6)</td></tr>
<tr><td>b0</td><td>CSTR</td><td colspan="2">Positioning Start
Movement command executed with this signal ON, command carried on till complete even if the signal is turned OFF on the way</td><td>3.7 (7)</td></tr>
</table>

(ON = Applicable bit is "1", OFF = Applicable bit is "0")

Signal Type		Bit	Symbol	Contents	Details
PLC Input	Current Position	32 Bit data	–	32-bit signed integer indicating the current position Unit: 0.01mm (Example) If +10.23mm, input $000003FF_H$ (1023mm in decimal system). (Note) Negative numbers are two's implement.	3.7 (28)
	Command Current	32 Bit data	–	32-bit integer The electrical current presently specified by a command is indicated. The setting unit is mA. This resistor makes an output in hexadecimal numbers. (Example) Reading: $000003FF_H$=1023 (Decimal number) =1023mA	3.7 (28)
	Current Speed	16 Bit data	–	32-bit integer The current speed is indicated. Unit: 1.0mm/sec or 0.1mm/sec. A change of the unit is to be conducted on Gateway Parameter Setting Tool. (Example) Reading: $000003FF_H$=1023 (Decimal number) = 10.23mm/sec (Note) Negative numbers are two's implement.	3.7 (28)
	Alarm Code	16 Bit data	–	16-bit integer The simple alarm code [Refer to Chapter 8 Troubleshooting] is output while an alarm is issued (ALM of Status Signal is ON).	3.7 (28)
	Status Signal	b15	EMGS	This signal turns ON during an emergency stop	3.7 (2)
		b14	CRDY	This signal turns ON when the controller is standing by.	3.7 (1)
		b13	ZONE2	"ON" for the current position within the zone set range The zone range setting is necessary for the parameter.	3.7 (11)
		b12	ZONE1	"ON" for the current position within the zone set range The zone range setting is necessary for the parameter.	
		b11	–	Unavailable	–
		b10			
		b9			
		b8	MEND	This signal turns ON when movement command is complete, stopping with servo-on and pressing is missed, and turns OFF when in emergency stop with servo is OFF and while CSTR Signal is ON	3.7 (21)
		b7	BALM	Warning for absolute battery voltage drop This signal turns ON with battery voltage drop	3.7 (22)
		b6	–	Unavailable	–
		b5	PSFL	This signal turns ON when the actuator missed the load in push-motion operation.	3.7 (20)
		b4	SV	This signal turns ON when operation standby is complete (Servo is ON).	3.7 (5)
		b3	ALM	This signal is ON while an alarm is generated.	3.7 (3)
		b2	MOVE	This signal is ON while in movement.	3.7 (8)
		b1	HEND	This signal turns ON at home return complete and is kept unless the home position is lost due to a fact such as an alarm.	3.7 (6)
		b0	PEND	This signal turns ON when positioning is complete and stopping with servo-on, and turns OFF when pressing is missed and while CSTR Signal is ON	3.7 (9)

3.4.7 Control Signals for Direct Indication Mode 2

This mode is not applicable for CompNet and MECHATROLINK specifications.

This is an operation mode to indicate directly with values for the target position, positioning width, speed, acceleration/deceleration and pressing current.
Set a value to each input and output data register. Set to the parameters when using the zone signals.
The main functions of MSCON capable to control in this mode are as described in the following table.

ROBO cylinder function	○: Direct control △: Indirect control ×: Disable	Remarks
Home-return operation	○	
Positioning operation	○	
Speed and acceleration/deceleration setting	○	
Pitch feeding (Incremental)	○	
Pressing operation	○	
Speed change during movement	○	
Operation at different acceleration and deceleration	×	
Pause	○	
Zone signal output	△	Parameters must be set.
PIO pattern selection	×	

(1) PLC Address Composition

(m is PLC input and output top word address for each axis number)

PLC→MSCON (PLC Output)		MSCON→PLC (PLC Input)	
Target Position	m to m+1	Current Position	m to m+1
Positioning Width	m+2 to m+3	Command Current	m+2 to m+3
Command Speed	m+4	Current Speed	m+4
Acceleration/Deceleration	m+5	Unavailable	m+5
Current limitation value while pressing	m+6	Alarm Code	m+6
Control Signal	m+7	Status Signal	m+7

[Refer to Section 3.4.2 for the address maps for each Fieldbus.]

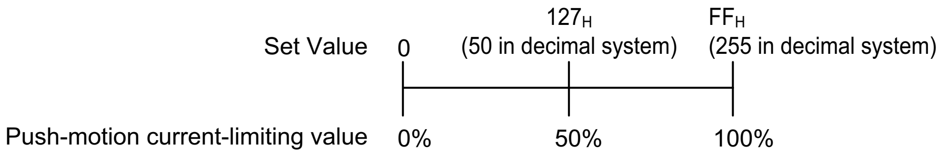
(2) I/O Signal Allocation for each Axis

The I/O signals for each axis consists of 8 words for each I/O bit register.

- The control signals and status signals are ON/OFF signals in units of bit.
- For the target position and current position, 2-word (32-bit) binary data is available and values from -999999 to +999999 (unit: 0.01mm) can be used. Negative numbers are to be dealt with two's complement.

⚠ Caution: Set the position data in <u>the range of the soft stroke (0 to effective stroke length)</u> of the actuator.

- Set the positioning width. The positioning width is expressed using 2-word (32 bits) binary data. The figures from 0 to +999999 (Unit: 0.01mm) can be set in PLC.
- The command speed is expressed using 1-word (16 bits) binary data. The figures from 1 to +65535 (Unit: 1.0mm/sec or 0.1mm/sec) can be set in PLC. A change of the unit is to be conducted on Gateway Parameter Setting Tool.
- The Acceleration/Deceleration is expressed using 1-word (16 bits) binary data. The figures from 1 to 300 (Unit: 0.01G) can be set in PLC.
- The pressing current limit value is expressed using 1-word (16 bits) binary data. The figures from 0 to 100% (0 to FF_H) can be set in PLC.



⚠ Caution: Have the setting with <u>values available in the range of for speed, acceleration/deceleration and pressing current</u> of the actuator. (Refer to the catalog or instruction manual of the actuator.) Otherwise, it may cause an abnormal condition of the servo or a malfunction of the actuator such as the alarm codes 0A3 "Position Command Information Data Error", 0C0 "Excess Actual Speed", 0C8 "Overcurrent", 0CA "Overheated" or 0E0 "Overloaded".

- The command current is expressed using 2-word (32 bits) binary data (Unit: 1mA).
- The current speed is expressed using 1-word (16 bits) binary data (Unit: 1.0mm/sec or 0.1mm/sec).
  The unit is the one set in the command speed. A positive number is output when the revolution of the driving motor is in CCW, while a negative number when CW. Negative numbers are output with two's complement.
  For Rotary Type, a positive number is output when rotating clockwise.
- The alarm code is expressed using 1-word (16 bits) binary data.

PLC Output (m is PLC output top word address for each axis number)

1 word=16 bit

Address m	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position (Lower word)																

Address m+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position (Upper word)																

(Note) If the target position is a negative value, the input is made with two's implement.

Address m+2	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Positioning Width (Lower word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1

Address m+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Positioning Width (Upper word)	–	–	–	–	–	–	–	–	–	–	–	–	524,288	262,144	131,072	65,536

Address m+4	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Velocity	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1

Address m+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Acceleration/ Deceleration	–	–	–	–	–	–	–	256	128	64	32	16	8	4	2	1

Address m+6	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current limitation value while pressing	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1

Address m+7	b15	b14	b13	b12	b11	B10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control Signal	BKRL	INC	DIR	PUSH	GSL1	GSL0	NTC1	NTC0	MOD1	MOD0	–	SON	RES	STP	HOME	CSTR

PLC Input (m is PLC input top word address for each axis number).

1 Word＝16 bit

Address m	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (Lower word)																

Address m+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (Upper word)																

(Note) If the target position is a negative value, the output is made with two's implement.

Address m+2	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Command Current (Lower word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1

Address m+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Command Current (Upper word)	–	–	–	–	–	–	–	–	–	–	–	–	524,288	262,144	131,072	65,536

Address m+4	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Speed																

(Note) It will be expressed with two's implement for a negative value.

Address m+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Unavailable																

Address m+6	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Alarm Code																

Address m+7	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Status Signal	EMGS	CRDY	ZONE2	ZONE1	–	–	–	MEND	BALM	–	PSFL	SV	ALM	MOVE	HEND	PEND

(3) I/O signal assignment

(ON = Applicable bit is “1”, OFF = Applicable bit is “0”)

Signal Type		Bit	Symbol	Contents	Details
PLC Output	Target Position	32 Bit data	–	32-bit signed integer indicating the current position Unit: 0.01mm Available range for Setting: -999999 to 999999 Set the target position with the value from the home position. (Example) If +25.40mm, input 000009EC$_H$ (2540 in decimal system). (Note) Input the negative value using a compliment of 2.	3.7 (28)
	Positioning Width	32 Bit data	–	32-bit integer Unit: 0.01mm Available range for Setting: 0 to 999999 (Example) If +25.40mm, input 000009EC$_H$ (2540 in decimal system). This register value has two meanings depending on the operation type. 1) Positioning operation ⇒ Range for positioning complete against the target position 2) Pressing operation ⇒ Pressing width (Pressing operation distance) A pressing operation is performed when PUSH Signal in the control signals is ON.	3.7 (28)
	Command Speed	16 Bit data	–	16-bit integer Unit: 1.0mm/sec or 0.1mm/sec (It is set to 1.0mm/sec in the initial setting.) A change of the unit is to be conducted on Gateway Parameter Setting Tool. Available range for Setting: 1 to 65535 Specify the speed at which to move the actuator. (Example) If 254.0mm/sec (1.0mm/s unit), input 09EC$_H$ (2540 in decimal system). It may cause an alarm or a malfunction if executing a movement command with 0 or a value more than the maximum speed of the actuator.	3.7 (28)
	Acceleration/Deceleration	16 Bit data	–	16-bit integer Unit: 0.01G Available range for Setting: 1 to 300 Specify the speed at which to move the actuator. The acceleration and deceleration will be the same value. (Example) If 0.30G, input 001E$_H$ (30 in decimal system). It may cause an alarm or a malfunction if executing a movement command with 0 or a value exceeding the maximum acceleration/deceleration of the actuator.	3.7 (28)
	Pressing Current Limit	16 Bit data	–	16-bit integer Unit : % Available range for Setting: 0 to 100 Indicate the current value for pressing operation. (Example) If “50%”, input “007F$_H$”. The pressing range available for indication differs depending on the actuator (Refer to the catalog or instruction manual for the actuator). It may cause an alarm or a malfunction if executing a movement command with a value more than the maximum pressing current.	3.7 (28)

<table>
<tr><th colspan="2">Signal Type</th><th>Bit</th><th>Symbol</th><th colspan="2">Contents</th><th>Details</th></tr>
<tr><td rowspan="16">PLC Output</td><td rowspan="16">Control Signal</td><td>b15</td><td>BKRL</td><td colspan="2">Brake release
ON: Brake release, OFF: Brake activated</td><td>3.7 (17)</td></tr>
<tr><td>b14</td><td>INC</td><td colspan="2">Incremental command
ON: Relative position movement command,
OFF: Absolute position movement command</td><td>3.7 (26)</td></tr>
<tr><td>b13</td><td>DIR</td><td colspan="2">Push direction specification
ON: Movement against home position,
OFF:Movement toward home position</td><td>3.7 (19)</td></tr>
<tr><td>b12</td><td>PUSH</td><td colspan="2">Push-motion specification
ON: Pressing operation, OFF: Positioning operation</td><td>3.7 (18)</td></tr>
<tr><td>b11</td><td>GSL1</td><td>Servo Gain Parameter Set Select 1</td><td rowspan="2">Select the servo gain parameter set number to be used<table><tr><th>GSL1</th><th>GSL0</th><th>Gain Set</th></tr><tr><td>OFF</td><td>OFF</td><td>Gain Parameter Set 0 Select</td></tr><tr><td>OFF</td><td>ON</td><td>Gain Parameter Set 1 Select</td></tr><tr><td>ON</td><td>OFF</td><td>Gain Parameter Set 2 Select</td></tr><tr><td>ON</td><td>ON</td><td>Gain Parameter Set 3 Select</td></tr></table></td><td rowspan="2">3.7 (25)</td></tr>
<tr><td>b10</td><td>GSL0</td><td>Servo Gain Parameter Set Select 0</td></tr>
<tr><td>b9</td><td>NTC1</td><td>Anti-Vibration Control Mode Select 1</td><td rowspan="2">Select the anti-vibration control mode number to be used<table><tr><th>NTC1</th><th>NTC0</th><th>Anti-Vibration Control Mode</th></tr><tr><td>OFF</td><td>OFF</td><td>Anti-vibration control not to be used</td></tr><tr><td>OFF</td><td>ON</td><td>Parameter Set 1 Select</td></tr><tr><td>ON</td><td>OFF</td><td>Parameter Set 2 Select</td></tr><tr><td>ON</td><td>ON</td><td>Parameter Set 3 Select</td></tr></table></td><td rowspan="2">3.7 (23)</td></tr>
<tr><td>b8</td><td>NTC0</td><td>Anti-Vibration Control Mode Select 1</td></tr>
<tr><td>b7</td><td>MOD1</td><td>Acceleration/ Deceleration Mode Select 1</td><td rowspan="2">Select the acceleration/deceleration mode number to be used<table><tr><th>MOD1</th><th>MOD0</th><th>Acceleration / deceleration mode</th></tr><tr><td>OFF</td><td>OFF</td><td>Trapezoid pattern control selected</td></tr><tr><td>OFF</td><td>ON</td><td>S-shaped motion control selected</td></tr><tr><td>ON</td><td>OFF</td><td>Primary delay filter control selected</td></tr></table></td><td rowspan="2">3.7 (24)</td></tr>
<tr><td>b6</td><td>MOD0</td><td>Acceleration/ Deceleration Mode Select 0</td></tr>
<tr><td>b5</td><td>–</td><td colspan="2">Unavailable</td><td>–</td></tr>
<tr><td>b4</td><td>SON</td><td colspan="2">Servo ON Command
ON: Servo ON, OFF: Servo OFF</td><td>3.7 (5)</td></tr>
<tr><td>b3</td><td>RES</td><td colspan="2">Reset
A reset is performed when this signal turns ON.</td><td>3.7 (4)</td></tr>
<tr><td>b2</td><td>STP</td><td colspan="2">Pause
ON: Pause, OFF: Pause release</td><td>3.7 (10)</td></tr>
<tr><td>b1</td><td>HOME</td><td colspan="2">Home return
Home-return command with this signal ON, command carried on till complete even if the signal is turned OFF on the way</td><td>3.7 (6)</td></tr>
<tr><td>b0</td><td>CSTR</td><td colspan="2">Positioning start
Movement command executed with this signal ON, command carried on till complete even if the signal is turned OFF on the way</td><td>3.7 (7)</td></tr>
</table>

(ON = Applicable bit is “1”, OFF = Applicable bit is “0”)

Signal Type		Bit	Symbol	Contents	Details
PLC Output	Current Position	32 Bit data	–	32-bit signed integer indicating the current position Unit: 0.01mm (Example) If +10.23mm, input 000003FF$_H$ (1023mm in decimal system). (Note) Input the negative value using a compliment of 2.	3.7 (28)
	Command Current	32 Bit data	–	32-bit integer The electrical current presently specified by a command is indicated. The setting unit is mA. This resistor makes an output in hexadecimal numbers. (Example) Reading: 000003FF$_H$ = 1023 (Decimal number) = 1023mA	3.7 (28)
	Current Speed	16 Bit data	–	32-bit integer The current speed is indicated. Unit: 1.0mm/sec or 0.1mm/sec. A change of the unit is to be conducted on Gateway Parameter Setting Tool. (Example) Reading: 000003FF$_H$ = 1023 (Decimal number) = 10.23mm/sec (Note) Input the negative value using a compliment of 2.	3.7 (28)
	Alarm Code	16 Bit data	–	16-bit integer The simple alarm code (refer to Chapter 8 Troubleshooting) is output while an alarm is issued (ALM of Status Signal is ON).	3.7 (28)
	Status Signal	b15	EMGS	This signal turns ON during an emergency stop	3.7 (2)
		b14	CRDY	This signal turns ON when the controller is standing by.	3.7 (1)
		b13	ZONE2	“ON” for the current position within the zone set range The zone range setting is necessary for the parameter.	3.7 (11)
		b12	ZONE1	“ON” for the current position within the zone set range The zone range setting is necessary for the parameter.	
		b11	–	Unavailable	–
		b10			
		b9			
		b8	MEND	This signal turns ON when movement command is complete, stopping with servo-on and pressing is missed, and turns OFF when in emergency stop with servo is OFF and while CSTR Signal is ON	3.7 (21)
		b7	BALM	Warning for absolute battery voltage drop This signal turns on with battery voltage drop	3.7 (22)
		b6	–	Unavailable	–
		b5	PSFL	This signal turns ON when the actuator missed the load in push-motion operation.	3.7 (20)
		b4	SV	This signal turns ON when operation standby is complete (Servo is ON).	3.7 (5)
		b3	ALM	This signal is ON while an alarm is generated.	3.7 (3)
		b2	MOVE	This signal is ON while in movement.	3.7 (8)
		b1	HEND	This signal turns ON at home return complete and is kept unless the home position is lost due to a fact such as an alarm.	3.7 (6)
		b0	PEND	This signal turns ON when positioning is complete and stopping with servo-on, and turns OFF when pressing is missed and while CSTR Signal is ON	3.7 (9)

3.4.8 Control Signals for Positioner 2 Mode

CompoNet and MECHATROLINK are not applicable for this mode.

This is the operation mode with the position No. set up. The operation is to be made with the position data set in the position table. This is a mode that the indication of the target position and the monitoring of the current value are removed from Positioner 1 Mode.
The settable No. of position data items is max 256 points.
The main functions of MSCON capable to control in this mode are as described in the following table.

ROBO cylinder function	○: Direct control △: Indirect control ×: Disabled	Remarks
Home-return operation	○	
Positioning operation	○	
Speed and acceleration/deceleration setting	△	These items must be set in the position data.
Pitch feeding (Incremental)	△	
Pressing operation	△	
Speed change during movement	△	
Operation at different acceleration and deceleration	△	
Pause	○	
Zone signal output	○	
PIO pattern selection	×	

(1) PLC Address Composition

(m is PLC input and output top word address for each axis number)

PLC→MSCON (PLC Output)		MSCON→PLC (PLC Input)	
Indicated Position No.	m	Completed Position No. (Simple Alarm Code)	m
Control Signal	m+1	Status Signal	m+1

[Refer to Section 3.4.2 for the address maps for each Fieldbus.]

(2) Input and Output Signal Assignment for each Axis
The I/O signals for each axis consists of 2 words for each I/O bit register.
- The control signals and status signals are ON/OFF signals in units of bit.
- For the indicated position number and complete position number, 1-word (16-bit) binary data is available and values from 0 to 255 can be used.

> ⚠ Caution: Set the operational condition in advance with using a teaching tool such as PC software in the position number to be used. Selecting a position number with no setting conducted will generate the alarm code 0A2 "Position Data Error".

PLC Output (m is PLC output top word address for each axis number)

1 word=16 bit

Address m	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Specified Position No.	–	–	–	–	–	–	–	–	PC128	PC64	PC32	PC16	PC8	PC4	PC2	PC1

Address m+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control Signal	BKRL	–	–	–	–	MODE	PWRT	JOG+	JOG-	JVEL	JISL	SON	RES	STP	HOME	CSTR

PLC Input (m is PLC Input top word address for each axis number)

1 word=16 bit

Address m	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Completed Position No.	–	–	–	–	–	–	–	–	PM128	PM64	PM32	PM16	PM8	PM4	PM2	PM1

Address m+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Status Signal	EMGS	CRDY	ZONE2	ZONE1	PZONE	MODES	WEND	MEND	BALM	–	PSFL	SV	ALM	MOVE	HEND	PEND

(3) I/O signal assignment

(ON = Applicable bit is "1", OFF = Applicable bit is "0")

Signal Type		Bit	Symbol	Contents	Details
PLC Input	Specified Position No.	16 bits Data	PC1 to PC128	16-bit integer Available range for Setting: 0 to 255 To operate, it is necessary to have the position data that the operation conditions are already set in advance with a teaching tool such as the PC software. In this register, indicate the position number the data is input with a binary number. Indicating a value out of the range or operating with a position number with no setting conducted will generate the alarm code 0A2 "Position Data Error".	3.7 (29)
	Control Signal	b15	BKRL	Brake release ON: Brake release, OFF: Brake activated	3.7 (17)
		b14	–	Unavailable	–
		b13			
		b12			
		b11			
		b10	MODE	Teaching mode command (Invalid in Simple Direct Mode) OFF: Standard mode, ON: Teaching mode	3.7 (15)
		b9	PWRT	Position import command (Invalid in Simple Direct Mode) ON: Position Data Import	3.7 (16)
		b8	JOG+	+Jog ON: Movement against home position, OFF: Stop	3.7 (12)
		b7	JOG-	-Jog ON: Movement toward home position, OFF: Stop	
		b6	JVEL	Jog-speed/inch-distance switching OFF : Use the setting values of Parameter No. 6 JOG Speed and No.48 Inching Distance in MSCON ON : Use the setting values of Parameter No. 7 JOG Speed 2 and No.49 Inching Distance in MSCON	3.7 (13)
		b5	JISL	Jog/inching switching ON: Inching, OFF: Jog	3.7 (14)
		b4	SON	Servo ON Command ON: Servo ON, OFF: Servo OFF	3.7 (5)
		b3	RES	Reset A reset is performed when this signal turns ON.	3.7 (4)
		b2	STP	Pause ON: Pause, OFF: Pause Release	3.7 (10)
		b1	HOME	Home return Home-return command with this signal ON, command carried on till complete even if the signal is turned OFF on the way	3.7 (6)
		b0	CSTR	Positioning Start Movement command executed with this signal ON, command carried on till complete even if the signal is turned OFF on the way	3.7 (7)

(ON = Applicable bit is "1", OFF = Applicable bit is "0")

Signal Type		Bit	Symbol	Contents	Details
PLC Input	Completed Position No. (Simple Alarm Code)	16 bits	PM1 to PM128	16-bit integer The positioning complete position number is output in a binary number once getting into the positioning band after moving to the target position. In the case that the position movement has not been performed at all, or during the movement, "0" is output. Read it by turning PEND Signal ON after movement. The simple alarm code [refer to Chapter 8 Troubleshooting] is output while an alarm is issued (ALM of Status Signal is ON).	3.7 (29)
	Status Signal	b15	EMGS	This signal turns ON during an emergency stop	3.7 (2)
		b14	CRDY	This signal turns ON when the controller is standing by.	3.7 (1)
		b13	ZONE2	"ON" for the current position within the zone 2 set range The zone range setting is necessary for the parameter.	3.7 (11)
		b12	ZONE1	"ON" for the current position within the zone 1 set range The zone range setting is necessary for the parameter.	
		b11	PZONE	Position zone (Invalid in Simple Direct Mode) This signal turns ON when the current position is inside the specified position zone.	3.7 (11)
		b10	MODES	Teaching mode signal (Invalid in Simple Direct Mode) This signal is ON while the teaching mode is selected.	3.7 (15)
		b9	WEND	Position data import complete (Invalid in Simple Direct Mode) This signal turns ON when reading is complete.	3.7 (16)
		b8	MEND	This signal turns ON when movement command is complete, stopping with servo-on and pressing is missed, and turns OFF when in emergency stop with servo is OFF and while CSTR Signal is ON	3.7 (21)
		b7	BALM	Warning for absolute battery voltage drop This signal turns ON with battery voltage drop	3.7 (22)
		b6	–	Unavailable	–
		b5	PSFL	This signal turns ON when the actuator missed the load in push-motion operation.	3.7 (20)
		b4	SV	This signal turns ON when operation standby is complete (Servo is ON).	3.7 (5)
		b3	ALM	This signal is ON while an alarm is generated.	3.7 (3)
		b2	MOVE	This signal is ON while in movement.	3.7 (8)
		b1	HEND	This signal turns ON at home return complete and is kept unless the home position is lost due to a fact such as an alarm.	3.7 (6)
		b0	PEND	This signal turns ON at positioning complete and is kept ON during a stop with the servo ON, but does not turn ON when pressing operation is failed.	3.7 (9)

3.4.9 Control Signals for Positioner 3 Mode

This is the operation mode with the position No. set up. The operation is to be made with the position data set in the position table. This is the mode with the minimum amount of input and output signals and the sent and received data in 1 word.
The settable No. of position data items is max 256 points.
The main functions of ROBO Cylinder capable to control in this mode are as described in the following table.

ROBO cylinder function	○: Direct control △: Indirect control ×: Disabled	Remarks
Home-return operation	○	
Positioning operation	○	
Speed and acceleration/deceleration setting	△	These items must be set in the position data.
Pitch feeding (Incremental)	×	
Pressing operation	△	
Speed change during movement	△	
Operation at different acceleration and deceleration	△	
Pause	○	
Zone signal output	△	Zones are set using parameters.

(1) PLC Address Composition

(m is PLC input and output top word address for each axis number)

PLC→MSCON (PLC Output)		MSCON→PLC (PLC Input)	
Control Signal･Specified Position No.	m	Status Signal･Completed Position No.	m

[Refer to Section 3.4.2 for the address maps for each Fieldbus.]

(2) Input and Output Signal Assignment for each Axis

The I/O signals for each axis consists of 1 words for each I/O bit register.

- The control signals and status signals are ON/OFF signals in units of bit.
- For the indicated position number and complete position number, 8-bit binary data is available and values from 0 to 255 can be used.

> ⚠ Caution: Set the operational condition in advance with using a teaching tool such as PC software in the position number to be used. Selecting a position number with no setting conducted will generate the alarm code 0A2 "Position Data Error".

PLC Output (m is PLC output top word address for each axis number)

1 word=16 bit

Address m	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control Signal/ Specified Position No.	BKRL	–	–	SON	RES	STP	HOME	CSTR	PC128	PC64	PC32	PC16	PC8	PC4	PC2	PC1
	Control Signal								Specified Position No.							

PLC Input (m is PLC Input top word address for each axis number)

1 word=16 bit

Address m	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Status Signal/ Completed Position No.	EMGS	ZONE1	PSFL	SV	ALM	MOVE	HEND	PEND	PM128	PM64	PM32	PM16	PM8	PM4	PM2	PM1
	Status Signal								Completed Position No.							

(3) I/O signal assignment

(ON = Applicable bit is "1", OFF = Applicable bit is "0")

Signal Type		Bit	Symbol	Contents	Details
PLC Input	Control Signal/ Specified Position No.	b15	BKRL	Brake release ON: Brake release, OFF: Brake activated	3.7 (17)
		b14	–	Unavailable	–
		b13			
		b12	SON	Servo ON Command ON: Servo ON, OFF: Servo OFF	3.7 (5)
		b11	RES	Reset A reset is performed when this signal turns ON.	3.7 (4)
		b10	STP	Pause ON: Pause, OFF: Pause Release	3.7 (10)
		b9	HOME	Home return Home-return command with this signal ON, command carried on till complete even if the signal is turned OFF on the way	3.7 (6)
		b8	CSTR	Positioning start Movement command executed with this signal ON, command carried on till complete even if the signal is turned OFF on the way	3.7 (7)
		b7	PC128	Command position number (8-bit binary data) Available range for Setting: 0 to 255 To operate, it is necessary to have the position data that the operation conditions are already set in advance with a teaching tool such as the PC software. In this register, indicate the position number the data is input with a binary number. Indicating a value out of the range or operating with a position number with no setting conducted will generate the alarm code 0A2 "Position Data Error".	3.7 (29)
		b6	PC64		
		b5	PC32		
		b4	PC16		
		b3	PC8		
		b2	PC4		
		b1	PC2		
		b0	PC1		
PLC Output	Status Signal/ Completed Position No.	b15	EMGS	This signal turns ON during an emergency stop	3.7 (2)
		b14	ZONE1	"ON" for the current position within the zone 1 set range The zone range setting is necessary for the parameter.	3.7 (11)
		b13	PSFL	This signal turns ON when the actuator missed the load in push-motion operation.	3.7 (20)
		b12	SV	This signal turns ON when operation standby is complete (Servo is ON).	3.7 (5)
		b11	ALM	This signal is ON while an alarm is generated.	3.7 (3)
		b10	MOVE	This signal is ON while in movement.	3.7 (8)
		b9	HEND	This signal turns ON at home return complete and is kept unless the home position is lost due to a fact such as an alarm.	3.7 (6)
		b8	PEND	This signal turns ON at positioning complete and is kept ON during a stop with the servo ON, but does not turn ON when pressing operation is failed.	3.7 (9)
		b7	PM128	Complete position number (8-bit binary data) The positioning complete position number is output in a binary number once getting into the positioning band after moving to the target position. In the case that the position movement has not been performed at all, or during the movement, "0" is output. Read it by turning PEND Signal ON after movement.	3.7 (29)
		b6	PM64		
		b5	PM32		
		b4	PM16		
		b3	PM8		
		b2	PM4		
		b1	PM2		
		b0	PM1		

3.4.10 Control Signals for Remote I/O Mode

It is an operation mode to control with ON/OFF of bits as it is done in PIO (24V I/O).
Set the position data from a teaching tool such as the RC PC software.
The number of positioning points depends on the operation pattern (PIO pattern) set in the parameters of MSCON unit.
The I/O specifications for the operation pattern are described as follows.

PIO Pattern	Operation Mode	I/O Specification
0	Positioning mode	Position number specification 64 points Zone signal output 1 point (Note1) Position zone signal output (Note 2) 1 point
1	Teaching mode	Positioning points 64 points Zone signal output (Note 2) 1 point Jog operation is available The current position can be written to a specified position.
2	256-point mode	Positioning points 256 points Zone signal output (Note 2) 1 point
3	–	Unavailable. Parameter data error would be generated if setting is made.
4	Solenoid valve mode 1	Positioning points 7 points Zone signal output 1 point (Note 1) Position zone signal output (Note 2) 1 point Operation command available only with position number indication
5	Solenoid valve mode 2	Positioning points 3 points Zone signal output 1 point (Note 1) Position zone signal output (Note 2) 1 point The actuator is operated by specifying forward, backward and intermediate position commands. Complete signal is able to output a signal equivalent to the limit switch

(Note 1) Set the range of the zone in MSCON parameter. It becomes constantly valid once the home-return operation is complete.
(Note 2) The range of the zone is to be set in the position table, and is activated only when that position number is indicated. It is invalid in other position number commands. The position zone signal can be switched over to the zone signal with the setting of Parameter No.149 of MSCON.

The MSCON functions capable to control in this mode are as described in the table below.
○: Operation available ×: Operation not available

ROBO cylinder function	Operation Pattern (PIO Pattern)				
	0	1	2	4	5
	Positioning Mode	Teaching Mode	256 points Mode	Solenoid Valve Mode 1	Solenoid Valve Mode 2
Home-return operation	○	○	○	○	○ (Note 1)
Positioning operation	○	○	○	○	○
Speed and acceleration/deceleration setting	○	○	○	○	○
Pitch feed (Incremental)	○	○	○	○	×
Pressing operation	○	○	○	○	○
Speed change during movement	○	○	○	○	○
Operation at different acceleration and deceleration	○	○	○	○	○
Pause	○	○	○	○	○ (Note 2)
Zone signal output	○	○	○	○	○

Note 1 Home-return operation is performed in the first movement command.
Note 2 It is available when the parameter No.27 of MSCON "Movement Command Type" is set to "0".

(1) PLC Address Composition

(m is PLC input and output top word address for each axis number)

PLC→MSCON (PLC Output)		MSCON→PLC (PLC Input)	
Port No.0 to 15	m	Port No.0 to 15	m

[Refer to Section 3.4.2 for the address maps for each Fieldbus.]

(2) Input and Output Signal Assignment for each Axis

The I/O signals for each axis consists of 1 word for each I/O bit register.

- The I/O bit register is controlled using the ON/OFF signal in units of bit. (ON = Applicable bit is "1", OFF = Applicable bit is "0")
- The content of the signal for each bit changes depending what is selected in the PIO patterns. [Refer to next section I/O signal assignment]

PLC Output (m is PLC input and output top word address for each axis number)

1 word=16 bit

Address m	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Controller Input port No.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

PLC Input (m is PLC input and output top word address for each axis number)

1 word=16 bit

Address m	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Controller Output Port No.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

(3) I/O signal assignment

The controller's I/O port signal varies depending on the parameter No.25 setting.

[Refer to 3.8 Remote I/O Mode]

		Set the parameter No.25 of MSCON					
		Positioning mode		Teaching mode		256-point mode	
		0		1		2	
Category	Port No.	Symbol	Signal Name	Symbol	Signal Name	Symbol	Signal Name
PLC output→ MSCON input	0	PC1	Specified position No.	PC1	Specified position No.	PC1	Specified position No.
	1	PC2		PC2		PC2	
	2	PC4		PC4		PC4	
	3	PC8		PC8		PC8	
	4	PC16		PC16		PC16	
	5	PC32		PC32		PC32	
	6	–	Unavailable	MODE	Teaching mode command	PC64	
	7	–		JISL	Jog/inching switching	PC128	
	8	–		JOG+	+Jog	–	Unavailable
	9	BKRL	Brake release	JOG-	-Jog	BKRL	Brake release
	10	–	Unavailable	–	Unavailable	–	Unavailable
	11	HOME	Home return	HOME	Home return	HOME	Home return
	12	*STP	Pause	*STP	Pause	*STP	Pause
	13	CSTR	Positioning start	CSTR/ PWRT	Positioning start/ Position data import command	CSTR	Positioning start
	14	RES	Reset	RES	Reset	RES	Reset
	15	SON	Servo ON command	SON	Servo ON command	SON	Servo ON command
MSCON output →PLC input	0	PM1	Completed position No.	PM1	Completed position No.	PM1	Completed position No.
	1	PM2		PM2		PM2	
	2	PM4		PM4		PM4	
	3	PM8		PM8		PM8	
	4	PM16		PM16		PM16	
	5	PM32		PM32		PM32	
	6	MOVE	Moving signal	MOVE	Moving signal	PM64	
	7	ZONE1	ZONE1	MODES	Teaching mode signal	PM128	
	8	PZONE/ Z0NE2	Position zone/ Zone 2	PZONE/ ZONE1	Position zone/ Zone 1	PZONE/ ZONE1	Position zone/ Zone 1
	9	–	Unavailable	–	Unavailable	–	Unavailable
	10	HEND	Home return completion	HEND	Home return completion	HEND	Home return completion
	11	PEND	Positioning completion signal	PEND/ WEND	Positioning completion signal/Position data import complete	PEND	Positioning completion signal
	12	SV	Operation preparation end	SV	Operation preparation completion	SV	Operation preparation end
	13	*EMGS	Emergency stop	*EMGS	Emergency stop	*EMGS	Emergency stop
	14	*ALM	Alarm	*ALM	Alarm	*ALM	Alarm
	15	*BALM	Absolute battery voltage drop alarm	*BALM	Absolute battery voltage drop alarm	*BALM	Absolute battery voltage drop alarm

(Note): "*" in codes above shows the signal of the active low.

(Reference) Signal of Active Low

A signal of active low is a signal that the input signal is processed when it is turned OFF, output signal is ordinarily on while the power is ON, and turns OFF when the signal is output.

		Set the parameter No.25 of MSCON			
		Solenoid valve mode 1		Solenoid valve mode 2	
		4		5	
Category	Port No.	Symbol	Signal Name	Symbol	Signal Name
PLC output→ MSCON input	0	ST0	Start position 0	ST0	Start position 0
	1	ST1	Start position 1	ST1	Start position 1
	2	ST2	Start position 2	ST2	Start position 2
	3	ST3	Start position 3	–	Unavailable
	4	ST4	Start position 4	–	
	5	ST5	Start position 5	–	
	6	ST6	Start position 6	–	
	7	–	Unavailable	–	
	8	–		–	
	9	BKRL	Brake release	BKRL	Brake release
	10	–	Unavailable	–	Unavailable
	11	HOME	Home return	–	Unavailable
	12	*STP	Pause	–	
	13	–	Unavailable	–	
	14	RES	Reset	RES	Reset
	15	SON	Servo ON command	SON	Servo ON Command
MSCON output →PLC input	0	PE0	Position 0 complete	LS0	Retrieval to the Edge Commands 0
	1	PE1	Position 1 complete	LS1	Retrieval to the Edge Commands 1
	2	PE2	Position 2 complete	LS2	Retrieval to the Edge Commands 2
	3	PE3	Position 3 complete	–	Unavailable
	4	PE4	Position 4 complete	–	
	5	PE5	Position 5 complete	–	
	6	PE6	Position 6 complete	–	
	7	ZONE1	Zone 1	ZONE1	Zone 1
	8	PZONE/ ZONE2	Position zone/ Zone 2	PZONE/ ZONE2	Position zone/ Zone 2
	9	–	Unavailable	–	Unavailable
	10	HEND	Home return completion	HEND	Home return completion
	11	PEND	Positioning completion signal	–	Unavailable
	12	SV	Operation preparation end	SV	Operation preparation end
	13	*EMGS	Emergency stop	*EMGS	Emergency stop
	14	*ALM	Alarm	*ALM	Alarm
	15	*BALM	Absolute battery voltage drop alarm	*BALM	Absolute battery voltage drop alarm

(Note): "*" in codes above shows the signal of the active low.

3.4.11 About Commands (Position Data Read/Write and Alarm Axis Read)

By sending a specific code to a specific address, the position data reading and writing, and the reading of the axis number that an alarm was issued and the alarm code can be performed.

> Caution: • The command cannot be used in MECHATROLINK.
> • It is not necessary to use commands in Simple Indication Mode because no position data is to be used in it.

Shown below is the table to indicate the assignment of each signal.

(1) PLC Address Composition

(n is PLC input and output top address.)

PLC→MSCON (PLC Output)		MSCON→PLC (PLC Input)	
Demand Command	n+2	Response Command	n+2
Data 0	n+3	Data 0	n+3
Data 1	n+4	Data 1	n+4
Data 2	n+5	Data 2	n+5
Data 3	n+6	Data 3	n+6

[Refer to Section 3.4.2 for the address maps for each Fieldbus.]

(2) Demand Command List

Class	Code	Description
Handshaking	0000_H	Demand command cleared
Write Position Data	1000_H	Writing of target position
	1001_H	Writing of pressing width
	1002_H	Writing of speed
	1003_H	Unavaillable
	1004_H	
	1005_H	Writing of acceleration
	1006_H	Writing of deceleration
	1007_H	Writing current limit at pressing
	1008_H	Unavaillable
Read Position Data	1040_H	Reading of target position
	1041_H	Reading of pressing width
	1042_H	Reading of speed
	1043_H	Unavaillable
	1044_H	
	1045_H	Reading of acceleration
	1046_H	Reading of deceleration
	1047_H	Reading of current limit at pressing
	1048_H	Unavaillable
Error Information Monitoring	4000_H	Acquiring alarm-issued axis
	4001_H	Acquiring alarm code

(3) Details of Commands

The input and output signals are consist of 5 words for each input and output data register.

- For the target position and current position, 2-word (32-bit) binary data is available and values from -999999 to +999999 (unit: 0.01mm) can be used. Negative numbers are to be dealt with two's complement.
- Binary data of 2-word (32-bit) for the pressing band and values from 1 to +999999 (unit: 0.01mm) in PLC can be used.

⚠ Caution: Set the position data of the actuator, such as the target position and positioning width, in the range of the soft stroke (0 to effective stroke length).

- Binary data of 2-word (32-bit) for the speed and values from 1 to +999999 (unit: 0.1mm/s) in PLC can be used. A change of the unit is to be conducted on Gateway Parameter Setting Tool.
- The Acceleration and Deceleration are expressed using 1-word (16-bit) binary data. The figures from 1 to 300 (unit: 0.01G) can be set in PLC.
- The pressing current limit value is expressed using 1-word (16-bit) binary data. The figures from 0 (0%) to 255 (100%) can be set in PLC.
- Binary data of 1-word (16-bit) for the axis numbers and values from 0 (1st Axis) to 3 (4th Axis) in PLC can be used.
- Binary data of 1-word (16-bit) for the position numbers and values from 0 (No.0) to 255 (No.255) in PLC can be used.
- The alarm code is expressed using 1-word (16-bit) binary data.

⚠ Caution: Have the setting with values available in the range of for speed, acceleration/deceleration and pressing current of the actuator. (Refer to the catalog or instruction manual of the actuator.) Otherwise, it may cause an abnormal condition of the servo or a malfunction of the actuator such as the alarm codes 0A3 "Position Command Information Data Error", 0C0 "Excess Actual Speed", 0C8 "Overcurrent", 0CA "Overheated" or 0E0 "Overloaded".

1) Demand command cleared
PLC Output (Address n is the input and output top address for MSCON Gateway Unit.)
(Note) Response command does not return.

1 word=16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Demand Command Cleared	n+2 Demand Command [0000h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+3 Data 0 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+4 Data 1 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2) Writing of Target Position
PLC Output (Address n is the input and output top address for MSCON Gateway Unit.)
(Note) If the writing is finished in normal condition, the same content as the demand command is returned to the response command.
If an error is generated, an error response is returned. [Refer to this Section 15).]

1 word=16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Writing of Target Position	n+2 Demand Command [1000h]	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	n+3 Data 0 [Position No.]	-	-	-	-	-	-	-	-	128	64	32	16	8	4	2	1
	n+4 Data 1 [Target Position (Lower word)]																
	n+5 Data 2 [Target Position (Upper word)]																
	n+6 Data 3 [Axis No.]	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2	1

3) Writing of Positioning Width
PLC Output (Address n is the input and output top address for MSCON Gateway Unit.)
(Note) If the writing is finished in normal condition, the same content as the demand command is returned to the response command. If an error is generated, an error response is returned. [Refer to this Section 15).]

1 word=16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Writing of Pressing Width	n+2 Demand Command [1001h]	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
	n+3 Data 0 [Position No.]	-	-	-	-	-	-	-	-	128	64	32	16	8	4	2	1
	n+4 Data 1 [Pressing Width (Lower word)]																
	n+5 Data 2 [Pressing Width (Upper word)]																
	n+6 Data 3 [Axis No.]	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2	1

4) Writing of Speed
PLC Output (Address n is the input and output top address for MSCON Gateway Unit.)
(Note) If the writing is finished in normal condition, the same content as the demand command is returned to the response command. If an error is generated, an error response is returned. [Refer to this Section 15).]

1 word=16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Writing of Speed	n+2 Demand Command [1002h]	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
	n+3 Data 0 [Position No.]	-	-	-	-	-	-	-	-	128	64	32	16	8	4	2	1
	n+4 Data 1 [Speed (Lower word)]	32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1
	n+5 Data 2 [Speed (Upper word)]	-	-	-	-	-	-	-	-	-	-	-	-	524288	262144	131072	65536
	n+6 Data 3 [Axis No.]	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2	1

5) Writing of Acceleration

PLC Output (Address n is the input and output top address for MSCON Gateway Unit.)

(Note) If the writing is finished in normal condition, the same content as the demand command is returned to the response command. If an error is generated, an error response is returned. [Refer to this Section 16).]

1 word=16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Writing of Acceleration	n+2 Demand Command [1005h]	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1
	n+3 Data 0 [Position No.]	-	-	-	-	-	-	-	-	128	64	32	16	8	4	2	1
	n+4 Data 1 [Acceleration]	-	-	-	-	-	-	-	256	128	64	32	16	8	4	2	1
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2	1

6) Writing of Deceleration

PLC Output (Address n is the input and output top address for MSCON Gateway Unit.)

(Note) If the writing is finished in normal condition, the same content as the demand command is returned to the response command. If an error is generated, an error response is returned. [Refer to this Section 16).]

1 word=16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Writing of Deceleration	n+2 Demand Command [1006h]	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0
	n+3 Data 0 [Position No.]	-	-	-	-	-	-	-	-	128	64	32	16	8	4	2	1
	n+4 Data 1 [Deceleration]	-	-	-	-	-	-	-	256	128	64	32	16	8	4	2	1
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2	1

7) Writing of Pressing Current Limit
PLC Output (Address n is the input and output top address for MSCON Gateway Unit.)
(Note) If the writing is finished in normal condition, the same content as the demand command is returned to the response command. If an error is generated, an error response is returned. [Refer to this Section 16).]

1 word=16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Writing of Pressing Current Limit	n+2 Demand Command [1007h]	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1
	n+3 Data 0 [Position No.]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+4 Data 1 [Pressing Current Limit]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

8) Reading of Target Position
PLC Output (Address n is the input and output top address for MSCON Gateway Unit.)

1 word=16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Target Position	n+2 Demand Command [1040h]	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0
	n+3 Data 0 [Position No.]	-	-	-	-	-	-	-	-	128	64	32	16	8	4	2	1
	n+4 Data 1 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2	1

PLC Input (Address n is the input and output top address for MSCON Gateway Unit.)

1 word=16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Target Position	n+2 Response Command [1040h]	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0
	n+3 Data 0 [Position No.]	-	-	-	-	-	-	-	-	128	64	32	16	8	4	2	1
	n+4 Data 1 [Target Position (Lower word)]																
	n+5 Data 2 [Target Position (Upper word)]																
	n+6 Data 3 [Axis No.]	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2	1

9) Reading of Pressing Width
PLC Output (Address n is the input and output top address for MSCON Gateway Unit.)

1 word=16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Pressing Width	n+2 Demand Command [1041h]	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1
	n+3 Data 0 [Position No.]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+4 Data 1 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

PLC Input (Address n is the input and output top address for MSCON Gateway Unit.)

1 word=16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Pressing Width	n+2 Response Command [1041h]	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1
	n+3 Data 0 [Position No.]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+4 Data 1 [Pressing Width (Lower word)]																
	n+5 Data 2 [Pressing Width (Upper word)]																
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

10) Reading of Speed
PLC Output (Address n is the input and output top address for MSCON Gateway Unit.)

1 word=16 bit

	Bit / Address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Speed	n+2 Demand Command [1042h]	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0
	n+3 Data 0 [Position No.]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+4 Data 1 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

PLC Input (Address n is the input and output top address for MSCON Gateway Unit.)

1 word=16 bit

	Bit / Address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Speed	n+2 Response Command [1042h]	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0
	n+3 Data 0 [Position No.]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+4 Data 1 [Speed (Lower word)]	32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1
	n+5 Data 2 [Speed (Upper word)]	–	–	–	–	–	–	–	–	–	–	–	–	524288	262144	131072	65536
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

11) Reading of Acceleration
PLC Output (Address n is the input and output top address for MSCON Gateway Unit.)

1 word=16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Acceleration	n+2 Demand Command [1045h]	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	1
	n+3 Data 0 [Position No.]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+4 Data 1 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

PLC Input (Address n is the input and output top address for MSCON Gateway Unit.)

1 word=16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Acceleration	n+2 Response Command [1045h]	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	1
	n+3 Data 0 [Position No.]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+4 Data 1 [Acceleration]	–	–	–	–	–	–	–	256	128	64	32	16	8	4	2	1
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

12) Reading of Deceleration
PLC Output (Address n is the input and output top address for MSCON Gateway Unit.)

1 word=16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Deceleration	n+2 Demand Command [1046h]	0	0	0	1	0	0	0	0	0	1	0	0	0	1	1	0
	n+3 Data 0 [Position No.]	-	-	-	-	-	-	-	-	128	64	32	16	8	4	2	1
	n+4 Data 1 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2	1

PLC Input (Address n is the input and output top address for MSCON Gateway Unit.)

1 word=16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Deceleration	n+2 Response Command [1046h]	0	0	0	1	0	0	0	0	0	1	0	0	0	1	1	0
	n+3 Data 0 [Position No.]	-	-	-	-	-	-	-	-	128	64	32	16	8	4	2	1
	n+4 Data 1 [Deceleration]	-	-	-	-	-	-	-	256	128	64	32	16	8	4	2	1
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2	1

13) Reading of Pressing Current Limit
PLC Output (Address n is the input and output top address for MSCON Gateway Unit.)

1 word=16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Pressing Current Limit	n+2 Demand Command [1047h]	0	0	0	1	0	0	0	0	0	1	0	0	0	1	1	1
	n+3 Data 0 [Position No.]	-	-	-	-	-	-	-	-	128	64	32	16	8	4	2	1
	n+4 Data 1 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2	1

PLC Input (Address n is the input and output top address for MSCON Gateway Unit.)

1 word=16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Pressing Current Limit	n+2 Response Command [1047h]	0	0	0	1	0	0	0	0	0	1	0	0	0	1	1	1
	n+3 Data 0 [Position No.]	-	-	-	-	-	-	-	-	128	64	32	16	8	4	2	1
	n+4 Data 1 [Pressing Current Limit]	-	-	-	-	-	-	-	-	128	64	32	16	8	4	2	1
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2	1

14) Reading of Alarm-issued Axis Number

PLC Output (Address n is the input and output top address for MSCON Gateway Unit.)

(Note) If this command is sent, the response command updates with the latest information until the demand command clear is sent.

1 word=16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Alarm-issued Axis Number	n+2 Demand Command [4000h]	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+3 Data 0 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+4 Data 1 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PLC Input (Address n is the input and output top address for MSCON Gateway Unit.)

1 word=16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Alarm-issued Axis Number	n+2 Response Command [4000h]	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+3 Data 0 [0]	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
	n+4 Data 1 [Alarm-issued Axis Number] 1: Alarm 2: Normal	I	I	I	I	I	I	I	I	I	I	Status of 5th Axis	Status of 4th Axis	Status of 3rd Axis	Status of 2nd Axis	Status of 1st Axis	Status of 0th Axis
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

15) Reading of Alarm Code

PLC Output (Address n is the input and output top address for MSCON Gateway Unit.)

(Note) If this command is sent, the response command updates with the latest information until the demand command clear is sent.

1 word=16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Alarm Code	n+2 Demand Command [4001h]	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	n+3 Data 0 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+4 Data 1 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

PLC Input (Address n is the input and output top address for MSCON Gateway Unit.)

1 word=16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Alarm Code	n+2 Response Command [4001h]	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	n+3 Data 0 [0]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+4 Data 1 [Alarm Code]																
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

16) Error Response Command
PLC Output (Address n is the input and output top address for MSCON Gateway Unit.)
In the case that the command did not complete in normal condition, this error response command is returned.

1 word=16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Error Response Command	n+2 Demand Command	1	The values are those with the bit 15 of the demand command code being 1.														
	n+3 Data 0 [Undefined]	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
	n+4 Data 1 [Error Detail]	0101_H: Incorrect Axis Number 0102_H: Incorrect Position Number 0103_H: Incorrect Command 0201_H: Communication Error 0202_H: Controller Execution Impossible															
	n+5 Data 2 [Undefined]	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
	n+6 Data 3 [Undefined]	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I

3.5 Input and Output Signal Process for Field Network

(1) I/O Signal Timings

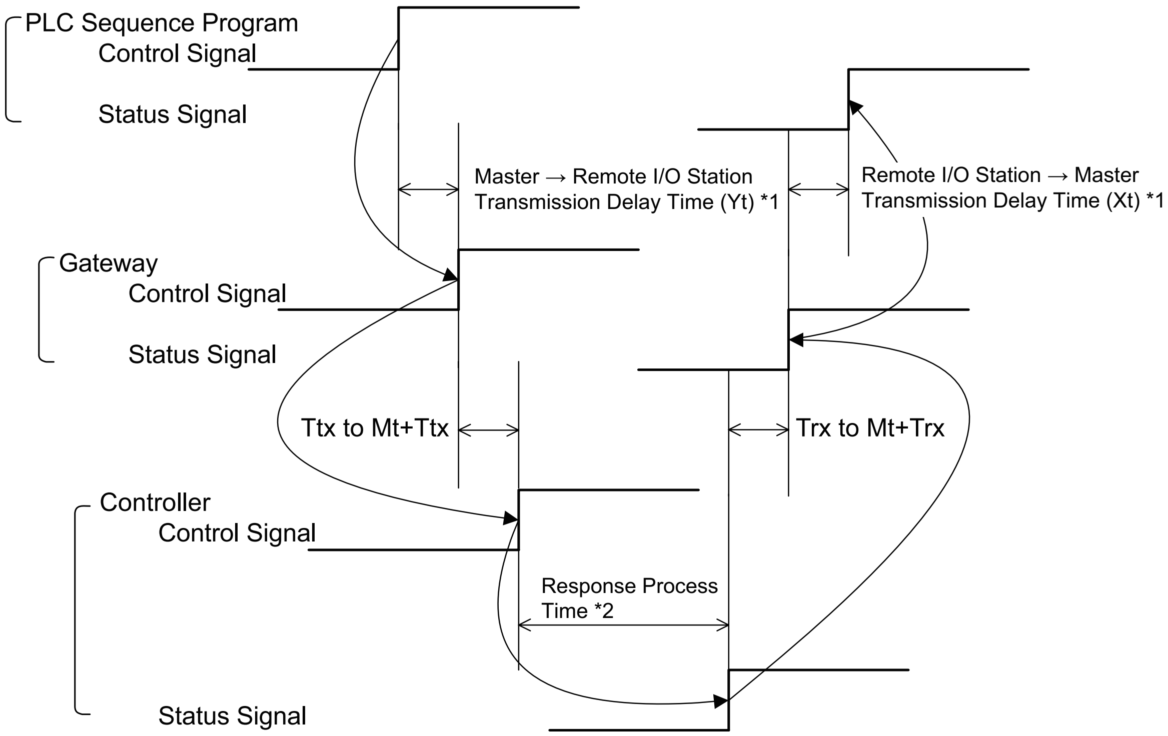
When any of the control signal is turned ON to perform the operation of the robot cylinder using the PLC's sequence program, the response (status) is returned to the PLC. The maximum response time is expressed using the following formula.
The value is constant regardless the number of composition axes.

Max. response time (msec.) = Yt + Xt +(3 × Mt) + Response process time (operation time, etc.)

Yt : Master Station → Slave Transmission Delay Time
Xt : Slave → Master Station Transmission Delay Time
(Yt and Xt: Field Network Transmission Delay Time)

Mt = MSCON internal communication sending time (Ttx) + MSCON internal communication receiving time (Trx)

Refer to the instruction manual of the mounted PLC for the master station → slave transfer delay time (Yt) and the slave → master station transfer delay time (Xt).



*1 Refer to PLC Manual
*2 Varies depending on the content of control

Mt = max.10ms
(data being processed at once for six axes)

(2) Command Sending and Receiving Timing (Reading and Writing of Position Data and Reading of Alarm Axis)

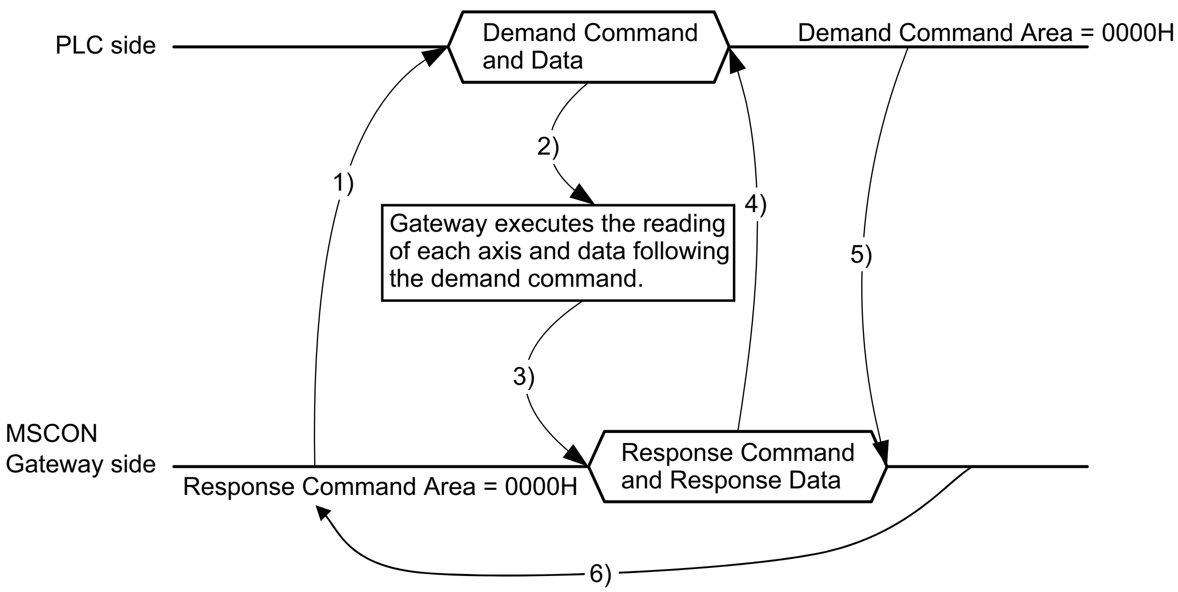
By writing and reading the specified commands to the area of 5-word next to Gateway control/status area, reading and writing of the position data and reading of alarm axis can be conducted.

Gateway executes the demand command ever time the control/status data exchange finishes for all the axes. [Refer to Section 3.4.11 About Command.]

● Step

1) PLC confirms the area of response command is 0.
2) PLC sets the necessary demand commands and data to the indicated area and send them.
3) Gateway detects that the area of the demand command has become other than 0, and rewrites the appropriate axis data if it is the writing command, and reads the requirement data from the appropriate axis if reading command.
4) Gateway output the response result to PLC once the command is executed.
5) Once PLC has confirmed the response result, clear the area for the demand command to 0.
6) Gateway clears the response command area to 0 and waits for the next command after it detects the demand command is cleared.

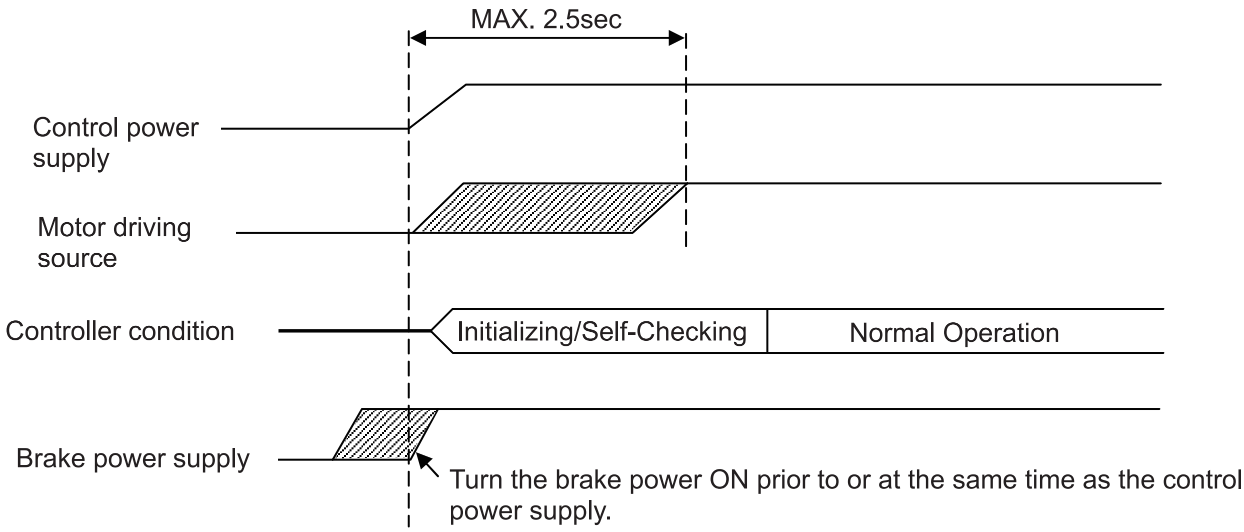
The procedures from 1) to 6) are repeated when continuously used.



3.6 Power Supply and Cutoff

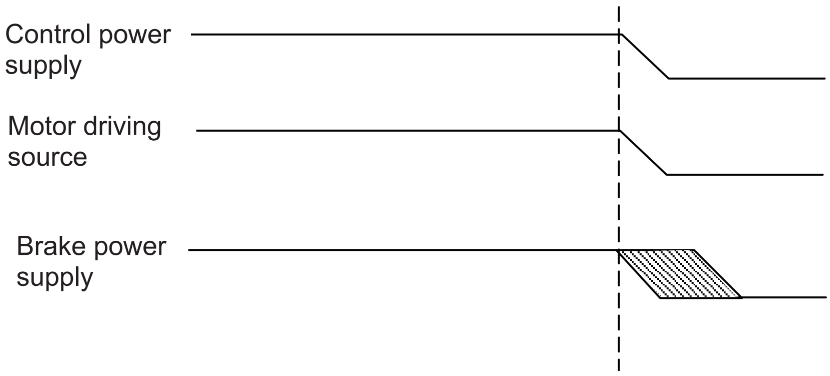
(1) Timing for Supplying Power

Turn ON the control power and motor driving source at the same time.
If a brake-equipped actuator is connected, put the brake power on prior to the control power or turn it ON at the same time.
If the motor power is not turned ON within 2.5sec after the control power supply is turned ON with the emergency stop being released, 0D3 Motor Power Supply Voltage Drop Error would be issued.
In case the motor power cannot be turned on within 2.5sec, turn ON the motor power under the condition of emergency stop, and then cancel the emergency stop.



(2) Timing for Power Cutoff

Cut off the control power and motor power supplies at the same time.
Cut the brake power OFF at the same time as the controller power supply or after shutting the controller power down.



(3) Power supply status LED

The conditions of the control power and motor driving source can be checked on the power supply status LEDs in the front panel.

○: Illuminating, ×: OFF

Name	Status	Display Color	Description
CHARGE	○	Red	Turned ON when motor driving source is ON (Keeps ON even if the driving source is turned OFF as long as an electric charge is remained)
	×	–	Motor driving source OFF
PWR	○	Green	Control power source operating in normal condition
	○	Orange	Control power source error (Turns ON when overvoltage is applied or internal overcurrent is detected) Condition remained until power shut down
	×	–	Control power supply OFF

⚠ Warning (Electric Shock Caution)
Do not touch the terminals for motor power input connector and motor connector while it is ON. You may get an electric shock in case the electric charge is still remained in the capacitor even after the driving source is turned OFF.

3.7 Control and functions of Input and output signals of Modes other than Remote I/O Mode

Input and output signals are prepared for each axis number.
The applicable bit is "1" when the signal is ON and "0" when it is OFF.

(1) Controller ready (CRDY) PLC Input Signal

Operation Mode	Positioner 1	Simple Direct	Direct numeric specification	Direct numeric specification 2	Positioner 2	Positioner 3
○ : Equipped × : Not equipped	○	○	○	○	○	×

Regardless of the alarm or servo conditions, when the MSCON initialization is completed normally after the power injection and the controller can control the system, it is turned ON. Even in the alarm condition, when the MSCON can control the system, it is turned ON.

(2) Emergency stop (EMGS) PLC Input Signal

Operation Mode	Positioner 1	Simple Direct	Direct numeric specification	Direct numeric specification 2	Positioner 2	Positioner 3
○ : Equipped × : Not equipped	○	○	○	○	○	○

When the controller is stopped in an emergency (motor driving power is cut off), it is turned ON.
When the emergency stop status is cleared, it is turned OFF.
Also, ALM* in the driver status LEDs flashes.
Have an appropriate safety treatment such as interlock with this signal for the host controller.
(Note) It is not an emergency stop output due to an alarm generation of the controller.

(3) Alarm (ALM) PLC Input Signal

Operation Mode	Positioner 1	Simple Direct	Direct numeric specification	Direct numeric specification 2	Positioner 2	Positioner 3
○ : Equipped × : Not equipped	○	○	○	○	○	○

This is a signal that is OFF in normal condition and turns ON when an alarm of operation cancelled level (Note 1) or higher is generated. This signal turns OFF once the reset (RES) signal is turned oON while an alarm of operation cancelled level is being generated. (In the case of the alarm with the cold start level, re-injection of the power is required.)
Also, ALM* in the driver status LEDs flashes.
Note 1: Refer to 8.4 Alarm List for details of alarms.

(4) Reset (RES) PLC Output Signal

Operation Mode	Positioner 1	Simple Direct	Direct numeric specification	Direct numeric specification 2	Positioner 2	Positioner 3
○ : Equipped × : Not equipped	○	○	○	○	○	○

The reset signal RES possesses two functions, one is an alarm reset while an alarm is being generated, and the other is to cancel the operation while in a pause.

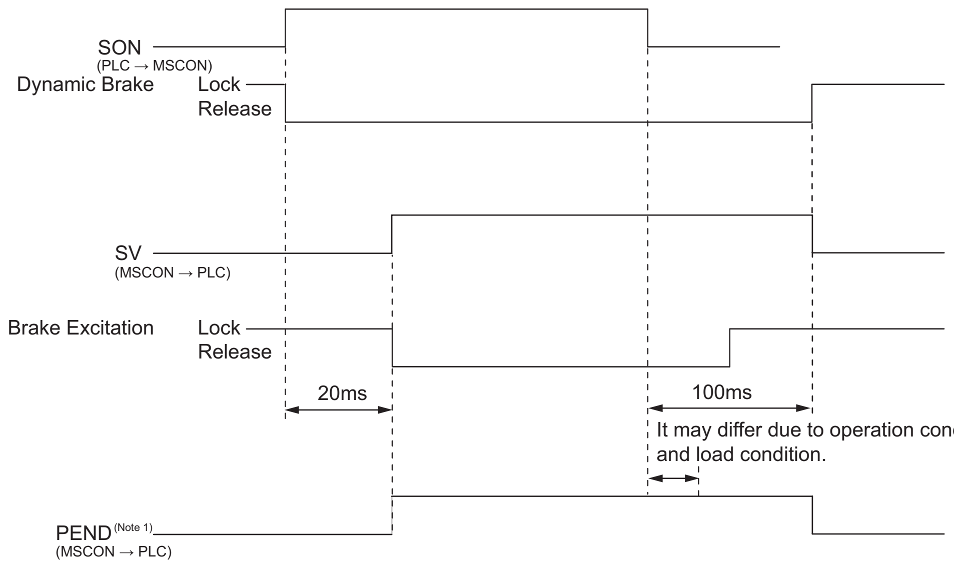
1) Once this signal is turned ON while an alarm of operation cancelled level is being generated, the alarm is cancelled. (In the case of the alarm with the cold start level, re-injection of the power is required.) Confirm the cause of the alarm and remove it before conducting a reset of the alarm. Having the alarm reset repeatedly without removing the cause of the alarm to restart the operation may cause a critical malfunction such as motor burn-down.
2) When this signal is turned ON from OFF condition during the pause condition, the reminder of the planned movement left can be cancelled and the remained operation can be deleted.

(5) Servo ON command (SON) PLC Output Signal
Operation ready (SV) PLC Input Signal
Positioning complete (PEND) PLC Input Signal

Operation Mode	Positioner 1	Simple Direct	Direct numeric specification	Direct numeric specification 2	Positioner 2	Positioner 3
○ : Equipped × : Not equipped	○	○	○	○	○	○

Servo ON command SON is the input signal making the servo motor of the actuator operable.

1) Once the Servo ON is executed and the operation comes available, Operation Ready SV starts turned ON. The positioning complete signal PEND turns ON at the same time. Also, the axis status LED (SV) on the front panel corresponding for the axis number turns ON in green.
2) With the power being supplied, then controller cannot be operated while the SV signal remains OFF. If SON Signal is turned OFF during the actuator operation, the actuator decelerates and stops with the emergency stop torque, servo turns OFF, and the motor goes into the free-run condition. The brake (option) is of release-in-excitation type. Therefore, the brake gets released when excitation is ON and the brake works (locks) when excitation is OFF.

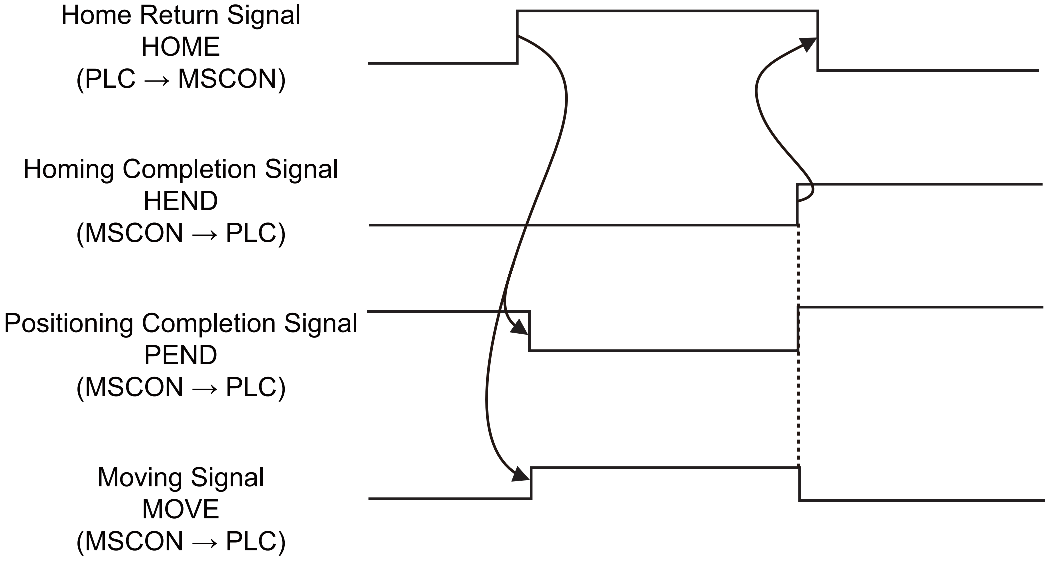


Note 1: PEND would not turn ON in the pause condition.

(6) Home return (HOME) PLC Output Signal
Home return completion (HEND) PLC Input Signal
Moving (MOVE) PLC Input Signal
Positioning complete (PEND) PLC Input Signal

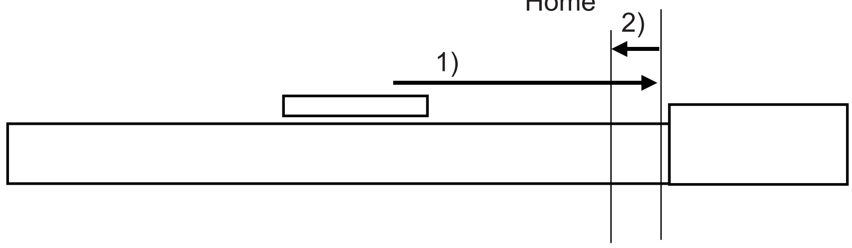
Operation Mode	Positioner 1	Simple Direct	Direct numeric specification	Direct numeric specification 2	Positioner 2	Positioner 3
○ : Equipped × : Not equipped	○	○	○	○	○	○

HOME Signal is a signal to conduct an automatic home-return operation.
Once HOME Signal is turned ON, this signal is processed as a rise (ON-edge), and the actuator starts home-return operation. Once the home-return operation is completed, the home-return operation complete signal HEND turns ON. The home return complete signal HEND is kept ON unless the home position is lost. The positioning complete signal PEND turns OFF and the moving signal MOVE turns ON during a home-return operation.



⚠ Caution: If an actuator of Incremental Type is connected, and in Position * Mode and Simple Direct Mode, when the positioning command is issued without performing the home-return operation after the power is turned ON, the positioning can be performed once only after the automatic home-return operation is executed.
Exercise caution that <u>in the derect indication mode</u>, issuing a positioning command to a given position following the power ON, without performing a home return first, <u>will generate an alarm "Error Code 83: ALARM HOME ABS (absolute position move command when home return is not yet completed)" (operation-reset alarm)</u>.

[Operation of Slider Type/Rod Type Actuator]

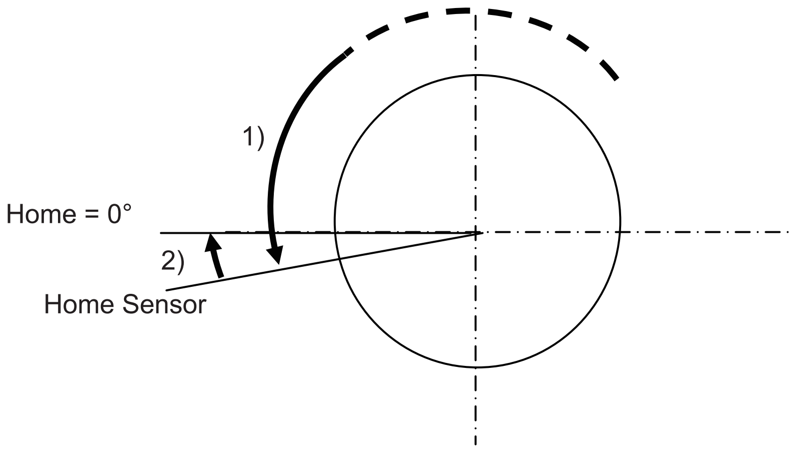


1) With the HOME signal being ON, the actuator moves toward the mechanical end at the home return speed.
   The speed for most of the actuators is 20mm/s, however, for some actuators it is less than 20mm/s. Refer to the instruction manual of each actuator.
2) The actuator is turned at the mechanical end and stopped at the home position.The movement amount (Note1) in this process follows the setting in Parameter No. 22 "Home return offset level". (Note1)

⚠Caution:	In the home reverse specification, the actuator moves in the reverse direction. Make sure to refer to Section 7.2 [12] when a change to Parameter No.22 "Home Return Offset Level" is required.

(Note1) It moves for the offset amount after the encoder Z-phase is detected.

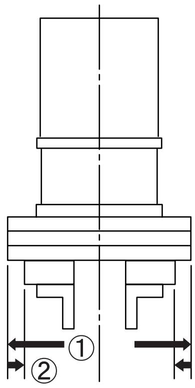
[Operation of Rotary Actuator]



1) By HOME Signal being ON, the rotary part turns in CCW (counterclockwise) from the view of load side. The velocity is either 20deg/s or 5deg/s. (It depends on the setting of each actuator.)
2) At the home sensor input, the actuator is turned in the reverse direction and stopped at the home position. The amount of movement at this time is that set in Parameter No.22 "Home-Return Offset" after Z-phase is detected.

⚠Caution:	Make sure to refer to Section 7.2 [12] when a change to Parameter No.22 "Home Return Offset Level" is required.

[For Gripper Type]



1) If the HOME signal is turned ON, the actuator moves toward the mechanical end at the home return speed (20mm/s).
2) The actuator is turned at the mechanical end and stopped at the home position. The amount of movement at this time is that set in Parameter No.22 “Home-Return Offset” after Z-phase is detected.

⚠Caution:	Make sure to refer to Section 7.2 [12] when a change to Parameter No.22 “Home Return Offset Level” is required.

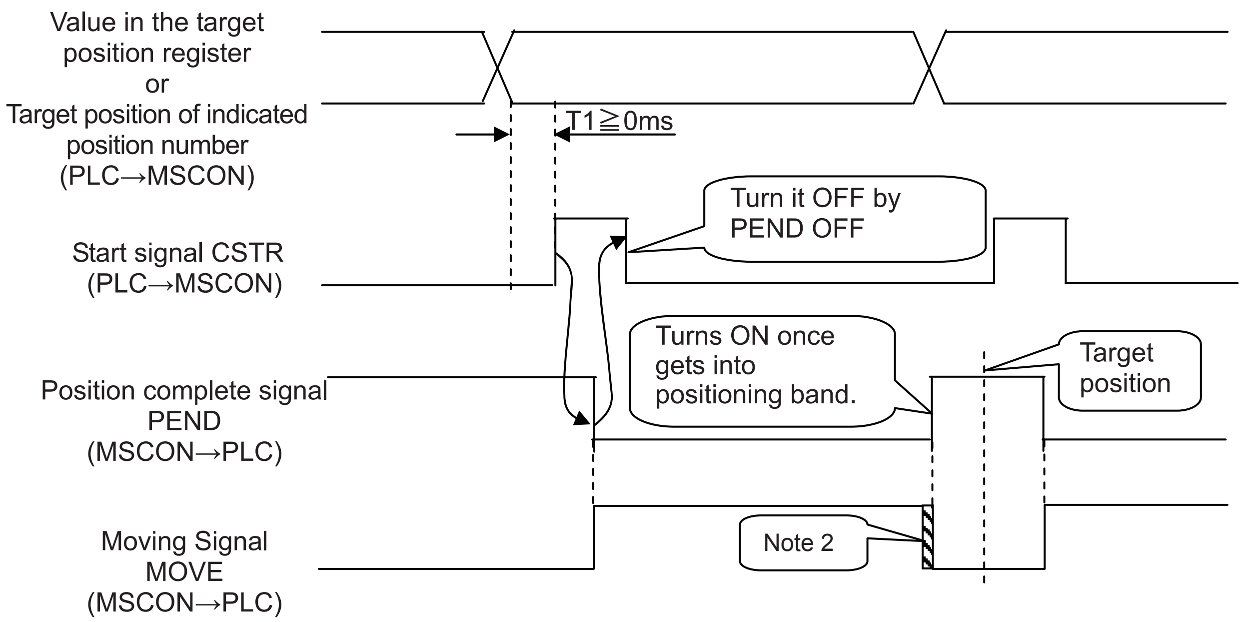
(7) Positioning start (CSTR) PLC Output Signal
Moving (MOVE) PLC Input Signal
Positioning complete (PEND) PLC Input Signal

Operation Mode	Positioner 1	Simple Direct	Direct numeric specification	Direct numeric specification 2	Positioner 2	Positioner 3
○ : Equipped × : Not equipped	○	○	○	○	○	○

This signal is processed at the startup (ON edge) and the positioning is performed to the target position with the specified position No. or set using the PLC's target position register.

1) Once the start signal CSTR is turned ON, the actuator starts to accelerate following the data in the specified position table to perform positioning at the target position.
2) Once the operation starts, the positioning complete signal PEND turns OFF. Turn OFF CSTR Signal. If CSTR Signal is not turned OFF, output of complete position number cannot be performed and the positioning complete signal would not turn ON when the positioning is complete.
3) Once the positioning is complete, the number of positioning complete position is output in the binary data by Complete Position No. PM1 to PM**, and the positioning complete signal PEND is turned ON at the same time.
4) The moving signal MOVE turns ON at the same time as the operation starts, and turns OFF once the positioning complete signal PEND turns ON or the movement command output completes.
5) The positioning complete signal PEND turns ON once the remaining movement gets into the range of the positioning band. PEND Signal will be kept ON once it is turned ON unless the start signal CSTR is turned back ON, servo is turned OFF (Note 1) or the actuator is out of the positioning band width range (Note 1).

Note 1: It can be switched over with Parameter No. 39.



Note 1: The complete position number output becomes 0 during a movement.
Note 2: MOVE turns ON at the same time as PEND turns OFF, and turns OFF once the command from a controller to the motor is finished. Therefore, when the positioning band setting is wide, the signal may turn OFF even in the actuator operation, and may turn OFF prior to PEND if the positioning band setting is narrow.

> ⚠Caution: When the servo-motor is turned OFF or stopped in an emergency while the actuator is stopped at the target position, the PEND signal is turned OFF temporarily.
> Then, when the servo-motor is turned ON and the actuator is within the positioning width, the PEND signal is turned ON again.
> When the positioning is completed with the CSTR signal turned ON, the PEND signal is not turned ON.

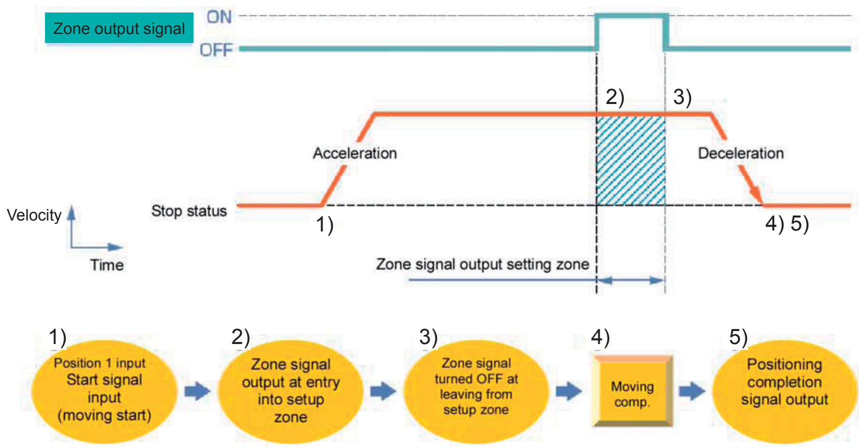
(8) Pause (STP) PLC Output Signal

Operation Mode	Positioner 1	Simple Direct	Direct numeric specification	Direct numeric specification 2	Positioner 2	Positioner 3
○ : Equipped × : Not equipped	○	○	○	○	○	○

When this signal is turned ON, the actuator movement is decelerated and stopped. When it is turned OFF, the actuator movement is restarted.
The acceleration in the operation restart or the deceleration in stopping operation, is expressed as the value for the acceleration/deceleration for the position No. set using the specified position No. resister in the Position* Mode and Simplified Direct Value Mode, and as the value set in the acceleration/deceleration register in the Derect indication mode.

(9) Zone 1 (ZONE1) PLC Input Signal
Zone 2 (ZONE2) PLC Input Signal
Position Zone (PZONE) PLC Input Signal

Operation Mode	Positioner 1	Simple Direct	Direct numeric specification	Direct numeric specification 2	Positioner 2	Positioner 3
○ : Equipped × : Not equipped	○	○	△ (No PZONE)	△ (No PZONE)	○	△ (Only for PZONE1)



This is a function enables to turn a signal on while the actuator is passing a certain position (in the zone range) or during a stop, in which there are two types.

1) Zone signal (ZONE1, ZONE2)·· Turn the output on at a position set in the parameter.
2) Position zone signal (PZONE)·· Turn the output on at a position set in the position table.

The roles of a sensor, such as the judgment of complete position at pressing complete, continuous operation range setting for the pitch feed or operation interlock of other devices in the setting range, can be made available.

(1) Zone signal (ZONE1, ZONE2)
Set the zone range to the parameter.
1) ZONE1: Parameter No.1 (Zone boundary 1+), Parameter No.2 (Zone boundary 1-)
2) ZONE2: Parameter No.23 (Zone boundary 2+), Parameter No.24 (Zone boundary 2-)

The zone signal is kept effective also during the emergency stop unless the memory of the origin is lost due to alarm.

(2) Position zone signal (PZONE)

No.	Position [mm]	Velocity [mm/s]	Accele-ration [G]	Decele-ration [G]	Pressing [%]	Thresh-old [%]	Positioning width [mm]	Zone+ [mm]	Zone- [mm]	Acceleration/ Deceleration mode	Incre-mental	Gain set	Stop mode
0													
1	0.00	250.00	0.20	0.20	0	0	0.10	50.00	30.00	0	0	0	0
2	100.00	250.00	0.20	0.20	0	0	0.10	70.00	60.00	0	0	0	0
3	50.00	250.00	0.20	0.20	50	0	20.00	60.00	65.00	0	0	0	0

Setting of zone range

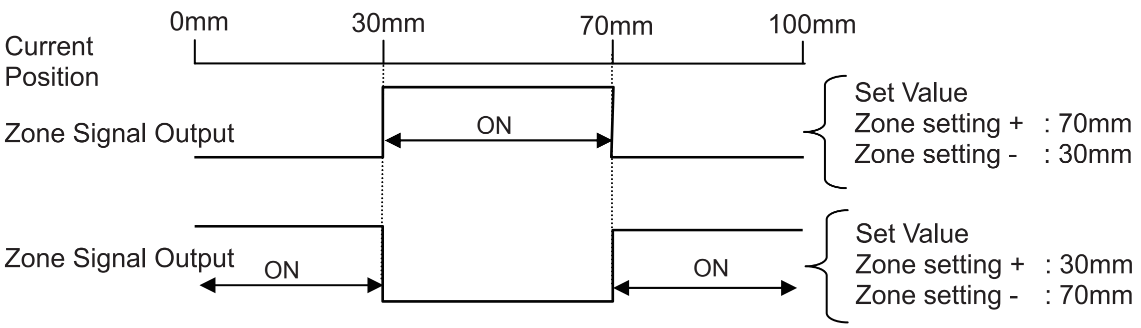
Set the zone range to the position table.
This set value becomes valid while the position number set in the zone range is executed. It is kept effective also during the emergency stop unless the actuator is operated or the memory of the origin is lost due to alarm.

(3) Output Ranges of Set Values and Signals
The zone output range differs depending on the difference of the values set in the zone positive side and negative side.

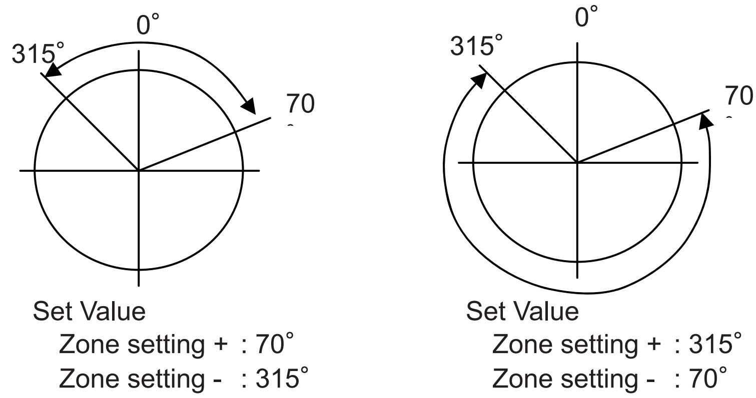
1) · Value set for positive side > value set for negative side:
Output signal turn ON in the range from the value on negative side to that on positive side, and turns OFF out of the range

2) · Value set for positive side < value set for negative side:
Output signal turn OFF in the range from the value on positive side to that on negative side, and turns ON out of the range

[Example of Line Axis]



[Example of rotary actuator of multi-rotation specification in index mode]



⚠ Caution: Since this signal becomes effective after the coordinate system is established after the home return is completed, it would not be output just with the power turned ON.

(10) + Jog (JOG+) PLC Output Signal
- Jog (JOG-) PLC Output Signal

Operation Mode	Positioner 1	Simple Direct	Direct numeric specification	Direct numeric specification 2	Positioner 2	Positioner 3
○ : Equipped × : Not equipped	○	○	○	×	○	×

This signal is the command for the jog operation startup or inching operation startup.
If a + command is issued, the actuator will operate in the direction opposite home. When a - command is issued, the actuator will operate in the direction of home.

1) Jog operation
Jog operation can be performed when the jog/inch switching (JISL) signal is OFF.
While the "JOG+" is turned ON, the movement direction is to the opposite of the home and when it is turned OFF, the actuator is decelerated and stopped.
While the "JOG-" is ON, the actuator will operate in the direction of home and when it is turned OFF, it is decelerated to a stop.
The operation is performed based on the set values of the following parameters.

- The speed is based on the parameter value ON/OFF specified using the Jog Speed/Inching Distance Change-Over (JVEL) signal.
  If the JVEL signal is OFF, the actuator operates according to parameter No.26, "PIO jog speed".
  If the JVEL signal is ON, the actuator operates according to parameter No.47, "PIO jog speed 2".
- The acceleration/deceleration conforms to the rate acceleration/deceleration (the specific value varies depending on the actuator).
- When both the JOG+ and JOG- signals are turned ON, the actuator is decelerated and stopped.

2) Inching (incremental) operation
The inching operation is available while the JISL signal is turned ON.
One time of ON input gives the actuator a constant amount of movement of the inching distance set in the parameter.
When the JOG+ is turned ON, the movement is to the opposite of the home and when the JOG- is turned ON, the movement is to the home.
The operation is performed based on the set values.

- The speed conforms to the value of the parameter ON/OFF specified by the JVEL signal.
  If the JVEL signal is OFF, the actuator operates according to parameter No.26, "PIO jog speed".
  If the JVEL signal is ON, the actuator operates according to parameter No.47, "PIO jog speed 2".
- The travel conforms to the value of the parameter ON/OFF specified by the JVEL signal.
  If the JVEL signal is OFF, the actuator operates according to parameter No.48, "PIO inch distance".
  If the JVEL signal is ON, the actuator operates according to parameter No.49, "PIO inch distance 2".
- The acceleration/deceleration conforms to the rate acceleration/deceleration (the specific value varies depending on the actuator).

During the normal operation, even when the "+" Jog Signal or "-" Jog Signal is turned ON, the normal operation is continued. (The Jog signal is ignored.)
In the pause condition, even when the "+" Jog Signal or "-" Jog Signal is turned ON, the actuator is not moved.

Note: Because the software stroke limit is disabled before the homing operation, the actuator might run against the mechanism end. Take the greatest care.

(11) Jog-speed/inch-distance switching (JVEL) PLC Output Signal

Operation Mode	Positioner 1	Simple Direct	Direct numeric specification	Direct numeric specification 2	Positioner 2	Positioner 3
○ : Equipped × : Not equipped	○	○	○	×	○	×

It is a signal to switch the parameters to indicate the speed or inching (incremental) distance when in JOG operation and inching operation. Table below shows the relations.

JVEL signal	Jog operation : JISL=OFF	Inch operation : JISL=ON
OFF	Parameter No.26, "Jog speed"	Parameter No.26, "Jog speed" Parameter No.48, "Inch distance"
ON	Parameter No.47, "Jog speed 2"	Parameter No.47, "Jog speed 2" Parameter No.49, "Inch distance 2"

(12) Jog/inching switching (JISL) PLC Output Signal

Operation Mode	Positioner 1	Simple Direct	Direct numeric specification	Direct numeric specification 2	Positioner 2	Positioner 3
○ : Equipped × : Not equipped	○	○	○	×	○	×

This signal changes over the jog operation and the inching (incremental) operation.
JISL = OFF : Jog operation
JISL = ON : Inching operation
When the JISL signal is turned ON (for inching operation) during the jog operation, the actuator is decelerated and performs the inching operation.
When the JISL signal is turned OFF (jog) while the actuator is moving by inching, the actuator will complete the movement and then switch to the jog function.

		Jog operation	Inching operation
	JISL	OFF	ON
JVEL = OFF	Speed	Parameter No.26, "Jog speed"	Parameter No.26, "Jog speed"
	Movement distance	–	Parameter No.48, "Inch distance"
	Acceleration/ deceleration	Rated value (The specific value varies depending on the actuator.)	Rated value (The specific value varies depending on the actuator.)
JVEL = ON	Speed	Parameter No.47, "Jog speed 2"	Parameter No.47, "Jog speed 2"
	Movement distance	–	Parameter No.49, "Inch distance 2"
	Acceleration/ deceleration	Rated value (The specific value varies depending on the actuator.)	Rated value (The specific value varies depending on the actuator.)
Operation		When the JOG +/JOG – signal is ON.	Upon detection of the leading (ON edge) of the JOG +/JOG - signal.

(13) Teaching mode command (MODE) PLC Output Signal
Teaching mode signal (MODES) PLC Input Signal

Operation Mode	Positioner 1	Simple Direct	Direct numeric specification	Direct numeric specification 2	Positioner 2	Positioner 3
○ : Equipped × : Not equipped	○	×	×	×	○	×

When the MODE signal is turned ON, the normal operation mode is changed to the teaching mode.
When the mode is changed to the teaching mode, the MODES Signal is turned ON.
After confirming that the MODES signal is turned ON on the PLC side, start the teaching operation.
(Note): In order to change the normal operation mode to the teaching mode, the following conditions are required.

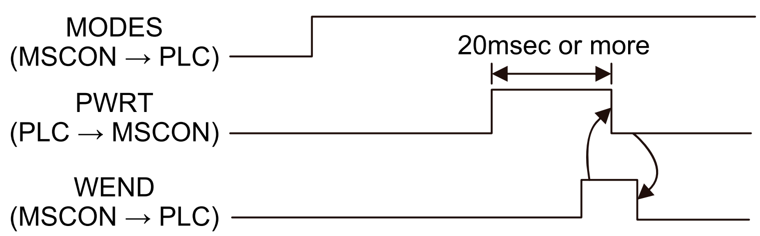
- The actuator operation (motor) is stopped.
- The + JOG (JOG+) signal and – JOG (JOG-) signal are turned OFF.
- The Position Data Import Command (PWRT) Signal and Positioning Start (CSTR) Signal are turned OFF.

(Note): When the PWRT signal is not turned OFF, the mode is not returned to the normal operation mode.

(14) Position data import command (PWRT) PLC Output Signal
Position data import complete (WEND) PLC Input Signal

Operation Mode	Positioner 1	Simple Direct	Direct numeric specification	Direct numeric specification 2	Positioner 2	Positioner 3
○ : Equipped × : Not equipped	○	×	×	×	○	×

The PWRT signal is available when the teaching mode signal (MODES) is turned ON.
Turn ON the PWRT signal (Note1), Then, the current position data will be written in the position data box for the position No. set using the PLC's specified Position No. channel. (Note2)
When the data writing is completed, the WEND signal is turned ON.
After the WEND signal is turned ON, turn OFF the PWRT signal in the host machine.
When the PWRT signal is turned OFF before the WEND signal is turned ON, the WEND signal is not turned ON.
When the PWRT signal is turned OFF the WEND signal is also turned OFF.
Note1: Turn it ON for 20msec or more. If the time is shorter than 20msec, the writing is not completed.
Note2: When the data items except for the position have not been defined, the parameter initial values are written. [Refer to Chapter 7 Parameter]



(15) Brake release (BKRL) PLC Output Signal

Operation Mode	Positioner 1	Simple Direct	Direct numeric specification	Direct numeric specification 2	Positioner 2	Positioner 3
○ : Equipped × : Not equipped	○	○	○	○	○	○

The brake can be released while BKRL signal is turned ON. For an actuator equipped with a brake, the brake can be controlled automatically with the ON/OFF of the servo, however, it may require to release the brake in such cases as when installing to the system or conducting Direct Teach [*1], when the slider or rod needs to be moved manually with hand. This operation also can be performed with the brake release switch on the controller front panel, or by supplying 24V to the brake power terminal on the control power connector.

*1 Direct Teaching: It is an operation to move the slider or rod manually with hand to read the coordinate to the position table.

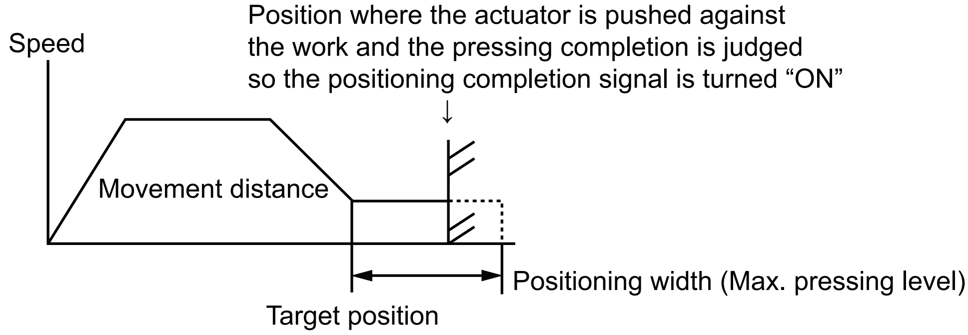
⚠ Warning: (1) Release the brake with a special care. Doing so carelessly may cause an injury or a malfunction of actuator, work piece or other devices due to a drop of the slider or rod.
(2) Make sure to put the setting back to activate the brake after releasing it. It is extremely dangerous to perform operation with the brake open. Drop of the slider or rod may cause injury or malfunction of actuator body, work piece or system.

(16) Push-motion specification (PUSH) PLC Output Signal

Operation Mode	Positioner 1	Simple Direct	Direct numeric specification	Direct numeric specification 2	Positioner 2	Positioner 3
○ : Equipped × : Not equipped	×	×	○	○	×	×

When the movement command signal is output after this signal is turned ON, the pressing operation is performed.
When this signal is set to OFF, the normal positioning operation is performed.

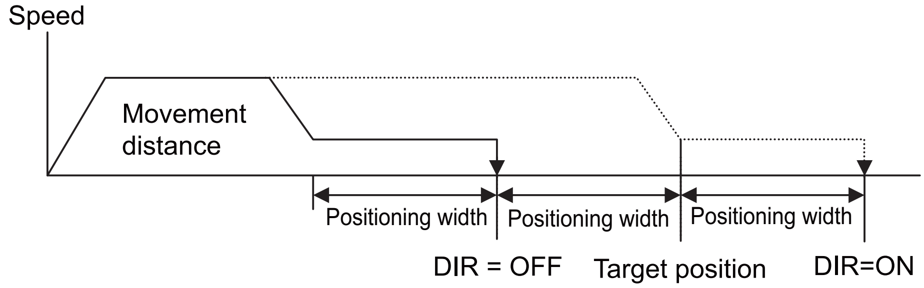
After reaching the target position (Note 1) from the current position, the actuator moves at the pressing speed for only the distance set in the positioning width.
The positioning complete signal (PEND) turns ON if the work piece hits and pressing is judged as completed while in the pressing operation.
Note 1: The value is that input in the target position register.



(17) Push direction specification (DIR) PLC Output Signal

Operation Mode	Positioner 1	Simple Direct	Direct numeric specification	Direct numeric specification 2	Positioner 2	Positioner 3
○ : Equipped × : Not equipped	×	×	○	○	×	×

This signal specifies the pressing direction.
When this signal is turned OFF, the pressing operation is performed to the direction of the value determined by adding the positioning width to the target position.
Pressing operation starts towards the position where the positioning width is added to the target position if this signal is turned ON.
When the normal positioning operatio, this signal is ineffective.



(18) Pressing and a miss (PSFL) PLC Input Signal

Operation Mode	Positioner 1	Simple Direct	Direct numeric specification	Direct numeric specification 2	Positioner 2	Positioner 3
○ : Equipped × : Not equipped	○	○	○	○	○	○

In the case that the pressing operation was performed, and the actuator moved the travel distance set in the controller position table positioning width or set using the PLC's positioning width register, but it was not pushed against the work, this signal is turned ON.

(19) Command complete signal (MEND) PLC Input Signal

Operation Mode	Positioner 1	Simple Direct	Direct numeric specification	Direct numeric specification 2	Positioner 2	Positioner 3
○ : Equipped × : Not equipped	○	○	○	○	○	×

This signal turns ON when the movement to the target position indicated by the host system is complete.
Even though the control is about the same as PEND, this signal turns ON even if pressing is missed.
It is OFF when servo is OFF or emergency stop is OFF. Also, if CSTR Signal is ON, this signal would not turn ON.

(20) Warning for Absolute Battery Voltage Drop (BALM) PLC Input Signal

Operation Mode	Positioner 1	Simple Direct	Direct numeric specification	Direct numeric specification 2	Positioner 2	Positioner 3
○ : Equipped × : Not equipped	○	○	○	○	○	×

1) This turns ON when the absolute battery voltage is in normal condition or the actuator is in incremental encoder type.
2) It turns OFF once the absolute battery voltage gets to 3.1V or less.
3) An alarm (Code 0EE: Absolute Encoder Error Detection 2) will be generated once the absolute battery voltage gets to 2.5V or less and the backup data cannot be retained.
4) It turns OFF if the motor temperature exceeds the value of this parameter when the overload caution load level ratio is set to a number other than 100% in Parameter No. 143. Lower the load level (by decreasing the acceleration speed level, etc.).

⚠ Warning: Making an operation with the backup data being lost may cause such accidents as an injury or malfunction of the actuator body, work piece or the whole system.
Replace the battery immediately if *BALM is turned off. [Refer to Section 6 Absolute Reset and Absolute battery] Use the dedicated battery (AB-5) for replacement.

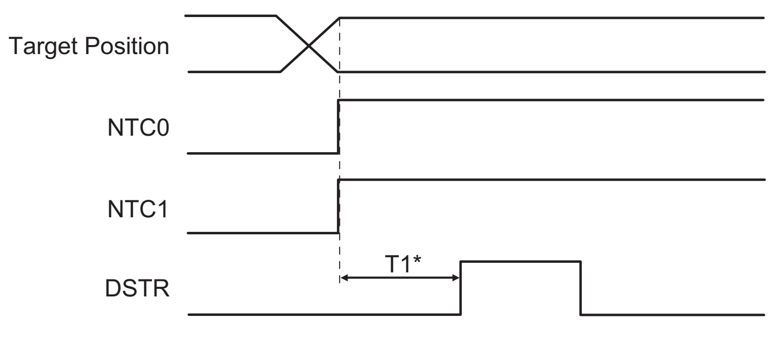
(21) Anti-Vibration Mode Select 0 and 1 (NTC0, NTC1) PLC Output Signal

Operation Mode	Positioner 1	Simple Direct	Direct numeric specification	Direct numeric specification 2	Positioner 2	Positioner 3
○ : Equipped × : Not equipped	×	×	×	○	×	×

Anti-vibration function controls the vibration of the load caused by IAI actuators.
Measure the frequency and set it to the parameter set. (3 types at maximum)
Select a registered parameter set with the combination of these signals.
[Refer to Chapter 4 Vibration Suppress Control Function for details.]

NTC1	NTC0	Function	Remarks
OFF	OFF	Anti-vibration control not to be used	Set in delivery
OFF	ON	Parameter Set 1 Select	
ON	OFF	Parameter Set 2 Select	
ON	ON	Parameter Set 3 Select	

Shown below is the timing for signal input.



*T1 : 0ms or more

⚠ Caution: To read the conditions of NTC0 and NTC1 signals when identifying the movement command (CSTR), the operation of NTC0 or NTC1 to turn ON/OFF while in movement will be ignored.

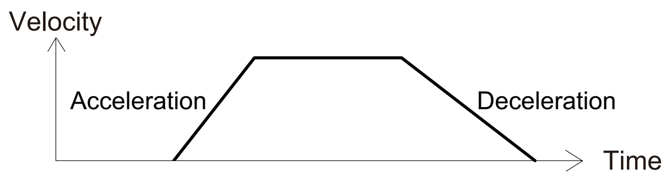
(22) Acceleration/deceleration mode (MOD1, MOD0) PLC Output Signal

Operation Mode	Positioner 1	Simple Direct	Direct numeric specification	Direct numeric specification 2	Positioner 2	Positioner 3
○ : Equipped × : Not equipped	×	×	×	○	×	×

This signal is used to select the acceleration/deceleration pattern characteristics. Select one of them before the actuator movement command.

MOD1	MOD0	Pattern name	Remarks
OFF	OFF	Trapezoid Pattern	Set in delivery
OFF	ON	S-shaped Motion	
ON	OFF	First-Order Lag Filter	
ON	ON	Unavailable	

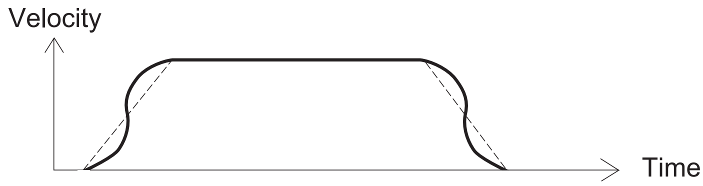
Trapezoid Pattern



(Note) The Acceleration and Deceleration are set in the “Acceleration” and “Deceleration” data boxes on the position data.

S-shaped Motion

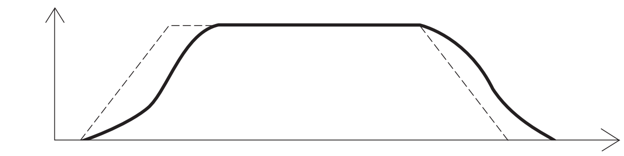
The S-shaped curve is described where at first in the acceleration, the line is gentle, but along the way, it suddenly becomes steep.
Use it in such application that setting the acceleration/deceleration rate high is desiredbecause high takt time is required, but in the movement start or immediately before stop, low acceleration/deceleration rate is favorable.



(Note) The S-shaped motion degree is set using the parameter No.56 “S-Shaped Motion Ratio Setting”. The setting unit is % and setting range is from “0” to “100”.
(The above figure shows the image graph with the Parameter No.56 set to “100”.)
When it is set to “0”, the S-shaped motion is disabled.
However, the setting is not reflected on the jog operation or inching operation performed using the personal computer or teaching pendant.

First-Order Lag Filter

This describes much gentle acceleration/deceleration curve than that for the linear acceleration/deceleration (trapezoid pattern).
Use it when it is not desired to give any slight vibration to the work in acceleration/deceleration operation.



(Note) The first-order lag degree set using the parameter No.55 "Position Command Primary Filter Time Constant". The minimum input unit is 0.1msec and setting range is from "0.0" to "100.0".
When it is set to "0", the first-order lag filter is disabled.
However, the setting is not reflected on the jog operation or inching operation performed using the personal computer or teaching pendant.

(23) Servo gain parameter set Select (GSL0, GSL1) PLC Output Signal

Operation Mode	Positioner 1	Simple Direct	Direct numeric specification	Direct numeric specification 2	Positioner 2	Positioner 3
○ : Equipped × : Not equipped	×	×	○	○	×	×

By registering four sets out of the following servo gain parameters (6 sets) in advance, an operation is available with the selected set for each position movement.
See the parameters for the details.

GSL1	GSL0	Function	Remarks
OFF	OFF	Parameter Set 0 Select	Set in delivery
OFF	ON	Parameter Set 1 Select	
ON	OFF	Parameter Set 2 Select	
ON	ON	Parameter Set 3 Select	

(24) Incremental command (INC) PLC Output Signal

Operation Mode	Positioner 1	Simple Direct	Direct numeric specification	Direct numeric specification 2	Positioner 2	Positioner 3
○ : Equipped × : Not equipped	×	×	○	○	×	×

When the movement command is issued while this signal is turned ON, the actuator is moved to the position expressed as the value input in the PLC's target position register based on the current position. (elative movement)
When this signal is turned OFF, the actuator is moved to the position expressed as the value set in the PLC's target position register.

(25) Operation for Positioner 1/Simple Direct Modes

If the position data is written to the target position register (for Simple Direct Mode) or the target position is set in the position data of MSCON (for Positioner 1 Mode), the operation shall be made with other information, such as the speed, acceleration/deceleration, positioning width, pressing force, etc., set to the position data.

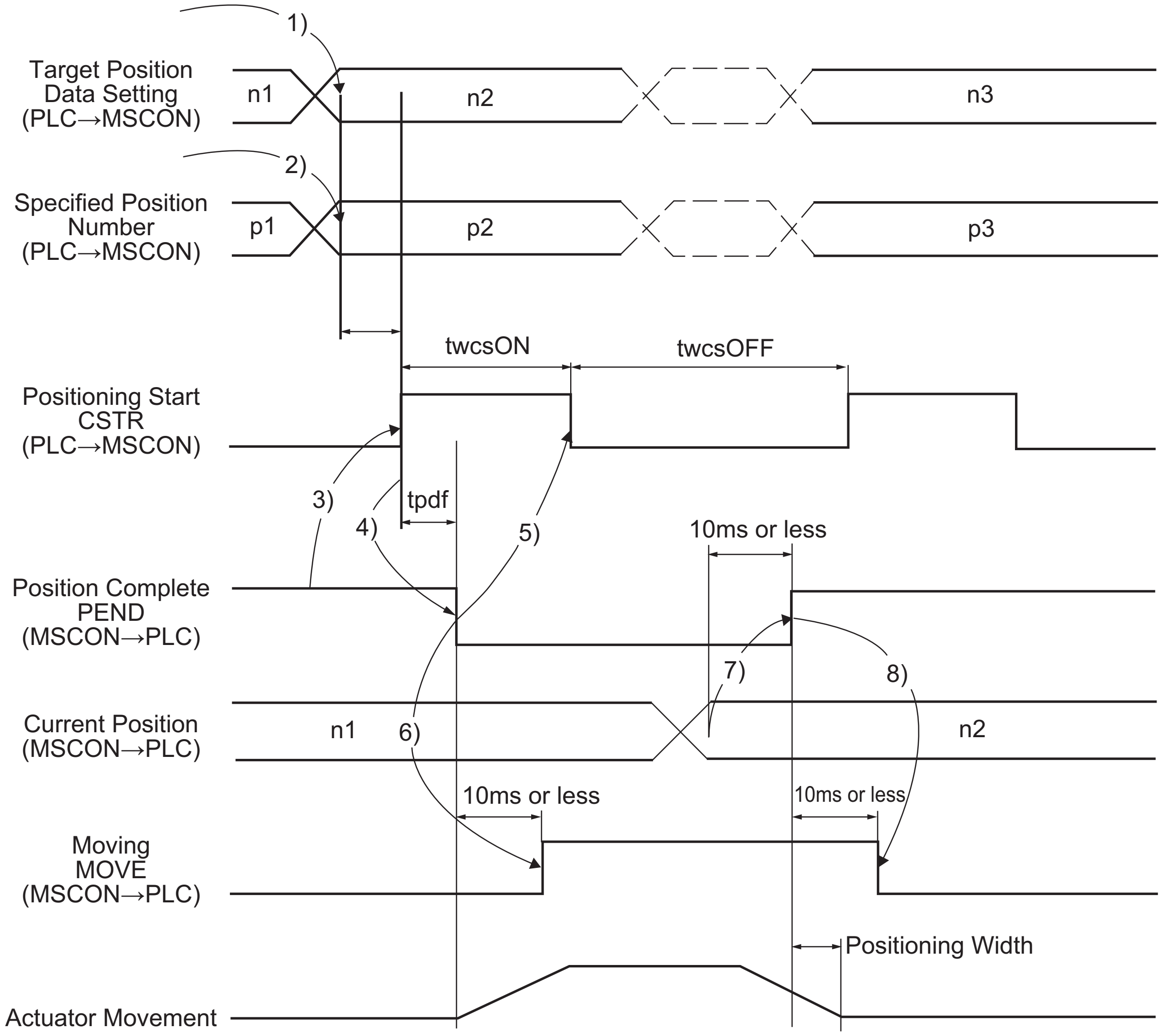
● Example of operation (Normal Positioning Operation with Simple Direct Mode)

(Preparation) Set the axis numbers to be used in Simple Direct Mode with Gateway Parameter Setting Tool. [Refer to 3.2. Initial Setting.]
Set the position data items (speed, acceleration/deceleration, pressing width, etc) except for the target position item, in the position table.

1) Set the target position data in the target position register.
2) Set the position No. where the speed and acceleration/deceleration, etc., have been set, in the setup position No. register.
3) In the condition where the positioning completion (PEND) signal is turned ON or under movement signal (MOVE) is turned OFF, turn ON the positioning command (CSTR) signal. The data items set in Steps 1) and 2) are read in the controller at the startup (ON edge) of the CSTR signal.
4) After the CSTR signal is turned ON, the PEND signal is turned OFF after tpdf.
5) After confirming that the PEND signal is turned OFF or MOVE signal is turned ON, turn OFF the CSTR signal. Do not change the value in the target position register until the CSTR signal is turned OFF.
6) At the same time when the PEND signal is turned OFF, the MOVE signal is turned ON.
7) The current position data is continuously updated. When the remaining travel distance becomes within the range of the positioning width set in the position data, and the CSTR signal is turned OFF, the PEND signal is turned ON. Then, the completed position No. is output to the completed position No. register.
   Accordingly, for the read of the completed position No. register when the positioning is completed, confirm it some time (Remaining Travel Distance Movement Time) after the PEND signal is turned ON.
   The current position data might be changed slightly even when the system is stopped.
8) MOVE signal turns OFF at the same time as or within 10ms after PEND signal turns ON.
9) The target position data can be changed during the actuator movement.
   In order to change the target position, change the target position data and turn ON the CSTR signal after the time longer than the PLC scanning time has passed.
   Change the value for the CSTR signal after the time longer than the PLC scanning time has passed.

● Example of operation (Pressing operation)

For the pressing operation, set the current limit to the pressing force box and pressing width to the pressing width box in the position data at the stage of (preparation). By conducting a positioning operation towards the set position number, the actuator performs a pressing operation.



To turn ON TwcsON, have an interval of time more than 10ms.
To turn OFF TwcsOFF, have an interval of time more than 10ms.
Tdpf = Yt+10+Xt (minimum value) to Yt+10+Xt+7 (maximum value)

(26) Operation for Direct Indication Mode

It is operated with the data set in the PLC's target position register, positioning width register, setup speed register, acceleration/deceleration register and pressing current limit setup register.

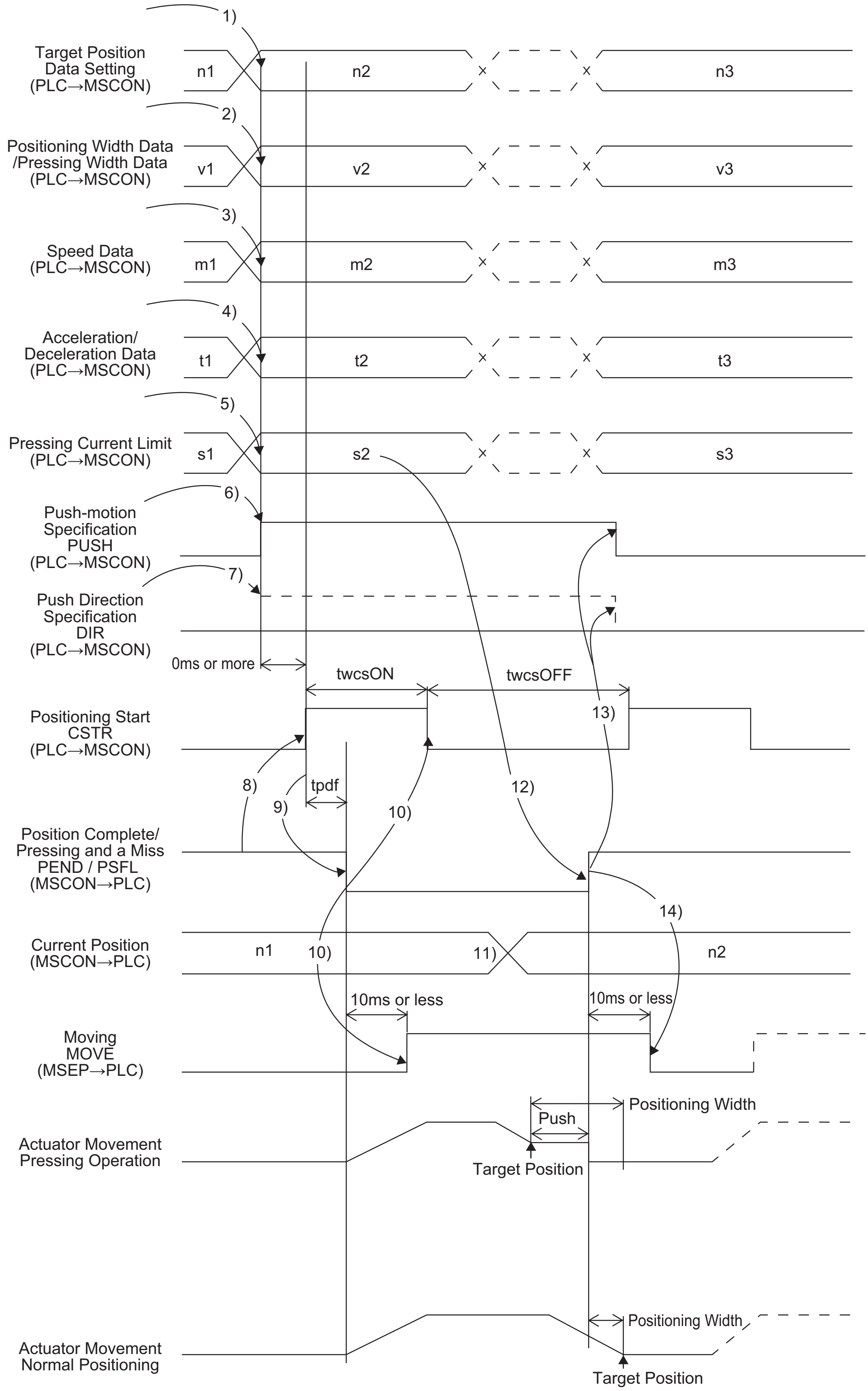
● Example of operation (Pressing operation)

(Preparation) Set the axis numbers to be used in Direct Indication Mode with Gateway Parameter Setting Tool.

1) Set the target position data in the target position register.
2) Set the positioning width (pressing width) data in the positioning width register.
3) Set the speed data to the speed register.
4) Set the acceleration/deceleration data to the acceleration/deceleration register.
5) Set the pressing current limit data in the pressing current limit value register.
6) Turn ON the pressing setup (PUSH) signal.
7) Specify the pressing direction using the pressing direction setup (DIR) signal.
8) In the condition where the positioning completion (PEND) signal is turned ON or under movement signal (MOVE) is turned OFF, turn ON the positioning start (CSTR) signal.
   The data items set in Steps 1) through 5) are read in the controller at the startup (ON edge) of the CSTR signal.
9) After the CSTR signal is turned ON, the PEND signal is turned OFF after tpdf.
10) After confirming that the PEND signal is turned OFF or MOVE signal is turned ON, turn OFF the CSTR signal. Do not change any value in each register until the CSTR signal has been turned OFF.
11) The current position data is continuously updated.
12) When the CSTR signal is turned OFF and the motor current reaches the current limit value set in Step 5), the PEND signal is turned ON. (Pressing complete)
   Even when the positioning width (pressing width) set in Step 2) is reached, in the case that the current does not reach the motor current limit value set in Step 5), the pressing and a miss (PSFL) signal is turned ON. In this case, the PEND signal is not turned ON. (Pressing and a miss)
13) After the PEND signal or PSFL signal is turned ON, turn OFF the PUSH signal.
14) MOVE signal turns OFF at the same time as or within 10ms after PEND signal turns ON.

● Example of operation (Normal positioning operation)

For the general positioning operation, set the signal in Step 6) to OFF.
When the remaining travel distance becomes within the range of the positioning width set in the position data, and the CSTR signal is turned OFF, the PEND signal is turned ON.



To turn ON TwcsON, have an interval of time more than 10ms.
To turn OFF TwcsOFF, have an interval of time more than 10ms.
Tdpf = Yt+10+Xt (minimum value) to Yt+10+Xt+7 (maximum value)

(27) Operation for Positioner 2 and Positioner 3 Modes

The operation is to be made with the target position, speed, acceleration/deceleration, positioning width and pressing force set in the position data of MSCON.

● Example of operation (Positioning operation)

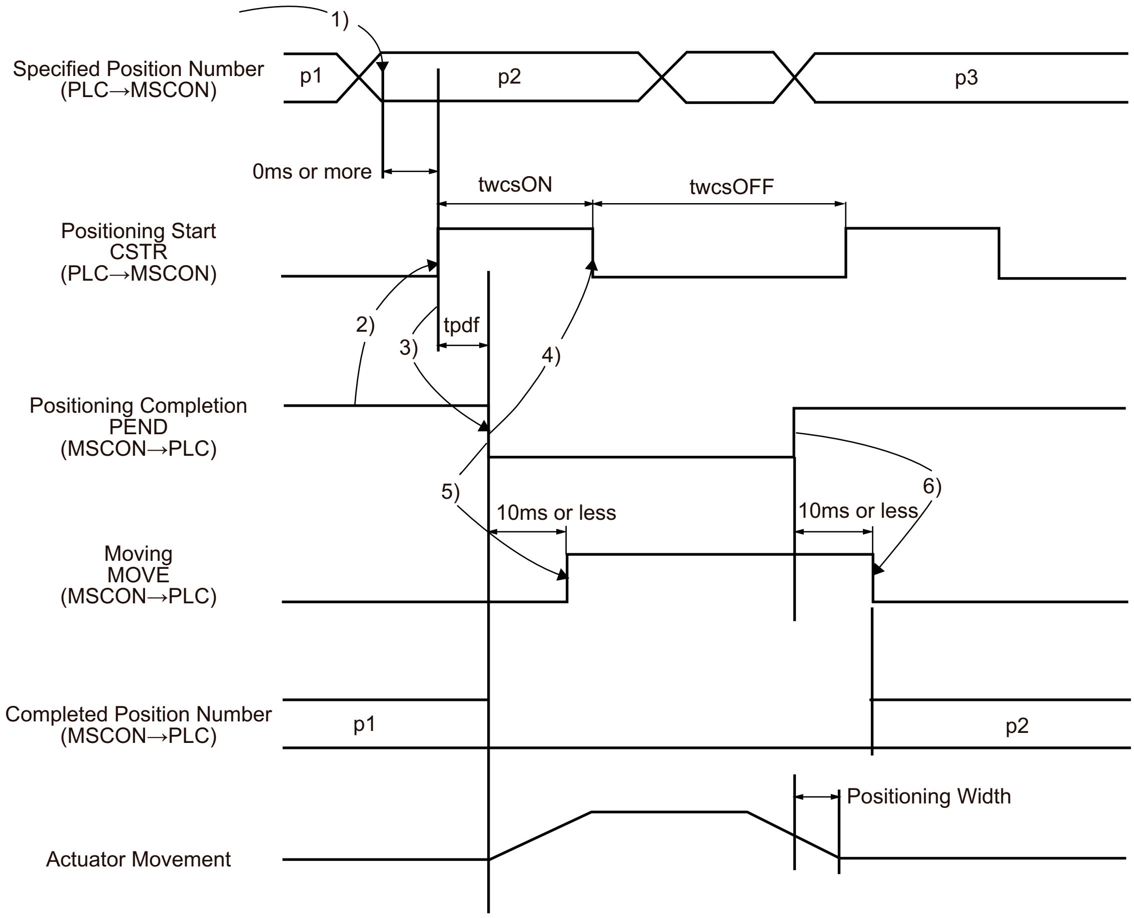
(Preparation) Set the axis numbers to be used in Positioner 2 or Positioner 3 Mode with Gateway Parameter Setting Tool. [Refer to 3.2. Initial Setting.]
Set the position data (target position, speed, acceleration/deceleration, etc.) to the position table.

(Note) If Positioner 3 Mode, have 1) and 2) at the same time.

1) Set the position No. where the speed and acceleration/deceleration, etc., have been set, in the setup position No. register.
2) In the condition where the positioning completion (PEND) signal is turned ON or under moving signal (MOVE) is turned OFF, turn ON the positioning start (CSTR) signal.
   The data items set in Step 1) is read in the controller at the startup (ON edge) of the CSTR signal.
3) After the CSTR signal is turned ON, the PEND signal is turned OFF after tpdf.
4) After confirming that the PEND signal is turned OFF or MOVE signal is turned ON, turn OFF the CSTR signal. Do not change the value in the target position register until the CSTR signal is turned OFF.
5) At the same time when the PEND signal is turned OFF, the MOVE signal is turned ON.
6) Once the remaining movement amount of the actuator gets into the range of the positioning width set in the parameter, PEND signal turns ON if CSTR signal is OFF, and the complete position number is output to the complete position number register.
   Accordingly, for the read of the completed position No. register when the positioning is completed, confirm it some time (Remaining Travel Distance Movement Time) after the PEND signal is turned ON.
   MOVE signal turns OFF at the same time as or within 10ms after PEND signal turns ON.

● Example of operation (Pressing operation)

For the pressing operation, set the current limit to the pressing box and pressing width to the positioning width box in the position data at the stage of (preparation). By conducting a positioning operation towards the set position number, the actuator performs a pressing operation.



To turn ON TwcsON, have an interval of time more than 10ms. To turn OFF TwcsOFF, have an interval of time more than 10ms. Tpdf = Yt+10+Xt (minimum value) to Yt+10+Xt+7 (maximum value)

3.8 Control and functions of Input and output signals of Remote I/O Mode
3.8.1 Operation Supportive Signal = Patterns 0 to 2, 4 and 5 in common

[1] Emergency stop status (EMGS)

PIO Signal	Output
	*EMGS
In common for all PIO patterns	○

○: Available, ×: Unavailable

1) The emergency stop status EMGS is turned ON when in normal condition and turned OFF when it opens between EMG+ and EMG- (emergency stop condition or disconnected) for "Emergency Stop Circuit".
2) The signal turns on once the emergency stop condition is cancelled and it closes between EMG+ and EMG-.

Have an appropriate safety treatment such as interlock with this signal for the host controller (PLC, etc.).

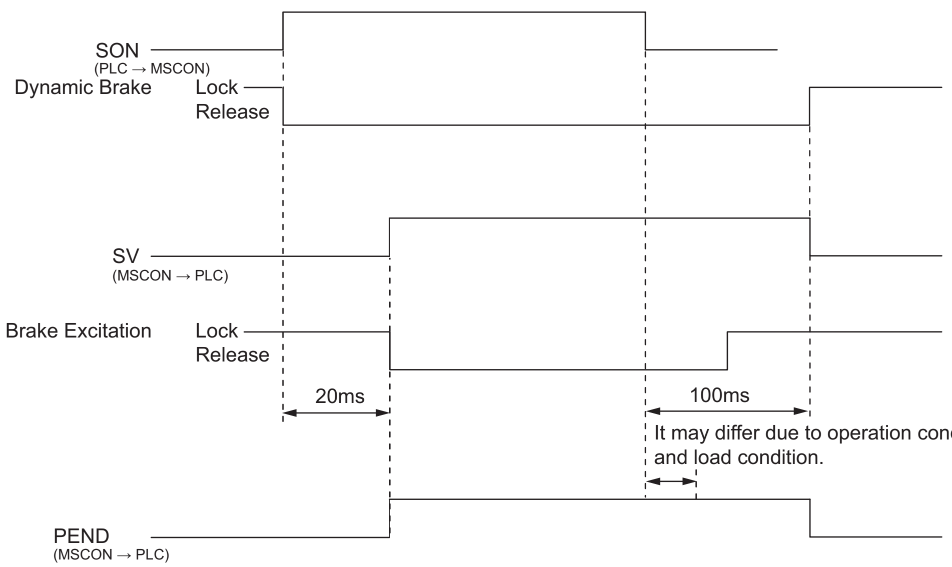
(Note) It is not an emergency stop output due to an alarm generation of the controller.

[2] Servo ON (SON, SV, PEND)

PIO Signal	Input	Output	
	SON	SV	PEND
Other than pattern 5	○	○	○
Pattern 5	○	○	×

○: Available, ×: Unavailable

1) Servo ON signal SON is the input signal making the servo motor of the actuator operable.
2) If the servo-on is performed to enable operation, the SV output signal is turned ON. The positioning complete signal PEND turns ON at the same time.
3) With the power being supplied, then controller cannot be operated while the SV signal remains OFF. If the SON signal is turned OFF under operation of the actuator, the actuator is decelerated and stopped with the emergency stop torque, the servo is turned OFF and the motor gets into the free-run condition.
   The brake (option) is excitation release type. Therefore, the brake gets released when excitation is ON and the brake works (locks) when excitation is OFF.



Note1: PEND would not turn ON in the pause condition.

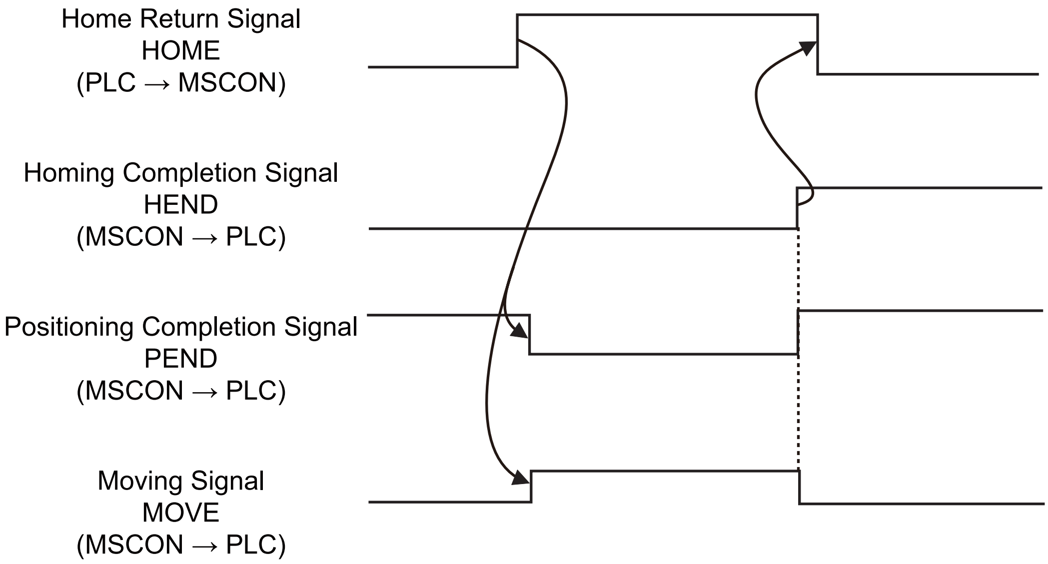
[3] Home return (HOME, HEND, PEND, MOVE)

PIO Signal	Input	Output		
	HOME	HEND	PEND	MOVE
Patterns 0 and 1	○	○	○	○
Patterns 2 and 4	○	○	○	×
Pattern 5	× (Note1)	○	×	×

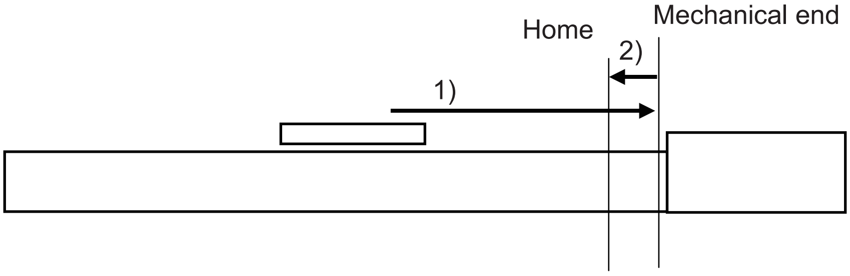
○ : Available, ×: Unavailable

Note1: Pattern 5 cannot make a home return with HOME signal. Refer to 3.8.4 [1] Home Return (ST0, HEND) for how to perform a home-return operation.

The HOME signal is intended for automatic home return. The HOME signal is caught at the rising edge (ON edge) to start the home return. At completion of the home return, home return completion signal HEND is turned ON. The home-return complete signal HEND is kept ON unless the memory of origin point is lost for a reason. The positioning complete signal PEND turns OFF and the moving signal MOVE turns ON during a home-return operation.



[Operation of Slider Type/Rod Type Actuator]

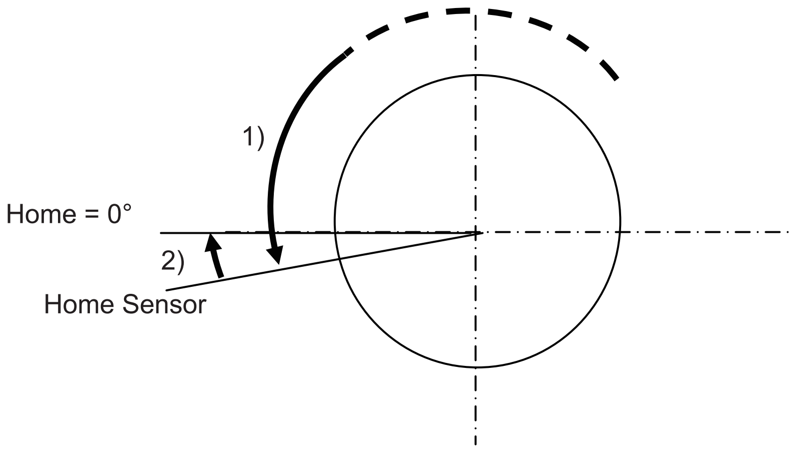


1) With the HOME signal being ON, the actuator moves toward the mechanical end at the home return speed.
   The speed for most of the actuators is 20mm/s, however, for some actuators it is less than 20mm/s. Refer to the instruction manual of each actuator.
2) The actuator is turned at the mechanical end and stopped at the home position.The movement amount (Note1) in this process follows the setting in Parameter No. 22 "Home return offset level".(Note1)

⚠Caution:	In the home reverse specification, the actuator moves in the reverse direction. Make sure to refer to Section 7.2 [12] when a change to Parameter No.22 "Home Return Offset Level" is required.

Note1: It moves for the offset amount after the encoder Z-phase is detected.

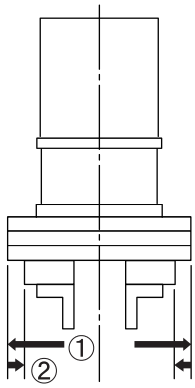
[Operation of Rotary Actuator]



1) By HOME Signal being ON, the rotary part turns in CCW (counterclockwise) from the view of load side. The velocity is either 20deg/s or 5deg/s. (It depends on the setting of each actuator.)
2) At the home sensor input, the actuator is turned in the reverse direction and stopped at the home position. The amount of movement at this time is that set in Parameter No.22 "Home-Return Offset" after Z-phase is detected.

⚠Caution:	Make sure to refer to Section 7.2 [12] when a change to Parameter No.22 "Home Return Offset Level" is required.

[For Gripper Type]



1) If the HOME signal is turned ON, the actuator moves toward the mechanical end at the home return speed (20mm/s).
2) The actuator is turned at the mechanical end and stopped at the home position. The amount of movement at this time is that set in Parameter No.22 “Home-Return Offset” after Z-phase is detected.

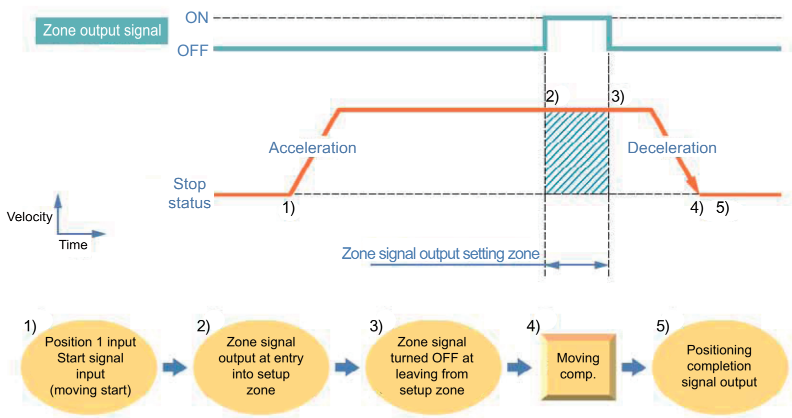
⚠Caution:	Make sure to refer to Section 7.2 [12] when a change to Parameter No.22 “Home Return Offset Level” is required.

[4] Zone signal and position zone signal (ZONE1, PZONE)

PIO Signal	Output	
	ZONE1(Note1)	PZONE(Note1)
Pattern 0	○	○
Pattern 1	×	○
Pattern 2	×	○
Pattern 4	○	○
Pattern 5	○	○

○ : Available, ×: Unavailable

Note1: PZONE Signal can be changed to ZONE1 and ZONE2 Signals by the setting in Parameter No.149.



This is a function enables to turn a signal on while the actuator is passing a certain position (in the zone range) or during a stop, in which there are two types.

1) Zone signal (ZONE1) ······················The output signal is turned ON at the position set by the proper parameter.

2) Position zone signal (PZONE) ·········The output signal is turned ON at the position set in the position table.

The feature can play a role as the sensor for judging whether the completion position is good or not at completion of pressing, setting the continuous operation zone in pitch feed or interlocking operations of other units in the setting zone.

(1) Zone signal (ZONE)

Set the zone range to the relevant parameter.

1) parameter No. 1 : “Zone Boarder 1 “+” Side”
2) parameter No. 2 : “Zone Boarder 1 “-” Side”

The zone signal ZONE is kept effective also during the emergency stop unless the memory of the origin is lost due to alarm.

(2) Position zone signal (PZONE)

No.	Position [mm]	Velocity [mm/s]	Accele-ration [G]	Decele-ration [G]	Pressing [%]	Thresh-old [%]	Positioning width [mm]	Zone+ [mm]	Zone- [mm]	Acceleration/ Deceleration mode	Incre-mental	Gain set	Stop mode
0													
1	0.00	250.00	0.20	0.20	0	0	0.10	50.00	30.00	0	0	0	0
2	100.00	250.00	0.20	0.20	0	0	0.10	70.00	60.00	0	0	0	0
3	50.00	250.00	0.20	0.20	50	0	20.00	60.00	65.00	0	0	0	0

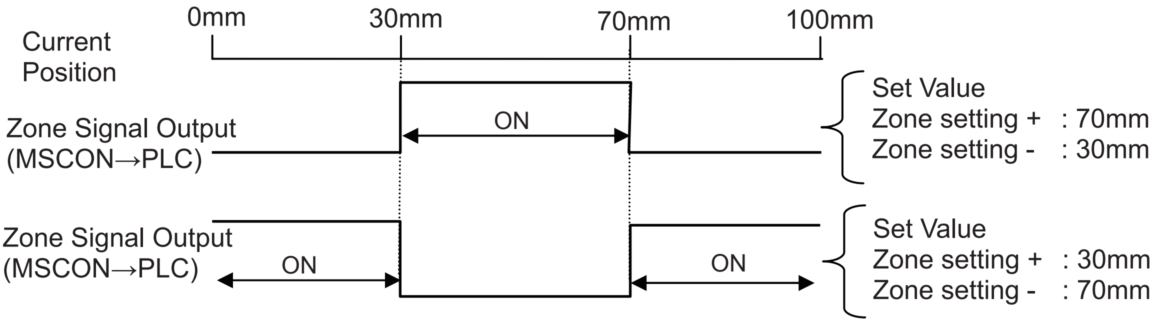
Setting of zone range

Zone ranges should be set in the position table.
While the operation corresponding to a position number is executed, the zone range set for the position number is valid. It is kept effective also during the emergency stop unless the actuator is operated or the memory of the origin is lost due to alarm.

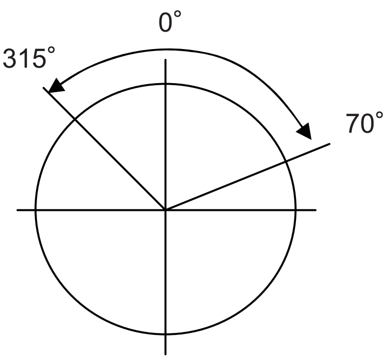
(3) Setting values and signal output range
The zone output range varies depending on the difference between the value set for the positive side of the zone and that for the negative side.

1) Value set for positive side > value set for negative side: Output signal turn ON in the range from the value on negative side to that on positive side, and turns OFF out of the range
2) Value set for positive side < value set for negative side: Output signal turn OFF in the range from the value on positive side to that on negative side, and turns ON out of the range

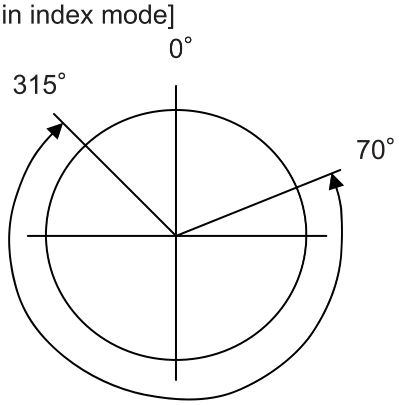
[Example of Line Axis]



[Example of rotary actuator of multi-rotation specification in index mode]



Set Value
Zone setting + : 70°
Zone setting - : 315°



Set Value
Zone setting + : 315°
Zone setting - : 70°

⚠ Caution: Since this signal becomes effective after the coordinate system is established after the home return is completed, it would not be output just with the power turned ON.

[5] Alarm, alarm reset (*ALM, RES)

PIO signal	Input	Output
	RES	*ALM
In common for all PIO patterns	○	○

○ : Available, ×: Unavailable

1) Alarm signal *ALM is set to ON in the normal status but turned OFF at the occurrence of an alarm at a level equal to or higher than the operation release level.
2) Turning reset signal RES ON under occurrence of an alarm at the operation release level allows the alarm(Note 1) to be released. The action is taken at the rising edge (ON edge).
3) The alarm reset should be done after the cause of the alarm is confirmed and removed. If alarm reset and restart are repeated many times without removal of the cause, a severe failure such as motor burnout may occur.

Note1: Check the 8.4 Alarm List for details of alarms.

> ⚠ Caution: Reset signal RES has two features, or alarm reset under occurrence of an alarm and operation interruption (cancellation of remaining moving distance) under temporary stop.
> For the operation interruption under temporary stop, refer to the description of the operation in each pattern.

[6] Binary output of alarm Information (*ALM, PM1 to 8)

PIO signal	Output	
	*ALM	PM1 to 8
Common to Patterns 0 to 2	○	○
Pattern 4(Note 1)	○	×
Pattern 5(Note 1)	○	×

○: Available, ×: Unavailable

Note1: Patterns 4 and 5 do not have this function.

1) If an alarm at a level equal to or higher than the operation release level occurs, completed position number output signals PM1 to PM8 output the alarm information in the binary code format.
2) The PLC can read the binary code of alarm signal *ALM as the strobe signal to refer to alarm information.
[8.4.2 Driver Simple Alarm Codes]

[7] Brake release (BKRL)

PIO signal	Input
	BKRL
Pattern 0	○
Pattern 1(Note 1)	×
Pattern 2、4、5	○

○ : Available, ×: Unavailable

Note1: Pattern 1 does not have this feature

The brake can be released while BKRL signal is set to ON. If a brake is installed in the actuator, the brake is automatically controlled by servo ON/OFF. Releasing the brake may be required to move the slider and/or the rod by hand in case of installation of the actuator in the machine or direct teach*1. This operation can be done by break release signal BKRL as well as the brake release switch ON the front panel of the controller.

*1 Direct teaching: This operation is intended to get coordinate values to the position by moving the slider and/or the rod by hand.

⚠ Warning: (1) Take sufficient care to release the brake. Doing so carelessly may cause an injury or a malfunction of actuator, work piece or other devices due to a drop of the slider or rod.
(2) After the brake is released, always make the brake applied again. Any operation with the brake remaining released is extremely dangerous. The slider or rod may drop to cause people to be injured and/or the actuator, the work and/or the machine to be damaged.

[8] Battery alarm (*BALM)

PIO signal	Input
	*BALM
In common for all PIO patterns	○

1) Battery alarm *BALM is set to ON in the normal absolute battery voltage or for an actuator of incremental encoder specification.
2) *BALM is turned OFF if the absolute battery voltage drops to be less than 3.1V.
3) An alarm code 0EE “absolute encode error detection 2” occurs if the absolute battery voltage drops to be less than 2.5V. The backup data cannot be held any more.
4) If Overload Warning Level Ratio is set to a value other than 100% in Parameter No.143, the power turns OFF once the motor temperature exceeds the value in this parameter. Lower the load level (by decreasing the acceleration speed, etc.).

⚠ Warning: If the machine is operated with the backup data erased, unintended motion may occur to cause people to be injured and/or the actuator, the work and/or the unit to be damaged.
If *BALM is turned OFF, replace the battery as soon as possible. [Refer to Chapter 6 Absolute Reset and Absolute Battery.]
Apply a dedicated battery (AB-5).

3.8.2 Operation with the Position No. Input = Operations of PIO Patterns 0 to 2

It is the operation methods for PIO Patterns 0 to 2. These patterns provide normal controller operation methods in which the controller is operated by turning the start signal ON after a position No. is entered.

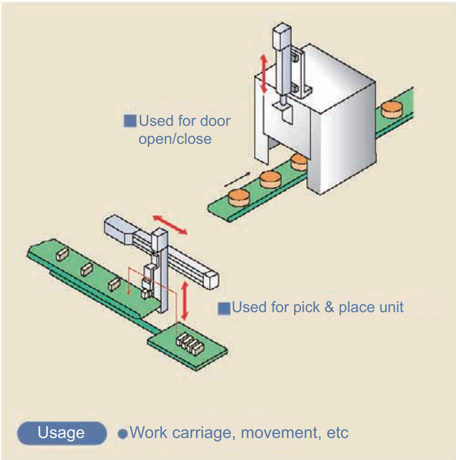
[1] Positioning [Basic] (PC1 to PC**, CSTR, PM1 to PM**, PEND, MOVE)

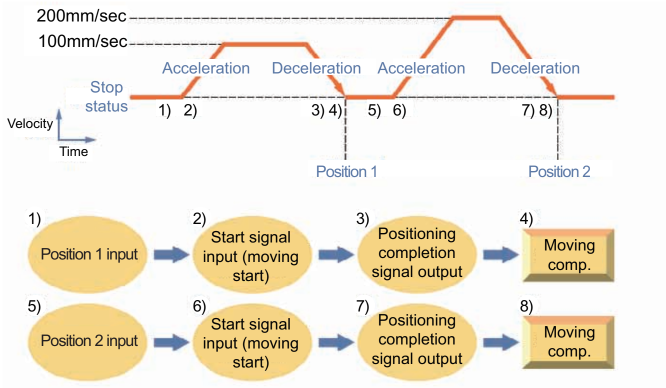
PIO signal	Input		Output				
	PC1 to PC**	CSTR	PM1 to PM**	PEND	MOVE	LOAD	TRQS
PIO pattern 0	PC1 to 32	○	PM1 to 32	○	○	×	×
PIO pattern 1	PC1 to 32	○	PM1 to 32	○	○	×	×
PIO pattern 2	PC1 to 128	○	PM1 to 128	○	×	×	×

○ : Available, ×: Unavailable

Note: Operation without home return leads the operation based on the data of the specified position No. after automatichome return. If one or more problems are found, interlock by home return complete signal HEND is required.

■ Sample use

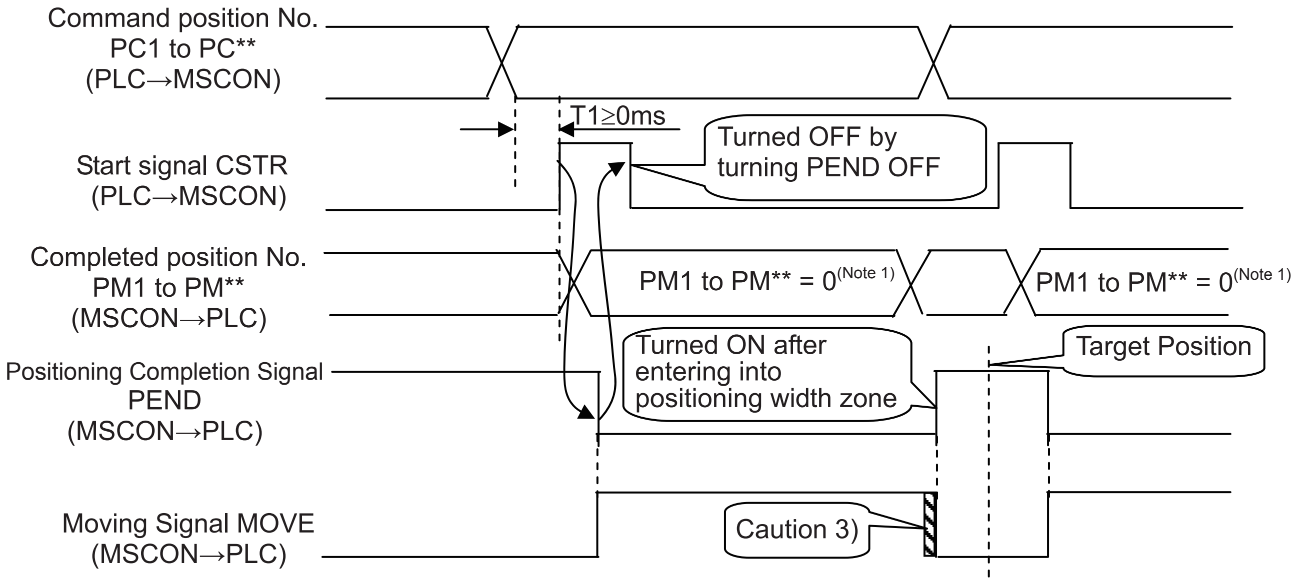




No.	Position [mm]	Velocity [mm/s]	Accele-ration [G]	Decele-ration [G]	Pressing [%]	Thresh-old [%]	Positioning width [mm]	Zone+ [mm]	Zone- [mm]	Acceleration/ Deceleration mode	Incre-mental	Gain set	Stop mode
0													
1	70.00	100.00	0.20	0.20	0	0	0.10	0.00	0.00	0	0	0	0
2	150.00	200.00	0.20	0.20	0	0	0.10	0.00	0.00	0	0	0	0

■ Control method

1) First enter command position No. PC1 to PC** with binary data. Next turn start signal CSTR ON. Then the actuator starts acceleration depending on the data in the specified position table for positioning to the target position.
2) At operation start, positioning complete signal PEND is turned OFF. Always turn the CSTR signal OFF. Without it, the completed position number is not output and the positioning complete signal is not turned ON at the completion of positioning.
3) When the positioning is completed, the positioning complete position numbers are output from complete position No.PM1 to PM** with binary data and also positioning complete signal PEND is turned ON.
4) The moving signal MOVE turns ON at the same time as the operation starts, and turns OFF once the positioning complete signal PEND turns ON or the movement command output completes.
5) Positioning complete signal PEND is turned ON if the remaining moving distance enters into the positioning width. PEND Signal will be kept ON once it is turned ON unless the start signal CSTR is turned back ON, servo is turned OFF (Note) or the actuator is out of the positioning band width range (Note).
   (Note) It can be switched over with Parameter No.39.



Note1: The completion position No. output is set to 0 during movement of the actuator.

⚠ Caution:

(1) At the completion of positioning, positioning complete signal PEND is not turned ON if start signal SCTR remains ON. If this occurs, turn CSTR OFF then PEND is turned ON immediately. Therefore, create the sequence program so that turning PEND OFF makes CSTR turned OFF and the PLC waits for the state in which PEND is turned ON.

(2) At the positioning to the position same as that specified in the stop (complete) position number, PEND is turned OFF once but moving signal MOVE is not turned ON.
Therefore, use PEND to turn CSTR OFF.
However, since the duration of being off is short, the signal of being off may not be read depending on the PLC scanning time. In such a case, turn CSTR off with using the timer.

(3) MOVE turns ON at the same time as PEND turns OFF, and turns OFF once the command from a controller to the motor is finished. Therefore, it may turn off while the actuator is moving if the setting of positioning width is large, and may turn OFF earlier that PEND OFF the positioning width setting is small.

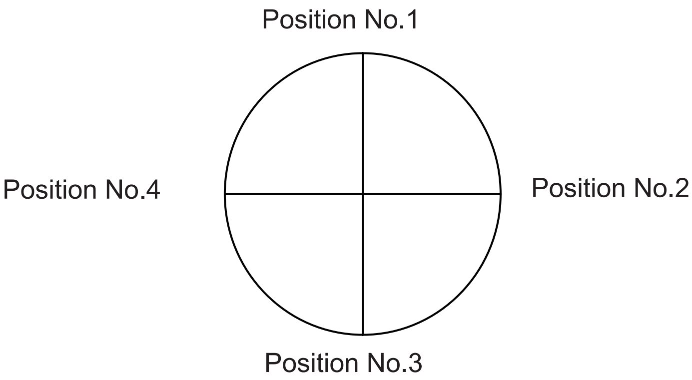
■ Binary data ○ : ON ● : OFF

Command position No. / Completed position No.	PC128 / PM128	PC64 / PM64	PC32 / PM32	PC16 / PM16	PC8 / PM8	PC4 / PM4	PC2 / PM2	PC1 / PM1
0	●	●	●	●	●	●	●	●
1	●	●	●	●	●	●	●	○
2	●	●	●	●	●	●	○	●
3	●	●	●	●	●	●	○	○
4	●	●	●	●	●	○	●	●
5	●	●	●	●	●	○	●	○
6	●	●	●	●	●	○	○	●
7	●	●	●	●	●	○	○	○
8	●	●	●	●	○	●	●	●
9	●	●	●	●	○	●	●	○
10	●	●	●	●	○	●	○	●
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
253	○	○	○	○	○	○	●	○
254	○	○	○	○	○	○	○	●
255	○	○	○	○	○	○	○	○

[Shortcut control of rotary actuator of multi-rotation specification]

(1) Set of shortcut selection
The shortcut selection can be made valid/invalid by Parameter No.80 “rotation axis shortcut selection”. If the shortcut selection is made valid, the actuator can be moved only in a single direction.

[Operation Examples]

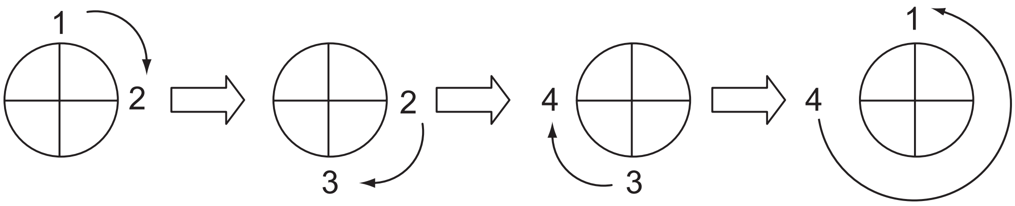


Position No.	Position
1	0
2	90
3	180
4	270

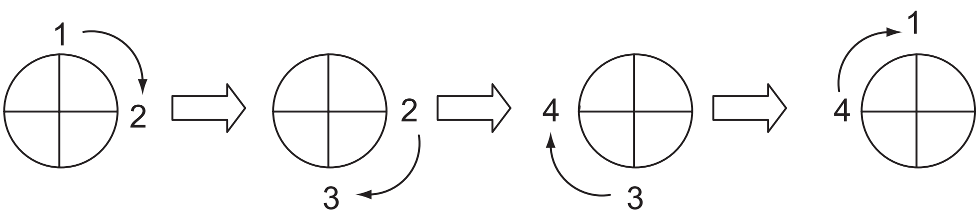
Enter position data assuming 1° = 1mm.
(Example) 1.2 is assumed as 1.2°.

For operation in the order of positions 1→2→3→4, the actuator is moved differently whether the shortcut selection is valid or invalid.

• When shortcut selection is invalid:

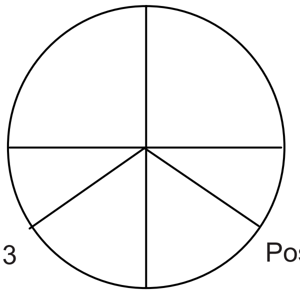


• When shortcut selection is valid:



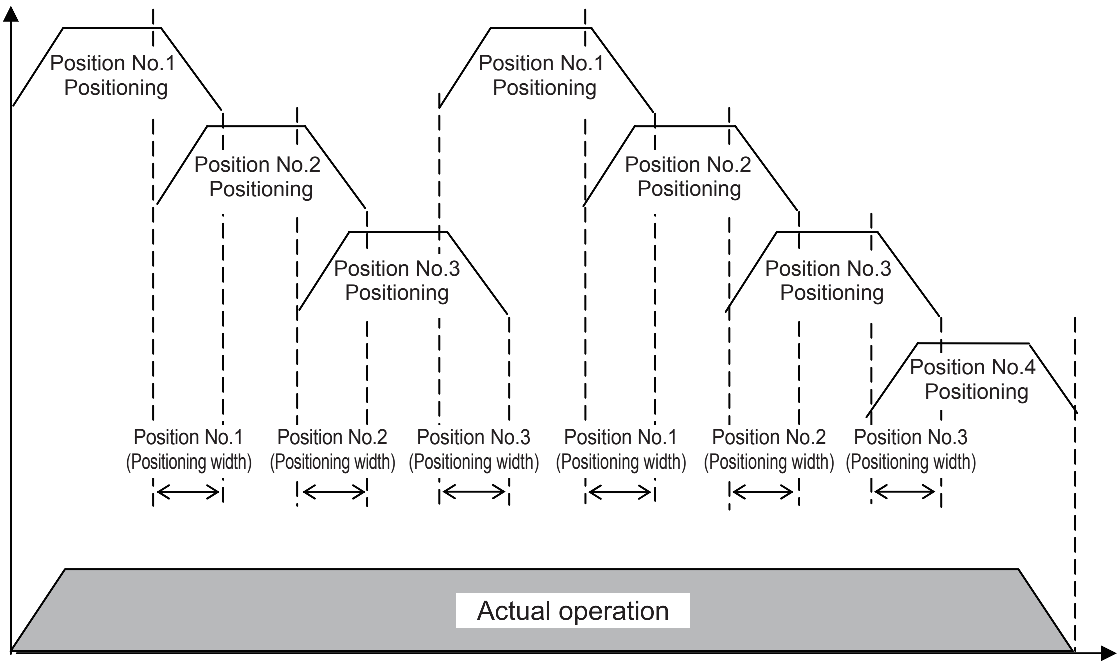
(2) Infinite Rotation Control
Making the shortcut selection valid and moving the actuator in a specific direction continuously allows the actuator to be rotated continuously as a motor. The continuous operation can be done as described below.

[Operation Examples]
This example rotates the actuator by 2 turns and finally stops it at position No.4.



Position No.	Position
1	0
2	120
3	240
4	90

Enter position data assuming 1° = 1mm.
(Example) 1.2 is assumed as 1.2°.

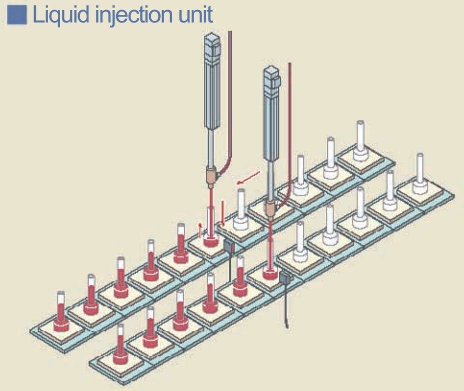


1) Widen the positioning widths of position No.1 to 3 so that they are located before the position at which deceleration is started.
2) Positioning of position No.1 makes positioning complete signal (PEND) turned ON before deceleration is started.
   If PEND is turned ON, positioning of position No.2 is executed. Similarly, positioning is repeated in the order of position No.3 → 1 → 2 → 3 → 4. Because the normal positioning always gives position data specified last the highest priority, the actuator can be rotated continuously.
3) If the speeds in position No.1 to 4 are set to be the same, the actuator can be rotated at the same speed. Then the actuator is stopped at the positioning set in position No.4. The number of rotations is defined by the number of repeats of position No.1 to 3.

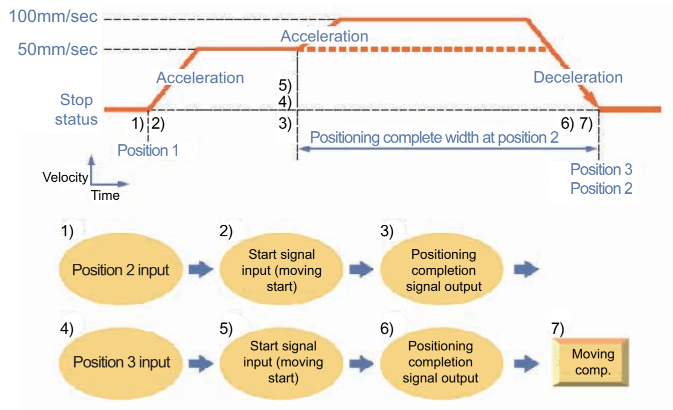
[2] Speed change during the movement

■ Sample use

■ Liquid injection unit



The unit inserts nozzles into containers, injects liquid, and moves the nozzles upward so that they may not be contact with the liquid surfaces.



No.	Position [mm]	Velocity [mm/s]	Accele-ration [G]	Decele-ration [G]	Pressing [%]	Thresh-old [%]	Positioning width [mm]	Zone+ [mm]	Zone- [mm]	Acceleration/ Deceleration mode	Incre-mental	Gain set	Stop mode
0													
1	150.00	250.00	0.20	0.20	0	0	0.10	0.00	0.00	0	0	0	0
2	0.00	50.00	0.20	0.20	0	0	100.00	0.00	0.00	0	0	0	0
3	0.00	100.00	0.20	0.20	0	0	0.10	0.00	5.00	0	0	0	0

■ Control method

The speed of the actuator can be changed while it moves. Positions are used by the number of speeds. The method of controlling the operation to each position is the same as that described in [1] Positioning.

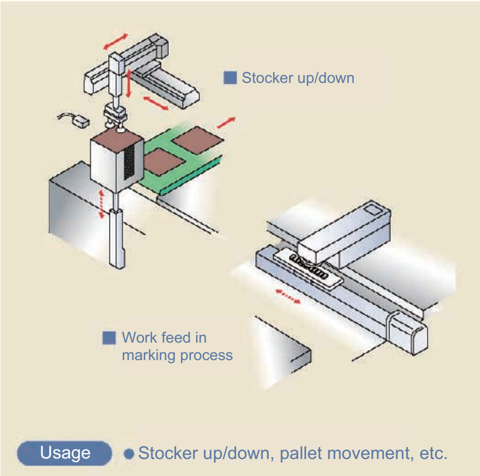
The example below describes the case of 2 speeds:

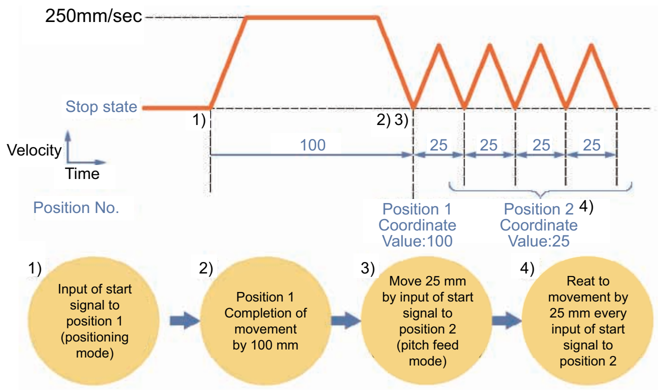
1) In this example, the speed is changed while the actuator moves from the position of 150mm to the position of 0mm. At first, set the positioning to the target position at the first speed in position No.2. In the positioning width, set the distance from the speed change position to the target position. The value is set to 100mm in the example. Thus, for position No.2, positioning complete signal PEND is turned ON at the position before the target position by 100mm.
2) Set the positioning to the target position at the second speed in position No.3.
3) Start position No.2. Then start position No.3 successively when PEND in position No.2 is turned ON. In normal positioning, position data specified later has always a priority over position data specified earlier. Thus, the operation in position No.3 is started on the way of the operation in position No.2.

In this example, the target positions No.2 and 3 are equal with each other. They may not be the same. However, setting the target positions to be equal with each other allows the distance from the speed change position to the target position to be known easily.
To increase in the number of speed change steps, add a position number and operation sequence, set the speed change position in the positioning width and operate the actuator continuously.

[3] Pitch feeding (relative movement = incremental feed)

■ Sample use





No.	Position [mm]	Velocity [mm/s]	Accele-ration [G]	Decele-ration [G]	Pressing [%]	Thresh-old [%]	Positioning width [mm]	Zone+ [mm]	Zone- [mm]	Acceleration/ Deceleration mode	Incre-mental	Gain set	Stop mode
0													
1	100.00	250.00	0.20	0.20	0	0	0.10	0.00	0.00	0	0	0	0
2	25.00	250.00	0.20	0.20	0	0	0.10	0.00	0.00	0	1	0	0

(Position No.2 sets pitch feed.)

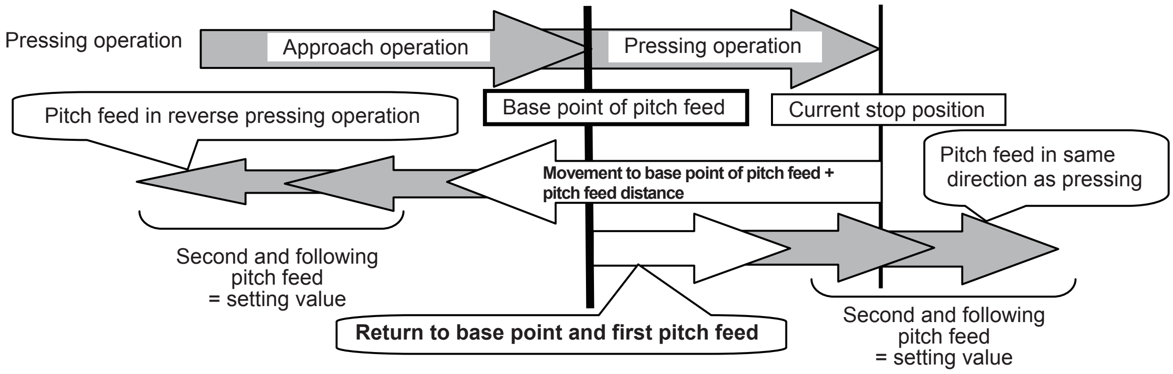
■ Control method

1) The method of controlling pitch feed is the same as that described in [1] Positioning except the setting of the position table. Repeat the positioning of a specific position No.
2) For pitch feed, the position set in the position table indicates the pitch. Set the pitch (relative moving distance = incremental moving distance) in column “Position”.
3) If the operation command is issued, the actuator moves from the current stop position by “Position” in the position table. To perform continuous movement, repeat the operation. The relative movement amount is calculated in “mm”. Therefore, there will be no cumulative tolerable error in repeated operations.

> ⚠ Caution: In the pitch feed, do not perform a command with a pitch smaller than the minimum encoder resolution (lead/encoder pulse number) or that less than positioning accuracy repeatability.
> There would be no deviation to occur even with the command because it is an operation command to the same position as the positioning complete condition, but the positioning control cannot be performed properly.

Caution: (1) If the actuator reaches the software limit corresponding to the stroke end in the pitch feed operation, the actuator stops at the position and positioning complete signal PEND is turned ON.

(2) Note that, in pitch feed just after pressing operation (to be in the pressing state), the start position is not the stop position at the completion of pressing but the coordinate value entered in "Position" of the pressing position data. The movement to the base point is added to the first pitch feed.



(3) If the position number for pitch feed is started (CSTR ON) during normal positioning, the actuator moves to the position of the coordinate resulting from adding the pitch feed distance to the target coordinate of the positioning. Repeating the start of pitch feed several times allows the pitch feed distance to be added to the target position by the number of repeats. Do not use the pitch feed function in such a way, because the PLC cannot confirm the complete position.

(4) Note that, if pitch feed is started (CSTR ON) repeatedly during pause, the actuator moves continuously by the distance based on the number of starts. In such a case, cancel the remaining moving distance by turning reset signal RES to ON in the pause state or take interlock so that the start signal is not turned ON during pause.

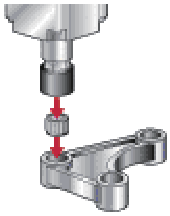
(5) At software limit (stroke end) in pitch feed, the actuator is decelerated to be stopped and positioning complete output PEND is output.

(6) MOVE turns ON at the same time as PEND turns OFF, and turns OFF once PEND turns ON or the movement command output completes. Accordingly, with a large positioning width being set, MOVE may be turned OFF while the actuator is moved.

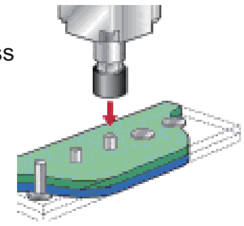
(7) Pressing is enabled by using the pitch feed function. However, do not make control of changing to pitch feed on the way of normal positioning (before PEND turning ON). Pressing is interrupted by using the pitch feed function as soon as start signal CSTR is turned ON. The PLC cannot manage the position of the actuator any more.

[4] Pressing operation

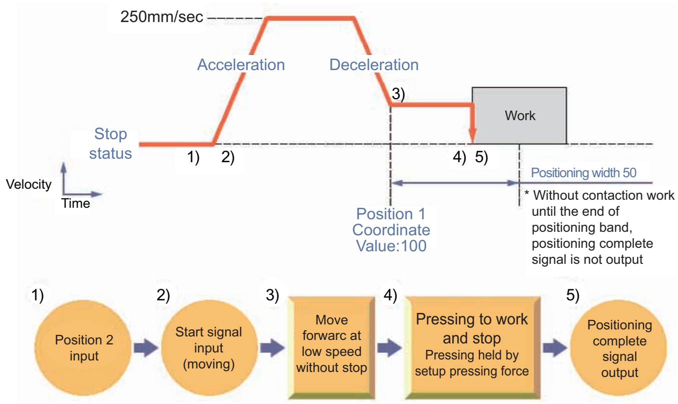
■ Sample use



Press-fitting process



Caulking process

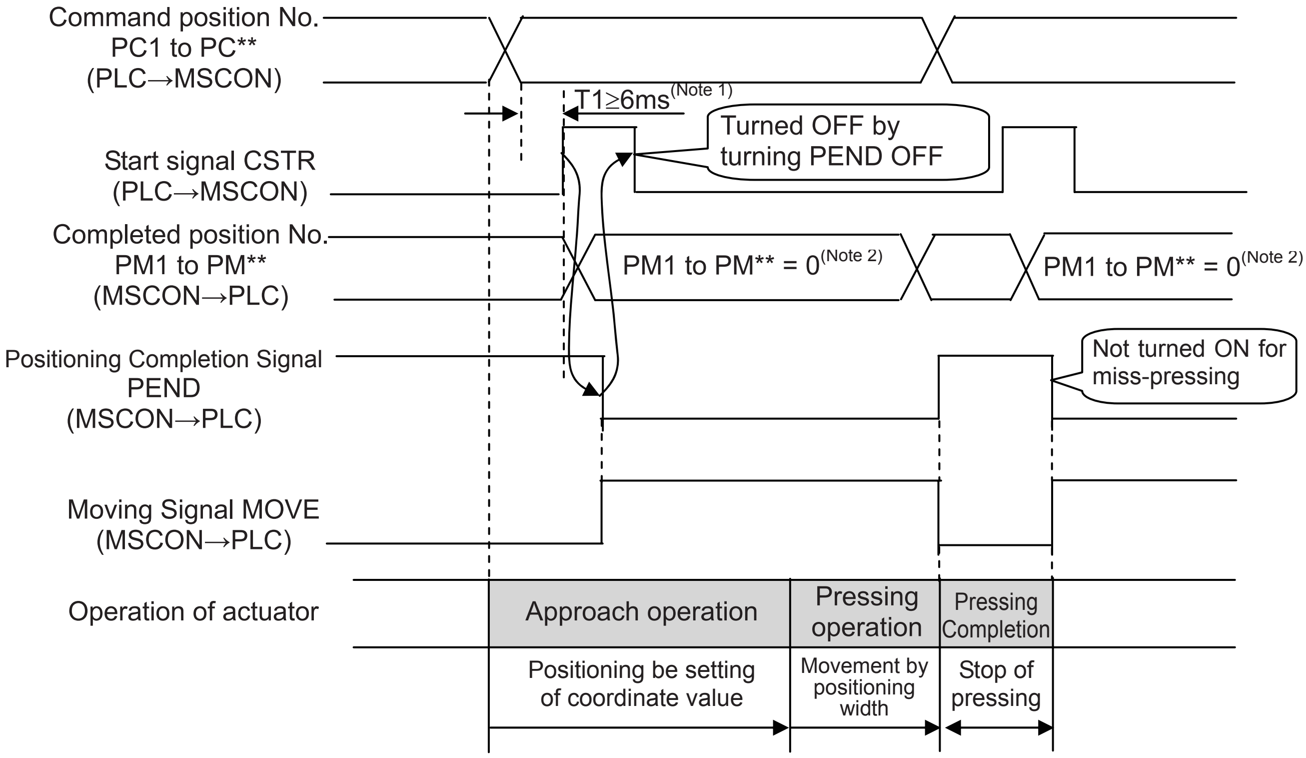


No.	Position [mm]	Velocity [mm/s]	Accele-ration [G]	Decele-ration [G]	Pressing [%]	Thresh-old [%]	Positioning width [mm]	Zone+ [mm]	Zone- [mm]	Acceleration/ Deceleration mode	Incre-mental	Gain set	Stop mode
0													
1	0.00	250.00	0.20	0.20	0	0	0.10	0.00	0.00	0	0	0	0
2	100.00	250.00	0.20	0.20	50	0	50.00	0.00	0.00	0	0	0	0

(Position No.2 sets pressing operation.)

■ Control method

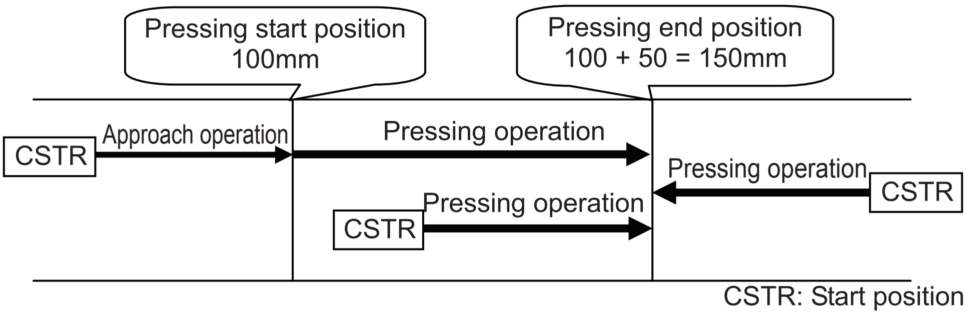
1) The method of controlling the pressing operation is the same as that described in [1] Positioning except the setting of the position table. Any setting of “Pressing” in the position table allows the pressing operation to be done. “Positioning width” is assumed as pressing operation distance.
2) The actuator moves at the setting speed and rating torque to the position of the coordinate set in “Position” in the similar way as normal positioning. Then the operation changes to pressing. The moving distance in pressing is the value set in “Positioning width”. The pressing is performed with the torque (current limit value) set in percent in “Pressing” of PIO patterns 1 to 2 being the upper limit.
3) The control method is the same as that in [1] Positioning. However, the processing of positioning complete signal PEND is different from that in [1] Positioning.
PEND is output when the shaft is stopped by pressing (pressing complete). If the work is not subject to pressing (miss-pressing), the actuator moves by the value set in “Positioning width” to stop but PEND is not turned ON.



Note1 Set the period taken from entering the position number to turning CSTR ON to 6ms or longer. Because 6ms timer process on the PLC is also entered to the controller, positioning at another position may occur. Take the PLC scan time into account.

Note2 The completion position No. output is set to 0 during movement of the actuator.

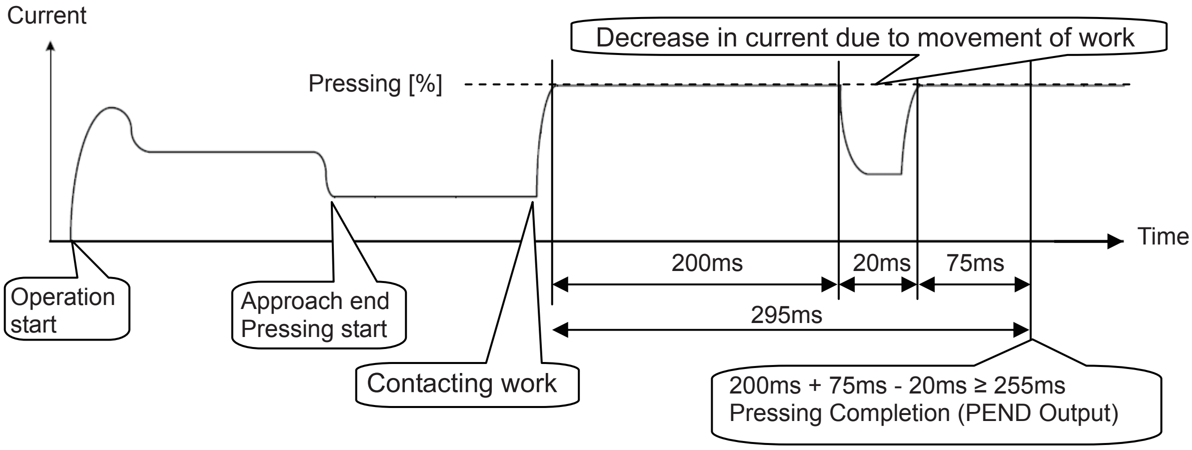
Caution: (1) The speed during pressing operation is set in Parameter No.34. Check the 9.1 List of Specifications of Connectable Actuators for the pressing operation speed.
Do not set any value larger than the value in the list. If the speed set in the position table is equal to or less than the pressing speed, the pressing is performed at the setup speed.
(2) The approach start position of pressing should be located at or before the pressing start position (coordinate 100mm or less in the above example) If not, the moving direction varies depending on the start position to be dangerous.
For example, pressing at coordinate larger than the pressing end position (larger than 150mm) is performed in the direction from the current position to the pressing end position. Note that pressing after positioning to the position of coordinate 100mm does not take place.



(3) The work is pressed after the pressing is completed. The work may moves backward or forward. If the actuator is moved backward before the approach position, alarm code 0DC "Pressing Motion Range Over Error" occurs to stop the actuator. In movement of the work in the pressing direction, PEND is turned OFF if the load current becomes lower than the current limit (pressing [%]). Miss-pressing occurs when the actuator moves by the pressing moving distance set in "Positioning width".
(4) Do not make control of changing to pressing on the way of normal positioning (before PEND turning ON). Depending on the position at which start signal CSTR is turned ON, the pressing is performed improperly. Then the PLC cannot manage the position of the actuator.
(5) Pressing control cannot be performed with the rotary actuator. If the index mode is selected for the rotary actuator of multi-rotation specification, pressing operation cannot be set. The positioning complete signal PEND is turned ON when the actuator reaches the positioning width.
(6) If the actuator gets pressed to the work during the approach operation, 0DC "Pressing Motion Range Over Error" would be issued.

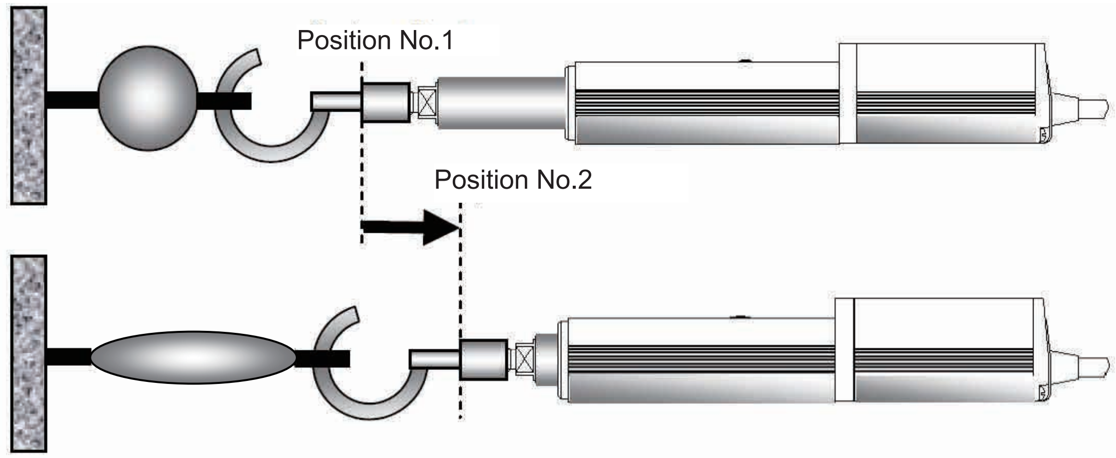
Judging completion of pressing operation

The operation monitors the torque (current limit value) in percent in “Pressing” of the position table and turns pressing complete signal PEND ON when the load current satisfies the condition shown below during pressing. PEND is turned ON at satisfaction of the condition if the work is not stopped.
(Accumulated time in which current reaches pressing value [%]) – (accumulated time in which current is less than pressing value [%]) ≥ 255ms (Parameter No.6)

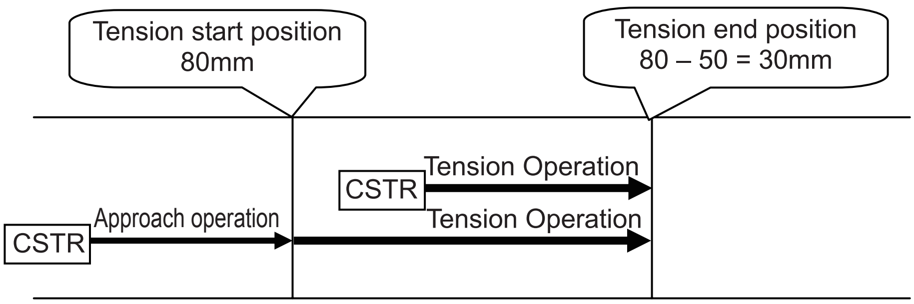


[5] Tension Operation

■ Image diagram



No.	Position [mm]	Velocity [mm/s]	Acceleration [G]	Deceleration [G]	Pressing [%]	Threshold [%]	Positioning width [mm]	Zone+ [mm]	Zone- [mm]	Acceleration/ Deceleration mode	Incremental	Gain set	Stop mode
0													
1	100.00	250.00	0.20	0.20	0	0	0.10	0.00	0.00	0	0	0	0
2	80.00	250.00	0.20	0.20	50	0	–50.00	0.00	0.00	0	0	0	0
3													



CSTR: Start position

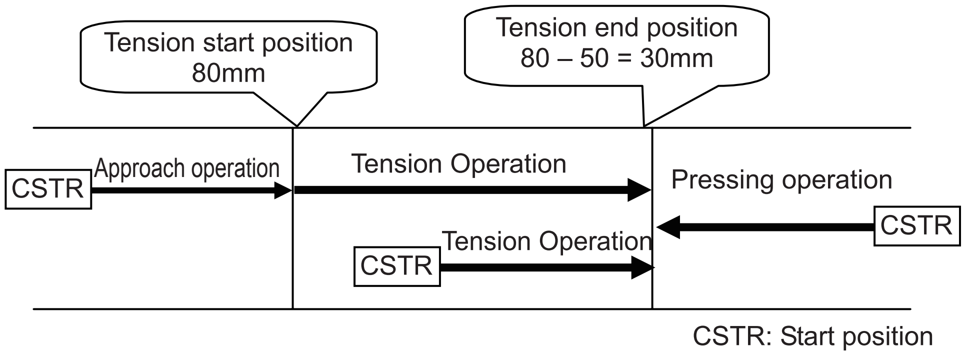
■ Control method

The method of controlling the tension operation is the same as that described in [4] Pressing operation. The control method is explained below by using the sample position table shown above.

1) Position No.2 indicates the settings of tension operation. The settings of “Position” and “Positioning width” show the tension start position and the tension quantity, respectively. Attach – (minus sign) to the tension quantity. Specify the upper limit of the torque required for tension in percent (limited current value) in “Pressing”. The speed, acceleration, and deceleration are the conditions of positioning to the coordinate value (80mm) set in “Position”.
2) Position No.1 indicates the tension start preparation position. Specify a value larger than the coordinate value at which the tension provided by position No.2 ends (80 – 50 = 30mm) in “Position”.
3) First define the positioning in position No.1. Next, the operation in position No.2 moves the actuator to the position of 80mm at the setting speed and rating torque and change to the tension operation. The actuator moves by 50mm in the negative direction in the tension operation. The upper limit of the tensile force is the torque set in percent.
4) In the similar way as pressing, the positioning complete signal is output when the shaft is stopped by tension (pressing complete). If the actuator cannot be stopped during movement within the setting positioning width (miss-pressing), it moves by the setting distance to stop but PEND is not turned ON.

⚠ Caution: (1) The speed during tension operation is set in Parameter No.34. Check the 9.1 List of Specifications of Connectable Actuators for the pressing speed. The speed for pulling operation is same as that for pressing operation. Do not set any value larger than the value in the list. If the speed set in the position table is equal to or less than the tension speed, the tension operation is performed at the setup speed.

(2) The tension ready position should be the tension start position or forward. If not, the moving direction varies depending on the start position to be dangerous. The tension operation from a coordinate (less than 30mm = 80 – 50 in the above example) located before the end position (30mm or less) changes to the pressing operation from the current position to the tension end position. Note that the tension operation after positioning to the position of 80mm does not take place.



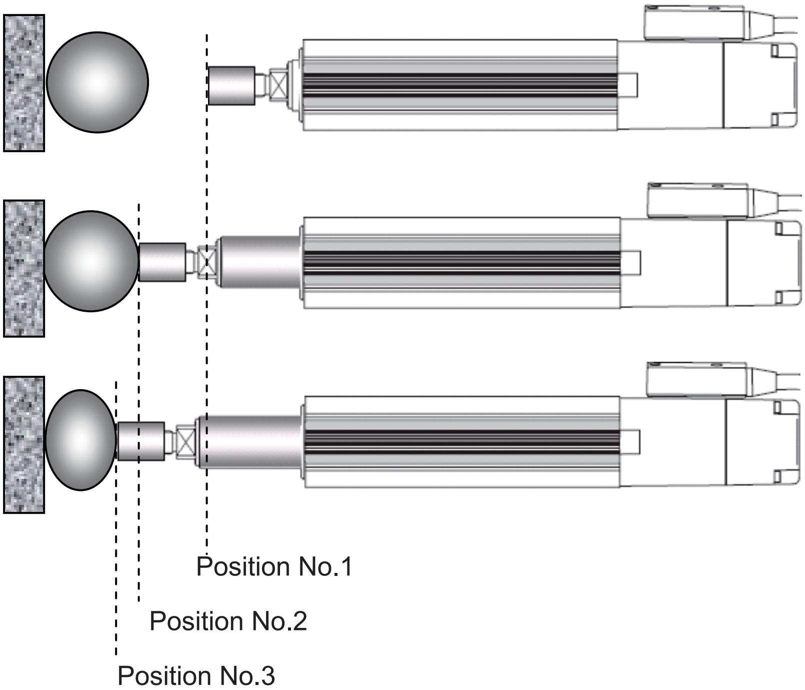
(3) The work is pulled also after completion of the tension. The work is drawn back or pulled further if the work is moved. When the work is drawn back before the approach position, alarm code 0DC "pressing operation range error" occurs to stop the work. When the work is moved in the tension direction and the load current becomes less than the current limit value (pressing in [%]), PEND is turned OFF. Naturally, the work reaches the tension moving distance set in "Positioning width" to cause miss-pressing.

(4) Do not make control of changing to tension operation on the way of normal positioning (before PEND turning ON). Depending on the position at which start signal is turned ON, the tension operation is performed improperly. Then the PLC cannot manage the position of the actuator.

(5) Tension operation cannot be performed with the rotary actuator.

[6] Multi-step pressing

■ Image diagram



No.	Position [mm]	Velocity [mm/s]	Accele-ration [G]	Decele-ration [G]	Pressing [%]	Thresh-old [%]	Positioning width [mm]	Zone+ [mm]	Zone- [mm]	Acceleration/ Deceleration mode	Incre-mental	Gain set	Stop mode
0													
1	0.00	250.00	0.20	0.20	0	0	0.10	0.00	0.00	0	0	0	0
2	50.00	250.00	0.20	0.20	30	0	20.00	0.00	0.00	0	0	0	0
3	50.00	250.00	0.20	0.20	50	0	20.00	0.00	0.00	0	0	0	0
4													

■ Control method

After pressing, the pressing pressure can only be changed in the pressing state.
The method of controlling multi-step pressing is the same as that described in [4] Pressing operation. Shown below is the explanation with the position table above as an example.

1) Set the weak pressing (30%) in position No.2 and perform the pressing operation.
2) If pressing complete signal PEND is turned ON, start the pressing operation with pressing pressure (50%) greater than the first pressure set in position No.3.
   The position data in position No.3 should be the same as that in position No.2 except the setting in "Pressing".
3) To add a pressing step with another pressing pressure, add a sequence consisting of a position number and a pressing operation.

[7] Teaching by PIO (MODE, MODES, PWRT, WEND, JISL, JOG+, JOG-)

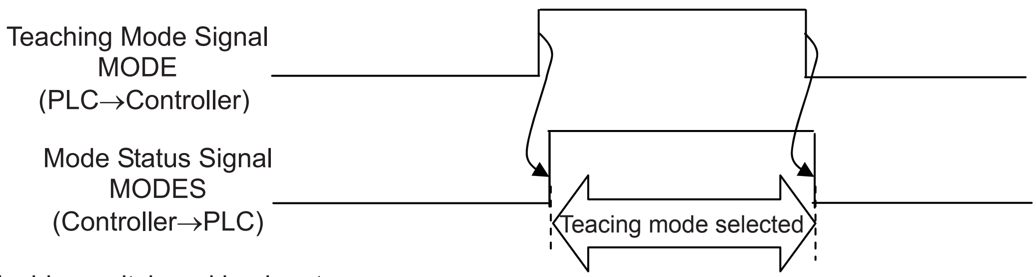
PIO signal	Input					Output	
	MODE	JISL	JOG+	JOG-	PWRT	MODES	WEND
Other than pattern 1	×	×	×	×	×	×	×
Pattern 1	○	○	○	○	○	○	○

○: Existence of signal, ×: No signal

(Note) The feature is available only in pattern 1.
Teaching by PIO is enabled.
It is possible to select the teaching mode, move the actuator to the target position with jog or inching operation, and write the coordinate value into any position number.

(1) Teaching Mode Selecting

1) To select the teaching mode, set teaching mode signal MODE to ON. If the teaching mode is selected, mode status signal MODES is turned ON.
   - While the actuator is operating, MODE signal input is invalid. Therefore, after the operation is completed, the MODES signal is turned ON.
   - With the MODES signal being ON, the CSTR signal is changed to teaching signal PWRT. Therefore, it is not possible to operate the actuator by specifying a position No.
2) To cancel the teaching mode to return to the normal operation mode, set the MODE signal to OFF. If the MODE signal is turned OFF, the MODES signal is turned OFF to return to the normal operation mode.



(2) Jog/inching switch and jog input

1) Jog/inching switching signal JISL indicates whether the jog operation*1 or inching operation*2 is performed by the jog input signal.
   JISL signal OFF ·············· Jog operation
   JISL signal ON················ Inching operation
2) There are two jog input signals, or JOG+ for operation in the positive direction and JOG- for operation in the negative direction.

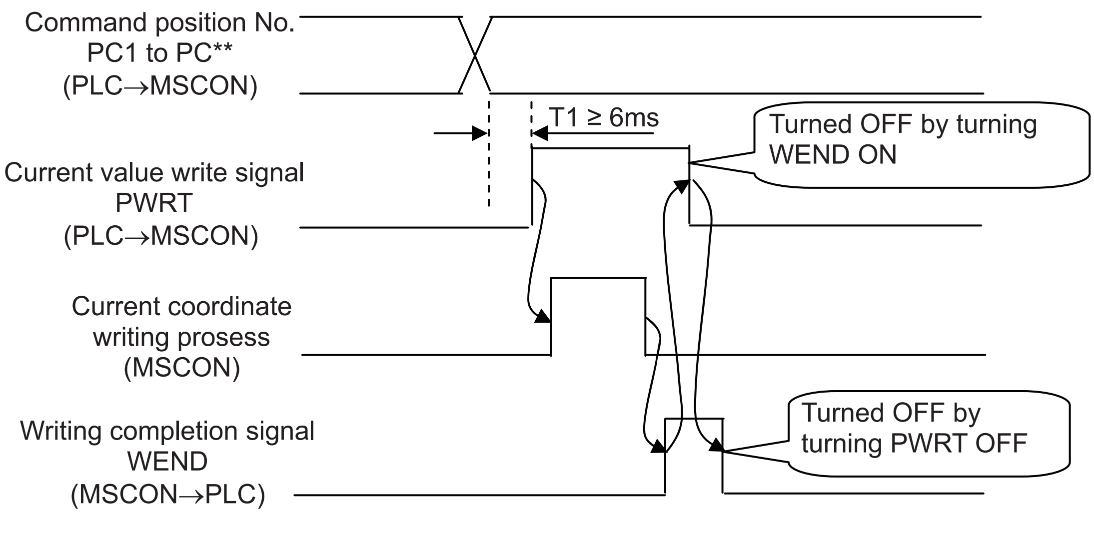
*1 Jog operation: The actuator is moved while the jog input signal is set to ON.
- JOG+ ·····While JOG+ is set to ON, the actuator is moved in the positive direction. If JOG+ is turned OFF, the actuator is decelerated and then stopped.
- JOG- ······While JOG- is set to ON, the actuator is moved in the negative direction. If JOG- is turned OFF, the actuator is decelerated and then stopped.
- Velocity ································· Value set in Parameter No.26 “PIO jog speed”.
- Acceleration/Deceleration ······ Rating acceleration/deceleration of actuator
- Pause Signal *STP················ Enabled

*2 Inching operation : Once the jog input signal is turned ON, the actuator is moved by a certain distance.
- JOG+ ·····Once JOG+ is turned ON, the actuator is moved by a certain distance in the positive direction.
- JOG- ······Once JOG- is turned ON, the actuator is moved by a certain distance in the negative direction.
- Moving distance ···················· Value set in Parameter No.48 “PIO inching distance”.
- Velocity ································· Value set in Parameter No.26 “PIO jog speed”.
- Acceleration/Deceleration ······ Rating acceleration/deceleration of actuator
- Pause Signal *STP················ Enabled

> ⚠ Warning: (1) In home return incomplete state, software limit cannot stop the actuator. Take interlock and prohibit the operation or perform the operation carefully.
> (2) If the JISL signal is changed during inching operation, the inching being operated is continued. If JISL is changed during job operation, the jog is stopped.

(3) Writing current data to position table

1) The feature is valid only when the teaching mode is selected (with the MODES signal being ON).
2) Specify the position number to which the current data is written in the binary data format in command position No.PC1 to PC32. Turn current value writing signal PWRT ON.
3) The coordinate value of the current position is written into the position table for the controller. If position data is written previously, only the coordinate value in "Position" is only rewritten. If nothing is written, the values set in the parameters below are written as the speed, acceleration/deceleration, positioning width, acceleration/deceleration mode, stop mode and vibration control No.. Other data is set to "0".
   - Velocity ······ Parameter No.8 "Default speed"
   - Acceleration ······ Parameter No.9 "Default acceleration/deceleration"
   - Deceleration ······ Parameter No.9 "Default acceleration/deceleration"
   - Positioning width ······ Parameter No.10 "Default positioning width (in-position)"
   - Acceleration/deceleration mode ··· Parameter No.52 "Default acceleration/deceleration mode"
   - Stop mode ······ Parameter No.53 "Default stop mode"
   - Vibration control No. ······ Parameter No.109 "Default vibration control No."
4) At the completion of writing, controller write complete signal WEND is output. Then turn the PWRT signal OFF.
5) When the PWRT signal is turned OFF the WEND signal is also turned OFF.
   Turn OFF PWRT after confirming WEND is turned ON.Turning it OFF before turning ON disturbs the proper data writing.



⚠Caution:

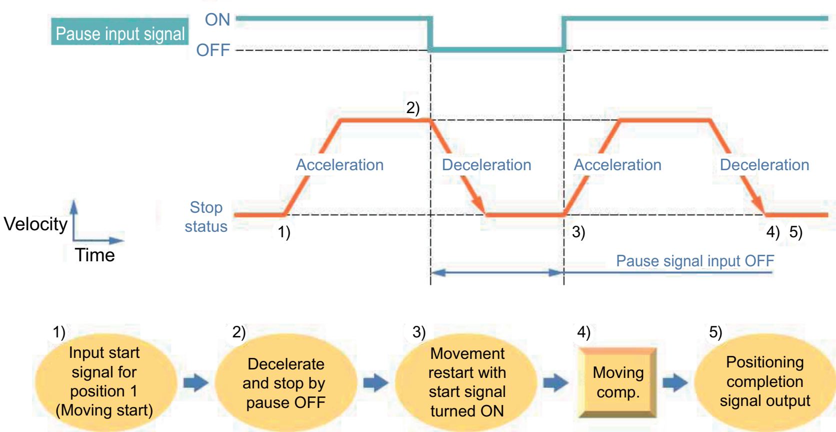
(1) Set the period taken from entering position No. to turning the PWRT ON to 6ms or longer. In spite of 6ms timer process in the PLC, commands may be input to the controller concurrently to cause writing to another position. Take the scanning time in the PLC into account, set a period as 2 to 4 times as the scanning time.
(2) Turning the PWRT signal ON in the state in which home return is not completed (the HEND signal is set to ON) causes alarm 093 “PWRT signal detected before completion of home return” to occur.
(3) Turning PWRT signal OFF before turning WEND signal ON disturbs the proper data writing.
(4) Writing processing with position table screen remaining open on a teaching tool such as PC cannot lead the data on the screen to be updated. To update and confirm writing data, take the following actions:
  1) PC software ··········· Left-click the button.
  2) Teaching Pendant or Touch Panel Teaching ··· Change to user adjustment screen, input “4” in adjustment No. and return to the position table screen after software reset.

  Check the relevant Instruction Manual for details of operation.

[8] Pause and operation interruption (*STP, RES, PEND, MOVE)

PIO signal	Input		Output	
	*STP	RES	PEND	MOVE
Pattern 0 to 1	○	○	○	○
Pattern 2	○	○	○	×

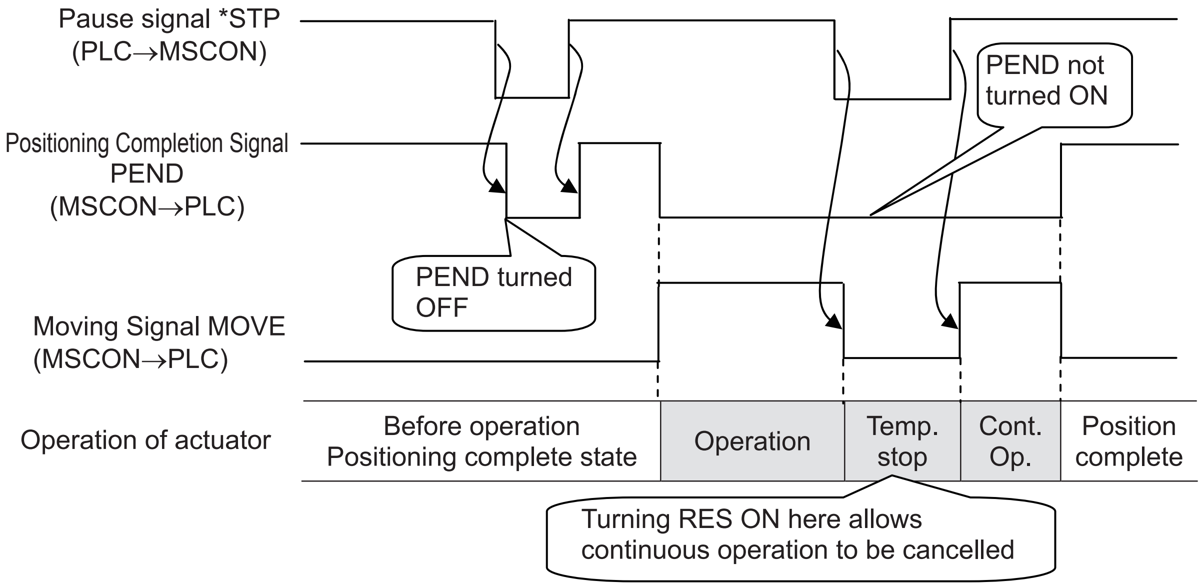
○: Existence of signal, ×: No signal



■ Control method

Pause is possible during movement. In addition, the remaining moving distance can be cancelled to interrupt the operation.
The pause signal is an input signal always set to ON. So, it is normally used to remain ON. Use this function for interlock in case where an object is invaded into the moving direction of the actuator being moved.

1) If pause signal *STP is turned OFF during operation of the actuator, the actuator is decelerated to a stop. The deceleration is defined by the value set in the position table.
2) During pause, moving signal MOVE is set to OFF but positioning complete signal PEND is not turned ON.
3) If pause signal *STP is returned to ON, the actuator continues the remaining movement. The acceleration is the value set in the position table.
4) Turning reset signal RES ON during pause (*STP being ON) allows the remaining movement to be canceled to interrupt the operation.



⚠Caution: (1)	At occurrence of an alarm in the release level (Note 1), RES can reset the alarm. Cancel the remaining moving distance after confirmation that alarm signal *ALM (being ON in normal state and OFF at occurrence of an alarm) is set to ON. Note 1: Check the 8.4 Alarm List for details of alarms.
(2)	Turning *STP OFF with the actuator being in the positioning complete state causes PEND to be turned OFF. Note that this situation may not occur when a sequence program is created.
(3)	If *STP is turned ON during pressing operation, the actuator is stopped with the pressing force remaining unchanged. If *STP is turned OFF, the pressing operation is restarted.

3.8.3 Direct Position Specification (Solenoid Valve Mode 1) = Operation of PIO Pattern 4

The start signal is provided for every position number. Only turning ON the relevant input signal according to the table shown below allows the operation based on the data in the target position number to be performed. The operation mode is called the solenoid valve mode because solenoid valves can directly drive air cylinders.

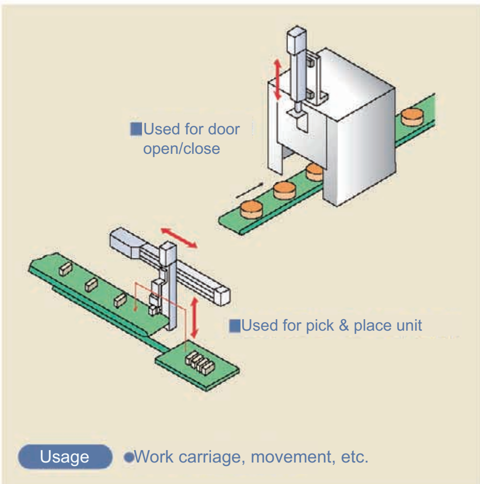
At the completion of positioning, every completed position number is output as well as the positioning complete signal.

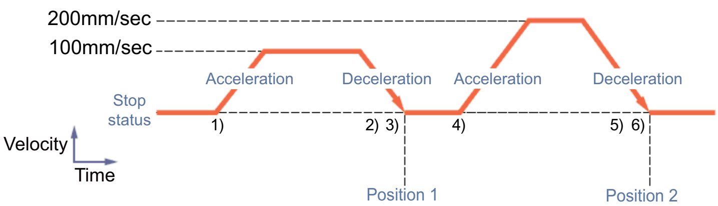
[1] Positioning [Basic] (ST1 to ST6, PE1 to PE6, PEND)

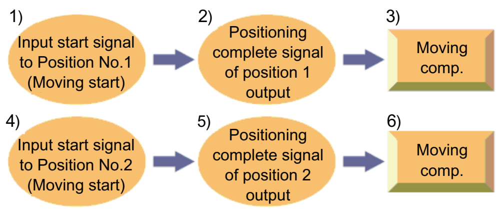
Position No.	Input	Output	
0	ST0	PE0	PEND
1	ST1	PE1	PEND
2	ST2	PE2	PEND
3	ST3	PE3	PEND
4	ST4	PE4	PEND
5	ST5	PE5	PEND
6	ST6	PE6	PEND

[Caution]
- Speed change is not allowed during movement.
- If start signal ST* is issued without home return, the home return operation is automatically done before the operation based on the data of the specified position number. When this specification is not desired, interlock by home return complete signal HEND is required.

■ Sample use



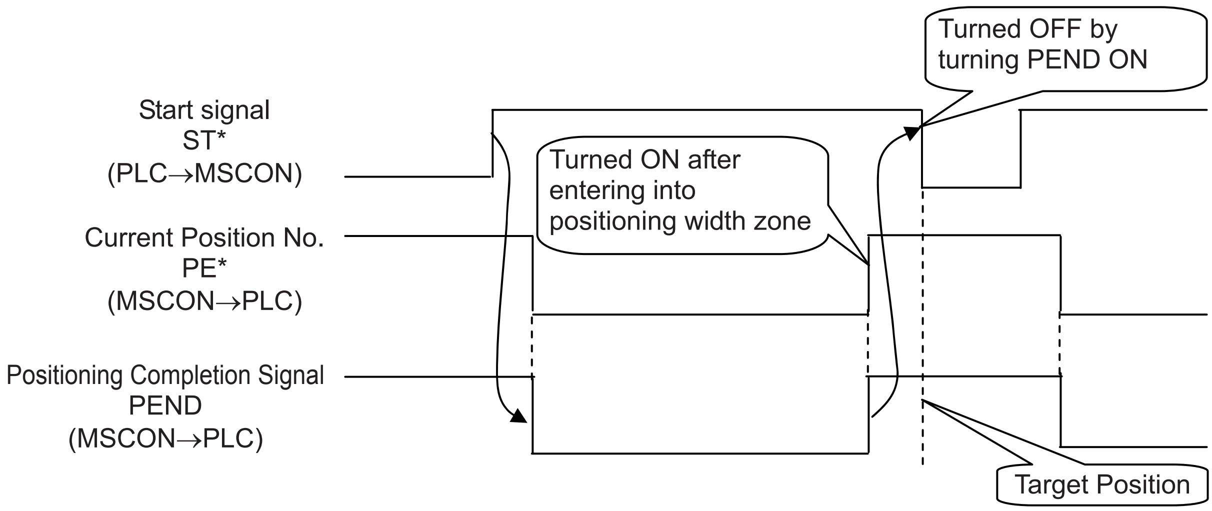




No.	Position [mm]	Velocity [mm/s]	Accele-ration [G]	Decele-ration [G]	Pressing [%]	Thresh-old [%]	Positioning width [mm]	Zone+ [mm]	Zone- [mm]	Acceleration/ Deceleration mode	Incre-mental	Gain set	Stop mode
0	0.00	100.00	0.20	0.20	0	0	0.10	0.00	0.00	0	0	0	0
1	70.00	100.00	0.20	0.20	0	0	0.10	0.00	0.00	0	0	0	0
2	150.00	200.00	0.20	0.20	0	0	0.10	0.00	0.00	0	0	0	0

■ Control method

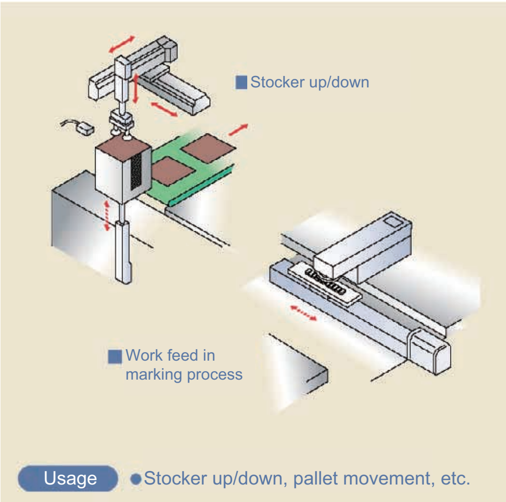
1) When start signal ST* is turned ON, the actuator starts acceleration based on the data in the specified position table for positioning to the target position.
2) At the completion of positioning, positioning complete signal PEND is turned ON as well as current position No. PE* of the specified position.
3) After PEND is turned ON, turn the ST* signal OFF.
4) Current position No. PE* and positioning completion signal PEND are turned ON if the remaining moving distance is entered into the positioning width zone. PE* and PEND turned ON once remain ON unless start signal ST* is turned ON again or the servo is turned OFF. They are also turned OFF when pause signal *STP is turned OFF.

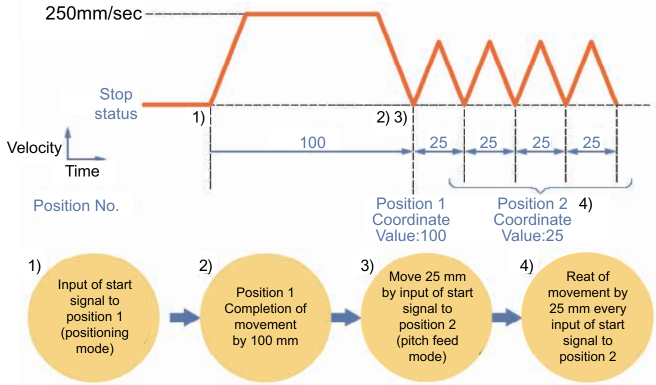


⚠ Caution: (1) If the ST* signal is turned ON for the position after completion of positioning, both the PE* and PEND signals remain ON (except the pitch feed operation).
(2) Both the PE* and PEND signals are set to ON in the positioning width zone. Accordingly, they may be turned ON under operation of the actuator if a large positioning width is set.
(3) Interlock should be taken so that two or more ST* signals are set to ON simultaneously.
   1) Entering the ST* signal of another position during positioning is invalid. If the ST* signal of another position is turned ON during positioning, the operation is terminated after the completion of the positioning being operated.
   2) Entering the ST* signal of another position with the ST* signal of the current position remaining ON after the completion of positioning allows the positioning to the other position to be executed.
(4) If Parameter No.27 “Move command type” is set to “0” (factory setting), turning ST* OFF during positioning caused the operation to be interrupted.

[2] Pitch feeding (relative movement = incremental feed)

■ Sample use





No.	Position [mm]	Velocity [mm/s]	Acceleration [G]	Deceleration [G]	Pressing [%]	Threshold [%]	Positioning width [mm]	Zone+ [mm]	Zone- [mm]	Acceleration/ Deceleration mode	Incremental	Gain set	Stop mode
0													
1	100.00	250.00	0.20	0.20	0	0	0.10	0.00	0.00	0	0	0	0
2	25.00	250.00	0.20	0.20	0	0	0.10	0.00	0.00	0	1	0	0

(Position No.2 sets pitch feed.)

■ Control method

1) The method of controlling pitch feed is the same as that described in [1] Positioning except the setting of the position table. Repeat the positioning of a specific position No.
2) For pitch feed, the position set in the position table indicates the pitch. Set the pitch (relative moving distance = incremental moving distance) in column "Position".
3) If the operation command is issued, the actuator moves from the current stop position by "Position" in the position table. To perform continuous movement, repeat the operation. Any accumulation error does not occur because the home position (coordinate value 0) is specified as the base point.

Caution:

(1) Because pitch feed is repeated, turning ON the ST* signal of the same position after completion of positioning causes both the PE* and PEND signals to be turned OFF at operation start and turned ON again at completion of positioning in the same way as [1] Positioning.

(2) If the actuator reaches the software limit (stroke end) in pitch feed, the actuator is decelerated to be stopped and current position No. PE* and positioning complete signal PEND are turned ON at the stop position.

(3) Both the PE* and PEND signals are set to ON in the positioning width zone. Accordingly, they may be turned ON under operation of the actuator if a large positioning width is set.

(4) Interlock should be taken so that two or more ST* signals are set to ON simultaneously.
  1) Entering the ST* signal of another position during positioning is invalid. If the ST* signal of another position is turned ON during positioning, the operation is terminated after the completion of the positioning being operated.
  2) Entering the ST* signal of another position with the ST* signal of the current position remaining ON after the completion of positioning allows the positioning to the other position to be executed.

(5) If Parameter No.27 “Move command type” is set to “0” (factory setting), turning ST* OFF during positioning caused the operation to be interrupted.

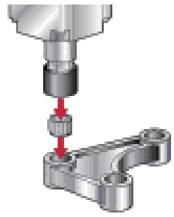
(6) Note that, when Parameter No.27 “Move command type” is set to “1”, starting (ST* ON) pitch feed repeatedly during pause causes the actuator to be moved successively by the number of starts. If this situation is supposed, cancel the remaining moving distance by turning reset signal RES ON in the pause state or take interlock so that start signals are not turned ON during pause.

(7) The pressing operation is enabled by using the pitch feed function.

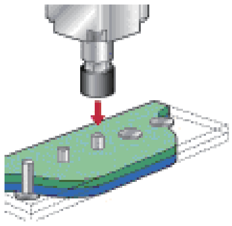
(8) In the pitch feed, do not perform a command with a pitch smaller than the minimum encoder resolution (lead/encoder pulse number) or that less than positioning accuracy repeatability.
There would be no deviation to occur even with the command because it is an operation command to the same position as the positioning complete condition, but the positioning control cannot be performed properly.

[3] Pressing operation

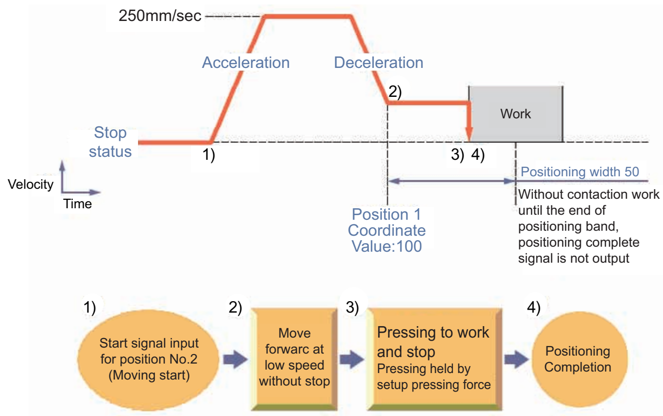
■ Sample use



Press-fitting process



Caulking process

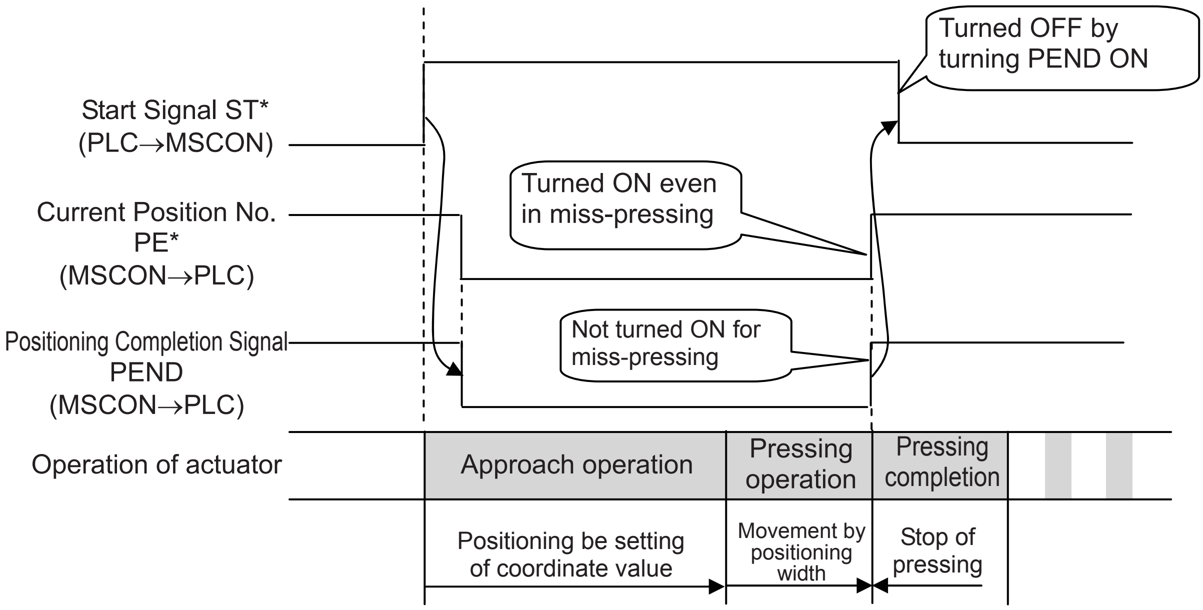


No.	Position [mm]	Velocity [mm/s]	Accele-ration [G]	Decele-ration [G]	Pressing [%]	Thresh-old [%]	Positioning width [mm]	Zone+ [mm]	Zone- [mm]	Acceleration/ Deceleration mode	Incre-mental	Gain set	Stop mode
0													
1	0.00	250.00	0.20	0.20	0	0	0.10	0.00	0.00	0	0	0	0
2	100.00	250.00	0.20	0.20	50	0	50.00	0.00	0.00	0	0	0	0

(Position No.2 sets pressing operation.)

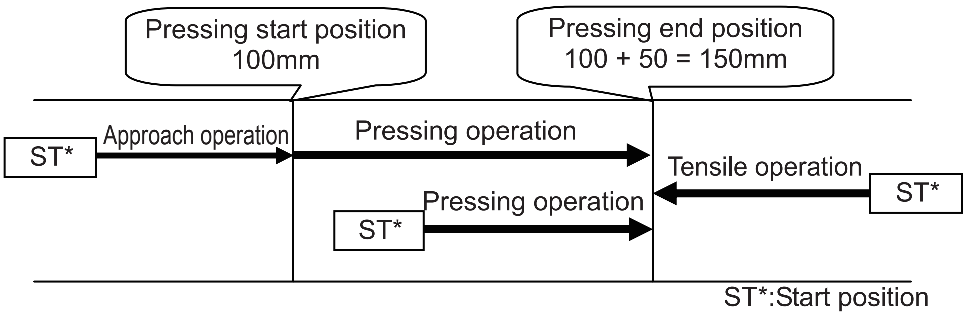
■ Control method

1) The method of controlling the pressing operation is the same as that described in [1] Positioning except the setting of the position table. Any setting of “Pressing” in the position table allows the pressing operation to be done. “Positioning width” is assumed as pressing operation distance.
2) The actuator moves at the setting speed and rating torque to the position of the coordinate set in “Position” in the similar way as normal positioning. Then the operation changes to pressing. The moving distance in pressing is the value set in “Positioning width”. The pressing is performed with the torque (current limit value) set in percent in “Pressing” of PIO patterns 4 being the upper limit.
   Pressing operation using force sensor of PIO pattern 7 performs pressing by the pressing force set in percent of the base thrust in pressing operation using force sensor*1.
3) The control method is the same as that in [1] Positioning. However, the processing of positioning complete signal PEND is different from that in [1] Positioning.
   PEND is output when the shaft is stopped by pressing (pressing complete). If the work is not subject to pressing (miss-pressing), the actuator moves by the value set in “Positioning width” to stop but PEND is not turned ON. The current position No. PE* is turned ON at the completion of pressing and even in miss-pressing.



Caution: (1) The speed during pressing operation is set in Parameter No.34. Check the 9.1 List of Specifications of Connectable Actuators for the pressing operation speed.
Do not set any value larger than the value in the list. If the speed set in the position table is equal to or less than the pressing speed, the pressing is performed at the setup speed.

(2) The approach start position of pressing should be located at or before the pressing start position (coordinate 100mm or less in the above example) If not, the moving direction varies depending on the start position to be dangerous.
For example, pressing at coordinate larger than the pressing end position (larger than 150mm) is performed in the direction from the current position to the pressing end position. It would not proceed to the pressing operation at 150mm point after positioning at 100mm point.



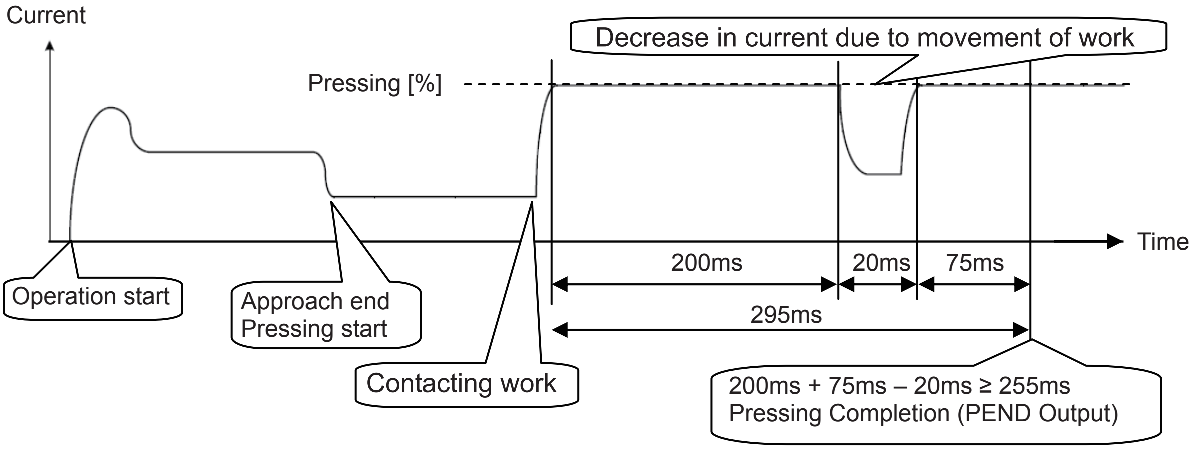
(3) The work is pressed after the pressing is completed. The work may moves backward or forward. If the actuator is moved backward before the approach position, alarm code 0DC "pressing operation range error" occurs to stop the actuator. In movement of the work in the pressing direction, PEND is turned OFF if the load current becomes lower than the current limit (pressing [%]). Miss-pressing occurs when the actuator moves by the pressing moving distance set in "Positioning width".

(4) Pressing control cannot be performed with the rotary actuator.

Judging completion of pressing operation

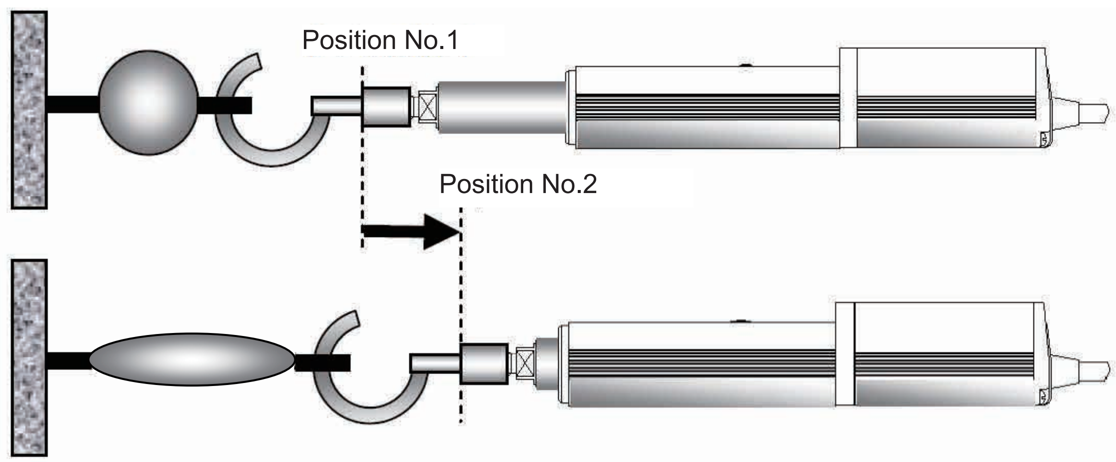
The operation monitors the torque (current limit value) in percent in “Pressing” of the position table and turns pressing complete signal PEND ON when the load current satisfies the condition shown below during pressing. PEND is turned ON at satisfaction of the condition if the work is not stopped.

(Accumulated time in which current reaches pressing value [%]) – (accumulated time in which current is less than pressing value [%]) ≥ 255ms (Parameter No.6)

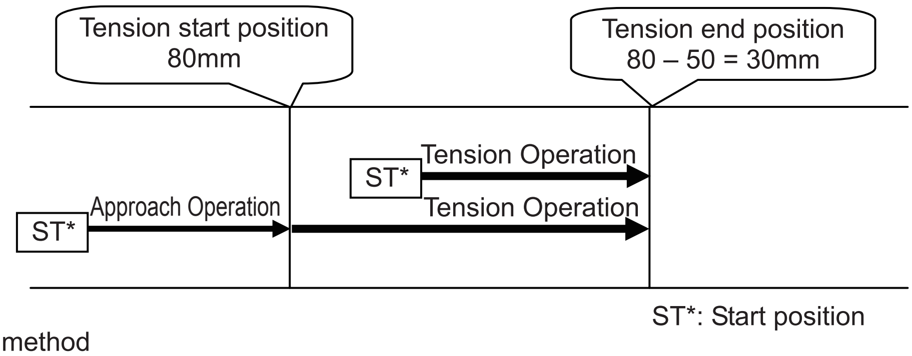


[4] Tension Operation

■ Image diagram



No.	Position [mm]	Velocity [mm/s]	Accele-ration [G]	Decele-ration [G]	Pressing [%]	Thresh-old [%]	Positioning width [mm]	Zone+ [mm]	Zone- [mm]	Acceleration/ Deceleration mode	Incre-mental	Gain set	Stop mode
0													
1	100.00	250.00	0.20	0.20	0	0	0.10	0.00	0.00	0	0	0	0
2	80.00	250.00	0.20	0.20	50	0	–50.00	0.00	0.00	0	0	0	0
3													



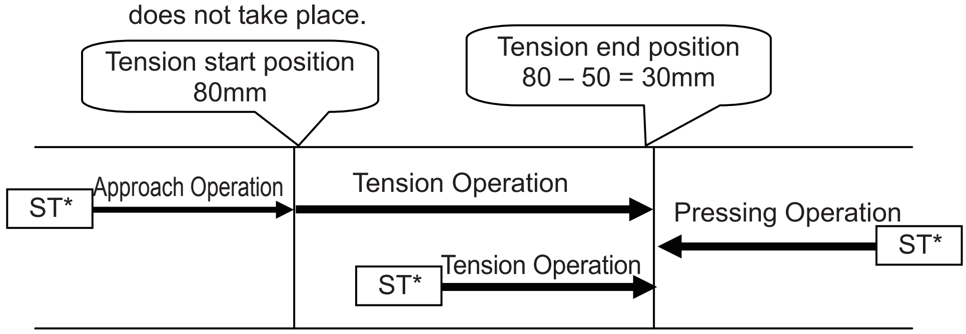
■ Control method

The method of controlling the tension operation is the same as that described in [3] Pressing operation. The control method is explained below by using the sample position table shown above.

1) Position No.2 indicates the settings of tension operation. The settings of "Position" and "Positioning width" show the tension start position and the tension quantity, respectively. Attach – (negative sign) to the tension quantity. Specify the upper limit of the torque required for tension in percent (limited current value) in "Pressing". The speed, acceleration, and deceleration are the conditions of positioning to the coordinate value (80mm) set in "Position".
2) Position No.1 indicates the tension start preparation position. Specify a value larger than the coordinate value at which the tension provided by position No.2 ends (80 – 50 = 30mm) in "Position".
3) First define the positioning in position No.1. Next, the operation in position No.2 moves the actuator to the position of 80mm at the setting speed and rating torque and change to the tension operation. The actuator moves by 50mm in the negative direction in the tension operation. The upper limit of the tensile force is the torque set in percent.
4) In the similar way as pressing, the positioning complete signal is output when the shaft is stopped by tension (pressing complete). If the actuator cannot be stopped during movement within the setting positioning width (miss-pressing), it moves by the setting distance to stop but PEND is not turned ON. The current position No. PE* is turned ON at the completion of pressing and even in miss-pressing.

⚠ Caution: (1) The speed during tension operation is set in Parameter No.34. [Refer to 9.1 List of Specifications of Connectable Actuators for the pressing speed.] Do not set any value larger than the value in the list. If the speed set in the position table is equal to or less than the tension speed, the tension operation is performed at the setup speed.

(2) The tension ready position should be the tension start position or forward. If not, the moving direction varies depending on the start position to be dangerous.
The tension operation from a coordinate (less than 30mm = 80 – 50 in the above example) located before the end position (30mm or less) changes to the pressing operation from the current position to the tension end position. Note that the tension operation after positioning to the position of 80mm does not take place.



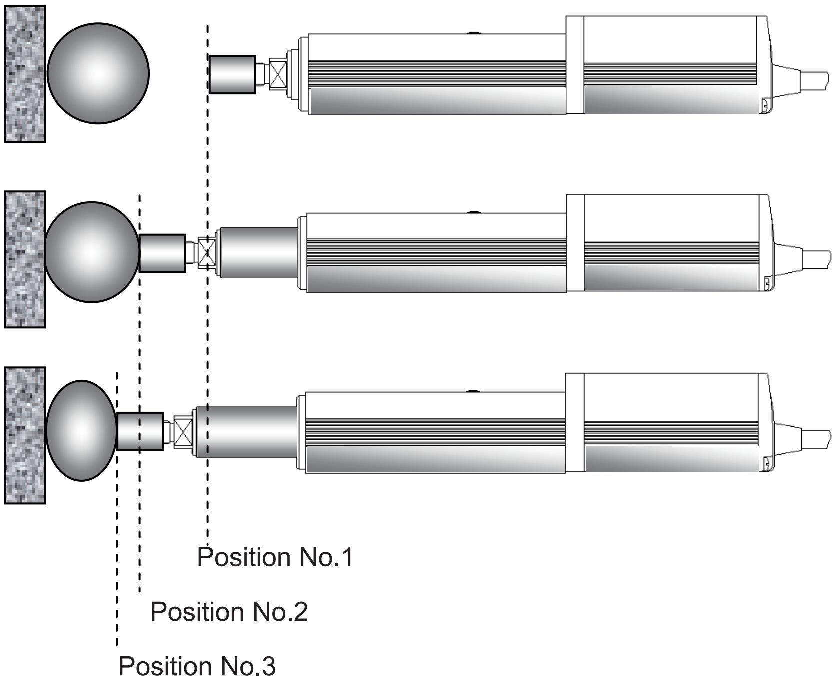
ST*: Start position

(3) The work is pulled also after completion of the tension. The work is drawn back or pulled further if the work is moved. When the work is drawn back before the approach position, alarm code 0DC "pressing operation range error" occurs to stop the work. When the work is moved in the tension direction and the load current becomes less than the current limit value (pressing in [%]), PEND is turned OFF. Naturally, the work reaches the tension moving distance set in "Positioning width" to cause miss-pressing.

(4) Tension operation cannot be performed with the rotary actuator.

[5] Multi-step pressing

■ Image diagram



No.	Position [mm]	Velocity [mm/s]	Accele-ration [G]	Decele-ration [G]	Pressing [%]	Thresh-old [%]	Positioning width [mm]	Zone+ [mm]	Zone- [mm]	Acceleration/ Deceleration mode	Incre-mental	Gain set	Stop mode
0													
1	0.00	250.00	0.20	0.20	0	0	0.10	0.00	0.00	0	0	0	0
2	50.00	250.00	0.20	0.20	30	0	20.00	0.00	0.00	0	0	0	0
3	50.00	250.00	0.20	0.20	50	0	20.00	0.00	0.00	0	0	0	0
4													

■ Control method

After pressing, the pressing pressure can only be changed in the pressing state.
The method of controlling multi-step pressing is the same as that described in [3] Pressing operation. Shown below is the explanation with the position table above as an example.

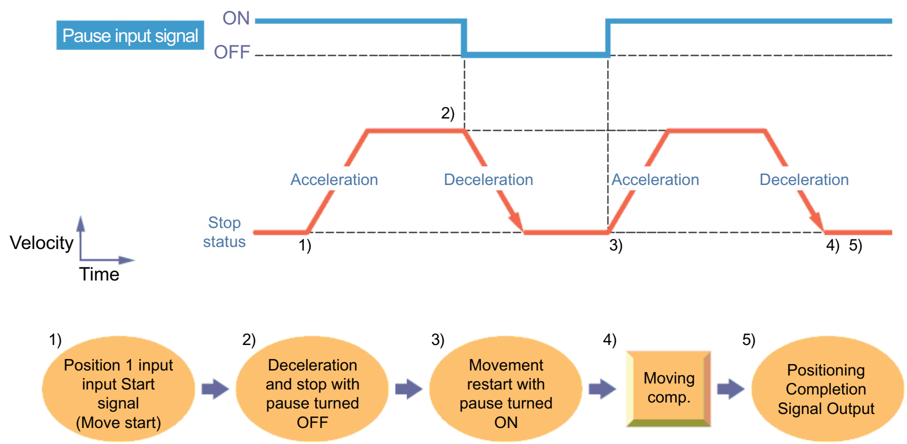
1) Set the weak pressing (30%) in position No.2 and perform the pressing operation.
2) If pressing complete signal PEND is turned ON, start the pressing operation with pressing pressure (50%) greater than the first pressure set in position No.3.
   In this particular operation, turn ON ST3 after completion of ST2, and turn OFF ST2 when PEND is turned OFF. In usual case, do not turn ON two or more ST* signals simultaneously.
   The position data in position No.3 should be the same as that in position No.2 except the setting in "Pressing".
3) To add a pressing step with another pressing pressure, add a sequence consisting of a position number and a pressing operation.

[6] Pause and operation interruption (ST*, *STP, RES, PE*, PEND)

Pause is possible during movement. In this mode, the following two methods are possible for pause.

1) Use of pause signal *STP
   Turning reset signal RES ON during the pause allows the remaining moving distance to be cancelled to interrupt the operation.
2) Use of start signal ST*
   This method is valid when Parameter No.27 “Move command type” is set to “0” (factory setting). The actuator can only be moved while the ST* signal is set to ON and stopped if ST* is turned OFF. Since setting the ST* signal to OFF is assumed as interrupt of operation, the remaining moving distance may not be cancelled.

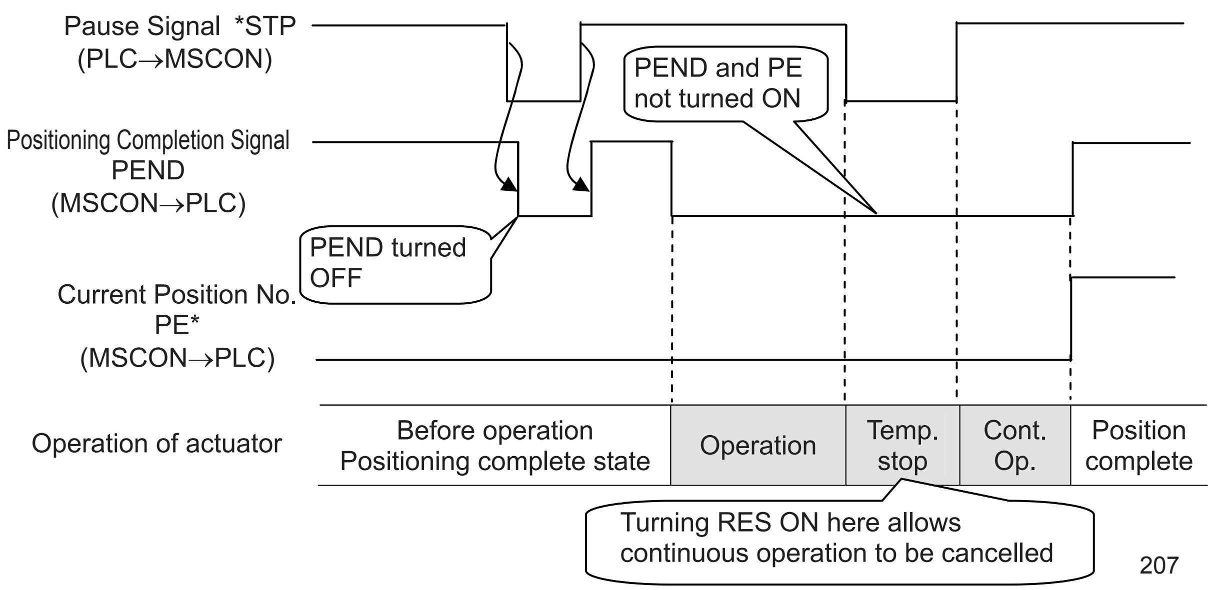
(1) Use of pause signal *STP



■ Control method

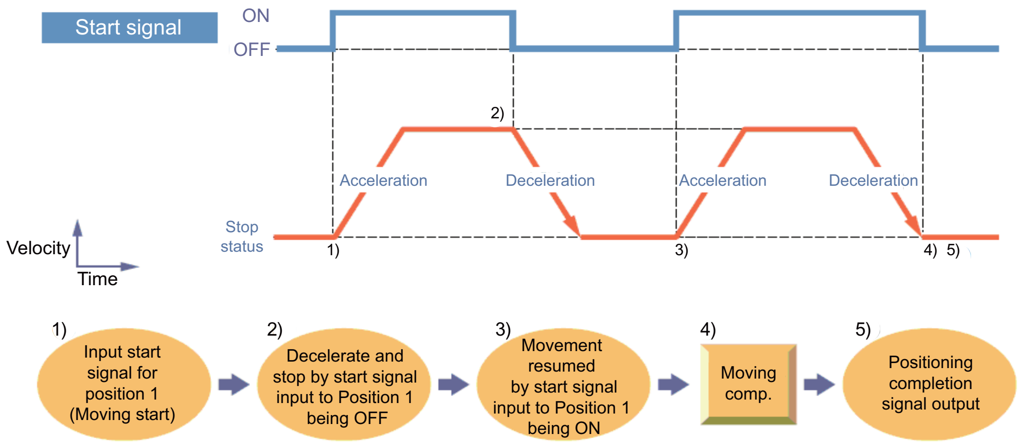
The pause signal is an input signal always set to ON. So, it is normally used to remain ON. Use this function for interlock in case where an object is invaded into the moving direction of the actuator being moved.

1) If pause signal *STP is turned OFF during operation of the actuator, the actuator is decelerated to a stop. The deceleration is defined by the value set in the position table.
2) During pause, current position No. PE* and positioning complete signal PEND are not turned ON.
3) If pause signal *STP is returned to ON, the actuator continues the remaining movement. The acceleration is the value set in the position table.
4) Turning reset signal RES ON during pause (*STP being ON) allows the remaining movement to be canceled to interrupt the operation.

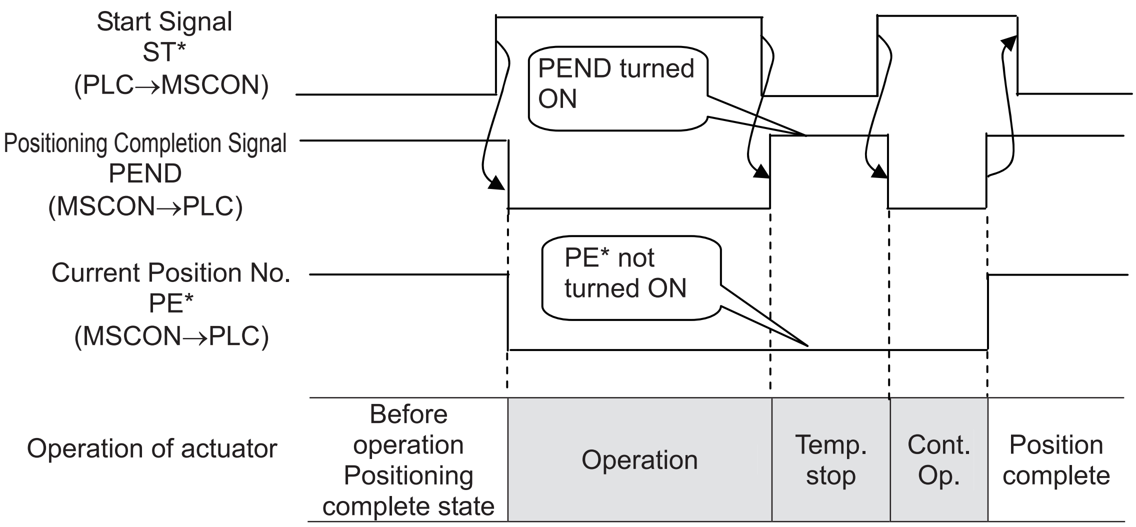


⚠Caution: (1) At occurrence of an alarm in the release level[Note 1], RES can reset the alarm. Cancel the remaining moving distance after confirmation that alarm signal *ALM (being ON in normal state and OFF at occurrence of an alarm) is set to ON.
Note 1: [Refer to 8.4 Alarm List for details of alarms.]
(2) Turning *STP OFF with the actuator being in the positioning complete state causes PEND to be turned OFF. Note that this situation may not occur when a sequence program is created.

(2) Use of start signal ST*



■ Control method
If start signal ST* is turned OFF during movement, the actuator can be paused.
Use the control method for interlock in case where an object is invaded into the moving direction of the actuator being moved.
1) If the ST* signal is turned OFF during movement, the actuator is paused. The deceleration is the value set in the position table.
2) Turning the ST* signal OFF causes the positioning to be interrupted and deemed complete signal PEND to be turned ON.
3) If the ST* signal is turned ON again, the remaining movement is continued. The acceleration is the value set in the position table.



3.8.4 Direct Position Specification (Solenoid Valve Mode 2) = Operation of PIO Pattern 5

The start signal is provided for every position number. Only turning ON the relevant input signal according to the table shown below allows the operation based on the data in the target position number to be performed. The operation mode is called the solenoid valve mode because solenoid valves can directly drive air cylinders. At invasion of the actuator into the positioning width set for each position, the output signal is turned ON in the operation of any position number or manual operation of the actuator in servo OFF status as if a sensor were installed.

<u>Positioning and speed change during operation are possible. Their control methods are the same as those of other patterns.</u>

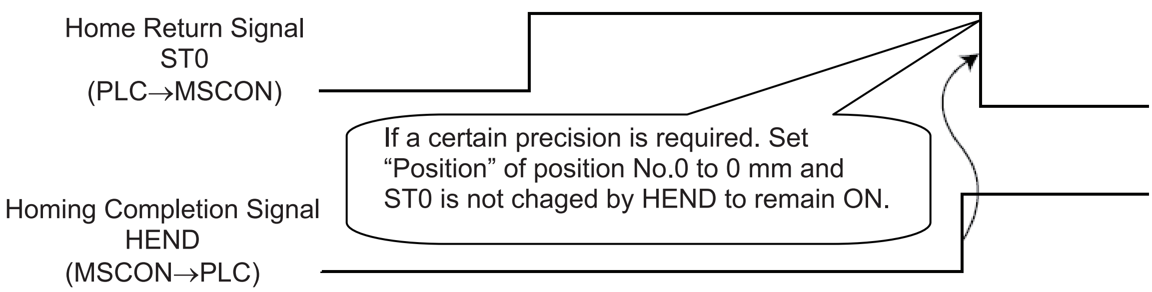
> ⚠ Caution: This pattern does not allow pressing and pitch feed.

[1] Home return (ST0, HEND)

The I/O of PIO varies as shown in the table below depending on the position number before home return.

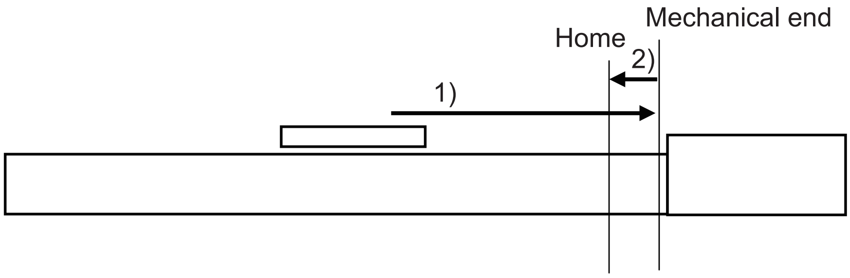
Position No.	Input	Output
0	ST0	LS0
1	ST1 ⇒ JOG+	LS1
2	ST2 ⇒ Invalid	LS2 ⇒ Invalid

Before home return, start signal ST0 works as JOG- moving to the home return direction while it is set to ON and ST1 works as JOG+ while it is set to ON. By using this function, move the actuator to a position at which home return can be done safely. The speed of ST1 is the home return speed.
After the home return is fully prepared, turn the ST0 signal ON to start the home return. At the completion of the home return, home return complete signal HEND is turned ON. Turn the ST0 signal OFF if HEND is turned ON. HEND remains ON unless the home is lose due to occurrence.
If a certain home positioning precision is required, Set “Position” of position No.0 to 0 mm and the ST0 signal is not changed by the HEND signal to remain ON. After the home return is completed, positioning is provided for position No.0. [Refer to [3] Positioning in this chapter]



> ⚠ Warning: (1) Use this pattern with Parameter No.27 “Move command type” set to “0” (factory setting). When Parameter No.27 is set to “1”, the home return is started as soon as the ST0 signal is turned ON and the operation cannot be stopped even if ST0 is turned OFF.
> (2) If “Position” in position No.0 is set to other than 0mm, the operation is continued without change to provide positioning after home return.

[Operation of Slider Type/Rod Type Actuator]



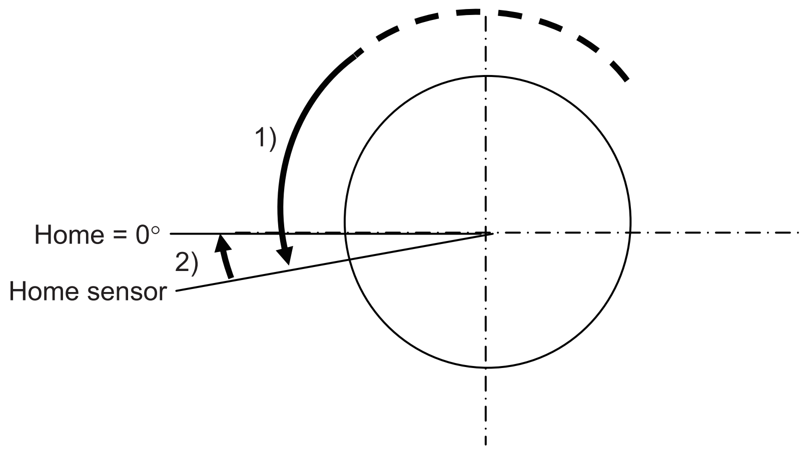
1) With the ST0 signal being ON, the actuator moves toward the mechanical end at the home return speed.
   The moving speed is 20mm/s for most actuators but less than 20mm/s for some actuators. Check the instruction manual of actuator.
2) The actuator is turned at the mechanical end and stopped at the home position. The moving distance is the value set by Parameter No.22 "Home return offset level".(Note 1)

⚠Caution: In the home reverse specification, the actuator moves in the reverse direction. Make sure to refer to Section 7.2 [12] when a change to Parameter No.22 "Home Return Offset Level" is required.

Note 1: It moves for the offset amount after the encoder Z-phase is detected.

[Operation of Rotary Actuator]

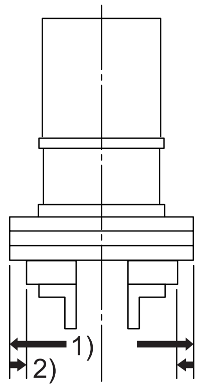
(1) 300° Rotation Specification



1) By HOME Signal being on, the rotary part turns in CCW (counterclockwise) from the view of load side. The velocity is either 20deg/s or 5deg/s. (It depends on the setting of each actuator.)
2) At the home sensor input, the actuator is turned in the reverse direction and stopped at the home position. The rotation angle is the value set by Parameter No.22 "Home return offset level" after the detection of phase Z.

⚠Caution: Make sure to refer to Section 7.2 [12] when a change to Parameter No.22 "Home Return Offset Level" is required.

[For gripper type]



1) If the HOME signal is turned ON, the actuator moves toward the mechanical end at the home return speed (20mm/s).
2) The actuator is turned at the mechanical end and stopped at the home position. The rotation angle is the value set by Parameter No.22 “Home return offset level” after the detection of phase Z.

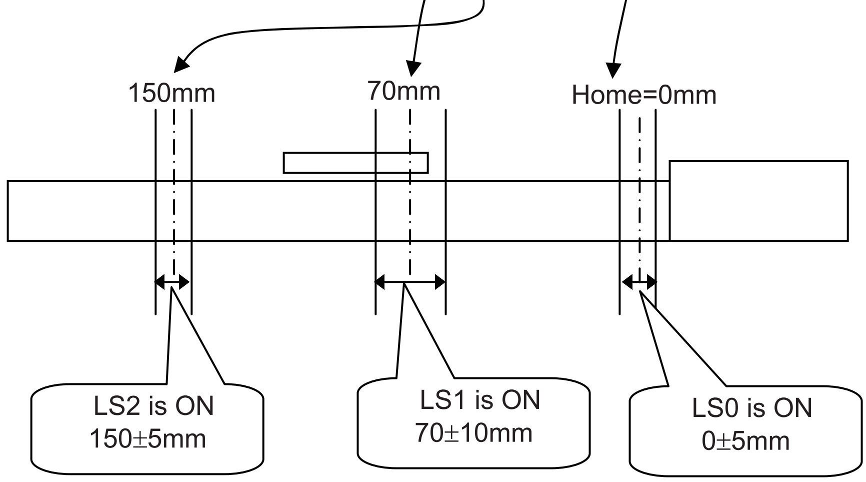
> ⚠ Caution: Make sure to refer to Section 7.2 [12] when a change to Parameter No.22 “Home Return Offset Level” is required.

[2] Features of LS signals (LS0 to 2)

The LS* signals are not complete signals for positioning commands such as those for other PIO patterns. Despite the specified position No., the corresponding LS* signal is turned ON when the actuator is entered into the setup value range as if the actuator were detected by a sensor installed.

(Example) The figure below shows the position table and the position at which each of the LS signals is turned ON. If the actuator passes any of the positioning widths in the operation by another position number or manual operation in the servo OFF state, the relevant LS signal is always turned ON.

No.	Position [mm]	Velocity [mm/s]	Accele-ration [G]	Decele-ration [G]	Pressing [%]	Thresh-old [%]	Positioning width [mm]	Zone+ [mm]	Zone- [mm]	Acceleration/ Deceleration mode	Incre-mental	Gain set	Stop mode
0	0.00	250.00	0.20	0.20	0	0	5.00	0.00	0.00	0	0	0	0
1	70.00	250.00	0.20	0.20	0	0	10.00	0.00	0.00	0	0	0	0
2	150.00	250.00	0.20	0.20	0	0	5.00	0.00	0.00	0	0	0	0



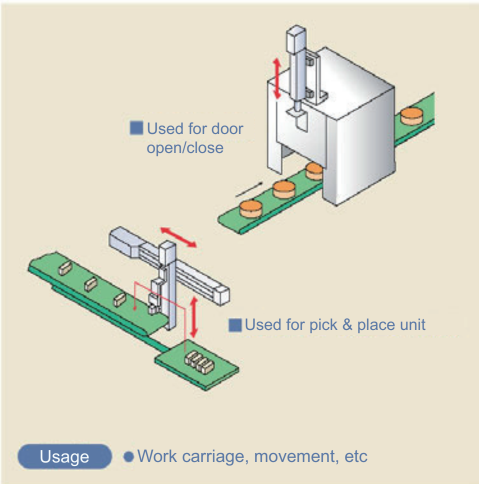
> ⚠ Caution: Even though a cold start error is generated, LS Signal would not turn OFF.

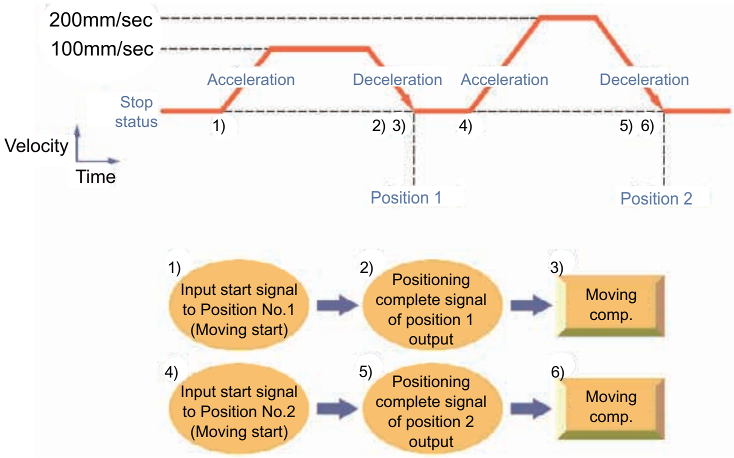
[3] Positioning [Basic] (ST0 to ST2, LS0 to LS1)

Position No.	Input	Output
0	ST0	LS0
1	ST1	LS1
2	ST2	LS2

[Caution] Pressing and pitch feed are unavailable.

■ Sample use



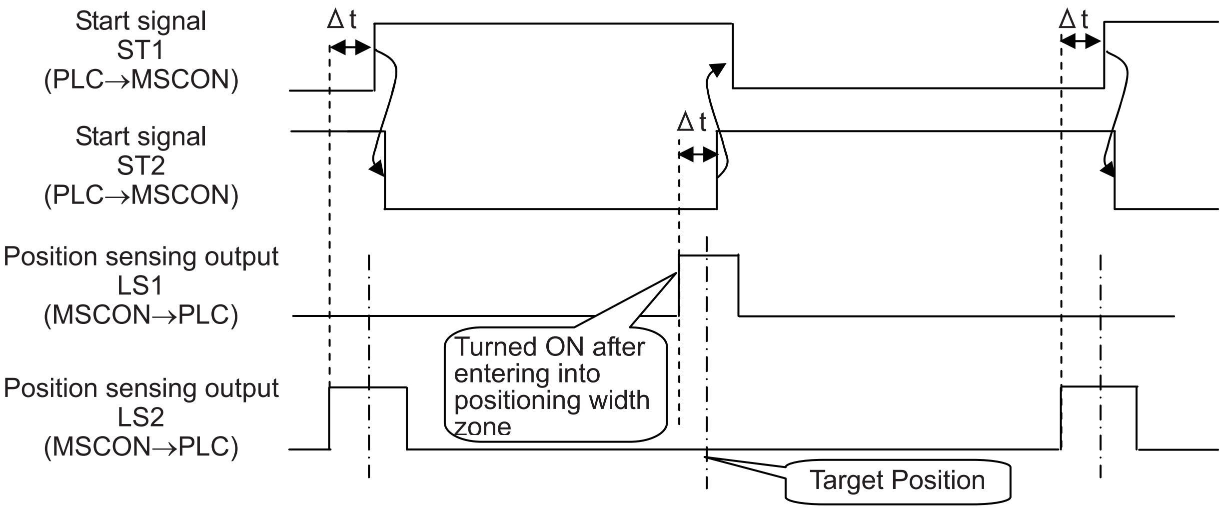


No.	Position [mm]	Velocity [mm/s]	Acceleration [G]	Deceleration [G]	Pressing [%]	Threshold [%]	Positioning width [mm]	Zone+ [mm]	Zone- [mm]	Acceleration/ Deceleration mode	Incremental	Gain set	Stop mode
0	0.00	100.00	0.20	0.20	0	0	0.10	0.00	0.00	0	0	0	0
1	70.00	100.00	0.20	0.20	0	0	0.10	0.00	0.00	0	0	0	0
2	150.00	200.00	0.20	0.20	0	0	0.10	0.00	0.00	0	0	0	0

■ Control method

1) When start signal ST* is turned ON, the actuator starts acceleration based on the data in the specified position table for positioning to the target position. Turning the ST* signal OFF on the way causes the actuator to be decelerated and stopped. So, make the ST* signal remain ON until the actuator reaches the target position.
2) At the completion of positioning, position detection output LS* of the specified position is turned ON.
3) Position detection output LS* is turned ON if the remaining moving distance enters into the positioning width. LS* is set to ON if the current position is located within the positioning width zone or OFF if the current position is located out of the positioning width zone (the same situation occurs in the servo OFF status).
4) Leave the ST* signal to be ON until the actuator is moved to another position and turn OFF it at the next ST* signal. If the ST* signal is turned OFF at the LS* signal, the actuator is decelerated to a stop in the positioning width and thus the actuator may not reach the target position. In continuous operation, turn ON the next ST* signal by setting the positioning width within the required precision range or setting the period taken from detection of the LS* signal to reaching the target position.

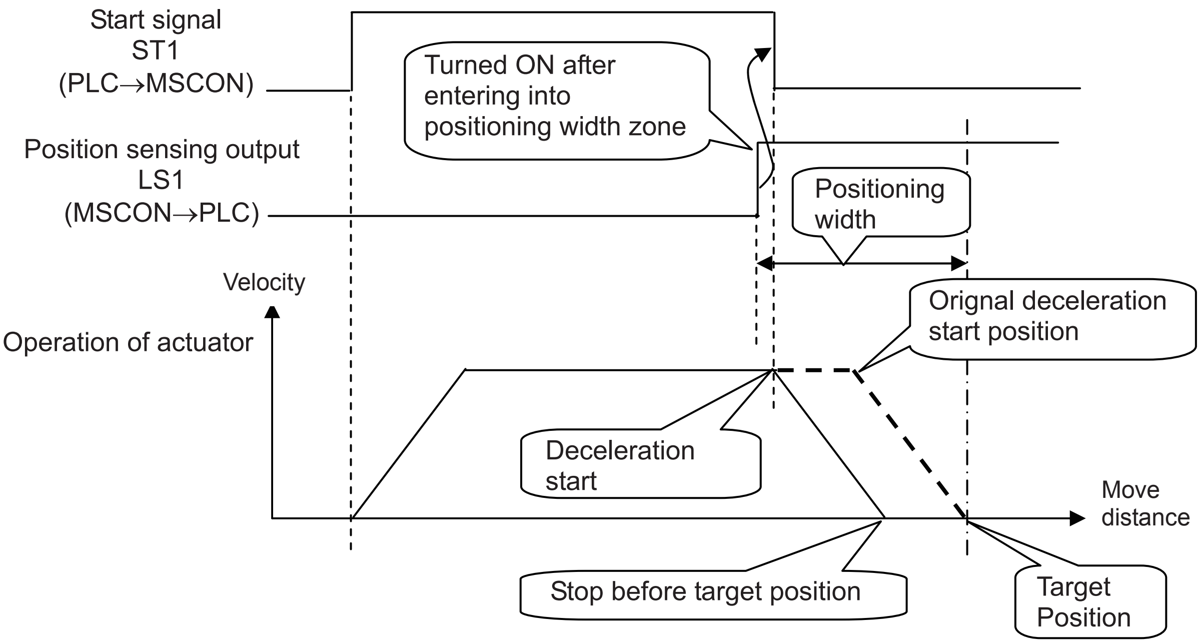
(Example) Repetition of ST1 → ST2 → ST1 →
Insert timer Δt if necessary.



Δ t : Time required to certainly reach the target position after the position sensing output LS1 or 2 is turned ON.

[Example of stop position when the ST* signal is turned OFF by the LS* signal]

If the positioning width is set at a position before the original deceleration start position, the actuator cannot reach the target position.

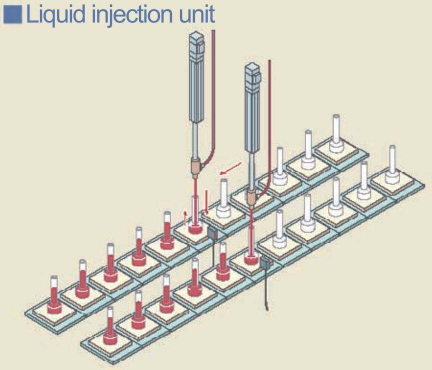


⚠ Caution: (1) If the ST* signal for the position is turned ON after the completion of positioning, the LS* signal remains ON.
(2) Both the LS* and PEND signals are set to ON in the positioning width zone. Accordingly, they may be turned ON under operation of the actuator if a large positioning width is set.
(3) Interlock should be taken so that two or more ST* signals are set to ON simultaneously. If two or more ST* signals are input simultaneously, they will be executed according to the following priorities: ST0→ST1→ST2

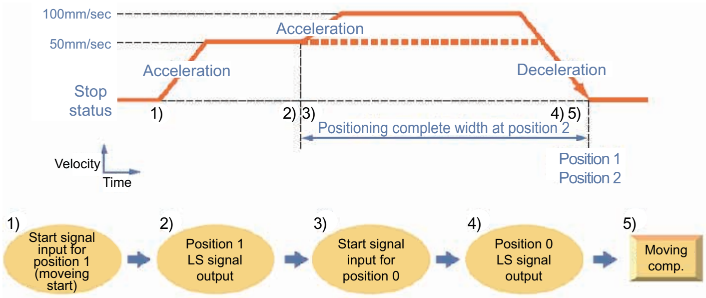
[4] Speed change during the movement

■ Sample use

■ Liquid injection unit



The unit inserts nozzles into containers, injects liquid, and moves the nozzles upward so that they may not be contact with the liquid surfaces.



No.	Position [mm]	Velocity [mm/s]	Acceleration [G]	Deceleration [G]	Pressing [%]	Thresh-old [%]	Positioning width [mm]	Zone+ [mm]	Zone- [mm]	Acceleration/ Deceleration mode	Incremental	Gain set	Stop mode
0	0.00	100.00	0.20	0.20	0	0	0.10	0.00	0.00	0	0	0	0
1	0.00	50.00	0.20	0.20	0	0	100.00	0.00	0.00	0	0	0	0
2	150.00	200.00	0.20	0.20	0	0	0.10	0.00	0.00	0	0	0	0

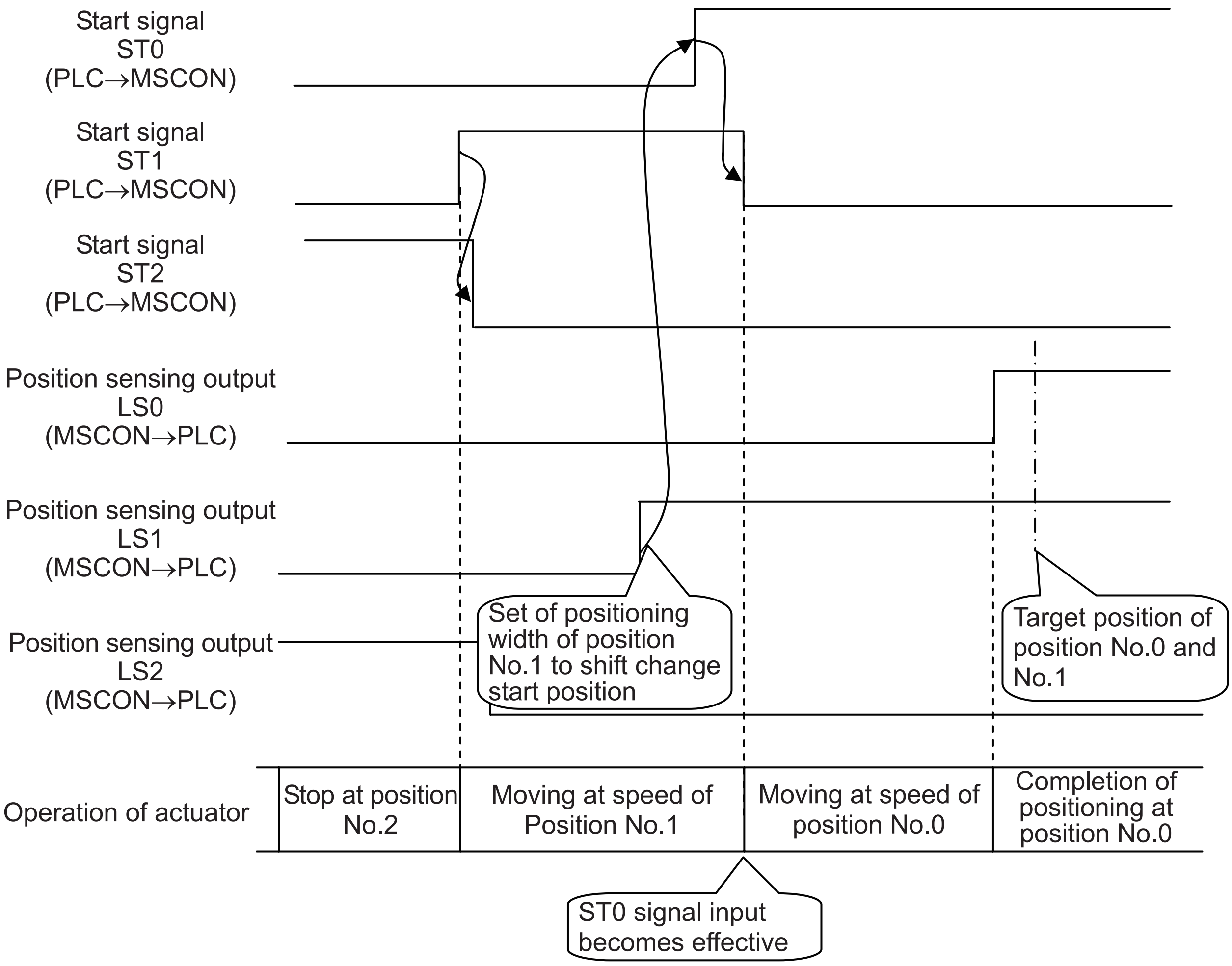
■ Control method

The speed of the actuator can be changed while it moves. The operation control method is the same as that in [3] Positioning. This pattern prioritizes the start signal specified later over the previous signal. Accordingly if another position No. is started during operation, then the new operation begins. This can be used to change the speed.

1) In this example, the speed is changed while the actuator moves from the position of 150mm to the position of 0mm. At first, set the positioning to the target position at the first speed in position No.1. In the positioning width, set the distance from the speed change position to the target position. The value is set to 100mm in the example. Thus, for position No.1, position sensing signal LS1 is turned ON at the position before the target position by 100mm.
2) Set the positioning to the target position at the second speed in position No.0.
3) Then start position No.1 (ST1 signal) and use position sensing output signal LS1 of position No.1 to start position No.0 (ST0 signal). Since this pattern prioritizes the signal specified later over the previous signal, the operation of No.1 is changed to the operation of No.0 during the operation of No.1.
   (Note) If there is a signal commanded afterwards, the commanded signal will start activating once the previously commanded signal is turned OFF.
4) Use position sensing signal LS0 of position No.0 to turn the ST1 signal OFF.

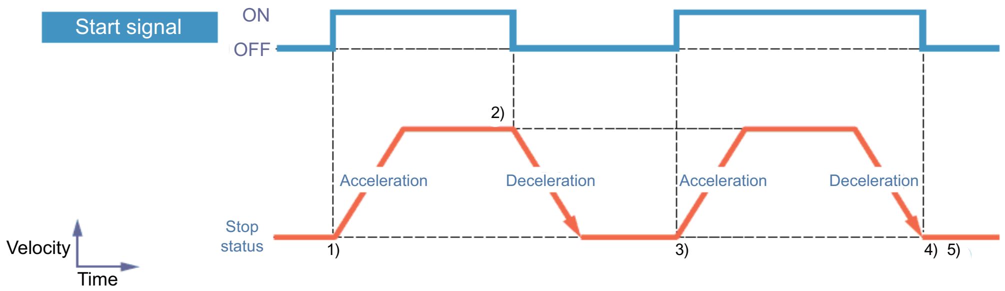
In this example, the target positions No.0 and 1 are equal with each other. They may not be the same. However, setting the target positions to be equal with each other allows the distance from the speed change position to the target position to be known easily.
Depending on the timing when the actuator accepts the input signal, the speed change may be delayed a little. Changing the positioning width can adjust the timing.

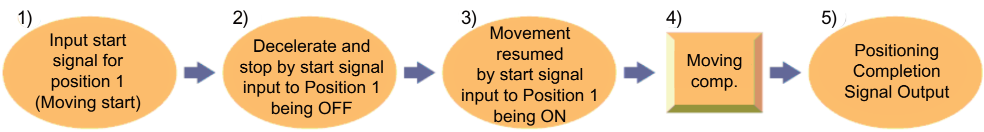
The timing chart shown below indicates that the actuator changes its speed while it moves to position No.1 after the completion of positioning at position No.2 and moves to position No.0.



[5] Pause and Operation Interruption (ST*, *STP, RES, PE*, PEND)

Turning start signal ST* OFF allows the actuator to be paused while it is moved. To restart it, turn the same ST* signal ON.

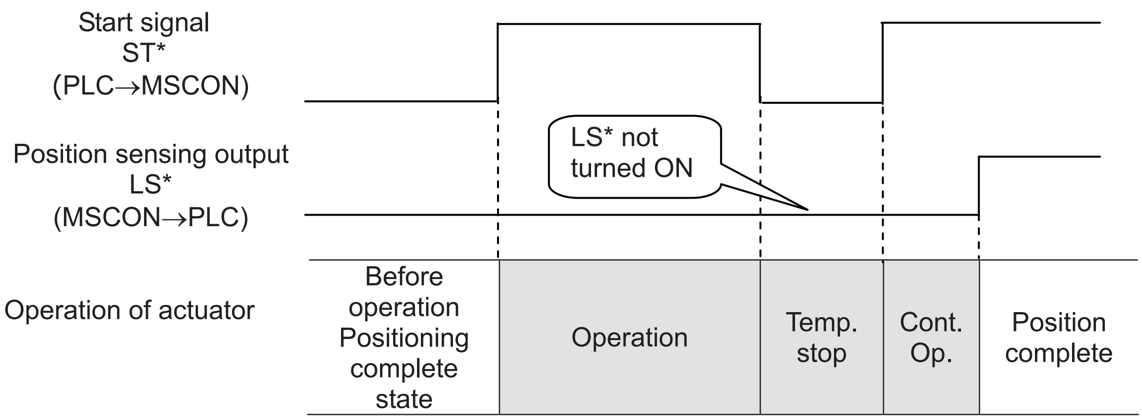




■ Control method

If start signal ST* is turned OFF during movement, the actuator can be paused.
Use the control method for interlock in case where an object is invaded into the moving direction of the actuator being moved.

1) If the ST* signal is turned OFF during movement, the actuator is decelerated to a stop. The deceleration is the value set in the position table.
2) If the ST* signal is turned ON again, the remaining movement is continued. The acceleration is the value set in the position table.

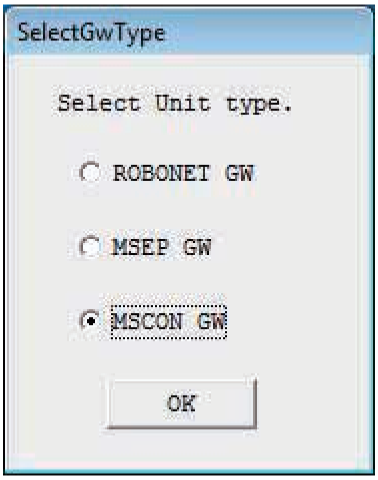


3.9 About Gateway Parameter Setting Tool

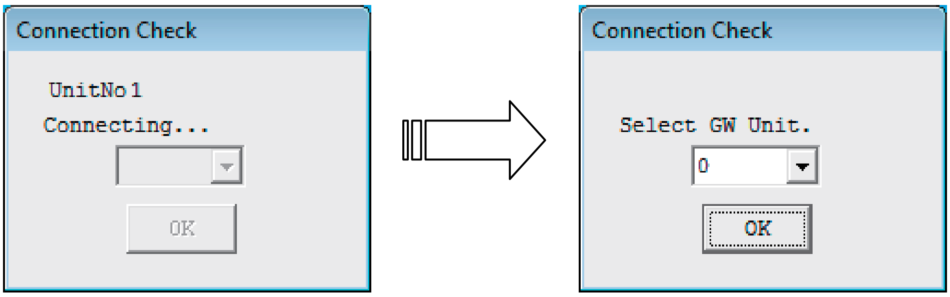
This tool is necessary for the initial setting process such as MSCON operation mode select.
Shown below is how to use the tool.

3.9.1 Startup of Tool

1) Boot the Gateway Parameter Setting Tool after the power to MSCON is turned ON, and the window shown below appears.
   Select “MSCON GW” and click on the OK button.



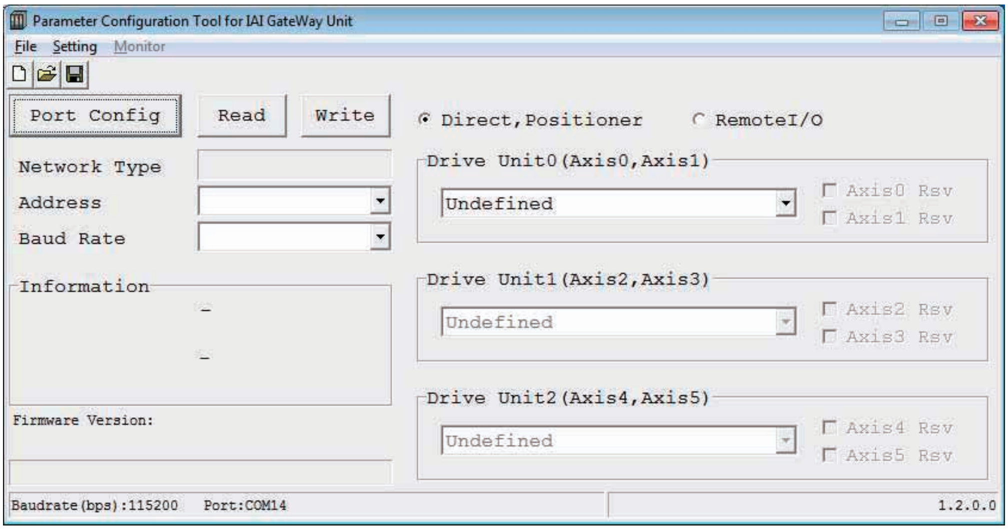
2) Once MSCON is detected the detected unit numbers become available to select. Select the unit number to be connected and click the OK button.



MSCON being detected

Select the unit number to be connected

3) The main window opens. The main window opens even when MSCON could not be detected. Click on the "Read" button in this window and the parameters start to be read from MSCON. Parameter transfer starts if the "Write" button is clicked. However, note that the transfer cannot be made if there is a blank like Address and Communication Speed in the figure below.

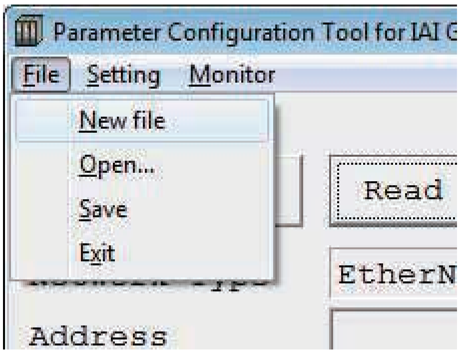


Main windows (Initial condition)

3.9.2 Explanation of each Menu

(Note) If MSCOM is not detected, there will be some items that cannot be displayed or selected.

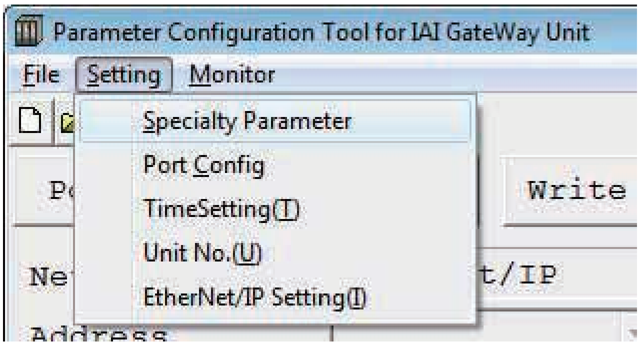
1) File Menu



In the main window, click on the file menu on the top left corner and the menu list pops up as shown in the figure above.

- New file : Create new network parameters and operation mode parameters.
- Open : Open the saved parameter files to show on the main window.
- Save : Save the parameter remained in the tool as a file.
- Exit : Close the tool.

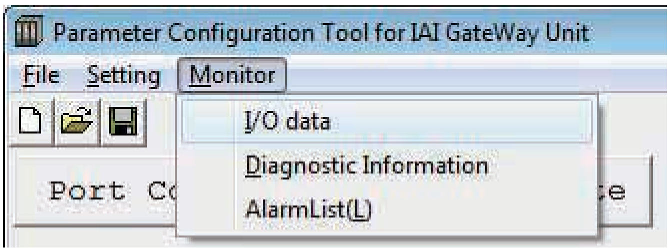
2) Setting Menu



Click on the “Setting” menu on the top left corner in the main window and the setting menu list pops up.

- Specialty Parameter : Set the parameters related to the process of Gateway area in MSCON.
  [Refer to 3.9.3 1), 2) and 3) GW Parameter */GW Mode Select.]
- Port Config : Set the communication speed between the tool and PC and COM port number.
- Time Setting : Set the clock retained in MSCON.
  [Refer to 3.2.3 4) Clock Setting.]
- Unit No. : Set the unit number of MSCON and top axis number in that unit.
  [Refer to 3.2.3 5) Unit Number.]
- EtherNet/IP Setting : For EtherNet/IP type, this menu is displayed.
  Set IP address etc.
  [Refer to 3.9.3 6) EtherNet/IP Setting]

3) Monitor menu

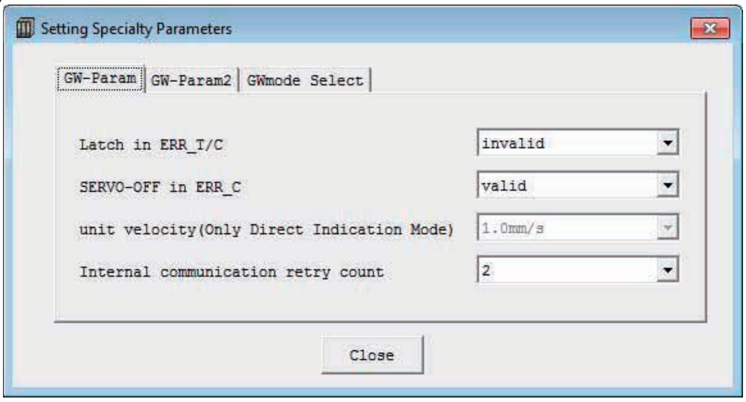


Click on the [Monitor] menu on the top left corner in the main window and the monitor menu list pops up.
(Note): “Monitor” cannot be selected before reading a parameter.

- I/O data : Show the details of the host PLC and MSCON data.
  [Refer to 3.2.3 6) I/O data.]
- Diagnosis Information : Show the number of ERRT and ERRC occurrence, emergency stops and scan time.
  [Refer to 3.2.3 7) Diagnosis information.]
- Alarm List(L) : Read and show the alarm list retained in MSCON.
  [Refer to 3.2.3 8) Alarm list.]

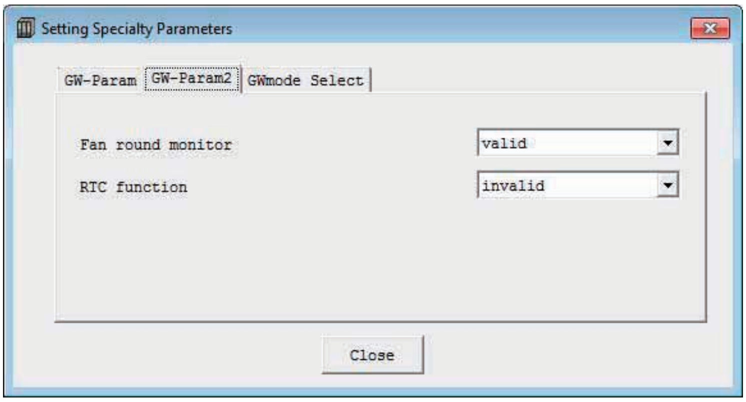
3.9.3 Description of Functions

1) GW-Param



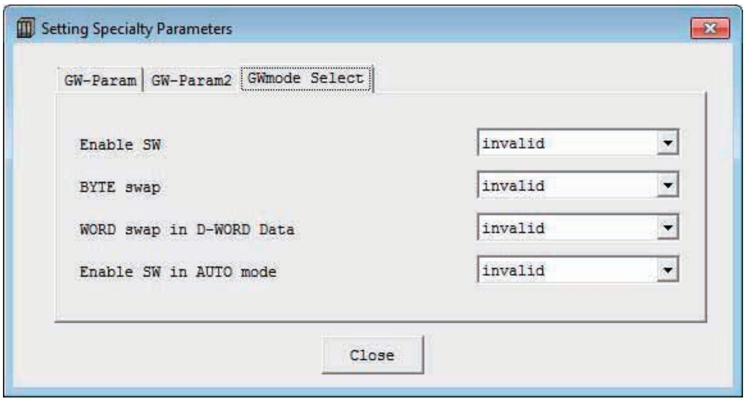
- Latch in ERR_T/C : Select whether to continue the error even in recoverable condition after ERRT and ERRC are issued.
- SERVO-OFF in ERR_C : Select whether to turn the servo OFF on the connected axes when ERRC is occurred.
- unit velocity (Only Direct Indication Mode) : Select the unit for speed from 1.0mm/s and 0.1mm/s.
- Internal communication retry count : Set the number of communication retries with the connected axes in AUTO mode.

2) GW-Param 2



- Fan round monitor : Select whether to/not to monitor the fan rotation speed with the monitor function.
- RTC function : Select whether to generate alarm when clock setting is lost.

3) GW mode Select



- Enable SW : Select whether to activate/inactivate the enable switch in TP.
- BYTE swap : Set the byte swap. [Refer to 3)-1 in this section.]
- WORD swap in D-WORD Data : Set whether to swap the W-word sized data with word size. [Refer to 3)-2 in this section.]
- Enable SW in AUTO mode : Select whether to activate/inactivate the enable switch in AUTO mode.

3)-1 BYTE swap: Swap the upper and lower in the sent and received data in byte unit. Set this considering the connected host system if necessary.

● = ON, ○ = OFF

MSCON Input register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	○	○	●	●	○	●	○	○	○	○	○	●	○	○	●	○	●	●	○	○	●	●	○	●	●	○	●	○	●	○	●	●
Hexadecimal data	3				4				1				2				C				D				A				B			

PLC: RWwnn	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	○	○	○	●	○	○	●	○	○	○	●	●	○	●	○	○	●	○	●	○	●	○	●	●	●	●	○	○	●	●	○	●
Hexadecimal data	1				2				3				4				A				B				C				D			

MSCON Output register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	○	○	●	●	○	●	○	○	○	○	○	●	○	○	●	○	●	●	○	○	●	●	○	●	●	○	●	○	●	○	●	●
Hexadecimal data	3				4				1				2				C				D				A				B			

PLC : RWrnn	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	○	○	○	●	○	○	●	○	○	○	●	●	○	●	○	○	●	○	●	○	●	○	●	●	●	●	○	○	●	●	○	●
Hexadecimal data	1				2				3				4				A				B				C				D			

3)-2 WORD Swap in D-WORD Data: Swap the upper and lower in the W-word sized sent and received data in word unit.
Set this considering the connected host system if necessary.

● = ON, ○ = OFF

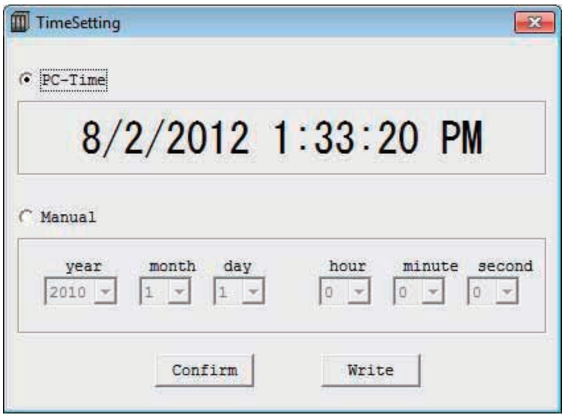
MSCON Input register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	●	○	●	○	●	○	●	●	●	●	○	○	●	●	○	●	○	○	○	●	○	○	●	○	○	○	●	●	○	●	○	○
Hexadecimal data	A				B				C				D				1				2				3				4			

PLC: RWwnn	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	○	○	○	●	○	○	●	○	○	○	●	●	○	●	○	○	●	○	●	○	●	○	●	●	●	●	○	○	●	●	○	●
Hexadecimal data	1				2				3				4				A				B				C				D			

MSCON Output register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	●	○	●	○	●	○	●	●	●	●	○	○	●	●	○	●	○	○	○	●	○	○	●	○	○	○	●	●	○	●	○	○
Hexadecimal data	A				B				C				D				1				2				3				4			

PLC: RWrnn	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	○	○	○	●	○	○	●	○	○	○	●	●	○	●	○	○	●	○	●	○	●	○	●	●	●	●	○	○	●	●	○	●
Hexadecimal data	1				2				3				4				A				B				C				D			

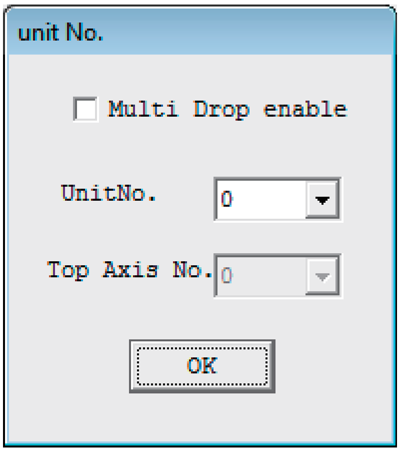
4) Time setting



By selecting Time on PC, the current time on the PC is acquired and set to MSCON. If Set Manually is selected, desired time set in the clock edit in the window can be set in MSCON. Click “Write”, and the time setting is transferred to MSCON and the data is written in. Clicking on the Confirm button and the clock data currently retained in MSCON can be read and displayed.

⚠ Caution:	The clock (calendar) function in MSCON can be retained for approximately 10 days (reference) after the power to MSCON is turned OFF. Once the clock data is lost, the time passed since the power is turned back on as 2000/1/1 0:00:00 is displayed as the current time.

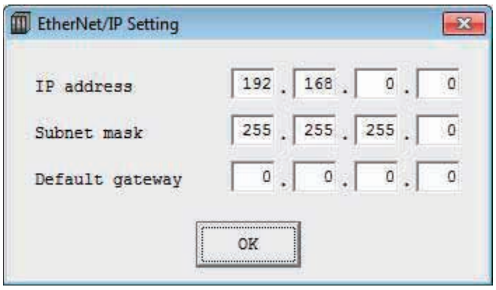
5) Unit Number Setting



This setting is to be conducted when 2 units of MSCON are to be connected to the PC software at the same time.
(It is not necessary to have this setting done for 1 unit of MSCON.)

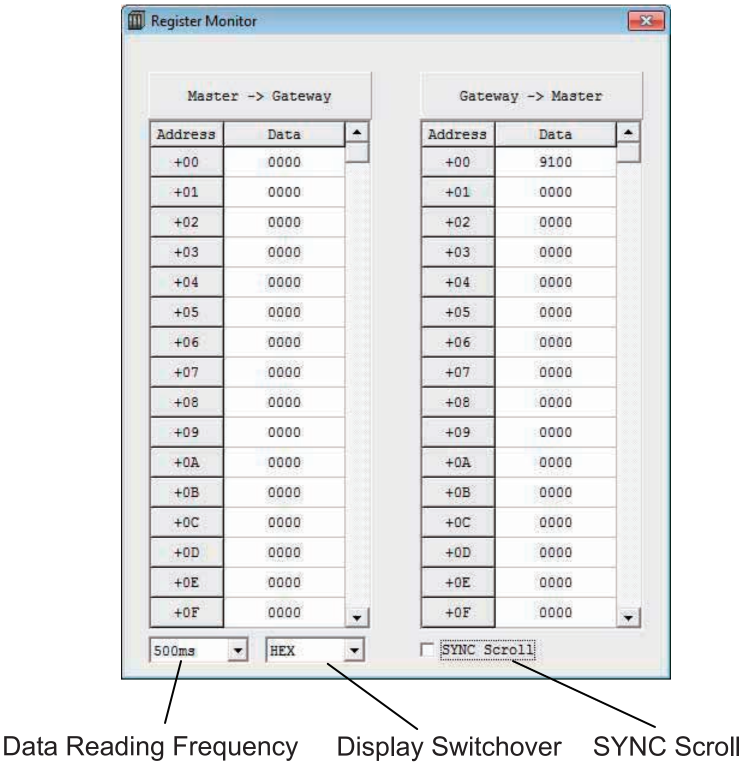
- Multi Drop enable : Tick in the box if the setting in this window is to be activated.
- Unit No. : Set the unit number of MSCON.
- Top Axis No. : Set the top axis number of MSCON composition axes.

6) EtherNet/IP Setting (Setting to be established for EtherNet/IP type)



- IP address: : Set IP address for MSCON.
- Subnet mask: : Set subnet mask.
- Default gateway : Set default gateway.

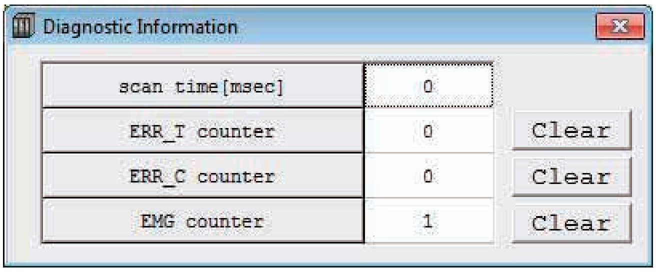
7) I/O monitor



In this register monitor window, shows the data that Gateway Unit has received from the host (master) and the data sent back to the host (master).

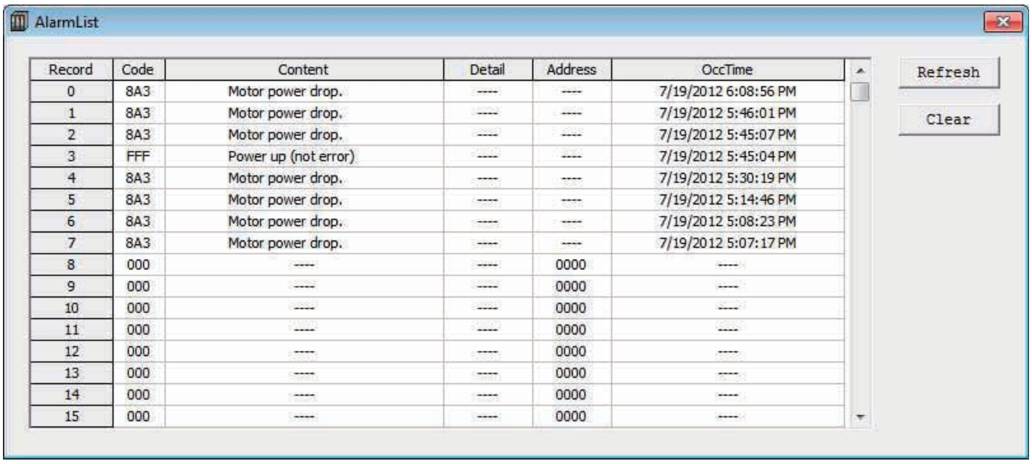
- Data Reading Frequency : Select the frequency of displayed data update from 100 to 500ms.
- Display Switchover : Select from binary and hexadecimal for the display.
- SYNC Scroll : Tick in the box to make the list of the sent and received data scrolled together.

8) Diagnosis Information



The number of the communication error (ERRC and ERRT) occurrence and number of the emergency stop (EMG) detection can be counted.

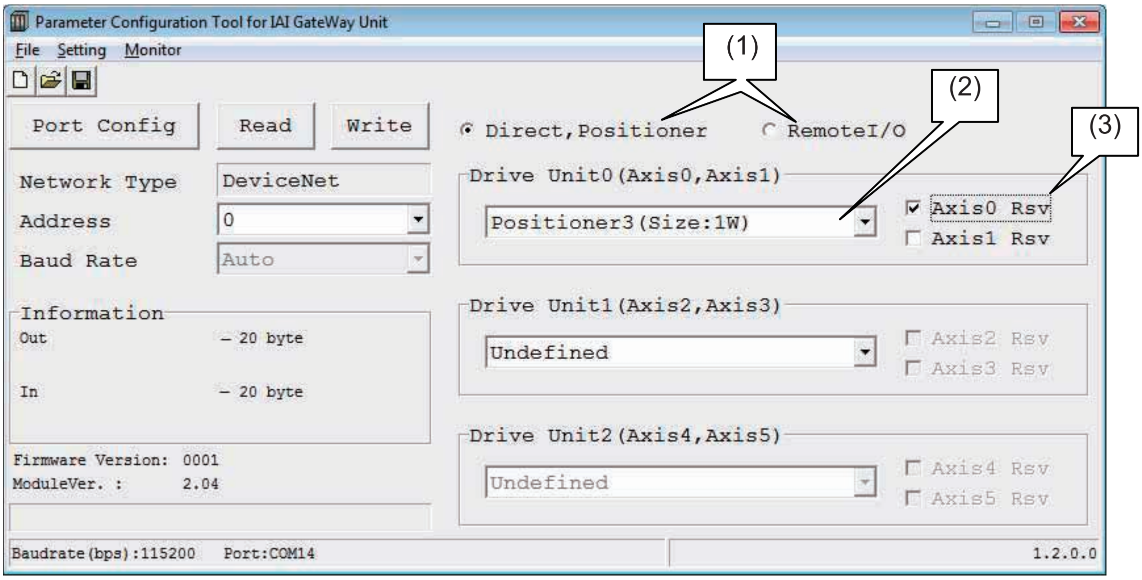
9) Alarm list



Record	Code	Content	Detail	Address	OccTime
0	8A3	Motor power drop.	----	----	7/19/2012 6:08:56 PM
1	8A3	Motor power drop.	----	----	7/19/2012 5:46:01 PM
2	8A3	Motor power drop.	----	----	7/19/2012 5:45:07 PM
3	FFF	Power up (not error)	----	----	7/19/2012 5:45:04 PM
4	8A3	Motor power drop.	----	----	7/19/2012 5:30:19 PM
5	8A3	Motor power drop.	----	----	7/19/2012 5:14:46 PM
6	8A3	Motor power drop.	----	----	7/19/2012 5:08:23 PM
7	8A3	Motor power drop.	----	----	7/19/2012 5:07:17 PM
8	000	----	----	0000	----
9	000	----	----	0000	----
10	000	----	----	0000	----
11	000	----	----	0000	----
12	000	----	----	0000	----
13	000	----	----	0000	----
14	000	----	----	0000	----
15	000	----	----	0000	----

Click on the “Update” button and the alarm list is read again from MSCON.
Click on the “Clear” button and the alarm list retained in MSCON are all deleted.
Refer to Chapter 8. Troubleshooting for the details of the alarms.

3.9.4 Operation Mode Setting



Operation mode setting is to be conducted in the following procedures.

1) Select (Note1) whether to use Remote I/O Mode.
2) Select (Note2) an operation mode for Drive Unit 0 (AX0: 1st axis, AX1: 2nd axis).
3) If making one of the axes for Drive Unit 0 the reserved axis (unused axis), tick on “Axis 0 Rsv” or “Axis 1 Rsv” (Note3) beside the operation mode setting box.
4) Once the operation mode for Drive Unit 0 is selected, selection of an operation mode for Drive Unit 1 (AX2: 3rd axis, AX3: 4th axis) becomes available. Select a desired operation mode. Also, if there is a reserved axis, tick on “Axis 2 Rsv” or “Axis 3 Rsv” beside the operation mode setting box.
5) Once the operation mode for Drive Unit 1 is selected, selection of an operation mode for Drive Unit 2 (AX4: 5th axis, AX5: 6th axis) becomes available. Select a desired operation mode. Also, if there is a reserved axis, tick on “Axis 4 Rsv” or “Axis 5 Rsv” beside the operation mode setting box.

Note 1: Remote I/O Mode and other modes cannot be set at the same time. When Remote I/O Mode is selected, the operation mode for all the actuator will become Remote I/O Mode.

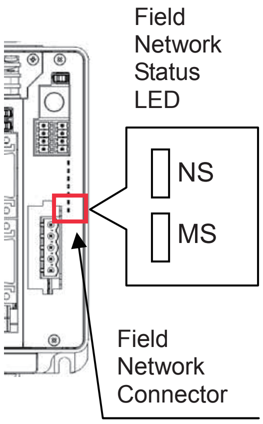
Note 2: For MSCON, setting of drive units in individual is the basic concept.

Note 3: If set as the reserved axis, but an actuator not to be connected, set as the invalid axis in Parameter No.158 Invalid Axis Setting.
Even when the number of the used axes is an odd number, have one more axis at the end input as a reserved axis to make an even number. It is necessary to secure as much area as when not set as reserved even if set as the reserved axis.

3.10 Field network status LEDs

The communication status of the field network can be checked.

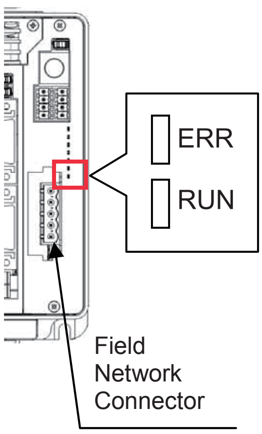
3.10.1 DeviceNet



○ : Illuminating, × : OFF, ☆ : Flashing

Name	Lamp status	Color	Description
NS	○	Green	Online (normally)
	☆		Online (Even though the network is established normally, it is not identified as MSCON by the master)
	○	Orange	An error occurs.
	☆		No response returned from another slave.
	☆(Illuminated by turns)	Green / Orange	In self-checking process.
MS	○	Green	Communication in normal condition
	☆		Parameter setting error
	○	Orange	Hardware breakdown
	☆		Light malfunction
	☆(Illuminated by turns)	Green / Orange	In self-checking process.

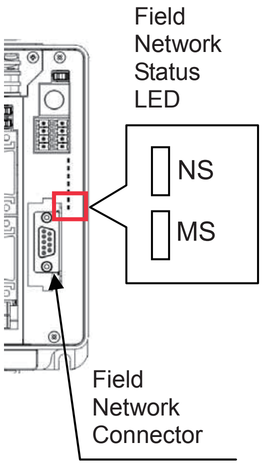
3.10.2 CC-Link



○ : Illuminating, × : OFF, ☆ : Flashing

Name	Lamp status	Color	Description
ERR	○	Orange	An error occurs. (CRC error, station No. setting error, baud rate setting error)
	☆		Station number or baud rate changed after the power-on
	×	–	Normal
RUN	○	Green	Communication in normal condition

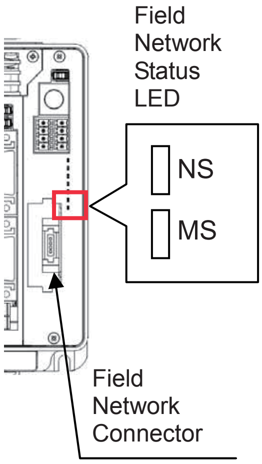
3.10.3 PROFIBUS



○ : Illuminating, × : OFF, ☆ : Flashing

Name	Lamp status	Color	Description
NS	○	Green	Online (normally)
	☆		Online (Even though the network is established normally, it is not identified as MSCON by the master)
	○	Orange	An error occurs.
MS	○	Green	Initializing completed
	☆		Initializing completed and in self-checking process
	○	Orange	An error occurs.

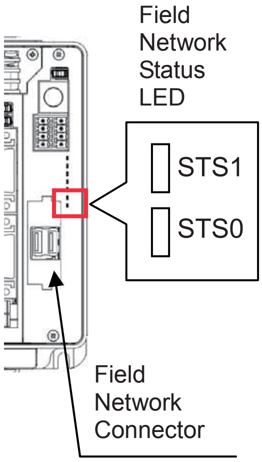
3.10.4 CompoNet



○ : Illuminating, × : OFF, ☆ : Flashing

Name	Lamp status	Color	Description
NS	○	Green	Online (normally)
	☆		Online (Even though the network is established normally, it is not identified as MSCON by the master)
	○	Orange	Node address duplication error, Wrong slave address setting
	☆		No response returned from another slave device
	×	–	Power is OFF, reset or in initializing process
MS	○	Green	Communication in normal condition
	○	Orange	Hardware breakdown
	☆		In initial setting process or EEPROM reading failed
	×	–	Power is OFF or under reset operation

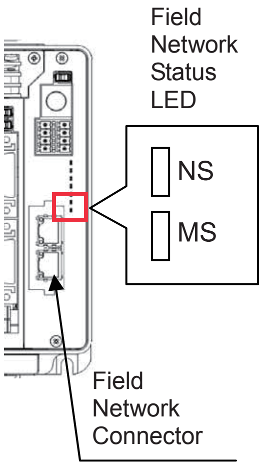
3.10.5 MECHATROLOINK



○ : Illuminating, × : OFF, ☆ : Flashing

Name	Lamp status	Color	Description
STS1	○	Green	CONNECT (network connection request) received, in communication process
	○	Orange	Communication error detection (Self-station status error, synchronizing frame status error)
	×	–	Initializing, or receiving DISCONNECT (network disconnection request)
STS0	○	Green	Initializing succeeded
	○	Orange	Initializing failed (RAM Check Error)
	×	–	Initializing started

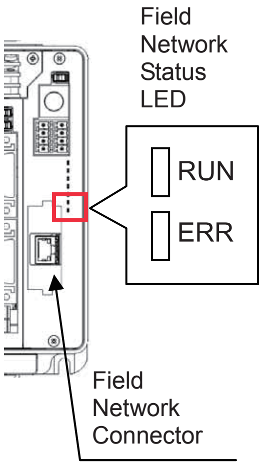
3.10.6 EtherNet/IP



○ : Illuminating, × : OFF, ☆ : Flashing

Name	Lamp status	Color	Description
NS	○	Green	Online (normally)
	☆		Online (Even though the network is established normally, the master does not identify as MSCON)
	○	Orange	Communication error (IP address duplication, etc.)
	☆		Communication error (Communication timeout has been detected)
	×	–	Power is OFF or IP address not established
MS	○	Green	Communication in normal condition
	☆	–	Construction information setting is not completed or the scanner (master) is in idling condition
	○	Orange	Hardware breakdown (The replacement of the board is required)
	☆		Light error such as initializing error and setting violation can be recovered by re-establishing
	×	–	Power OFF

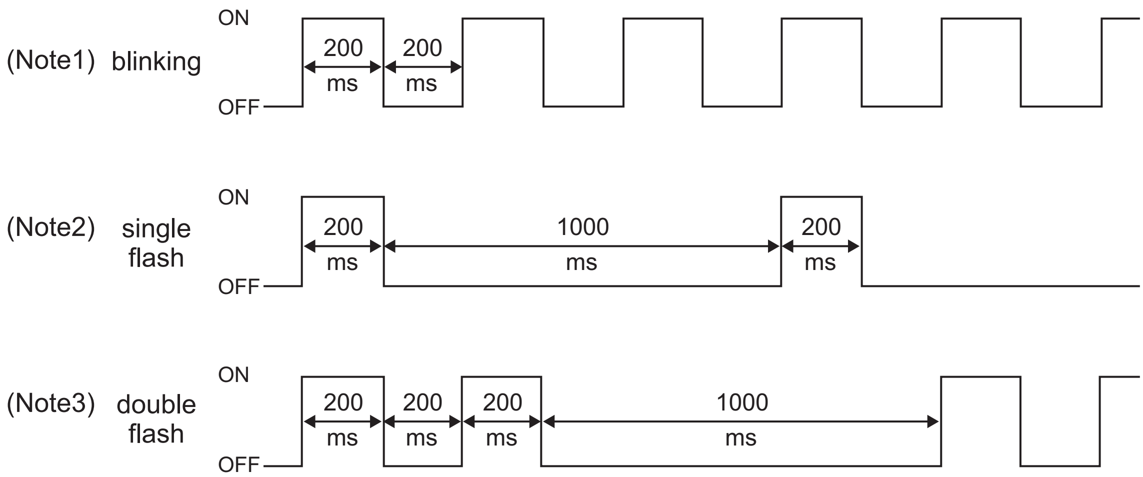
3.10.7 EtherCAT



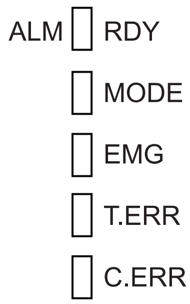
○ : Illuminating, × : OFF, ☆ : Flashing

Name	Lamp status	Color	Description
RUN	○	Green	Communication in normal condition (OPERATION)
	☆ (Note1)		PRE-OPERATION
	☆ (Note2)		SAFE-OPEREATION
	○	Orange	Communication component (module) error
	×	–	Condition of power being OFF or initializing (INIT)
ERR	○	Orange	Communication component (module) error
	☆ (Note1) (200ms cycle)	Orange	Construction information (settings) error (Information received from the master cannot be set)
	☆ (Note3)	Orange	Communication section circuit error (Watchdog Timer • Timeout)
	×	–	No abnormality or the power is OFF

- Timing of LED Flashing



3.11 Gateway status LED



○ : Illuminating, × : OFF, ☆ : Flashing

Name	Lamp status	Color	Description
ALM/RDY	○	Green	Normal
	○	Orange	Alarm issued
	×	–	Control power supply OFF
MODE	○	Green	AUTO mode being selected
	×	–	MANU mode being selected
EMG	○	Red	Emergency-stop input
	×	–	Not an emergency stop
T.ERR	○	Orange	Communication error between Gateway ⇔ driver board
	×	–	Not a communication error between Gateway ⇔ driver board
C.ERR	○	Orange	Field network communication error
	×	–	Not a field network communication error

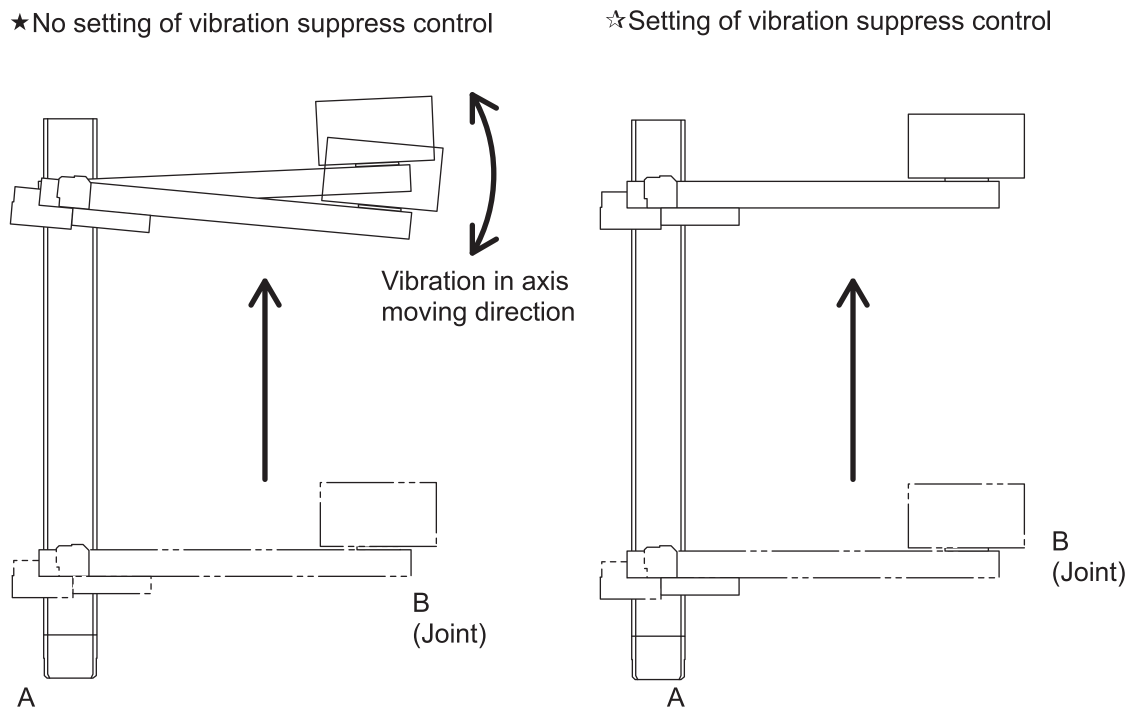
Chapter 4 Vibration Suppress Control Function

The vibration suppress control function suppresses vibrations of loads induced by our actuators.
The function can suppress vibrations in the same direction as the movement of the actuator in the frequency range from 0.5Hz to 30Hz.
Measure the frequency of the generated vibration and set it to the parameter. Three frequencies can be defined as parameters. Specify the parameters in the position table to reflect them on suppression of vibrations generated by the operation. For a single moving command (position data), only a single parameter can be set.

Note: Before this function can be used, you must read the cautions described on the next page.

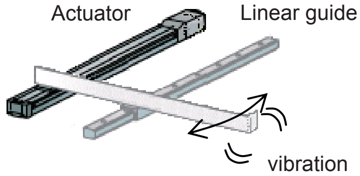
[Functional Operation Image]

The figure below shows an example in which two actuators are subject to 2-axis combination. Actuator A is moved to cause actuator B corresponding to a joint to be vibrated. Measure the vibrations of B in the direction in which A is moved and make proper vibration suppress control in the direction to suppress the vibrations of B. Vibrations of Actuator B caused by the movement of B cannot be suppressed by Actuator A.



⚠ Caution:

- Use of Frequency Analysis Tool for Anti-Vibration Control
  If using the frequency analysis tool for anti-vibration control installed in the PC software, it is necessary to get the key file, copy and store it in the same folder as the executable file (RcPc.exe) of the PC software.
  Please contact IAI for the key file.
- Vibrations subject to vibration suppress control
  It is the vibration of the load generated by IAI actuator, and is in the same directions as the actuator movement.
- Vibrations not subject to vibration suppress control
  1) Vibration whose source is not the operation of the actuator
  2) Vibration in a direction different from the direction in which the actuator, or the vibration source, is moved.
  3) Vibration of vibrating object itself (This function moves objects easily vibrated without vibrations and cannot suppress vibrations already generated.)
- Conditions in which vibration suppress effect can hardly be obtained
  1) When the frequency to control is the same value as the mechanical angle of the motor (motor rotation) or the electrical angle of the motor
     Frequency of motor's mechanical angle (motor revolution):
       operation speed [mm/s]/lead length [mm]
     Frequency of motor's electric angle:
       4 times of frequency of mechanical angle for servo motor installation axis
     Example 1: Servo motor installation axis
       For lead length 20mm and operation speed 100mm/s:
         Frequency of mechanical angle (motor revolution) : 5Hz
         Frequency of electric angle (four times of frequency of mechanical angle) : 20Hz
  2) When a higher speed response is required for the vibration control than the set speed control response, the speed response is not able to catch up with the vibration control.
  3) In case of a system shown in the figure on the right, the vibration cannot be controlled directly by the actuator, thus the effect may be only small or even nothing.



- Vibration suppress control unavailable in home return and pressing operations
  Home return and pressing operations cannot suppress vibrations. Operating the vibration suppress control function in pressing causes 0A2 "position data error" to occur.
- Prohibition of simultaneous use of vibration suppress control with feed forward gain
  The vibration suppress control function cannot be used with feed forward gain simultaneously.
- Prohibition of switch to use vibration suppress control during moving operation.
  Switching between vibration suppress control and normal positioning is disabled during movement of the actuator. Any switching command causes 0C5 "Illegal control system transition command error" to occur.
- Response of vibration suppress control
  Vibration suppress control has time lag from speed command in the operation plan. This makes takt time longer.
  Lower the setting frequency is, longer the time lag is.
- Consideration of servo gain
  If the servo gain setting is not conducted properly, the effect of the anti-vibration control may get dropped. First adjust the servo gain prior to setting of vibration suppress control.

4.1 Setting Procedure

To use the vibration suppress control function, make proper measurements and settings depending on the procedure described below.

Before setting vibration suppress control

1) Are steps up to trial adjustment 2 in Starting Procedure/Positioner Mode completed?
2) Is the key file stored in the folder that the PC Software startup file is stored if the specific frequency is to be measured using the vibration control frequency analysis tool stored in the PC Software?

→No

1) Provide start setting according to Starting Procedure/Positioner Mode.
2) It is necessary to obtain a key file aside from the software if you wish to use the frequency analysis tool for anti-vibration control included in the PC software. Please contact us for the details.

↓ Yes

Confirmation of vibration to be suppressed

Is vibration source our actuator? Is vibration direction the same as moving direction?

→No

This function cannot suppress the vibration.Take other measures.

↓ Yes

Measurement of Natural frequency

Measure the Natural frequency by any of the following methods:

- Use the frequency analysis tool for anti-vibration control installed in the PC software
  [Refer to the Instruction Manual of the RC PC software.]
- Use of measuring instrument such as vibration meter or acceleration pickup
- Calculation from video image data

↓

Setting of parameter for vibration suppress control
[See next page.]

- Set the measured natural frequency in the parameter.
  Note: With the frequency analysis tool for anti-vibration control installed in the PC software, it is able to write parameters from the tool.
- Set related parameters.

↓

Setting of vibration suppress control parameter set No.

Set the anti-vibration control parameter set number to be used to the position number that anti-vibration of the position table is required.

↓

Test run (check of vibration suppress effect)

Operate the actuator.
Is sufficient vibration suppress effect obtained?

→No

↓ Yes

Now the settings are completed.

4.2 Settings of Parameters for Vibration Suppress Control

Set the parameters associated with vibration suppress control, which are listed in the table below.

Parameter No.	Parameter Set No.	Parameter Name	Unit	Default	Input Range
97	1	Damping characteristic coefficient 1	Rate	10	0 to 1000
98		Damping characteristic coefficient 2	Rate	1000	0 to 1000
99		Natural frequency	1/1000Hz	10000	500 to 30000
100		Notch filter gain	Rate	9990	1 to 20000
101	2	Damping characteristic coefficient 1	Rate	10	0 to 1000
102		Damping characteristic coefficient 2	Rate	1000	0 to 1000
103		Natural frequency	1/1000Hz	10000	500 to 30000
104		Notch filter gain	Rate	9990	1 to 20000
105	3	Damping characteristic coefficient 1	Rate	10	0 to 1000
106		Damping characteristic coefficient 2	Rate	1000	0 to 1000
107		Natural frequency	1/1000Hz	10000	500 to 30000
108		Notch filter gain	Rate	9990	1 to 20000
109		Default vibration suppress No.		0	0 to 3
110		Stop method at servo OFF		0	0, 1

[1] Damping characteristic coefficient 1,2 (Parameter No.97, 98, 101, 102, 105, and 106)
Do not change.

[2] Natural frequency [1/1000Hz] (Parameter No.99, 103 and 107)
Set the natural frequency of the load measured. It can be input directly to the parameter from the frequency analysis tool for anti-vibration control included in the PC software if the tool is already used. [Refer to the Instruction Manual of the RC PC software.]
Set the specific frequency of the loaded object close to the setting so a higher anti-vibration performance can be obtained.

> [Reference] Other vibration measuring methods
> - Use of measuring instrument such as vibration meter and acceleration pickup
> - Calculation from video image data

[3] Notch filter gain (Parameter No.100, 104 and 108)
Set the notch filter gain following the table below in response to the measured specific frequency of the loaded object. See the table below for reference. Provide fine adjustment if overshooting occurs.
If the notch filter gain setting is too high, overshooting would occur during the settling time.
If the notch filter gain setting is too low, undershooting would occur during the settling time.

Measured Natural Frequency [Hz]	Setting Value of Notch Filter Gain
0.5	9900
1	9980
2 to 30	9990

[4] Default vibration suppress No. (Parameter No.109)
When a position is written into a position table not registered yet, the value set to this parameter is automatically entered in the "Vibration suppress No." field. To change the setting, edit the position table later.
0: Normal position control (default)
1: Use Anti-Vibration Control Parameter Set 1
2: Use Anti-Vibration Control Parameter Set 2
3: Use Anti-Vibration Control Parameter Set 3

[5] Stop method at servo OFF (Parameter No.110)
The table below shows the relationship between the values of Parameter No.110 and stop commands.

Stop Command	Stop Process			
	0		1	
	Vibration suppress control	Normal positioning control	Vibration suppress control	Normal positioning control
Pause	Anti-vibration deceleration stop	Normal deceleration and stop	Anti-vibration deceleration stop	Normal deceleration and stop
Servo OFF	Sudden stop by emergency stop torque			
Emergency Stop				
Error (Operation-cancellation level alarms)				
Error (Cold start)	Sudden stop by emergency stop torque			

4.3 Setting of Position Data

To make the anti-vibration control effective, set the parameter set number to be used in Anti-Vibration Number Column in Position Data.
Note: The vibration suppress control function cannot be used in pressing operation.

No.	Position [mm]	Velocity [mm/s]	Accele-ration [G]	Decele-ration [G]	Pressing [%]	Thresh-old [%]	Positioning width [mm]	Zone+ [mm]	Zone- [mm]	Acceleration/ Deceleration mode	Incre-mental	Gain set	Stop mode	Vibration suppress No.
0														
1	0.00	50.00	0.01	0.01	0	0	0.10	0.00	0.00	0	0	0	0	0
2	50.00	50.00	0.01	0.01	0	0	0.10	0.00	0.00	0	0	0	0	1
3	50.00	50.00	0.01	0.01	50	0	0.10	0.00	0.00	0	0	0	0	3
4														

Set natural frequency 1 (enabled)
Set natural frequency 3 (It cannot be in common with Error: 0A2 Position Data Error Pressing Operation.)

Chapter 5 Power Saving Function (Automatic Servo-off Function)

The product possesses an automatic servo-off function to reduce the power consumption while the actuators are stopped. Read the description in this chapter carefully to save power so that the controller can be operated safely.
The servo is automatically turned OFF after a certain period from completion of positioning. The next positioning command is issued to turn the servo ON automatically and achieve the positioning. No holding current flows in the stop state to allow the power consumption to be saved.
Three periods from completion of positioning to servo OFF can be set as parameters. The period used for the automatic servo OFF is specified in the position table.
This function can be set for each axis number (actuator).

> ⚠Warning: Do not use this function if the automatic servo OFF is followed by pitch feed (relative movement).
> Servo ON/OFF may cause slight position shift to occur. If position shift occurs due to external force during servo OFF, positioning to the correct position is disabled. It is because pitch feed is operated based on the position at start used as the base point.

> ⚠Caution: This function is ineffective for pressing. Do not use. It becomes effective at completion of positioning. In pressing, the function becomes effective only when miss-pressing occurs (the status at the completion of operation without pressing is the same as that at the completion of positioning).
> No retaining torque is provided in automatic servo-off. The actuator can move with an external force. Pay attention to the interference to the peripherals and the safety in the installation.

(1) Setting of periods taken until automatic servo OFF
Three periods from completion of positioning to automatic servo OFF can be set in the following parameters in seconds [sec].

Parameter No.	Description
36	Auto Servo Motor OFF Delay Time 1 (Unit: sec)
37	Auto Servo Motor OFF Delay Time 2 (Unit: sec)
38	Auto Servo Motor OFF Delay Time 3 (Unit: sec)

(2) Set of power-saving mode
Select a proper power-saving mode from the conditions below. Set the corresponding value in the stop mode of the position table.
[Refer to 14) Stop mode in 3.3 Set of Position Table.]

Set Value	Operation after completion of positioning	Parameter No.
0	Servo ON not changed	–
1	Automatic servo OFF after certain period	36
2	Automatic servo OFF after certain period	37
3	Automatic servo OFF after certain period	38

(3) Status of positioning complete signal in selection of automatic servo OFF
Automatic servo OFF causes the actuator to be in other than the positioning complete state due to the servo OFF. Positioning complete signal (PEND) is turned OFF. PEND by changing PEND signal to an in-position signal (INP) that judges whether the actuator is in the positioning width range, not to the positioning complete signal, this can be a signal that would not turn OFF while the servo is OFF.
This setting is reflected on complete position numbers PM1 to PM** in PIO patterns 0 to 2 confirming the positioning complete position No. or current position numbers PE** in PIO patterns 4.
This setting can be conducted in Parameter No.39.

Value set in Parameter No.39	Content of PEND signal	Signal outputs during automatic servo OFF		
		PEND	PM1 to PM**	PE**
0	Positioning Completion Signal	OFF	OFF	OFF
1	In-position Signal	ON	ON	ON

(Note) While in the automatic servo-off, SV in Driver Status LEDs on the front panel flashes in green.

[For Parameter No.39 = 0]

Operation of actuator	Positioning operation	Automatic servo OFF standby	Servo OFF	Positioning operation
Servo Condition	ON	ON	OFF	ON
Completed Position No. Output (Current position number output)	PM1 to **=0 (PE**=OFF)	PM1 to **=Output (PE**=ON)	PM1 to **=0 (PE**=OFF)	PM1 to **=0 (PE**=OFF)
Positioning Completion Signal PEND	OFF	ON	OFF	OFF

Servo OFF Delay Time
(Parameter No.36 to 37)

[For Parameter No.39 = 1]

Operation of actuator	Positioning operation	Automatic servo OFF standby	Servo OFF	Positioning operation
Servo Condition	ON	ON	OFF	ON
Completed Position No. Output (Current position number output)	PM1 to **=0 (PE**=OFF)	PM1 to **=Output (PE**=ON)	PM1 to **=0 Output (PE**=ON)	PM1 to **=0 (PE**=OFF)
Positioning Completion Signal PEND	OFF	ON	ON	OFF

Servo OFF Delay Time
(Parameter No.36 to 37)

Chapter 6 Absolute Reset and Absolute Battery

6.1 Absolute Reset

The controller of absolute specification holds encoder position information by battery backup. It is not necessary to perform the home-return operation every time the power is turned ON.
In order to hold the encoder position information, absolute reset is required.
Provide absolute reset in the following cases:

(1) Initial activation
(2) Replacement of absolute battery
(3) Disconnection of encoder cable from controller

The absolute reset is performed by using a teaching tool such as PC software. Described below are the steps how to perform it.

[1] Absolute Reset Procedures

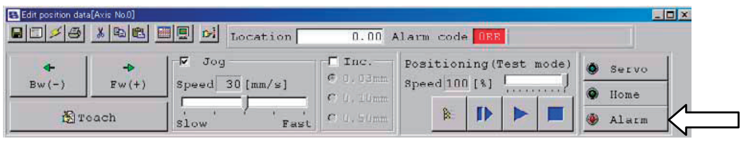
1) Connect the controller with the actuator. [Refer to Chapters 1 and 2.]
2) Connect the absolute battery (Enclosed battery if starting up for the first time, new battery if replacing) to the absolute battery connecting connector on the front panel of the controller. [Refer to 6.2 Absolute Battery.]
3) Put the operation mode setting switch on the front panel of MSCON to MANU side, and turn ON the power to the controller.
4) The absolute encoder error appears on the teaching tool. Perform alarm reset.
5) Perform home-return operation. Once the home return is complete, the point of origin is memorized at the same time the origin point is established.
6) Repeat the steps 1) to 5) to all the connected absolute type actuators.

[Reference] By marking the home position for each actuator on the mechanical side, it will be easy to adjust the position in case the home position is misaligned in the next absolute reset.
[Refer to Repeatability of Home Position described below for the details.]

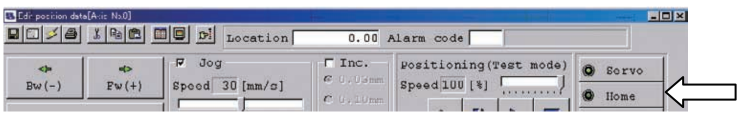
In below explains the procedure using each teaching tool:

(1) For PC software

1) Select position data on the main screen and click the $\boxed{\text{Alarm}}$ button.

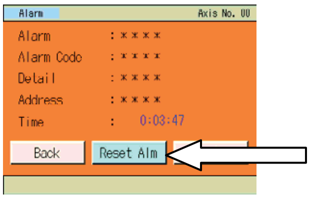


2) Select the position data in the main window and press $\boxed{\text{Servo}}$ → $\boxed{\text{Home}}$.



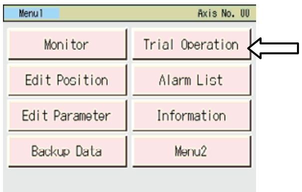
(2) For CON-PTA/PDA/PGA

1)



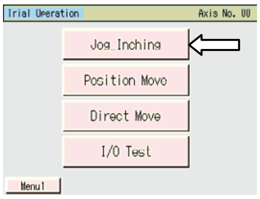
Press Reset Alm.

2)



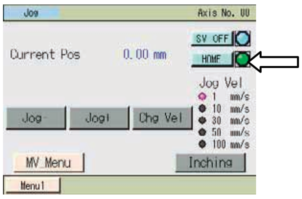
Press Trial Operation on the Menu 1 screen.

3)



Press Jog_Inching on Trial screen.

4)



Press Home on Job/Inching screen.

Adjustment for Repeatability of Home Position

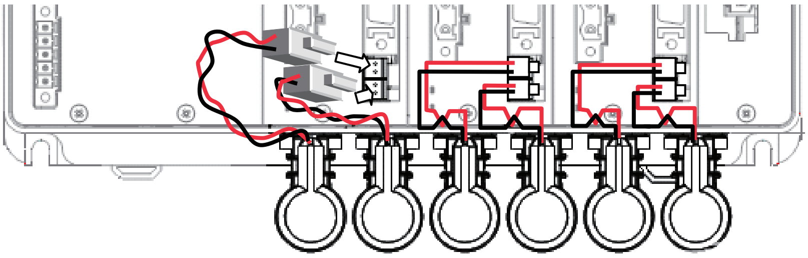
In case the home position has changed from where it was previously in an absolute reset after the absolute data has lost, it can be adjusted in Parameter No. 22 Home Return Offset.

Mark the home position on the mechanical side at the first startup. From the position where it has changed from the original home position after the absolute reset, move the actuator to the marked position with such an operation as JOG operation. Read the coordinates and add (if the number is positive, and subtract if negative) them to the values in Parameter No. 22.

(Note) At this time, note the values in Parameter No. 22 before the adjustment so the setting can be put back in any occasions.

6.2 Absolute Battery

An absolute battery is enclosed with the absolute type controller.
The absolute battery is used to back up the absolute data.
Connect the battery to the absolute battery connector on the front panel of the controller.



6.2.1 Absolute encoder backup specifications

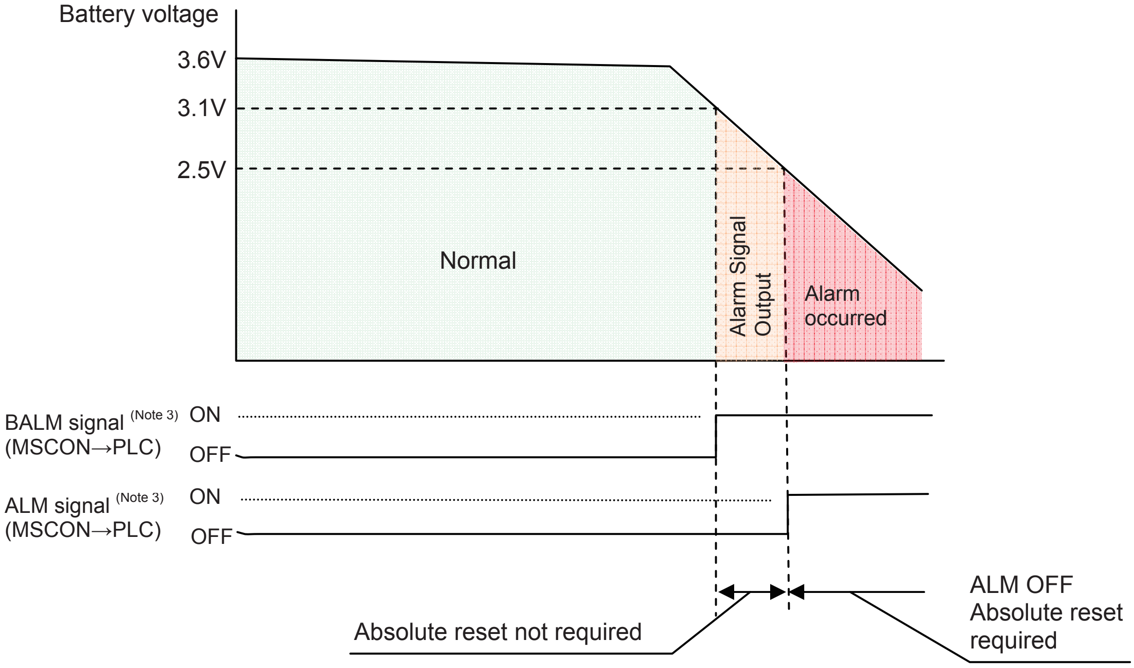
<table>
<tr><th colspan="2">Item</th><th>Specifications</th></tr>
<tr><td colspan="2">Battery model</td><td>AB-5</td></tr>
<tr><td colspan="2">Battery voltage</td><td>3.6V</td></tr>
<tr><td colspan="2">Current capacity</td><td>2000mAH</td></tr>
<tr><td colspan="2" rowspan="2">Reference for battery replacing timing(Note 1)
(Ambient temperature 40°C)</td><td>2 years after use (if left unused without power supply to controller)</td></tr>
<tr><td>4 years after use (if 50% of time with power supply to controller)</td></tr>
<tr><td rowspan="4">Error detection *1</td><td>Output of voltage drop alert signal (output of BALM)</td><td>3.1V ±3% or less</td></tr>
<tr><td>Output of Alarm output (output of ALM)</td><td>2.5V ±8% or less</td></tr>
<tr><td rowspan="2">Warning → Reference for time suspended after alert till alarm</td><td>7 days if the controller is operated continuously at 20°C.</td></tr>
<tr><td>2.5 days if the controller is operated continuously at 40°C.</td></tr>
<tr><td colspan="2">Absolute data retaining duration at battery replacement</td><td>15 minutes (Have the replacing work done within this time. If it is before the alarm is generated, absolute reset is not necessary within this specified time.)</td></tr>
</table>

Note 1: Replace the battery regularly.

*1 Error detection: If the voltage of the absolute battery is dropped, the error detection responding to the voltage is held.

Voltage	PIO Signals	Alarm
3.1V ±3% or less	Voltage drop alert signal *BALM (Note 2) ON	No message
2.5V ±8% or less	Alarm signal *ALM (Note 2) OFF	OEE Absolute Encoder Error Detection 2 or OEF Absolute Encoder Error Detection 3

Note 2: BALM and ALM are the signals of active low in Remote I/O Mode, and active high in other modes. (Note) there is no BALM Signal in Positioner Mode 3.
Replace the battery before alarm is generated due to the lamp display by BALM signal of PLC.
If the alarm is generated, it will be necessary to absolute reset after the battery replacement.



Note 3: BALM and ALM are the signals of active low in Remote I/O Mode, and active high in other modes. There is no BALM Signal in Positioner Mode 3.

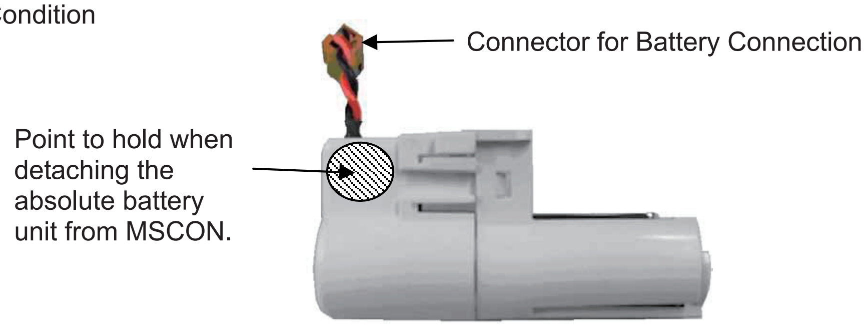
6.2.2 Replacement of absolute battery

For the battery replacement, remove the battery connector while keeping the power to the controller ON, and change the battery installed in the battery holder.

⚠Caution:	To replace the old absolute battery with a new one with the controller power being off, complete the replacement within 15 minutes from the removal of the old battery if it is before the alarm is generated. The absolute data may get lost if it exceeds 15 minutes.

[1] Absolute battery unit
Absolute battery unit consists of three components. [Refer to the diagram below]

- Assembled Condition



[2] Detachment
1) Unplug the connector for battery connection off the battery connector on the front panel of MSCON.
2) Hold the point to detach the absolute battery unit and pull the absolute battery unit off towards you.

[3] Attachment
1) Push the absolute battery unit along the attachment frame on the bottom of MSCON until it makes a click noise.
2) Plug the connector for battery connection to the battery connector on the front panel of MSCON. [Refer to 2.4.4 Battery Connection.]

Chapter 7 Parameter

Parameter data should be set appropriately according to the applicaiton requirements.
When a change is required to the parameters, make sure to back up the data before the change so the settings can be returned anytime.
With using PC software, it is able to store the backup to the PC. Leave a memo if using a teaching pendant which cannot mount a memory card.
Also, for the purpose of rapid recovery after the investigation of failure unit or replacing the controller, keep data backup or memo also after the parameter change.
The change to the parameters will be activated after they are edited, written to the FeRAM, then either software reset or reboot of the power. It will not become active only with setting on the teaching tool.

⚠ Warning:

(1) Parameter setting has great influences on operations of the controller. Incorrect parameter setting may not only cause malfunction or failure of the controller to occur but also people and assets to be exposed to risk.
The controller is configured to be applicable to normal operation at shipment. Before providing certain change or setting for the controller to be fit to your system, understand the control methods of the controller sufficiently. Please contact us if you have anything unclear.

(2) Do not turn OFF the power to the controller during the parameter writing. Parameter cannot be written properly, which may cause an unexpected operation, and is extremely dangerous.

7.1 Parameter List

Each axis number has the following parameter table. Have the setting and checking on each axis number.
The categories in the table below indicate whether parameters should be set or not. There are five categories as follows:

- A : Check the settings before use.
- B : Use parameters of this category depending on their uses.
- C : Use parameters of this category with the settings at shipments leaving unchanged as a rule. Normally they may not be set.
- D : Parameters of the category are set at shipment in accordance with the specification of the actuator. Normally they may not be set.
- E : Parameters of the category are exclusively used by us for convenience of production. Changing their settings may not only cause the actuator to operate improperly but also to be damaged. So, never change the setting of the parameters.

Category do not appear on the teaching tool.
Also, the unused parameter numbers are not mentioned in the list.

No.	Category	Name	Symbol	Unit (Note 1)	Input Range	Default factory setting	Relevant sections
1	B	Zone 1 Positive Side	ZNM1	mm [deg]	-9999.99 to 9999.99	Actual stroke on positive side (Note 2)	7.2 [1]
2	B	Zone 1 Negative Side	ZNL1	mm [deg]	-9999.99 to 9999.99	Actual stroke on negative side (Note 2)	7.2 [1]
3	A	Soft Limit Positive Side	LIMM	mm [deg]	-9999.99 to 9999.99	Actual stroke on positive side (Note 2)	7.2 [2]
4	A	Soft Limit Negative Side	LIML	mm [deg]	-9999.99 to 9999.99	Actual stroke on negative side (Note 2)	7.2 [2]
5	D	Home Return Direction	ORG	-	0: Reverse 1: Normal	In accordance with actuator (Note 2)	7.2 [3]
6	C	Push & Hold Stop Judgment Period	PSWT	msec	0 to 9999	255	7.2 [4]
7	C	Servo Gain Number	PLGO	-	0 to 31	In accordance with actuator (Note 2)	7.2 [5] 7.3
8	B	Default Velocity	VCMD	mm/s [deg/s]	1 to Actuator’s max. speed	Rated actuator speed (Note 2)	7.2 [6]
9	B	Default Acceleration/Deceleration	ACMD	G	0.01 to actuator's max. acceleration/ deceleration	Rated actuator's acceleration/ Deceleration (Note 2)	7.2 [7]
10	B	Default Positioning Width	INP	mm [deg]	0.01 to 999.99	0.10	7.2 [8]
13	C	Current-Limiting Value During Home Return	ODPW	%	1 to 300	In accordance with actuator (Note 2)	7.2 [9]
14	E	Dynamic Brake	FSTP	-	0: Disabled 1: Enabled	1	7.2 [10]
15	B	Pause Input Disable Selection	FPIO	-	0: Enabled 1: Disabled	0	7.2 [11]
18	E	Home Position Check Sensor Input Polarity	AIOF	-	0 to 2	In accordance with actuator (Note 2)	7.2 [12]
19	E	Overrun Sensor Input Polarity	AIOF	-	0 to 2	In accordance with actuator (Note 2)	7.2 [13]
20	E	Creep Sensor Input Polarity	AIOF	-	0 to 2	In accordance with actuator (Note 2)	7.2 [14]
21	B	Servo ON Input Disable Selection	FPIO	-	0: Enabled 1: Disabled	0	7.2 [15]

Note 1: The unit [deg] is for rotary actuator. It is displayed in mm in the teaching tools.
Note 2: The setting values vary in accordance with the specification of the actuator. At shipment, the parameters are set in accordance with the specification.

Parameter List (continued)

No.	Category	Name	Symbol	Unit (Note 1)	Input Range	Default factory setting	Relevant sections
22	C	Home Return Offset Level	OFST	mm [deg]	0.00 to 9999.99	In accordance with actuator (Note 2)	7.2 [16]
23	B	Zone 2 Positive Side	ZNM2	mm [deg]	-9999.99 to 9999.99	Actual stroke on positive side (Note 2)	7.2 [1]
24	B	Zone 2 Negative Side	ZNL2	mm [deg]	-9999.99 to 9999.99	Actual stroke on negative side (Note 2)	7.2 [1]
25	A	PIO Pattern Selection	IOPN	-	0 to 2, 4, 5 and 8	8	7.2 [18]
26	B	PIO Jog Velocity	IOJV	mm/s [deg/s]	1 to Actuator’s max. speed	100	7.2 [19]
27	B	Movement Command Type	FPIO	-	0 : Level 1 : Edge	0	7.2 [20]
31	C	Velocity Loop Proportional Gain	VLPG	-	1 to 27661	In accordance with actuator (Note 2)	7.2 [21] 7.3
32	C	Velocity Loop Integral Gain	VLPT	-	1 to 217270	In accordance with actuator (Note 2)	7.2 [22] 7.3
33	C	Torque Filter Time Constant	TRQF	-	0 to 2500	In accordance with actuator (Note 2)	7.2 [23] 7.3
34	C	Push Velocity	PSHV	mm/s [deg/s]	1 to actuator's max. pressing speed	In accordance with actuator (Note 2)	7.2 [24]
35	C	Safety Velocity	SAFV	mm/s [deg/s]	1 to 250 (maximum speed for the actuators with 250 or less)	100	7.2 [25]
36	B	Auto Servo-motor OFF Delay Time 1	ASO1	sec	0 to 9999	0	7.2 [26]
37	B	Auto Servo-motor OFF Delay Time 2	ASO2	sec	0 to 9999	0	7.2 [26]
38	B	Auto Servo-motor OFF Delay Time 3	ASO3	sec	0 to 9999	0	7.2 [26]
39	B	Position Complete Signal Output Method (Note 3)	FPIO	-	0: PEND 1: INP	0	7.2 [27]
40	C	Home-return Input Disable	FPIO	-	0: Enabled 1: Disabled	0	7.2 [28]
46	B	Velocity Override	OVRD	%	1 to 100	100	7.2 [29]
47	B	PIO Jog Velocity 2	IOV2	mm/s [deg/s]	1 to Actuator’s max. speed	100	7.2 [19]
48	B	PIO Inching Distance	IOID	mm [deg/s]	0.01 to 1.00	0.1	7.2 [31]
49	B	PIO Inching Distance 2	IOD2	mm [deg/s]	0.01 to 1.00	0.1	7.2 [31]
50	C	Load Output Judgment Time Period	LDWT	msec	0 to 9999	255	7.2 [32]
52	B	Default Acceleration/ Deceleration Mode	CTLF	-	0 to 2	0 (Trapezoid)	7.2 [33]
53	B	Default Stop Mode	CTLF	-	0 to 3	0 (Not applicable)	7.2 [34]
54	C	Current Control Width Number	CLPF	-	0 to 4	In accordance with actuator (Note 2)	7.2 [35]
55	B	Position Command Primary Filter Time Constant	PLPF	msec	0.0 to 100.0	0.0	7.2 [36]
56	B	S-motion Rate	SCRV	%	0 to 100	0	7.2 [37]
62	B	Pulse Count Direction	FPIO		For future extension use. Unavailable		
65	B	Electronic Gear Numerator	CNUM				
66	B	Electronic Gear Denominator	CDEN				

Note 1: The unit [deg] is for rotary actuator. It is displayed in mm in the teaching tools.
Note 2: The setting values vary in accordance with the specification of the actuator. At shipment, the parameters are set in accordance with the specification.

Chapter 7 Parameter

Parameter List (continued)

No.	Category	Name		Symbol	Unit (Note 1)	Input Range	Default factory setting	Relevant sections
71	B	Feed Forward Gain		PLFG	-	0 to 100	0	7.2 [41] 7.3
73	D	Encoder Voltage Level		EVLV	-	0 to 3	Depending on encoder cable length (Note 2)	7.2 [42]
75	D	Electromagnetic Brake Power Monitor		FSTP	-	0: Disabled 1: Enabled	In accordance with actuator (Note 2)	7.2 [43]
76	E	Belt Breaking Sensor Input Polarity		AIOF		For future extension use. Unavailable		
77	D	Ball Screw Lead Length		LEAD	mm [deg]	0.01 to 999.99	In accordance with actuator (Note 2)	7.2 [45]
78	D	Axis Operation Type		ATYP	-	0: Linear axis 1: Rotary axis	In accordance with actuator (Note 2)	7.2 [46]
79	B	Rotary Axis Mode Selection		ATYP	-	0: Normal mode 1: Index mode	In accordance with actuator (Note 2)	7.2 [47]
80	B	Rotational Axis Shortcut Selection		ATYP	-	0: Disabled 1: Enabled	In accordance with actuator (Note 2)	7.2 [48]
88	D	Software Limit Margin		SLMA	mm	0 to 9999.99	In accordance with actuator (Note 2)	7.2 [49]
89	D	Allowable time of exceeding torque allowing continuous pressing		PSCT	sec	0 to 300	In accordance with actuator (Note 2)	7.2 [50]
91	C	Current Limit Value at Stopping Due to Miss-pressing		FSTP	-	0: Current limit during movement 1: Current limit value during pressing	0	7.2 [51]
92	C	Use of Loadcell Selection		FFRC		For future extension use. Unavailable		
93	C	Selection of Pressing Control		FFRC				
94	C	Pressing operation Using Force Sensor Gain		FRCG				
95	C	Positive Side of Force Judgment Margin		FJMM				
96	C	Negative Side of Force Judgment Margin		FJML				
97	C	Vibration suppress parameter set 1	Damping Characteristic Coefficient 1	DC11	-	0 to 1000	10	4.2
98	C		Damping Characteristic Coefficient 2	DC21	-	0 to 1000	1000	4.2
99	B		Natural Frequency	NP01	1/1000Hz	500 to 30000	10000	4.2
100	C		Notch Filter Gain	NFG1	-	1 to 20000	9990	4.2
101	C	Vibration suppress parameter set 2	Damping Characteristic Coefficient 1	DC12	-	0 to 1000	10	4.2
102	C		Damping Characteristic Coefficient 2	DC22	-	0 to 1000	1000	4.2
103	B		Natural Frequency	NP02	1/1000Hz	500 to 30000	10000	4.2
104	C		Notch Filter Gain	NFG2	-	1 to 20000	9990	4.2

Note 1: The unit [deg] is for rotary actuator. It is displayed in mm in the teaching tools.
Note 2: The setting values vary in accordance with the specification of the actuator. At shipment, the parameters are set in accordance with the specification.

Parameter List (continued)

No.	Category	Name		Symbol	Unit (Note 1)	Input Range	Default factory setting	Relevant sections
105	C	Vibration suppress parameter set 3	Damping Characteristic Coefficient 1	DC11	-	0 to 1000	10	4.2
106	C		Damping Characteristic Coefficient 2	DC21	-	0 to 1000	1000	4.2
107	B		Natural Frequency	NP01	1/1000Hz	500 to 30000	10000	4.2
108	C		Notch Filter Gain	NFG2	-	1 to 20000	9990	4.2
109	B	Default Vibration Suppress No.		CTLF	-	0 to 3	0	4.2
110	B	Stop Method at Servo OFF		FSTP	-	0: Rapid stop 1: Deceleration to stop	0	4.2
112	B	Monitoring Mode Selection		FMNT	-	0: Unused 1: Monitor Function 1 2: Monitor Function 2 3: Monitor Function 3	1	7.2 [59]
113	B	Monitoring Period		FMNT	msec	1 to 100	1	7.2 [60]
117	B	Automatic Loadcell Calibration at Start		FFRC		For future extension use. Unavailable		
118	B	Pressing Operation without Completion of Loadcell Calibration		FFRC				
119	B	Loadcell Calibration Time		CLBT				
120	C	Servo Gain Number 1		PLG1	-	0 to 31	In accordance with actuator (Note 2)	7.2 [5] 7.3
121	C	Feed Forward Gain 1		PLF1	-	0 to 100	In accordance with actuator (Note 2)	7.2 [41]
122	C	Velocity Loop Proportional Gain 1		VLG1	-	1 to 27661	In accordance with actuator (Note 2)	7.2 [21] 7.3
123	C	Velocity Loop Integral Gain 1		VLT1	-	1 to 217270	In accordance with actuator (Note 2)	7.2 [22] 7.3
124	C	Torque Filter Time Constant 1		TRF1	-	0 to 2500	In accordance with actuator (Note 2)	7.2 [23] 7.3
125	C	Current Control Width Number 1		CLP1		0 to 4	In accordance with actuator (Note 2)	7.2 [35] 7.3
126	C	Servo Gain Number 2		PLG2	-	0 to 31	In accordance with actuator (Note 2)	7.2 [5] 7.3
127	C	Feed Forward Gain 2		PLF2	-	0 to 100	In accordance with actuator (Note 2)	7.2 [41]
128	C	Speed Loop Proportional Gain 2		VLG2	-	1 to 27661	In accordance with actuator (Note 2)	7.2 [21] 7.3
129	C	Speed Loop Integral Gain 2		VLT2	-	1 to 217270	In accordance with actuator (Note 2)	7.2 [22] 7.3
130	C	Torque Filter Time Constant 2		TRF2	-	0 to 2500	In accordance with actuator (Note 2)	7.2 [23] 7.3

Note 2: The setting values vary in accordance with the specification of the actuator. At shipment, the parameters are set in accordance with the specification.

Parameter List (continued)

No.	Category	Name	Symbol	Unit (Note 1)	Input Range	Default factory setting	Relevant sections
131	C	Current Control Width Number 2	CLP2		0 to 4	In accordance with actuator (Note 2)	7.2 [35] 7.3
132	C	Servo Gain Number 3	PLG3	-	0 to 31	In accordance with actuator (Note 2)	7.2 [5] 7.3
133	C	Feed Forward Gain 3	PLF3	-	0 to 100	In accordance with actuator (Note 2)	7.2 [41]
134	C	Speed Loop Proportional Gain 3	VLG3	-	1 to 27661	In accordance with actuator (Note 2)	7.2 [21] 7.3
135	C	Speed Loop Integral Gain 3	VLT3	-	1 to 217270	In accordance with actuator (Note 2)	7.2 [22] 7.3
136	C	Torque Filter Time Constant 3	TRF3	-	0 to 2500	In accordance with actuator (Note 2)	7.2 [23] 7.3
137	C	Current Control Width Number 3	CLP3	-	0 to 4	In accordance with actuator (Note 2)	7.2 [35] 7.3
138	C	Servo Gain Switchover Time Constant	GCFT	ms	10 to 2000	10	7.2 [82]
139	A	Home Preset Value	PRST	mm	-9999.99 to 9999.99	In accordance with actuator (Note 2)	7.2 [83]
143	B	Overload Level Ratio	OLWL	%	50 to 100	100	7.2 [84]
147	B	Total Movement Count Threshold	TMCT	Times	0 to 999999999	0 (Disabled)	7.2 [85]
148	B	Total Operated Distance Threshold	ODOT	m	0 to 999999999	0 (Disabled)	7.2 [86]
149	B	Zone Output Changeover	FPIO	-	0: Not to change 1: To change	0	7.2 [87]
150	A	Linear Absolute Home Preset Value	LAPS		For future extension use. Unavailable		
151	B	Light Error Alarm Output Select	FSTP	-	0: Battery voltage drop warning output 1: Output of battery voltage drop warning or message-level alarm	0	7.2 [89]
157	B	Drive Cutoff Alarm Level	FSTP	-	0 to 2	0	7.2 [90]
158	B	Enable/Disable Axis Select	ATYP	-	0: Enabled 1: Disabled	0	7.2 [91]

Note 2: The setting values vary in accordance with the specification of the actuator. At shipment, the parameters are set in accordance with the specification.

7.2 Detail Explanation of Parameters

Establish settings for each axis number.

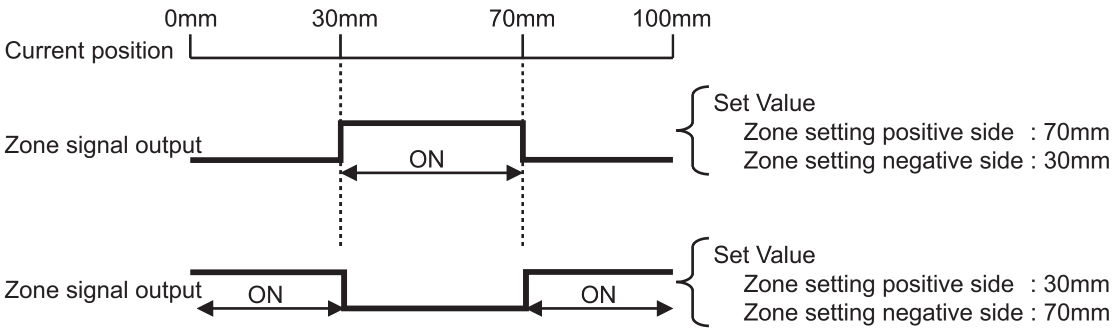
> ⚠ Caution: • If parameters are changed (writing), provide software reset or reconnect the power to reflect the setting values.
> • The unit [deg] is for rotary actuator and lever type gripper. Pay attention that it is displayed in mm in the teaching tools.

[1] Zone 1 positive side, zone 1 negative side (Parameter No.1, No.2) Zone 2 positive side, zone 2 negative side (Parameter No.23, No.24)

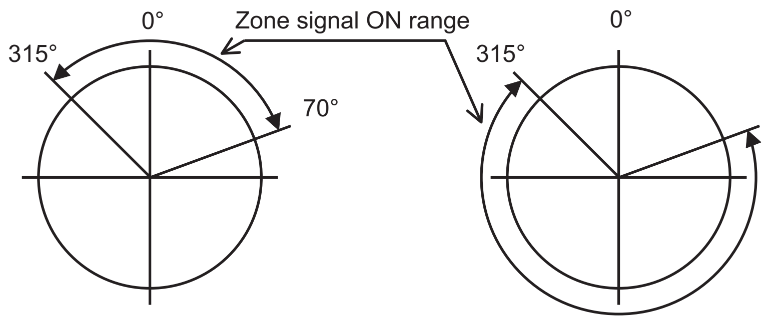
No.	Name	Symbol	Unit	Input Range	Default factory setting
1	Zone 1 Positive Side	ZNM1	mm [deg]	-9999.99 to 9999.99	Actual stroke on positive side
2	Zone 1 Negative Side	ZNL1	mm [deg]	-9999.99 to 9999.99	Actual stroke on negative side
23	Zone 2 Positive Side	ZNM2	mm [deg]	-9999.99 to 9999.99	Actual stroke on positive side
24	Zone 2 Negative Side	ZNL2	mm [deg]	-9999.99 to 9999.99	Actual stroke on negative side

These parameters are used to set the zone in which zone signal (ZONE1 or ZONE2) turns ON.
The minimum setting unit is 0.01 mm [deg].
If a specific value is set to both zone setting positive side and zone setting negative side, the zone signal is not output.
A setting sample is shown below.

[Example of when line axis]



[Example of Rotary Actuator Index Mode]

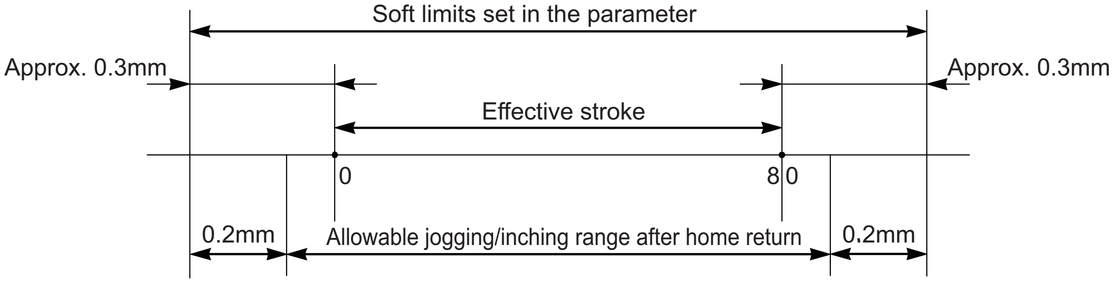


> ⚠ Caution: The zone detection range would not output unless the value exceeds that of the minimum resolution (actuator lead length / No. of Encoder Pluses).

[2] Soft limit positive side, Soft limit negative side (Parameter No.3, No.4)

No.	Name	Symbol	Unit	Input Range	Default factory setting
3	Soft Limit Positive Side	LIMM	mm [deg]	-9999.99 to 9999.99	Actual stroke on positive side
4	Soft Limit Negative Side	LIML	mm [deg]	-9999.99 to 9999.99	Actual stroke on negative side

0.3mm [deg] is added to the outside of the effective actuator stroke for the setting at the delivery (since there would be an error at the end of effective stroke if set to 0). Change the setting if required for the cases such as when there is interference or to prevent a crash, or when using the actuator with slightly exceeding effective stroke in the operational range.
An incorrect soft limit setting will cause the actuator to collide into the mechanical end, so exercise sufficient caution.
The minimum setting unit is 0.01mm.
Note: To change a soft limit, set a value corresponding to 0.3mm outside of the effective stroke.
Example) Set the effective stroke to between 0mm to 80mm
Parameter No.3 (positive side) 80.3
Parameter No.4 (negative side) -0.3



The operational range for jog and inching after the home return is 0.2mm [deg] less than the set value.
Alarm Code 0D9 “Soft Limit Over Error” will be generated when the set value exceeded the value (0 when shipped out) set in Parameter No.88 “Software Limit Margin”. If the setting is not done in Parameter No.88, the value set in this parameter become the detection value for Alarm Code 0D9 “Soft Limit Over Error”.

[3] Home return direction (Parameter No.5)

No.	Name	Symbol	Unit	Input Range	Default factory setting
5	Home Return Direction	ORG	-	0: Reverse 1: Normal	In accordance with actuator

Unless there is a request of Home Reversed Type (option), the home-return direction is on the motor side for the line axis, counterclockwise side for the rotary axis and outer (open) side for the gripper. [Refer to the coordinate system of the actuator.]
If it becomes necessary to reverse the home direction after the actuator is installed on the machine, change the setting.

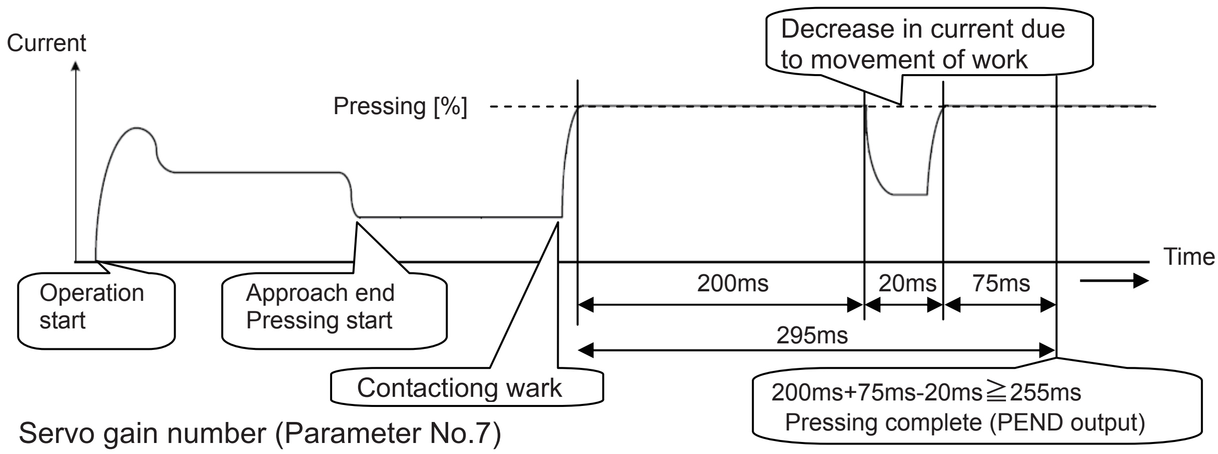
⚠ Caution: For the actuator of rod or rotary type, the home direction cannot be changed.

[4] Press & hold stop judgment period (Parameter No.6)

No.	Name	Symbol	Unit	Input Range	Default factory setting
6	Push & Hold Stop Judgment Period	PSWT	msec	0 to 9999	255

Judging completion of pressing operation

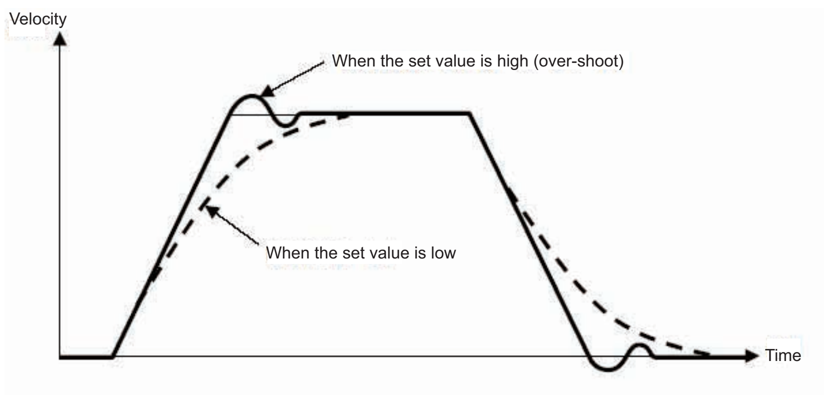
(1) For Standard type (PIO pattern 0 to 2)
The operation monitors the torque (current limit value) in percent in "Pressing" of the position table and turns pressing complete signal PEND ON when the load current satisfies the condition shown below during pressing. PEND is turned ON at satisfaction of the condition if the work is not stopped.
(Accumulated time in which current reaches pressing value [%])
- (accumulated time in which current is less than pressing value [%])
255 ms (Parameter No.6)



[5] Servo gain number (Parameter No.7)

No.	Name	Symbol	Unit	Input Range	Default factory setting
7	Servo Gain Number	PLGO	-	0 to 31	In accordance with actuator

The servo gain is also called position loop gain or position control system proportion gain. The parameter defines the response when a position control loop is used. Increasing the set value improves the tracking performance with respect to the position command. However, increasing the parameter value excessively increases the changes of overshooting.
When the set value is too low, the follow-up ability to the position command is degraded and it takes longer time to complete the positioning.
For a system of low mechanical rigidity or low natural frequency (every object has its own natural frequency), setting a large servo gain number may generate mechanical resonance, which then cause not only vibrations and/or noises but also overload error to occur.



[6] Default velocity (Parameter No.8)

No.	Name	Symbol	Unit	Input Range	Default factory setting
8	Default Velocity	VCMD	mm/s [deg/s]	1 to Actuator's max. speed	Rated actuator speed

The factory setting is the rated velocity of the actuator.
When a target position is set in an unregistered position table, the setting in this parameter is automatically written in the applicable position number.
It is convenient to set the velocity often used.

[7] Default acceleration/deceleration (Parameter No.9)

No.	Name	Symbol	Unit	Input Range	Default factory setting
9	Default Acceleration/Deceleration	ACMD	G	0.01 to actuator's max. acceleration/ deceleration	Rated actuator's acceleration/ deceleration

The factory setting is the rated acceleration/deceleration of the actuator.
When a target position is set in an unregistered position table, the setting in this parameter is automatically written in the applicable position number.
It is convenient to set the acceleration/deceleration often used.

[8] Default positioning width (in-position) (Parameter No.10)

No.	Name	Symbol	Unit	Input Range	Default factory setting
10	Default Positioning Width	INP	mm [deg]	0.01 to 999.99	0.10

When a target position is set in an unregistered position table, the setting in this parameter is automatically written in the applicable position number. When the remaining moving distance enters into this width, the positioning complete signal PEND/INP is output.
It is convenient to set the positioning width often used.

[9] Current-limiting value during home return (Parameter No.13)

No.	Name	Symbol	Unit	Input Range	Default factory setting
13	Current-Limiting Value During Home Return	ODPW	%	1 to 300	In accordance with actuator

The setting is established for the current to suit for the standard type actuator at the delivery.
Increasing this setting will increase the home return torque.
Normally this parameter need not be changed. If the home return should be completed before the correct position depending on the affixing method, load condition or other factors when the actuator is used in a vertical application, the setting value must be increased. Please contact IAI.

[10] Dynamic brake (Parameter No.14)

No.	Name	Symbol	Unit	Input Range	Default factory setting
14	Dynamic Brake	FSTP	-	0: Disabled 1: Enabled	1

This parameter defines whether the dynamic brake is enabled or disabled while the actuator is at standstill.
Normally it need not be changed.

[11] Pause input disable selection (Parameter No.15)

No.	Name	Symbol	Unit	Input Range	Default factory setting
15	Pause Input Disable Selection	FPIO	-	0: Disabled 1: Enabled	0

This parameter defines whether the pause input signal is disabled or enabled.
If a pause operation is not needed, set the parameter to “1” and an operation becomes available without controlling the pause signal.

Set Value	Description
0	Enabled (Use)
1	Disabled (Does not use)

[12] Home position check sensor input polarity (Parameter No.18)

No.	Name	Symbol	Unit	Input Range	Default factory setting
18	Home Position Check Sensor Input Polarity	AIOF	-	0 to 2	In accordance with actuator

The home sensor is an option.

Set Value	Description
0	Standard specification (sensor not used)
1	Input is a contact
2	Input is b contact

[13] Overrun sensor input polarity (Parameter No.19)

No.	Name	Symbol	Unit	Input Range	Default factory setting
19	Overrun Sensor Input Polarity	AIOF	-	0 to 2	In accordance with actuator

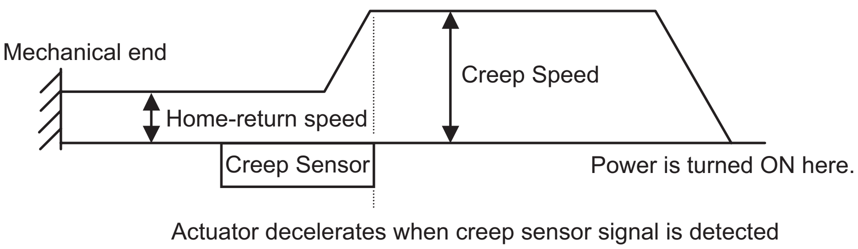
This parameter is set properly prior to the shipment according to the specification of the actuator.

Set Value	Description
0	Standard specification without sensor
1	Over travel detection sensor input is a contact
2	Over travel detection sensor input is b contact

[14] Creep sensor input polarity (Parameter No.20)

No.	Name	Symbol	Unit	Input Range	Default factory setting
20	Creep Sensor Input Polarity	AIOF	-	0 to 2	In accordance with actuator

Even though the actuator with long stroke requires time to home-return if the power is shut at a point far from the home position, the required time can be improved with using the creep sensor.
The actuator moves at the creep speed (100mm/s or less) until a creep sensor signal is detected, upon which the actuator will decelerate to the home return speed.
Creep sensor is an option for the line axis type.
This parameter is set properly prior to the shipment according to the specification of the actuator.



Set Value	Description
0	Not to use
1	Input is a contact
2	Input is b contact

[15] Servo ON input disable (Parameter No.21)

No.	Name	Symbol	Unit	Input Range	Default factory setting
21	Servo ON Input Disable Selection	FPIO	-	0: Enabled 1: Disabled	0

This parameter defines whether the servo ON input signal is disabled or enabled.
When the servo ON input signal is disabled, the servo is turned ON as soon as the controller power is turned ON.
Set this parameter to “1” if servo ON/OFF is not provided.

Set Value	Description
0	Enabled (Use)
1	Disabled (Does not use)

[16] Home return offset level (Parameter No.22)

No.	Name	Symbol	Unit	Input Range	Default factory setting
22	Home Return Offset Level	OFST	mm [deg]	0.00 to 9999.99	In accordance with actuator

In this setting can set the distance from the mechanical end to the home position.
An adjustment is available for the following cases.
1) Want to match the actuator home position and the mechanical origin of the system.
2) Want to set a new home after reversing the factory-set home direction.
3) Want to eliminate a slight deviation from the previous home position generated after replacing the actuator.

[Adjustment Process]
1) Homing execution
2) Offset check
3) Parameter setting change
4) If setting a number close to a multiple of the lead length (including home-return offset value = 0) to the home offset value, there is a possibility to servo lock on Z-phase at absolute reset, thus the coordinates may get shifted for the lead length.
   For Absolute Type, do not attempt to set a value near a number that the lead length is multiplied by an integral number.
   Have enough margin.
   After the setting, repeat home return several times to confirm that the actuator always returns to the same home position.

⚠ Caution: If the home return offset has been changed, the soft limit parameters must also be adjusted accordingly.
In case the there is a necessity of setting a value more than the initial setting, contact IAI.

[17] Zone 2 positive side, zone 2 negative side (Parameter No.23, No.24)

[Refer to 7.2 [1].]

[18] PIO pattern selection (Parameter No.25)

No.	Name	Symbol	Unit	Input Range	Default factory setting
25	PIO Pattern Selection	IOPN	-	0 to 2, 4, 5 and 8	8

Select an operation pattern.
[Refer to 3.1 Basic Operation for the details of PIO patterns.]
PIO Patterns 0 to 2, 4 and 5 are available to be selected when Remote I/O Mode is selected.
PIO Pattern 8 can be selected when other than Remote I/O Mode.

Type	Value set in Parameter No.25	Mode	Feature
PIO pattern 0	0	Positioning mode (Standard type)	• Number of positioning points: 64 points • Position command: Binary code • Zone signal output: 1 point • Position zone signal output: 1 point
PIO pattern 1	1	Teaching mode (Teaching type)	• Number of positioning points: 64 points • Position command: Binary code • Position zone signal output: 1 point • Jog operation enabled • Writing current position data to position table enabled
PIO pattern 2	2	256-point mode (Number of positioning points256-point type)	• Number of positioning points: 256 points • Position command: Binary code • Position zone signal output: 1 point
PIO pattern 4	4	Solenoid valve mode 1 (7-point type)	• Number of positioning points: 7 points • Position command: Individual No. signal ON • Zone signal output: 1 point • Position zone signal output: 1 point
PIO pattern 5	5	Solenoid valve mode 2 (3-point type)	• Number of positioning points: 3 points • Position command: Individual No. signal ON • Signal equivalent to LS (limit switch) enabled • Zone signal output: 1 point • Position zone signal output: 1 point
PIO pattern 8	8	(1) Positioner 1 (2) Positioner 2 (3) Positioner 3 (4) Simple Direct (5) Direct numeric specification (6) Direct numeric specification 2	• Selectable from six types of modes • Number of positioning points: 256 points (Direct Indication and Simple Direct Modes excluded) • Monitoring of controller and actuators status Note: Refer to Chapter 3. Operation for details.

[19] PIO jog velocity (Parameter No.26), PIO jog velocity 2 (Parameter No.47)

No.	Name	Symbol	Unit	Input Range	Default factory setting
26	PIO Jog Velocity	IOJV	mm/s [deg/s]	1 to Actuator's max. speed	100

This is the setting for the JOG operation velocity with JOG+/- Signal (JOG Input Command) when PIO Pattern = 1 (Teaching Mode) is being selected.
Set an appropriate value in Parameter No.26 in accordance with the purpose of use.
Note 1: The maximum speed is limited to 250mm/s.

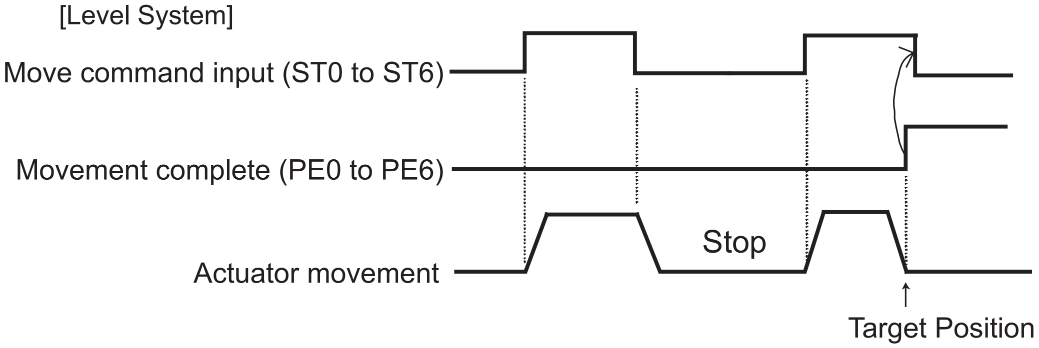
[20] Movement command type (Parameter No.27)

No.	Name	Symbol	Unit	Input Range	Default factory setting
27	Movement Command Type	FPIO	-	0 : Level 1 : Edge	0

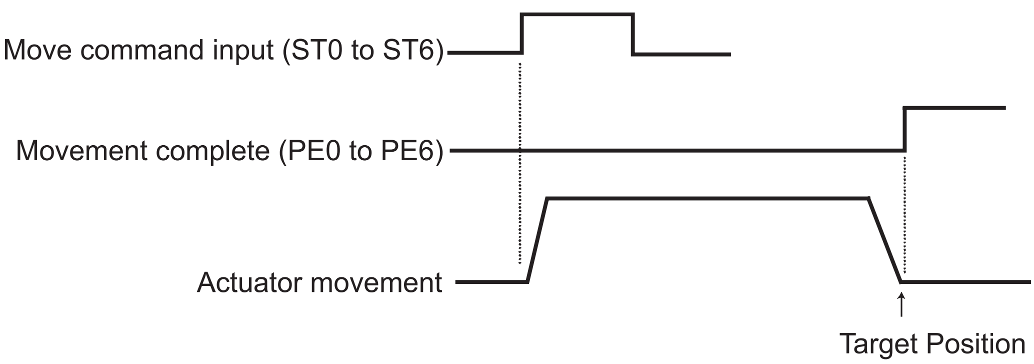
Set the input methods for the start signal (ST0 to ST6, or ST0 to ST2 if PIO Pattern = 5) when PIO Pattern 4 = Solenoid Valve Mode 1 (7-point type) and PIO Pattern 5 = Solenoid Valve Mode 2 (3-point type).

Set Value	Input Method	Description
0	Level	The actuator starts moving when the input signal turns ON. When the signal turns OFF during movement, the actuator will decelerate to a stop and complete its operation.
1	Edge	The actuator starts moving when the rising edge of the input signal is detected. The actuator will not stop when the signal turns OFF during the movement, until the target position is reached.

[Level System]



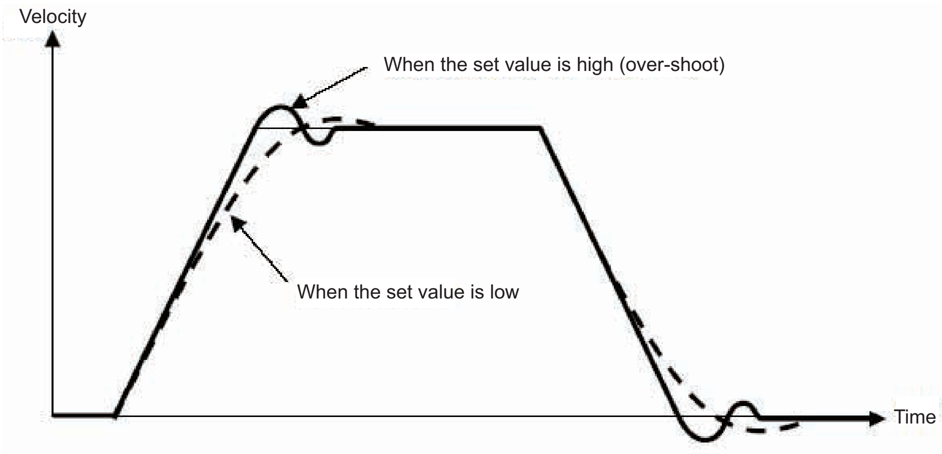
[Edge System]



[21] Velocity loop proportional gain (Parameter No.31)

No.	Name	Symbol	Unit	Input Range	Default factory setting
31	Velocity Loop Proportional Gain	VLPG	-	1 to 27661	In accordance with actuator

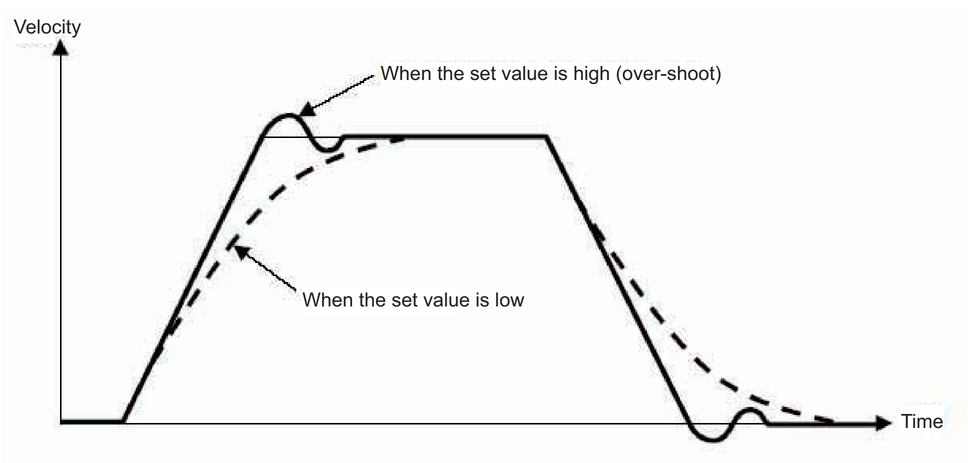
This parameter determines the response of the speed control loop. When the set value is increased, the follow-up ability to the velocity command becomes better (the servo-motor rigidity is enhanced). The higher the load inertia becomes, the larger the value should be set. However, excessively increasing the setting will cause overshooting or oscillation, which facilitates producing the vibrations of the mechanical system.



[22] Velocity loop integral gain (Parameter No.32)

No.	Name	Symbol	Unit	Input Range	Default factory setting
32	Velocity Loop Integral Gain	VLPT	-	1 to 217270	In accordance with actuator

Any machine produces frictions. This parameter is intended to cope with deviation generated by external causes including frictions. Increasing the setting value improves the reactive force
against load change. That is, the servo rigidity increases. However, increasing the parameter value excessively may make the gain too high, which then cause the machine system to be vibrated due to overshoot or shaking.
Tune it to obtain the optimum setting by watching the velocity response.



[23] Torque filter time constant (Parameter No.33)

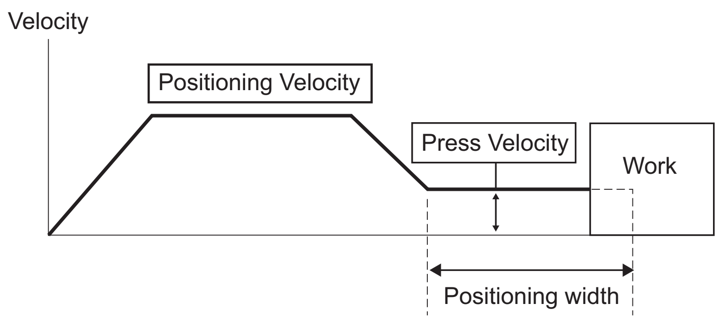
No.	Name	Symbol	Unit	Input Range	Default factory setting
33	Torque Filter Time Constant	TRQF	-	0 to 2500	In accordance with actuator

This parameter decides the filter time constant for the torque command. When vibrations and/or noises occur due to mechanical resonance during operation, this parameter may be able to suppress the mechanical resonance. This function is effective for torsion resonance of ball screws (several hundreds Hz).

[24] Press velocity (Parameter No.34)

No.	Name	Symbol	Unit	Input Range	Default factory setting
34	Push Velocity	PSHV	mm/s [deg/s]	1 to actuator's max. pressing speed	In accordance with actuator

This is the parameter to set the velocity in pressing operation.
The setting is done considering the actuator type when the product is delivered. [Refer Appendix to 9.1 List of Specifications of Connectable Actuators]
If a change to the setting is required, make sure to have the setting below the maximum pressing velocity of the actuator. Setting it fast may disable to obtain the specified pressing force. Also when setting at a low velocity, take 5mm/s as the minimum. Specified pressing force may not be obtained also when a low speed setting is set.



Caution: If the velocity of the positioning of the position table is set below this parameter, the pressing speed will become the same as the positioning speed.

[25] Safety velocity (Parameter No.35)

No.	Name	Symbol	Unit	Input Range	Default factory setting
35	Safety Velocity	SAFV	mm/s [deg/s]	1 to 250 (maximum speed for the actuators with 250 or less)	100

This is the parameter to set the maximum speed of manual operation while the safety velocity selected in the teaching tool. Do not have the setting more than necessary.

[26] Auto servo motor OFF delay time 1, 2, 3 (Parameter No.36, No.37, No.38)

No.	Name	Symbol	Unit	Input Range	Default factory setting
36	Auto Servo-motor OFF Delay Time 1	ASO1	sec	0 to 9999	0
37	Auto Servo-motor OFF Delay Time 2	ASO2	sec	0 to 9999	0
38	Auto Servo-motor OFF Delay Time 3	ASO3	sec	0 to 9999	0

Set the duration before the servo turns OFF after positioning process is complete when the power saving function is used.
[Refer to Chapter 5 Power-saving Function.]

[27] Position complete signal output method (Parameter No.39)

No.	Name	Symbol	Unit	Input Range	Default factory setting
39	Position Complete Signal Output Method	FPIO	-	0: PEND 1: INP	0

This is the parameter to select the type of the positioning complete signals to be used.
It is available except for when PIO Pattern = 5 (Solenoid Valve Type 2 [3-point type]) is selected.
There are 2 types of positioning complete signals and the output condition would differ depending on whether the servo is ON after the positioning is complete or the servo is OFF.

Setting	Signal Type	During Servo ON (positioning complete)	During Servo OFF
0	PEND	It will not turn OFF even if the current position is out of the range of the positioning width.	Turns OFF in any case
1	INP	Turns ON when the current position is in the positioning width, and OFF when out of it.	

Complete position No. outputs PM1 to PM** and current position No. outputs PE0 to PE6 are issued in the similar way.

[28] Home return input disable (Parameter No.40)

No.	Name	Symbol	Unit	Input Range	Default factory setting
40	Home-return Input Disable	FPIO	-	0: Enabled 1: Disable	0

This parameter defines whether the home return input signal is disabled or enabled.
Normally this parameter need not be changed.

Set Value	Description
0	Enabled (Use)
1	Disable (Does not use)

[29] Velocity override (Parameter No.46)

No.	Name	Symbol	Unit	Input Range	Default factory setting
46	Velocity Override	OVRD	%	1 to 100	100

When move commands are issued from the PLC, the moving speed set in the “Velocity” field of the position table can be overridden by the value set by this parameter.
Actual movement velocity = [Velocity set in the position table] × [setting value in Parameter No.46]
Example) Value in the “Velocity” field of the position table: 500mm/s
Setting in Parameter No.46 20%
In this case, the actual movement speed becomes 100mm/s.
The minimum setting unit is 1% and the input range is 1 to 100%.
Note: This parameter is ignored for move commands from a teaching tool such as PC software.

[30] PIO jog velocity 2 (Parameter No.47)

Refer to Section 7.2 [19] for details.

[31] PIO inch distance, PIO inch distance 2 (Parameter No.48, No.49)

No.	Name	Symbol	Unit	Input Range	Default factory setting
48	PIO Inching Distance	IOID	mm [deg/s]	0.01 to 1.00	0.1
49 (Note 1)	PIO Inching Distance 2	IOD2	mm [deg/s]	0.01 to 1.00	0.1

When the selected PIO pattern is “1” (teaching mode), this parameter defines the inching distance to be applied when inching input commands are received from the PLC.
The maximum allowable value is 1 mm.
Note 1: Parameter No.49 “PIO inching distance 2” is not used for the controller.

[32] Load output judgment time period (Parameter No.50)

No.	Name	Symbol	Unit	Input Range	Default factory setting
50	Load Output Judgment Time Period	LDWT	msec	0 to 9999	255

This parameter defines the time taken to judging whether torque level status signal (TRQS) is ON.
If the command torque exceeds the value set in “Threshold” of position data for the time set by this parameter during pressing operation, torque level status signal (TRQS) is turned ON.
Refer to 3.8.2 [4] or 3.8.3 [3] Pressing Operation for the details of the pressing operation.

[33] Default acceleration/deceleration mode (Parameter No.52)

No.	Name	Symbol	Unit	Input Range	Default factory setting
52	Default Acceleration/ Deceleration Mode	CTLF	-	0 to 2	0 (Trapezoid)

When a target position is written to an unregistered position table, this value is automatically set as the “Acceleration/deceleration mode” of the applicable position number.

Set Value	Description
0	Trapezoid
1	S-motion
2	Primary delay filter

[34] Default stop mode (Parameter No.53)

No.	Name	Symbol	Unit	Input Range	Default factory setting
53	Default Stop Mode	CTLF	-	0 to 3	0 (Not applicable)

This parameter defines the power-saving function.
[Refer to Chapter 5 Power-saving Function.]

[35] Current control width number (Parameter No.54)

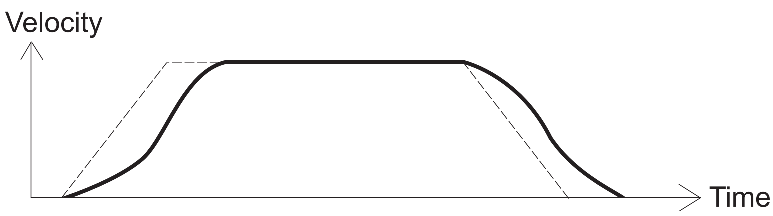
No.	Name	Symbol	Unit	Input Range	Default factory setting
54	Current Control Width Number	CLPF	-	0 to 4	In accordance with actuator

This parameter is for the manufacturer’s use only to determine the response capability of thecurrent loop control. Therefore, do not change the settings in this parameter. If the parameter ischanged carelessly, control safety may be adversely affected and a very dangerous situationmay result.

[36] Position command primary filter time constant (Parameter No.55)

No.	Name	Symbol	Unit	Input Range	Default factory setting
55	Position Command Primary Filter Time Constant	PLPF	msec	0.0 to 100.0	0.0

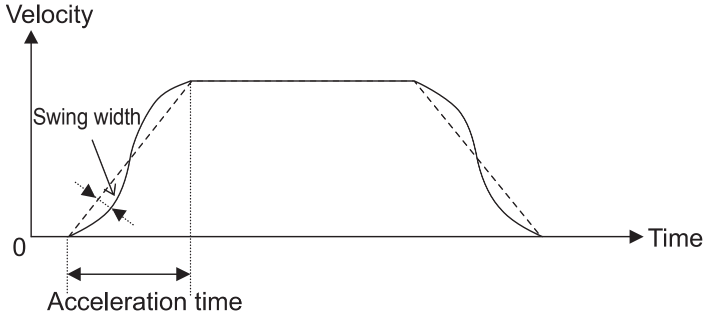
This is to be used when setting the value in “Acceleration/Deceleration Mode” box in the position table to 2 “Primary Delay Filter”.
The primary delay filter is disabled if “0” is set.
The greater the setting value is, the longer the delay is and the slower the acceleration/deceleration is. The impact at the acceleration and deceleration will be eased, but the takt time will become longer.



[37] S-motion rate (Parameter No.56)

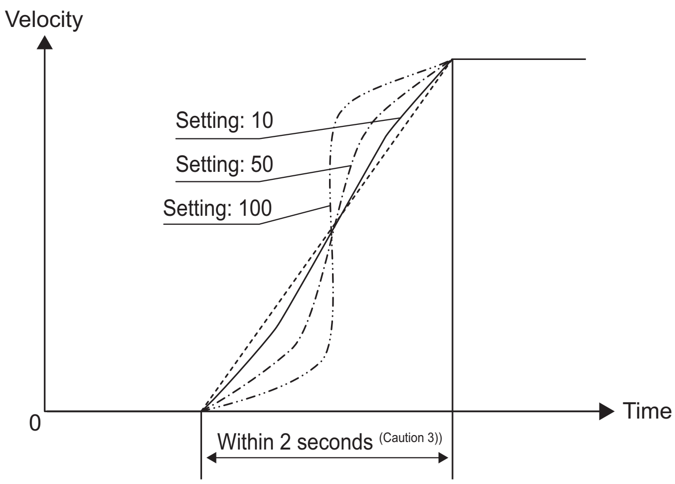
No.	Name	Symbol	Unit	Input Range	Default factory setting
56	S-motion Rate	SCRV	%	0 to 100	0

This parameter is used when the value in the "Acceleration/deceleration mode" field of the position table is set to "1 (S-motion)".
This enables to ease the impact at acceleration and deceleration without making the takt time longer.



The S-motion is a sine curve that has the acceleration time as 1 cycle.
The level of its swing width can be set by this parameter.

Setting of Parameter No.56 [%]	Level of swing width
0 [Set in delivery]	No S-motion (Dotted line shown in the image below)
100	Sine curve swing width × 1 (Double-dashed line shown in the image below)
50	Sine curve swing width × 0.5 (Dashed line shown in the image below)
10	Sine curve swing width × 0.1 (Solid line shown in the image below)



⚠ Caution:
1) If the S-motion is specified in acceleration/deceleration mode, executing position command or direct value command while the actuator is moving causes an actuator to move along the trapezoid pattern.
   To change a speed during operation, be sure to specify such a position command while the actuator is in pause state.
2) In the index mode of rotary actuator, the S-motion control is disabled. If S-motion acceleration/deceleration is specified, the trapezoid pattern is used in acceleration/deceleration mode.
3) If acceleration time or deceleration time exceeds 2 seconds, do not specify S-motion control. The actuator will be the trapezoid operation.
4) Do not perform temporary stop during acceleration or deceleration. The speed change (acceleration) may cause the dangerous situation.

Chapter 7 Parameter

[38] Pulse count direction (Parameter No.62)
This is the parameter for the future extension. Do not attempt to change the initial settings.

[39] Electronic gear numerator (Parameter No.65)
This is the parameter for the future extension. Do not attempt to change the initial settings.

[40] Electronic gear denominator (Parameter No.66)
This is the parameter for the future extension. Do not attempt to change the initial settings.

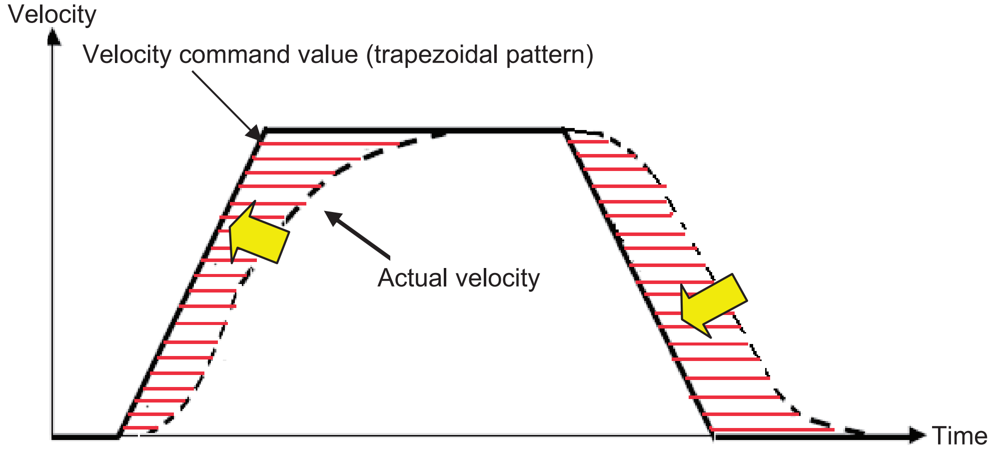
[41] Feed forward gain (Parameter No.71)

No.	Name	Symbol	Unit	Input Range	Default factory setting
71	Feed Forward Gain	PLFG	-	0 to 100	0

This parameter defines the level of feed forward gain to be applied to position control.
Setting this parameter allows the servo gain to be increased and the response of the position control loop to be improved. This is the parameter to improve the takt time and traceability even more after fine-tuning the settings for “Servo Gain Number (Parameter No.7)”, “Velocity Loop Proportional Gain (Parameter No.31)”, etc.
This can result in shorter positioning time.
The gain adjustment of position, speed and current loop in feedback control can directly change the response of the servo control system. Thus, improper adjustment may cause the control system to be unstable and further vibrations and/or noises to occur. On the other hand, since this parameter only changes the speed command value and does not relate with the servo loop, it neither makes the control system unstable nor generate continuous vibrations and/or noises. However, excessive setting may generate vibrations and/or noises until the machine can follow command values in every operation.

In the trapezoidal pattern, adding the value resulting from multiplying the speed command by the feed forward gain to the speed command can reduce the delay of speed follow-up and the position deviation.

The feedback control providing control in accordance with the result causes control delay to occur. This conducts the supportive control independent from the control delay.



⚠Caution: Anti-vibration control function is unavailable when the feed-forward gain is used (with the settings except for 0).

[42] Encoder voltage level (Parameter No.73)

No.	Name	Symbol	Unit	Input Range	Default factory setting
73	Encoder Voltage Level	EVLV	-	0 to 3	Depending on encoder cable length

To stabilize encoder detection signals, this parameter defines the voltage supplied to the encoder circuit to one of four levels in accordance with the encoder type and the length of the encoder relay cable.
Normally this parameter need not be changed. If you have changed the length of the encoder relay cable after the shipment, the value of the parameter may be changed.
If you wish to change this parameter, always consult us in advance. If the setting is not optimum, it may cause an operation error of the actuator or malfunction of the encoder.

[43] Electromagnetic brake power monitor (Parameter No.75)

No.	Name	Symbol	Unit	Input Range	Default factory setting
75	Electromagnetic Brake Power Monitor	FSTP	-	0: Disabled 1: Enabled	In accordance with actuator

A power monitor function is provided to prevent actuator malfunction or breakdown of parts caused by an abnormal voltage of the 24V brake power supply when an actuator with brake is used.
Normally this parameter need not be changed because it has been set properly prior to the shipment in accordance with the actuator, i.e. whether or not the actuator is equipped with brake.

Set Value	Description
0	Disabled (no brake)
1	Enabled (with brake)

⚠ Caution: If this parameter is set to “Disabled”, no brake control is provided.

[44] Belt breaking sensor input polarity (Parameter No.76)

This is the parameter for the future extension. Do not attempt to change the initial settings.

[45] Ball screw lead length (Parameter No.77)

No.	Name	Symbol	Unit	Input Range	Default factory setting
77	Ball Screw Lead Length	LEAD	mm [deg]	0.01 to 999.99	In accordance with actuator

This parameter set the ball screw lead length.
The factory setting is the value in accordance with the actuator characteristics.

⚠ Caution: If the setting is changed, not only the normal operation with indicated speed, acceleration or amount to move is disabled, but also it may cause a generation of alarm, or malfunction of the unit.

[46] Axis operation type (Parameter No.78)

No.	Name	Symbol	Unit	Input Range	Default factory setting
78	Axis Operation Type	ATYP	-	0: Linear axis 1: Rotary axis	In accordance with actuator

This parameter defines the type of the actuator used.

Connected Actuator	Set Value	Reference
Linear Axis	0	Actuator other than rotational axis
Rotary Axis	1	Rotary Axis (RS-30/60, RCS2-RT6/RT6R/RT7/RT7R /RTC8L/RTC8HL/RTC10L/RTC12L)

⚠Caution: Do not change the setting of this parameter. Failure to follow this may cause an alarm or fault to occur.

[47] Rotary axis mode selection (Parameter No.79)

No.	Name	Symbol	Unit	Input Range	Default factory setting
79	Rotary Axis Mode Selection	ATYP	-	0: Normal mode 1: Index mode	In accordance with actuator

This parameter defines the mode of the rotational axis.
When the axis operation type (Parameter No.78) is set to "Rotary Axis" and the index mode is selected, the current value indication is fixed to "0 to 359.99". When the index mode is selected, the short course control is enabled.

Set Value	Description
0	Normal Mode
1	Index Mode

• The index mode cannot be specified for actuators of absolute specification.

Note: With the rotational axes RS-30/60 and RCS2-RTC8L/RTC8HL/RTC10//RTC12L, the factory setting is "1" (index mode).
With the rotational axes RCS2-RT6/RT6R/RT7/RT7R, the factory setting is "0" (normal mode).

⚠ Caution: When it is set to "Index Mode", the push & hold operation is not available. Even when data is entered in the "Push & Hold" data box in the Position Data, it becomes invalid and normal operation is performed. The positioning width becomes the parameter's default value for the positioning width.

⚠ Caution: Change the value in the soft limit at the same time when changing the setting of Index Mode to Normal Mode. Parameter data error would be generated if the value in the soft limit is set to 0. Set a value that is -0.3mm out of the effective stroke.

[48] Rotational axis shortcut selection (Parameter No.80)

No.	Name	Symbol	Unit	Input Range	Default factory setting
80	Rotational Axis Shortcut Selection	ATYP	-	0: Disabled 1: Enabled	In accordance with actuator

Select whether valid/invalid the shortcut when positioning is performed except for when having the relative position movement in the multiple rotation type rotary actuator.
The shortcut means that the actuator is rotated to the next position in the rotational direction of the smaller travel distance.

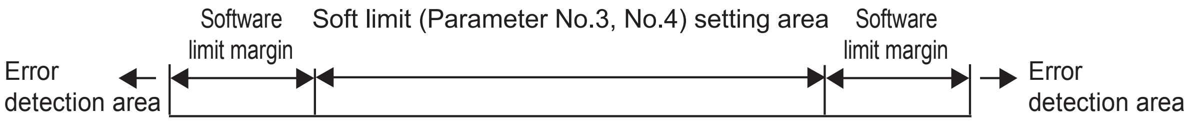
Set Value	Description
0	Disabled
1	Enabled

Refer to [Nearer Direction Control of Multi-Rotation Type Rotary Actuator] in 3.8.2 Position Number Input Operation.

[49] Software limit margin (Parameter No.88)

No.	Name	Symbol	Unit	Input Range	Default factory setting
88	Software Limit Margin	SLMA	mm	0 to 9999.99	In accordance with actuator

This is the parameter to set the position of over error detection against the soft limit errors set in Parameters No.3 and No.4.
It is not necessary to change the setting in normal use.



[50] Allowable time of exceeding torque allowing continuous pressing (Parameter No.89)

This is the parameter for the future extension. Do not attempt to change the initial settings.

[51] Current limit value at stopping due to miss-pressing (Parameter No.91)

No.	Name	Symbol	Unit	Input Range	Default factory setting
91	Current Limit Value at Stopping Due to Miss-pressing	FSTP	-	0: Current limit during Movement 1: Current limit value during pressing	0

This parameter defines the restricted current value at stopping due to miss-pressing.
This restricted current value locks the servo till the next moving command.

Parameter No.91	Description
0	Current limit value during movement (2.8 to 4 times of rating value depending on actuator characteristics)
1	Press-motion current-limiting value

[52] Use of loadcell selection (Parameter No.92)

This is the parameter for the future extension. Do not attempt to change the initial settings.

[53] Selection of pressing control (Parameter No.93)

This is the parameter for the future extension. Do not attempt to change the initial settings.

[54] Pressing operation using force sensor gain (Parameter No.94)

This is the parameter for the future extension. Do not attempt to change the initial settings.

[55] Positive and negative side of force judgment margin (Parameter No.95, No.96)

This is the parameter for the future extension. Do not attempt to change the initial settings.

[56] Damping characteristic coefficient 1, 2 / Natural frequency / Notch filter gain (Parameter No.97 to No.108)

This parameter is exclusively used for vibration suppress control.

	Name	Parameter No.
Parameter set 1	Damping characteristic coefficient 1	97
	Damping characteristic coefficient 2	98
	Natural frequency	99
	Notch filter gain	100
Parameter set 2	Damping characteristic coefficient 1	101
	Damping characteristic coefficient 2	102
	Natural frequency	103
	Notch filter gain	104
Parameter set 3	Damping characteristic coefficient 1	105
	Damping characteristic coefficient 2	106
	Natural frequency	107
	Notch filter gain	108

[Refer to Chapter 4 Vibration Suppress Control Function (Option) for details.]

[57] Default vibration suppress No. (Parameter No.109)

This parameter is exclusively used for vibration suppress control.

[Refer to Chapter 4 Vibration Suppress Control Function (Option) for details.]

[58] Stop method at servo OFF (Parameter No.110)

This parameter defines how to stop the actuator at issue of servo OFF command, emergency stop or occurrence of an error (operation release level).

<table>
<tr><th rowspan="3">Stop Command</th><th colspan="4">Set Value</th></tr>
<tr><th colspan="2">0</th><th colspan="2">1</th></tr>
<tr><th>In Anti-Vibration Control Process</th><th>In Normal Position Control Process</th><th>In Anti-Vibration Control Process</th><th>In Normal Position Control Process</th></tr>
<tr><td>Pause</td><td>Vibration Control Deceleration and Stop</td><td>Normal Deceleration and Stop</td><td rowspan="4">Vibration Control Deceleration and Stop</td><td rowspan="4">Normal Deceleration and Stop</td></tr>
<tr><td>Servo OFF</td><td colspan="2" rowspan="3">Sudden stop due to emergency stop torque</td></tr>
<tr><td>Emergency Stop</td></tr>
<tr><td>Error (Operation Cancellation Level)</td></tr>
<tr><td>Error (Cold Start)</td><td colspan="4">Sudden stop due to emergency stop torque</td></tr>
</table>

[59] Monitoring mode selection (Parameter No.112)

No.	Name	Symbol	Unit	Input Range	Default factory setting
112	Monitoring Mode Selection	FMNT	-	0: Unused 1: Monitor Function 1 2: Monitor Function 2 3: Monitor Function 3	1

The controller can be connected with PC software to monitor the servo.
This parameter allows you to select a monitoring mode function (servo monitor).
Check the Instruction Manual of the RC PC software for details.

Set Value	Description
0	Unused
1	Sets the 4CH-15000 record mode.
2	Sets the 8CH-7500 record mode.
3	Sets the 2CH-30000 record mode.

[60] Monitoring period (Parameter No.113)

No.	Name	Symbol	Unit	Input Range	Default factory setting
113	Monitoring Period	FMNT	msec	1 to 100	1

This is the parameter to set up the frequency of time to obtain data (Sampling Frequency) when the monitoring mode is selected.
By setting the value in this parameter bigger, the frequency of data obtaining can be made longer.
It is set to 1ms in the initial setting. Up to 100ms can be set.

1ms frequency setting	100ms frequency setting
Up to 15 seconds in 4CH-15000 record mode	Up to 1500 seconds (25 minutes) in 4CH-15000 record mode
Up to 7.5 seconds in 8CH-7500 record mode	Up to 750 seconds (12.5 minutes) in 8CH-7500 record mode
Up to 30 seconds in 2CH-30000 record mode	Up to 3000 seconds (50 minutes) in 2CH-30000 record mode

[61] Automatic loadcell calibration at start (Parameter No.117)

This is the parameter for the future extension. Do not attempt to change the initial settings.

[62] Pressing operation without completion of loadcell calibration (Parameter No.118)

This is the parameter for the future extension. Do not attempt to change the initial settings.

[63] Loadcell calibration time (Parameter No.119)

This is the parameter for the future extension. Do not attempt to change the initial settings.

[64] Servo gain number 1 (Parameter No.120)
This parameter determines the response of the position control loop.
[Refer to description of Parameter No.7.]

[65] Feed forward gain 1 (Parameter No.121)
This parameter defines the feed forward gain of the position control system.
[Refer to description of Parameter No.71.]

[66] Velocity loop proportional gain 1 (Parameter No.122)
This parameter determines the response of the speed control loop.
[Refer to description of Parameter No.31.]

[67] Velosity loop integral gain 1 (Parameter No.123)
This parameter determines the response of the speed control loop.
[Refer to description of Parameter No.32.]

[68] Torque filter time constant 1 (Parameter No.124)
This parameter decides the filter time constant for the torque command.
[Refer to description of Parameter No.33.]

[69] Current control width number 1 (Parameter No.125)
This parameter defines the control width of the current control system.
[Refer to description of Parameter No.54.]

[70] Servo gain number 2 (Parameter No.126)
This parameter determines the response of the position control loop.
[Refer to description of Parameter No.7.]

[71] Feed forward gain 2 (Parameter No.127)
This parameter defines the feed forward gain of the position control system.
[Refer to description of Parameter No.71.]

[72] Speed loop proportional gain 2 (Parameter No.128)
This parameter determines the response of the speed control loop.
[Refer to description of Parameter No.31.]

[73] Speed loop integral gain 2 (Parameter No.129)
This parameter determines the response of the speed control loop.
[Refer to description of Parameter No.32.]

[74] Torque filter time constant 2 (Parameter No.130)
This parameter decides the filter time constant for the torque command.
[Refer to description of Parameter No.33.]

[75] Current control width number 2 (Parameter No.131)
This parameter defines the control width of the current control system.
[Refer to description of Parameter No.54.]

[76] Servo gain number 3 (Parameter No.132)
This parameter determines the response of the position control loop.
[Refer to description of Parameter No.7.]

[77] Feed forward gain 3 (Parameter No.133)
This parameter defines the feed forward gain of the position control system.
[Refer to description of Parameter No.71.]

[78] Velocity loop proportional gain 3 (Parameter No.134)
This parameter determines the response of the speed control loop.
[Refer to description of Parameter No.31.]

[79] Velocity loop integral gain 3 (Parameter No.135)
This parameter determines the response of the speed control loop.
[Refer to description of Parameter No.32.]

[80] Torque filter time constant 3 (Parameter No.136)
This parameter decides the filter time constant for the torque command.
[Refer to description of Parameter No.33.]

[81] Current control width number 3 (Parameter No.137)
This parameter defines the control width of the current control system.
[Refer to description of Parameter No.54.]

[82] Servo gain switchover time constant (Parameter No.138)

No.	Name	Symbol	Unit	Input Range	Default factory setting
138	Servo Gain Switchover Time Constant	GCFT	ms	10 to 2000	10

When a switchover of the servo gain set is commanded in the position table, the switchover process is completed after time more than 3 times of the time spent in the setting of this parameter is passed since the operation of the commanded position number has started.

⚠ Caution: A time constant being rather short may cause the servo gain to change rapidly to have the operation of the actuator unstable.

[83] Home preset value (Parameter No.139)

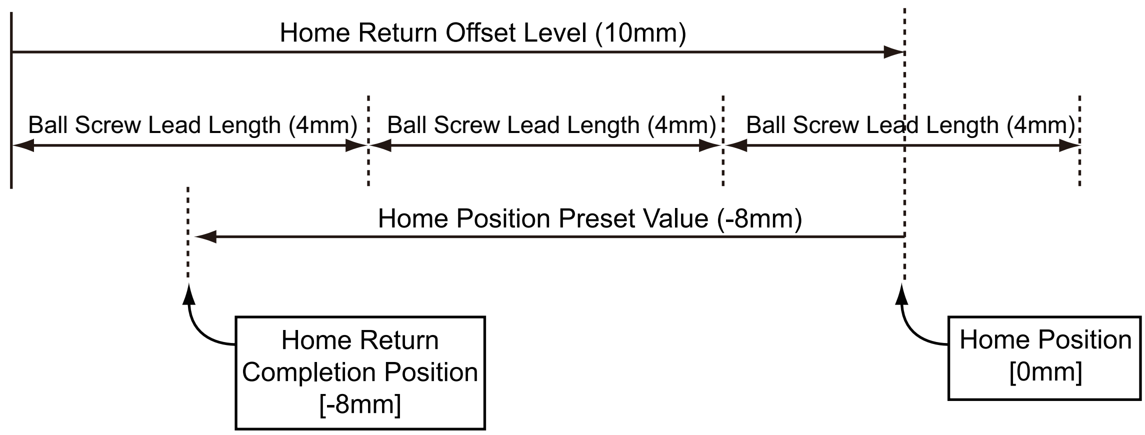
No.	Name	Symbol	Unit	Input Range	Default factory setting
139	Home Preset Value	PRST	mm	-9999.99 to 9999.99	In accordance with actuator

For the actuator of absolute specification, set this parameter so that (home return offset + value of this parameter) is within the range between 0 and the ball screw lead.
The value should be an integer multiple of ± (ball screw lead length) including 0.00.
(If the home return offset is within the range between 0 and ball screw lead length, the value of this parameter is 0.00.)
When this parameter is set to a value other than 0.00, the home return complete position is determined by calculating (home position + position set by this parameter)

⚠Caution: If the above condition is not satisfied, the home position at restart after home return may shift by an integer multiple of the ball screw lead.

For the actuator of incremental specification, always set this parameter to 0.00.

<Setting example 1>
With ball screw lead length 4mm and home return offset level 10mm, set this parameter to -8mm.



[84] Overload level ratio (Parameter No. 143)

No.	Name	Symbol	Unit	Input Range	Default factory setting
143	Overload Level Ratio	OLWL	%	50 to 100	100

With the motor temperature of when an operation is held at the rating being set as 100%, the overload warning (message level) is output when the motor temperature exceeds the rate set in this parameter.
The judgment would not be made if the value is set to 100%.

[85] Total movement count threshold (Parameter No.147)

No.	Name	Symbol	Unit	Input Range	Default factory setting
147	Total Movement Count Threshold	TMCT	Times	0 to 999999999	0 (Disabled)

An alarm is generated when the total movement count exceeds the value set to this parameter.
The judgment would not be made if the value is set to 0.

[86] Total operated distance threshold (Parameter No.148)

No.	Name	Symbol	Unit	Input Range	Default factory setting
148	Total Operated Distance Threshold	ODOT	m	0 to 999999999	0 (Disabled)

An alarm is generated when the total operation distance exceeds the value set to this parameter.
The judgment would not be made if the value is set to 0.

[87] Zone output changeover (Parameter No.149)

No.	Name	Symbol	Unit	Input Range	Default factory setting
149	Zone Output Changeover	FPIO	-	0: Not to change 1: To change	0

In Remote I/O Mode, the effective zone signals are determined by the setting of this parameter and the setting of Parameter No.25 PIO Pattern Select.
The relationship between the parameter settings and effective zone signal outputs are as shown in the table below.

Operation Mode	Parameter No.25 PIO pattern selection	Parameter No.149 Zone Output Changeover	
		0	1
Remote I/O Mode	0	ZONE1 PZONE	ZONE1 ZONE2
	1	PZONE	ZONE1
	2		
	4	ZONE1 PZONE	ZONE1 ZONE2
	5		

[88] Linear absolute home preset value (Parameter No.150)
This is the parameter for the future extension. Do not attempt to change the initial settings.

[89] Light error alarm output select (Parameter No.151)

No.	Name	Symbol	Unit	Input Range	Default factory setting
151	Light Error Alarm Output Select	FSTP	-	0: Battery voltage drop warning output 1: Output of battery voltage drop warning or message-level alarm	0

It can be selected if an output is to be made when a message-level alarm is generated as well as when the battery voltage drop error is occurred for the output condition of BALM signal.

[90] Drive cutoff alarm level (Parameter No.157)

No.	Name	Symbol	Unit	Input Range	Default factory setting
157	Drive Cutoff Alarm Level	FSTP	-	0 to 2	0

Set the alarm level to have a drive source cutoff.

Set Value	Description
0	When overcurrent alarm is issued, Drive Cutoff
1	When cold start level alarm is issued, Drive Cutoff
2	Operation Cancel Level or When cold start level alarm is issued, Drive Cutoff

[91] Active/Inactive axis select (Parameter No.158)

No.	Name	Symbol	Unit	Input Range	Default factory setting
158	Active/Inactive Axis Select	ATYP	-	0: Enabled 1: Disabled	0

In the case an operation is desired to be made with less axes than what were purchased, by setting this parameter to ineffective, an alarm would not be generated.
It is useful when connecting specific axes for operation at the startup or can be reserved for an extension in the future.

7.3 Servo Adjustment

The parameters are preset at the factory before shipment so that the actuator operates stably within the rated (maximum) transportable weight.
However, the preset setting cannot always be the optimum load condition in the actual use. In such cases, servo adjustment may be required.
This section describes the basic servo adjustment method.

> ⚠ Caution: Rapid and excessive settings are dangerous. They may devices including the actuator to be damaged and/or people to be injured. Take sufficient note on the setting.
> Record settings during servo adjustment so that prior settings can always be recovered.
> When a problem arises and the solution cannot be found, please contact IAI.

No.	Situation that requires adjustment	How to Adjust
1	Takes time to finish positioning Positioning accuracy is not appropriate Shorter takt time is desired	• Set Parameter No.55 “Position command primary filter time constant” to “0” if it is set. • Increase the value of Parameter No.7 “Servo gain number”. By setting a larger value, the follow-up ability to the position command becomes better. Set the value to any of 3 to 10 roughly or up to 15 at the maximum. If the value is too large, an overshoot is caused easily and may cause noise or vibration. If the value of Parameter No.7 “Servo gain number” is increased, also adjust the Parameter No.31 “Speed loop proportional gain” in increasing direction to ensure the stability in the control system. To increase the value of Parameter No.31 “Speed loop proportional gain” by about 20% of the default. Prior to the setting, adjust Parameter No.7 “Servo gain number”.
2	Vibration is generated at acceleration/deceleration	• The cause of the problem is excessive “acceleration/deceleration setting” or vulnerable structure of the unit on which the actuator is installed. If possible, reinforce the unit itself, first. • Decrease the values of “acceleration/deceleration setting”. • Decrease the number of Parameter No.7 “Servo gain number”. If the Parameter No.7 “Servo gain number” is too low, it takes long time to finish the positioning.
3	Speed is uneven during the movement Speed accuracy is not appropriate	• Increase the value of Parameter No.31 “Speed loop proportional gain”. By setting a larger value, the follow-up ability to the speed command becomes better. Setting too large value makes the mechanical components easy to vibrate. As a reference for the setting, increase the value little by little by 20% from the initial setting.

No.	Situation that requires adjustment	How to Adjust
4	Abnormal noise is generated. Especially, when stopped state and operation in low speed (less than 50mm/sec), comparatively high noise is generated.	• Input the "Torque Filter Time Constant". Try to increase by 50 as a reference for the setting. If the setting is too large, it may cause a loss of control system stability and lead the generation of vibration. [Important] Prior to Adjustment: This phenomenon is likely to occur when the stiffness of the mechanical components is not sufficient. The actuator itself may also resonate if its stroke is over 600mm or it is belt-driven type. Before having an adjustment, check if: 1) The value for Parameter No.7 "Servo gain number", Parameter No.31 "Speed loop proportional gain", or Parameter No.32 "Speed loop integral gain" are excessive. 2) The stiffness of the load is sufficient as much as possible, or the attachments are not loosened. 3) The actuator unit is mounted securely with a proper torque. 4) There is no waviness on the actuator mounting surface.
5	Trace precision is desired to be improved. Equi-speed performance is desired to be improved. Response is desired to be improved.	• Make the condition optimized with Parameter No.7 "Servo gain number" and Parameter No.31 "Velocity loop proportional gain" adjusted by referring to the way to adjust stated in No.1 to 3 in the previous page. [Reference] The most important factor is to select the actuator (motor). The servo is extremely sensitive to the inertia of the load. If the inertia moment of the load is too large in comparison with the inertia moment of the servo motor itself, the motor is highly affected by the load. This may cause the actuator to be controlled unstably. Therefore, to improve the precisions of the trace, position, speed and response of the actuator, the load inertia ratio must be made small.
6	Large static friction of load makes actuator start slowly. Large load inertia makes response of actuator low at start and stop. Takt time is desired to be shortened.	• Set parameter No.71 "Feed forward gain". Select a value in the range from 10 to 50 roughly. The larger the setting value is, the smaller the deviation is. Then the response is improved. Setting a large value may cause vibrations and/or noises to occur. Set the feed forward gain in order to improve the response of the actuator further after adjusting Parameter No.7 "Servo gain number" and Parameter No.31 "Speed loop proportional gain".
7	There is an impact at the start or stop.	• Change the setting in Parameter No.55 "Position command primary filter time constant" to approximately 50ms. If there is no improvement in situation, try to increase the setting gradually. If there is an improvement, try to decrease the setting gradually to the boundary. Making a change to this setting will make the settling time longer thus the takt time also becomes longer. The accuracy for the positioning also becomes worse. It is recommended, to solve the problem from the root cause, to replace the host positioning unit with one that is equipped with acceleration/deceleration function.

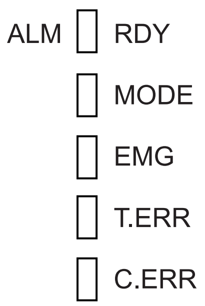
Chapter 8 Troubleshooting

8.1 Action to Be Taken upon Occurrence of Problem

Upon occurrence of a problem, take an appropriate action according to the procedure below in order to ensure quick recovery and prevent recurrence of the problem.

(1) Checking Status (Condition) Display LEDs on Gateway

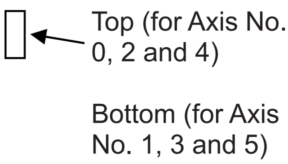
○ : Illuminating, × : OFF



Name	Lamp condition	Color	Description
ALM/RDY	○	Green	Normal
	○	Orange	Alarm issued
	×	-	Control Power OFF
MODE	○	Green	AUTO Mode being selected
	×	-	MANU Mode being selected
EMG	○	Red	Emergency-stop input
	×	-	Not an emergency stop
T.ERR	○	Orange	Communication error between Gateway ⇔ driver board
	×	-	Not a communication error between Gateway ⇔ driver board
C.ERR	○	Orange	Field network communication error
	×	-	Not a field network communication error

(2) Checking Driver Status (Condition) Display LEDs on Each Axis

○: Illuminating, ×: OFF, ☆: Flashing



LED (SV*/ALM*) * : Asix No. = 0 to 5		Driver status
Lamp condition	Color	
○	Green	Servo ON
☆	Green	Automatic servo is OFF
×	-	Servo OFF
○	Red	Alarm generated, Emergency-stop input, Motor driving power OFF

(3) If there is/isn't an alarm generated in host controller (such as PLC)
(4) Check the voltage of control power supply (24V DC) and drive (motor) power supply
(5) Check the voltage of fieldbus power supply
(6) Check the voltage (24V DC) of the power supply for brake (For the actuator with the brake).
(7) Alarm Check(Note1)
Check the alarm code on the teaching tool such as PC software.
(8) Check the connectors for disconnection or connection error.
(9) Check the cables for connection error, disconnection or pinching.
Before performing a continuity check, turn off the power (to prevent electric shocks) and disconnect the cables of measuring instruments (to prevent accidental power connection due to sneak current path).
(10) Check the I/O signals.
Using the host controller (PLC, etc.) or a teaching tool such as PC software, check the presence of inconsistency in I/O signal conditions.
(11) Check the noise elimination measures (grounding, installation of surge killer, etc.).
(12) Check the events leading to the occurrence of problem(Note 1), as well as the operating condition at the time of occurrence.
(13) Analyze the cause.

(14) Treatment

Note1 The time of alarm generated can be recorded if the clock is set to the current time on Gateway Parameter Setting Tool.
The date and time data set once is retained for about 10 days if the power supply of the controller is OFF. If the setting is not conducted or the time data is lost, it will be the time passed since 2000/1/1, 00:00:00 when the power is turned ON. Even if the date and time data is lost, the generated error code is retained.
Alarms subject to this function only include those in 8.4 Alarm but do not include errors in the teaching tool such as PC software.

(!) Request: In troubleshooting, exclude normal portions from suspicious targets to narrow down the causes. Check 1) to 12) described above before contacting us.

8.2 Fault Diagnosis

This section describes faults largely divided into three types as follows:

(1) Impossible operation of controller
(2) Positioning and speed of poor precision (incorrect operation)
(3) Generation of noise and/or vibration
(4) Communication not established

8.2.1 Impossible operation of controller

Situation	Possible cause	Check/Treatment
Power supply status LED turns ON in orange when the power is turned ON.	Control power supply error (when overvoltage applied or internal overcurrent detected)	Check the voltage of the control power supply (24V DC).
EMG in gateway status LEDs turns ON in red.	During emergency-stop.	To cancel emergency stop, make short-circuit between EMG+ and EMG- of the system I/O connector. (Already short-circuited at delivery) [Refer to 2.2 [3] Power Supply and Emergency Stop]
ALM/RDY in gateway status LEDs turns ON in orange, or driver status LED (SV/ALM) for each axis turns ON in red.	Occurrence of alarm.	Check the error code with the teaching tool being connected and remove the cause by referring the alarm list. [Refer to 8.4 Alarm List.]
Both position No. and start signal are input to the controller, but the actuator does not move.	1) Servo OFF condition 2) The pause signal is OFF. 3) Positioning command is issued to a stop position. 4) There is no positioning data set to the commanded position number. 5) Writing the information in a wrong area for Direct Indication Mode.	1) Is the LED (SV/ALM) on the driver board that the axis to be operated is connected turned ON in green? [Refer to Name for Each Parts and Their Functions] Turn ON the servo-on signal SON. 2) Turn OFF the pause signal STP. 3) Check the sequence or the settings of the position table. 4) It will generate Alarm Code 0A2 “Position Data Error”. Conduct the position table setting.
Operation is not performed even though the teaching tool is connected, and power to the controller motor and control circuit is supplied. (the emergency stop switch is released on the teaching pendant)	Cable treatment or mode selection 1) Emergency stop condition 2) The pause signal is OFF. 3) In pause	1) When the setting of the emergency stop circuit is connected to the system I/O connecter, cancel the emergency stop. In case it is difficult to cancel it for such a reason as starting up, as a temporary treatment, make short-circuit between EMG+ and EMG- of the system I/O connector. ⚠ Warning If the process of 1) is conducted, put back the setting as soon as the adjustment work is finished. Starting the operation without putting it back may cause a serious accident since the emergency stop is set invalid 2) 3) Put the operation mode switch on the front panel of the controller to “MANU” side, and select the teach mode on the teaching tool.

8.2.2 Positioning and speed of poor precision (incorrect operation)

Situation	Possible cause	Check/Treatment
Completion of operation on the way to home return	In the home return of our standard specification, the actuator is first pressed to the mechanical end, moved oppositely, and subject to positioning stop at the home position. Therefore, the product may judge as the mechanical end even though it is still on the way when the load is large and interfere with surrounding object. 1) A load exceeding its rating weight is installed on the actuator. 2) It is touched to interference in the way of the run. 3) Torsion stress is applied to guide due to improper fixing method of the actuator or uneven fastening of bolts. 4) The sliding resistance of the actuator itself is large.	1) Reduce the load. 2) Remove the interference. 3) Loosen the fixing bolts once and check whether the slider can move smoothly. If the slider can move smoothly, check if there is a deformation on the attached surface, and install the actuator again following the instructions stated in Instruction Manual. 4) Please contact IAI.
Shocks at start and/or stop.	Acceleration/deceleration is set too high.	Decrease the settings of acceleration/deceleration.
Overshoot during deceleration to stop.	The load inertia is large.	Decrease the setting of deceleration.
Positioning of poor precision Uneven speed during movement Acceleration/deceleration not smooth (bad speed response)	[Refer to 7.3 Servo Adjustment.]	
Positioning at a position different from that of commanded position No.	Proper position number is not commanded.	Check the input signal on I/O monitor on the teaching tool.
Complete signal PEND is not output even though positioning process is completed.	Start signal CSTR is not turned OFF.	Make the start signal CSTR turned OFF before completing the positioning process by the turn-off of positioning complete signal PEND after starting operation, and so on.

8.2.3 Generation of noise and/or vibration

Situation	Possible cause	Check/Treatment
Generation of noise and/or vibration from actuator itself	Noise and vibration are generated by many causes including the status of load, the installation of the actuator, and the rigidity of the unit on which the actuator is installed.	Servo adjustment may improve the situation. [Refer to 7.3 Servo Adjustment.]
Vibrations of load	1) Acceleration/deceleration is set too high. 2) The installation structure and/or the installed load are easily affected by acceleration/deceleration.	1) Decrease the settings of acceleration/deceleration.

8.2.4 Impossible Communication

Situation	Possible cause	Check/Treatment
Not connectable with host unit	1) Communication rates do not match. 2) The station number (node address) is set to be duplicate with that of another unit or out of the range. 3) Poor wiring or disconnection of communication cable	1) Set the communication rate to match that of the host machine. [Refer to the Instruction Manual of the host unit.] 2) Correct the station number (node address) setting. Station number (node address) vary depending on communication modes. Refer to 3.4 Fieldbus Type Address Map and the instruction manuals for the host devices for the details. 3) Check if the wiring is conducted correctly. Confirm that the connectors are joined solidly, and the cables inserted to the connectors are surely fixed. Check if termination resistances are connected to network terminals with correct values. Check if the communication power supply is established properly for DeviceNet Type. [Refer to the Instruction Manual of the host unit.]

8.3 Alarm

8.3.1 Gateway Alarm Codes

The alarm codes are read into b7 to b0 in Gateway Status Signal 0.

Note: The alarm code shown on Gateway Parameter Setting Tool is applied with “8” on the top of the alarm codes listed below.
(Example) If the alarm code is 43, it will be shown as 843.

Alarm Code	Alarm Name	Cause/Treatment
43	Absolute Battery Charge Voltage Drop	Cause : The voltage of the absolute battery charger has dropped. Treatment : Check the wire layout (especially connectors) between the absolute battery box and MSCON controller.
48	Decrease in Fan Revolution	Cause : The fan rotation speed has decreased for the cooling fan on the main unit. Treatment : It is considered that it is the end of the product life of the fan (approximately 3 years). Replace the fan.
49	Time Notification Error	Cause : It is an internal communication error of MSCON. The clock data transfer from Gateway board to the driver board has failed. Treatment : Turn the power OFF and reboot. If the same error occurs again, please contact IAI.
4A	Real Time Clock Operation Stop Detection	Cause : Clock data has lost. The clock data can be remained for approximately 10 days after the power to the MSCON is turned OFF. Treatment : Have the clock setting done from the Gateway Parameter Setting Tool again.
4B	Real Time Clock Access Error	Cause : It is an internal error of MSCON. The clock data failed to be acquired internally. Treatment : Turn the power OFF and reboot. If the same error occurs again, please contact IAI.
50	Fieldbus Communication Error (ERR-C)	Cause : It is a Fieldbus link error. If the flip-flop is set in Gateway Parameter Setting Tool during this error, the actuator is stopped in the condition of the error and any command is ignored until it receives a release signal. Treatment : Check the settings for Fieldbus (node addresses, communication speed, etc.) and wiring layout.
60	Master-Slave Axes Communication Error (ERR-T)	Cause : It is an internal error of MSCON. The communication with the driver board to connect each axis of the actuators was not able to be established. Treatment : It is considered that the driver board is not inserted or there is a failure in the connection (connector is not inserted deep enough). Please check it.
61	Master-Slave Axes Communication Internal Error (Sending)	Cause : It is an internal error of MSCON. The communication with the driver board to connect each axis of the actuators was not able to be established. Treatment : Turn the power OFF and reboot. If the same error occurs again, please contact IAI.
62	Master-Slave Axes Communication Internal Error (Receiving)	Cause : It is an internal error of MSCON. The communication with the driver board to connect each axis of the actuators was not able to be established. Treatment : Turn the power OFF and reboot. If the same error occurs again, please contact IAI.
6A	Driver Board Operation Pattern Error	Cause : There are mode that cannot exist together in the operation modes of each axis. Treatment : Set the operation modes again on Gateway Parameter Setting Tool.
80	GW Parameter Error	Cause : There is an error in Gateway parameters. Treatment : Check the settings such as the number of connected axes and operation mode on Gateway Parameter Setting Tool.

Alarm Code	Alarm Name	Cause/Treatment
81	Parameter Check Sum Error	Cause : There is a possibility that the memory data inside MSCON has destroyed. Treatment : Establish all the settings again on Gateway Parameter Setting Tool or write the backup data if it exists.
90	Driver Board Mount Error	Cause : The number of axes (number of driver boards) set in Gateway Parameter Setting Tool does not match with the number of the actually connected axes. Treatment : Match the numbers of the axes.
9C	Fieldbus Module Not Detected	Cause : Communication board for Fieldbus was not detected. 1) Communication board is not inserted. 2) Malfunction of communication board Treatment : Turn the power OFF and reboot. If the same error occurs again, please contact IAI.
9E	Fan Error	Cause : A Fan error was detected. Treatment : It is considered that it is the end of the product life of the fan (approximately 3 years). Replace the fan.
A0	Control Power Overvoltage	Cause : Control power voltage reached beyond the overvoltage threshold (120% of 24V DC = 28.8V). 1) The voltage of 24V DC power supply is high. 2) A faulty part inside the controller Treatment : Check the voltage of the input power supply.
A1	Control Power Voltage Drop	Cause : The control power voltage dropped less than the voltage drop threshold (70% of 24V DC = 16.8V). 1) The voltage of 24V DC power is low 2) A faulty part inside the controller Treatment : Check the power voltage. If the voltage is normal, please contact IAI.
A2	Motor Power Voltage Error	Cause : 1) There is a lack in number of regenerative resistors. 2) Malfunction of component inside the controller can be considered. Treatment: 1) Add some more regenerative resistors. 2) If it occurs often, possibility of controller malfunction is high. Please contact IAI.
AB	Assumed Regenerative Discharge Excessive Power	Cause : The regenerative electric power exceeded what can be dealt with the regenerative resistor. Treatment : Decrease the acceleration/deceleration speed, revise the operation interval or connect an external optional regenerative resistor.
AC	Continuous Regenerative Excessive Discharge	Cause : The regenerative electric power exceeded what can be dealt with the regenerative resistor. Treatment : Decrease the acceleration/deceleration speed, revise the operation interval or connect an external optional regenerative resistor. If there is no improvement even with the treatment, it is likely a malfunction of the controller.
FFF	Power-on Log	It is the log at the power being on (it is not an error).

8.3.2 Alarm Code for Each Axis

[1] Simple Alarm Code

Simple alarm codes are read into the complete position register (PM8 to PM1) in Position 1/ Simple Direct Modes when an alarm is generated.

○ : ON ● : OFF

*ALM	ALM8 (PM8)	ALM4 (PM4)	ALM2 (PM2)	ALM1 (PM1)	Binary Code	Description: Alarm code is shown in ( ).
○	●	●	●	●	–	Normal
●	●	●	○	●	2	Software reset during servo ON (090) Position number error during teaching (091) PWRT signal detected during movement (092) PWRT signal detected before completion of home return (093)
●	●	●	○	○	3	Move command during servo OFF (080) Position Command in Incomplete Home Return (082) Absolute position move command when home return is not yet completed (083) Movement Command during Home Return Operation (084) Position No. error during movement (085) Position Command Data Error (0A3) Command Deceleration Error (0A7)
●	●	○	●	●	4	Mismatched PCB (0F4)
●	●	○	○	●	6	Parameter data error (0A1) Position data error (0A2) Unsupported motor/encoder type (0A8)
●	●	○	○	○	7	Z-Phase Position Error（0B5） Home sensor non-detection (0BA) Home return timeout (0BE) Creep sensor not detected (0BF)
●	○	●	●	●	8	Actual Speed Excessive (0C0) Overrun detected (0C2)
●	○	●	●	○	9	Electromagnetic Brake Unreleased Error (0A5) Dynamic brake not released (0A6) Overcurrent (0C8) Overheat (0CA) Current Sensor Offset Adjustment Error (0CB)
●	○	●	○	○	11	Electric Angling Mismatching (0B4) Deviation Overflow (0D8) Software stroke limit exceeded (0D9) Pressing Motion Range Over Error (0DC)
●	○	○	●	●	12	Exceeded allowable time of exceeding torque allowing continuous pressing (0C4) Illegal control system transition command (0C5) Overload (0E0) Driver logic error (0F0)

(Note) *ALM Signal is an active low signal. It is ON when the power is applied to the controller, and turns OFF when the signal is output.

○ : ON ● : OFF

*ALM	ALM8 (PM8)	ALM4 (PM4)	ALM2 (PM2)	ALM1 (PM1)	Binary Code	Description: Alarm code is shown in ( ).
●	○	○	●	○	13	Encoder send error (0E4) Encoder Receipt Error (0E5) Encoder count error (0E6) Absolute Encoder Error Detection 2 (0EE) Absolute Encoder Error Detection 3 (0EF)
●	○	○	○	●	14	CPU Error (0FA) FPGA Error (0FB) Logic Error (0FC)
●	○	○	○	○	15	Nonvolatile memory write verify error (0F5) Nonvolatile memory write timeout (0F6) Nonvolatile memory data destroyed (0F8)

(Note) *ALM Signal is an active low signal. It is ON when the power is applied to the controller, and turns OFF when the signal is output.

[2] Alarm Level

The alarms are classified to 3 types of levels by the content of the error.

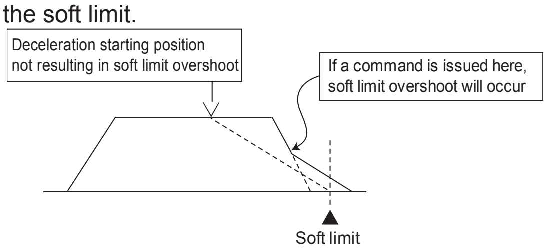
Alarm level	ALM lamp	*ALM signal	Status when an error occurred	Cancellation method
Message	OFF	No output	No stop	Alarm of maintenance output such as excess of number of movement times or of the teaching tool such as PC software [Refer to Instruction Manual of each tool for details.]
Operation release	ON	Output	Servo OFF after deceleration to stop	Alarm reset by teaching tool
Cold start	ON	Output	Servo OFF after deceleration to stop	Software reset or power reconnection by teaching tool. Home return is required for any actuators of other than absolute specification.

⚠ Caution: Reset each alarm after identifying and removing the cause.
If the cause of the alarm cannot be removed or when the alarm cannot be reset after removing the cause, please contact IAI.
If the same error occurs again after resetting the alarm, it means that the cause of the alarm has not been removed.

[3] Alarm List

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
048	Message	Driver overload alarm	Cause : The load current exceeded the value set in Parameter No.143 "Overload Level Ratio". This alarm is kept alarm condition until reset is made. This alarm turns ON when the load current exceeds the setting from a value below the setting. Treatment : Lower the setting of acceleration/deceleration. Also, increase the frequency of pause.
04E		Exceeded movement count threshold	Cause : The total number of the operation times exceeded the value set in Parameter No.147 "Total Movement Count Threshold".
04F		Exceeded operated distance threshold	Cause : The total number of the operation distance exceeded the value set in Parameter No.148 "Total Operated Distance Threshold".
06B		Maintenance information data error	Cause : The maintenance information (total movement count, total operated distance) is lost. Treatment : Please contact IAI.
080	Operation release	Move command in servo OFF	Cause : A move command was issued when the servo is OFF. Treatment : Issue a movement command after confirming the servo is ON (servo ON signal SV or position complete signal PEND is ON).
082		Position Command in incomplete home return	Cause : A position move command was issued before home return was completed. Treatment : Issue a command after confirming that home return has been completed HEND is ON.
083		Numerical command in incomplete home return	Cause : An absolute position command was issued by numerical specification before home return was completed (direct command from Field Network). Treatment : Issue a numeric specification after performing home return operation and confirming the complete signal HEND.
084		Movement command during home return operation	Cause : A move command was issued when home return was still in progress. Treatment : Issue a movement command after performing home return operation and confirming the complete signal HEND.
085		Position No. error during movement	Cause : A non-existing (invalid) position number was specified in the positioner mode. Treatment : Check the position table again and indicate an effective position number.
090		Software reset during servo ON	Cause : A software reset command was issued when the servo was ON. Treatment : Issue a software reset command after confirming that the servo is OFF (SV signal is 0).
091		Position No. error in teaching	Cause : The position number out of the available range was selected in the teaching. Treatment : Select the position number from 63 or smaller.
092		PWRT signal detection during movement	Cause : The current position write signal PWRT was input in the teaching mode of PIO pattern 1 while the actuator was jogging. Treatment : Input the PWRT signal after confirming that the job button is not pressed and the actuator is stopped (MOVE output signal is OFF).

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
093	Operation release	PWRT signal detection in incomplete home return	Cause : The current position write signal PWRT was input in the teaching mode of PIO pattern 1 when home return was not yet completed. Treatment : Input the HOME signal first to perform home return, and then input the PWRT signal after confirming that the home return has completed (HEND output signal is ON).
0A1	Cold start	Parameter data error	Cause : The data input range in the parameter area is not appropriate. This error occurs when the magnitude relationship is apparently inappropriate such as when 300mm was incorrectly input as the value of the soft limit negative side while the value of the soft limit positive side was 200.3mm. Treatment : Change the value to the appropriate one.

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
0A2	Operation release	Position data error	Cause : 1) A move command was input when no target position was set in the “Position” field of a position No. in the position table. 2) The value of the target value in the “Position” field exceeded the Parameter No.3 and 4 “Soft limit set value”. 3) A target position was specified in the “Position” field by relative coordinate in the solenoid valve mode 2 of PIO pattern 5. 4) Pressing operation was specified while the vibration suppress control function remained effective. Treatment : 1) Set the target position. 2) Change the target position value to the one within the soft limit set value. 3) The target position cannot be set by relative coordinate (incremental feed). 4) The vibration suppress control function and pressing operation cannot be used concurrently. Provide setting so that either of the functions is effective.
0A3		Position command data error	Cause : 1) The speed or acceleration/deceleration value during direct numeric specification exceeded the maximum set value. 2) Pressing operation was specified in the field bus specification while the vibration suppress function remained effective. Treatment : 1) Table to input a proper value. 2) The vibration suppress control function and pressing operation cannot be used concurrently. Provide setting so that either of the functions is effective.
0A5		Electromagnetic brake unreleased error	Cause : The brake cannot be released. Treatment : Supplied the 24V power unit for the electromagnetic brake.
0A6	Cold start	Dynamic brake not released	Cause : The dynamic brake cannot be released when the servo is ON due to noise and electrostatic, etc. Treatment : Implement measures to eliminate noise or electrostatic. There is a concern of circuit breakdown. Please contact IAI.
0A7	Operation release	Command deceleration error	Cause : Even though the deceleration setting was changed lower during a movement, because there is not enough deceleration distance for the deceleration from the current position, the actuator exceeded the soft limit.  Treatment : Make the timing earlier for the movement command for the deceleration speed change.

Chapter 8 Troubleshooting

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
0A8	Cold start	Unsupported motor/encoder types	Cause : The motor connected to the controller is not applicable or the type of the encoder that the motor is connected is not applicable. Treatment : Please contact us if the alarm is issued even with the applicable actuator and the same problem happens again even after rebooting the power.
0B4		Electric angling mismatching	Cause : This alarm indicates that the position deviation counter has overflowed. Treatment : The alarm occurs when the actuator cannot be operated. Confirm about the load conditions, that the work does not interfere with any object nearby or the brake has been released, etc. If the error occurs even when the servo is ON, breakage of the encoder cable is considered. Check the cable connection. Please contact IAI if there is no failure in the cable and connector connections.
0B5	Operation release	Z-Phase position error	The position where the Z-phase is detected before the home return operation, is out of the specified range. Cause : Encoder Error Treatment : Please contact IAI.
0BA		Home sensor non-detection	Cause : This indicates that the home-return operation of the actuator equipped with origin sensor (option except rotary actuator) is not completed in normal condition. 1) Work is interfering with peripheral equipment in the middle of home return. 2) Large slide resistance of the actuator itself 3) Installation failure, breakdown or disconnection of the home sensor Treatment : In the case that the work does not interfere with anything, the cause 2) or 3) is supposed. In such case, please contact IAI.
0BE		Home return timeout	Cause : Home return does not complete after elapse of a certain period after the start of home return. Treatment : This error does not occur in normal operation. The combination of the controller and actuator may be incorrect. Please contact IAI.
0BF		Creep sensor not detected	Cause : This indicates the actuator detected the creep sensor (option) before detecting the origin sensor (option except for rotary actuator), or the actuator reached the mechanical end (or the actuator cannot move anymore because the load is too large). 1) The position to apply the creep sensor, which is moved after the product was delivered, is not appropriate. 2) The creep sensor is faulty. 3) The cable is disconnected or the connector is not plugged in properly. 4) The actuator cannot move due to heavy load caused by interference. Treatment : 1) Readjust the sensor installation position. 2) Replace the creep sensor. 3) Perform continuity check to see if the connector is plugged in properly. 4) Check the interference and the transportable weight and make sure there is no external force applied.

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
0C0	Operation release	Actual speed excessive	Cause : This indicates the number of motor rotation exceeded the number of allowable rotation. 1) The slide resistance of the actuator is locally high. 2) The load is increased too much due to a external force. With the reasons above, it can be considered a sudden speed increase has occurred before detecting the servo error. Treatment : Even though this would not occur in normal operation, check if there is any abnormality in the parts assembly condition. Also check if there is a possibility that an external force may be applied in the direction of the actuator movement.
0C2		Overrun sensor detected	Cause : This indicates that a signal from the OT sensor (option) installed at the mechanical end is detected. 1) The actuator was moved by hand or by external force being applied while the servo was OFF (normal detection). 2) The actuator was jogged or operated by pulse-train in a condition where the home coordinates were not yet established and thus the soft stroke limit did not function correctly (normal detection). 3) The home position achieved is not correct, or in the case of an absolute type controller the coordinates have shifted due to an inappropriate absolute reset position. 4) There is a mismatch between the sensor characteristics and the setting in Parameter No.19 “Overrun sensor input polarity”, or the wiring layout is wrong. 5) There is a mistake in the mating of the controller and actuator, or the settings in Parameters No.3 and 4 “Soft limit value” and Parameter No.77 “Ball screw limit length” are not appropriate. Treatment : If 1) or 2) is suspected, move the actuator in the opposite direction by hand. If this error occurred inside the effective stroke range, 3), 4), or 5) is a likely cause. For 3), conduct a home-return operation to check the home position. Conduct the absolute reset again if it is the absolute type. Contact us if the home position would not come to the proper position. If 4) or 5) are suspected, please contact IAI.
0C4	Cold start	Exceeded allowable time of exceeding torque allowing continuous pressing	Cause : The continuous pressing time exceeds the time set for parameter No.89 “Allowable time of exceeding torque allowing continuous pressing”. Treatment : Check the sequence again. Set the pressing time to be within the setting time.

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
0C5	Operation release	Illegal transition command in control system	Cause : 1) Change the operation from the vibration suppress control operation to the normal position control operation. 2) Change the operation from the normal position control operation to the vibration suppress control operation. Treatment : Change the sequence so the next action is conducted after confirming the positioning complete signal (PEND) is turned ON for both cases 1) and 2).
0C8	Cold start	Overcurrent	Cause : The output current in the power circuit section is increased abnormally. Treatment : This alarm will not be generated in normal operation. 1) Degradation of motor coil insulation 2) Malfunction of components inside controller can be concerned. Check if there is deterioration in the insulation by measuring the phase resistance between the monitor connection lines U, V and W. The values for the phase resistance should be almost the same. There is a concern the insulation is deteriorated if the values are different in large amount. Please contact IAI.
0CA		Overheated	Cause : This indicates overheat (75°C or more) of the components inside the controller. 1) Operation is performed with the load condition exceeding the specified range. 2) High temperature around the controller. 3) A faulty part inside the controller. Treatment : 1) Revise the operation condition such as decreasing the acceleration/deceleration speed. 2) Lower the ambient temperature of the controller. (Note) This error would not normally occur. If it occurs, confirm there is not 1) or 2) above. If the same error is issued again even after confirming 1) or 2) is not in the condition, it is considered to be a malfunction. Please contact IAI.
0CB		Current sensor offset adjustment error	Cause : An error was found to the sensor in the status check of the current detection sensor conducted at the initializing process in the startup. 1) The current detection sensor or any of its surrounding parts is faulty. 2) The actuator has moved with external force when the power was turned ON. Treatment : It is necessary to replace the PCB if it occurs even after rebooting the power. Please contact IAI.

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
0D8	Operation release	Deviation overflow	Cause : This alarm indicates that the position deviation counter has overflowed. 1) The speed dropped or the actuator stopped due to the effect of external force or overload. 2) The excited-phase detection operation following the power-on is unstable. 3) The power supply voltage dropped. 4) Servo gain number is too small Treatment : 1) This error occurs when the actuator cannot be operated as it is commanded. Check the load conditions such as if the work is touching to the surrounding object, or brake is properly released, and remove the cause. 2) Overload can be concerned. Revise the transportable weight and redo the home-return operation. 3) Check for the source voltage.
0D9		Software stroke limit exceeded	Cause : The current position of the actuator exceeds the software stroke limit. Treatment : Return the actuator to be within the range of the software stroke limit.
0DC		Pressing motion range over error	Cause : 1) After the pressing operation has complete, the force to push back is too large and the pushed back to the pressing start position (“Position” in the position table). 2) The actuator touched the work during the approach movement before the pressing movement. Treatment : 1) Revise the setting and adjust it so the force to push back gets smaller. 2) Set the “Position” setting in front in the position table to shorten the approach distance.
0E0	Cold start	Overload	Cause : 1) The work weight exceeds the rated weight, or an external force is applied and the load increased. 2) If the actuator is equipped with a brake, the brake is not released. 3) The slide resistance of the actuator is locally high. Treatment : 1) Check the work and its surrounding area to remove the cause. 2) Turn ON the brake release switch to see if the brake is released. If the brake is not released, the brake itself may be faulty, cable may be disconnected, or the controller may be faulty. Please contact IAI. 3) In the case that the work can be moved by hand, move it. Then, check that there is no location where a sliding resistant is too large. Check if the installation face is distorted. When the error occurs in operation of the actuator only, Please contact IAI. ⚠Caution Restart the operation after making sure to remove the cause. If you cannot determine that the cause is removed completely, wait for at least 30 minutes before turning on the power to prevent the motor coil from burning. Generating this error repeatedly without waiting long enough could burn down the motor coil.

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
0E4	Cold start	Encoder send error	Cause : The data sending and receiving between the controller and encoder is conducted by the serial communication. This error indicates that the data sent from the controller was not received properly at the encoder side. 1) Encoder cable is about to break or connector is not plugged properly 2) Effect of noise 3) One or more communication ICs installed on the encoder board are faulty. 4) One or more communication ICs installed on the controller board are faulty. Treatment : 1) Check on the cables and the connector joints to see if any abnormality. 2) Interrupt the power to the peripheral equipment and activate only the actuator. If any error does not occur, it might be caused by noise. Take proper measures against noise. If 3) or 4) is the case, the encoder or controller must be replaced. If the cause cannot be specified, please contact IAI.
0E5		Encoder receipt error	Cause : This shows the data was not received in normal condition from the encoder side to the controller. 1) Cable breakage of encoder cable or connector connection failure. (If the detail code in the error list of the teaching tool is 0001_H.) 2) Effect of noise. (If the detail code in the error list of the teaching tool is 0002_H.) 3) Malfunction of component (communication part) inside the actuator. 4) A faulty part inside the controller (communication part). Treatment : 1) Check if any wire breakage on a connector and the condition of wire connections. 2) Interrupt the power to the peripheral equipment and activate only the actuator. If any error does not occur, it might be caused by noise. Take proper measures against noise. If 3) or 4) is the case, it is necessary to replace the actuator (motor part) or controller. If the cause cannot be specified, please contact IAI.
0E6		Encoder count error	Cause : This error code appears when the encoder cannot detect the position information properly. 1) The encoder relay cable or supplied actuator cable is disconnected or its connector is not plugged in correctly. 2) Foreign matter is deposited on the code wheel. 3) The position relationship between the code wheel and photo sensor changed due to shaft center shift caused by application of excessive external force, etc. 4) Faulty encoder board component Treatment : 1) Check if any wire breakage on a connector and the condition of wire connections. For the case of 2), 3) or 4), it is necessary either to clean the code wheel, adjust the installation position, replace the motor unit or replace the actuator. In any case, please contact IAI.

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
0EE	Cold start	Absolute encoder error detection 2	Cause : This is the condition where the position information can not be detected in the absolute encoder. 1) Voltage drop of absolute battery. 2) The encoder relay cable or supplied actuator cable is disconnected or its connector is not plugged in correctly. Treatment : 1) Check the battery alarm output BALM and replace the battery if it is ON (OFF for Remote I/O Mode). 2) Check if any wire breakage on a connector and the condition of wire connections. Whichever action is taken under 1) or 2), an absolute reset must be performed. If the cables are normal, faulty encoder is suspected. Please contact IAI.
0EF		Absolute encoder error detection 3	Absolute encoder is not detecting the position information properly. (ABS encoder overspeed error) Cause : This error occurs in such cases as the speed exceeded the tracing acceleration speed limit in the drop by the brake release at the power cutoff of the absolute type vertical axis. (This condition should not occur in normal conditions of use. Take sufficient note on forced brake release.) Treatment : If the error is occurred, it is necessary to absolute reset.
0F0		Driver logic error	Cause : Exceeded load, parameter (motor type) mismatched, noise, malfunction of controller, etc. Treatment : Please contact IAI.
0F4		Mismatched PCB	This controller uses a different print circuit board depending on the motor capacity. Mismatch of connected motor and the PCB is detected in the startup check. Cause : The actuator may not match the controller. Check the model. Treatment : Should this error occur, please contact IAI.
0F5		Nonvolatile memory write verify error	It is verified at the data writing process to the non-volatile memory that the data inside the memory and the data to be written are matched. There was a mismatch detected in this process. Cause : Faulty nonvolatile memory. Treatment : When the error is caused even when the power is re-input, please contact IAI.
0F6		Nonvolatile memory write timeout	There is no response in the specified time duration during the data writing to the non-volatile memory. Cause : Faulty nonvolatile memory. Treatment : When the error is caused even when the power is re-input, please contact IAI.
0F8		Nonvolatile memory data destroyed	Abnormal data was detected during the nonvolatile memory check after starting. Cause : Faulty nonvolatile memory. Treatment : When the error is caused even when the power is re-input, please contact IAI.
0FA		CPU error	The CPU operation is not normal. Cause : 1) Faulty CPU 2) Malfunction due to noise Treatment : When the error is caused even when the power is re-input, please contact IAI.

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
0FB	Cold start	FPGA error (Faulty component)	The FPGA is not operating properly. Cause : 1) Malfunction due to the effect of noise, etc. 2) Faulty FPGA 3) Faulty circuit component around the FPGA. 4) Inappropriate board installation in the controller. Treatment : Turn the power OFF and reboot. If the error occurs again, check for presence of noise. If a spare controller is available, replace the problem controller with the spare controller. A recurring error with the spare controller suggests presence of noise. If the cause cannot be identified, please contact IAI.
100 to 1FF	Message	Alarm on teaching tool	[Refer to the Instruction Manual of teaching tool.]
200 to 2FF	Operation release	Alarm on teaching tool	[Refer to the Instruction Manual of teaching tool.]
300 to 3FF	Cold start	Alarm on teaching tool	[Refer to the Instruction Manual of teaching tool.]

8.4 Noise Prevention

In case a trouble is occurred and is suspected to be noise-related, have the actions described below to strengthen the noise countermeasure. It is not that you need to have all the items to be conducted to prevent noise.

(1) Mount a noise filter (Note 1) on motor power input line and attach a surge absorber (Note 1) on the primary side of the noise filter.
(2) Attach a clamp filter (Note 1) on line of the secondary side of the noise filter.
(3) Attach a clamp filter on each of MSCON side and actuator side of the motor cable.

Note 1: Select yourself the best ones for your own system.

Chapter 9 Appendix

9.1 List of Specifications of Connectable Actuators

Specifications described in the specification list are limited to the information required to set operation conditions and parameters. For other detailed specifications, refer to brochures and Instruction Manuals of actuators.

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS2 (Rod Type)	RA4C (Note)	20	16384	12	Horizontal/ Vertical	600	0.3	–	–	–
				6		300	0.3	–	–	–
				3		150	0.2	–	–	–
		30		12		600	0.3	–	–	–
							High Accel/ Decel Type : 1.0	–	–	–
				6		300	0.3	–	–	–
							High Accel/ Decel Type : 1.0	–	–	–
				3		150	0.2	–	–	–
	RGS4C	20	16384	12	Horizontal/ Vertical	600	0.3	–	–	–
				6		300	0.3	–	–	–
				3		150	0.2	–	–	–
		30		12		600	0.3	–	–	–
							High Accel/ Decel Type : 1.0	–	–	–
				6		300	0.3	–	–	–
							High Accel/ Decel Type : 1.0	–	–	–
				3		150	0.2	–	–	–
	RGD4C	20	16384	12	Horizontal/ Vertical	600	0.3	–	–	–
				6		300	0.3	–	–	–
				3		150	0.2	–	–	–
		30		12		600	0.3	–	–	–
							High Accel/ Decel Type : 1.0	–	–	–
				6		300	0.3	–	–	–
							High Accel/ Decel Type : 1.0	–	–	–
				3		150	0.2	–	–	–
	RA4D	20	16384	12	Horizontal/ Vertical	600	0.3	–	–	–
				6		300	0.3	–	–	–
				3		150	0.2	–	–	–
		30		12		600	0.3	–	–	–
				6		300	0.3	–	–	–
				3		150	0.2	–	–	–

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the off board tuning function, refer to the instruction manual for RC PC Software.

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS2 (Rod Type)	RGS4D	20	16384	12	Horizontal/ Vertical	600	0.3	–	–	–
				6		300	0.3	–	–	–
				3		150	0.2	–	–	–
		30		12		600	0.3	–	–	–
				6		300	0.3	–	–	–
				3		150	0.2	–	–	–
	RGD4D	20	16384	12	Horizontal/ Vertical	600	0.3	–	–	–
				6		300	0.3	–	–	–
				3		150	0.2	–	–	–
		30		12		600	0.3	–	–	–
				6		300	0.3	–	–	–
				3		150	0.2	–	–	–
	RA4R	20	16384	12	Horizontal/ Vertical	600	0.3	–	–	–
				6		300	0.3	–	–	–
				3		150	0.2	–	–	–
		30		12		600	0.3	–	–	–
				6		300	0.3	–	–	–
				3		150	0.3	–	–	–
	RGD4R	20	16384	12	Horizontal/ Vertical	600	0.3	–	–	–
				6		300	0.3	–	–	–
				3		150	0.2	–	–	–
		30		12		600	0.3	–	–	–
				6		300	0.3	–	–	–
				3		150	0.2	–	–	–
RCS2 (Rod Type)	RA5C (Note)	60	16384	16	Horizontal/ Vertical	800 (at 50 to 250st) 755 (at 300st)	0.3	–	–	–
				8		400 (at 50 to 250st) 377 (at 300st)	0.3	–	–	–
				4		200 (at 50 to 250st) 188 (at 300st)	0.2	–	–	–
				16		800 (at 50 to 250st) 755 (at 300st)	0.3	–	–	–
							High Accel/ Decel Type : 1.0	–	–	–
				8		400 (at 50 to 250st) 377 (at 300st)	0.3	–	–	–
							High Accel/ Decel Type : 1.0	–	–	–
				4		200 (at 50 to 250st) 188 (at 300st)	0.2	–	–	–

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the off board tuning function, refer to the instruction manual for RC PC Software.

<table>
<tr><th>Actuator Series</th><th>Type</th><th>Motor Output
[W]</th><th>No. of Encoder Pluses</th><th>Lead
[mm]</th><th>Oriented Direction</th><th>Maximum Speed
[mm/s]</th><th>Maximum Acceleration/ Deceleration
[G]</th><th>Minimum Pressing Force
[N]</th><th>Maximum Pressing Force
[N]</th><th>Rated Pressing Speed
[mm/s]</th></tr>
<tr><td rowspan="17">RCS2
(Rod Type)</td><td rowspan="8">RGS5C</td><td rowspan="3">60</td><td rowspan="8">16384</td><td>12</td><td rowspan="8">Horizontal/ Vertical</td><td>800
(at 50 to 250st)
755 (at 300st)</td><td>0.3</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>6</td><td>400
(at 50 to 250st)
377 (at 300st)</td><td>0.3</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>3</td><td>200
(at 50 to 250st)
188 (at 300st)</td><td>0.2</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td rowspan="5">100</td><td rowspan="2">12</td><td rowspan="2">800
(at 50 to 250st)
755 (at 300st)</td><td>0.3</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>High Accel/ Decel Type : 1.0</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">400
(at 50 to 250st)
377 (at 300st)</td><td>0.3</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>High Accel/ Decel Type : 1.0</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>3</td><td>200
(at 50 to 250st)
188 (at 300st)</td><td>0.2</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td rowspan="6">RGD5C</td><td rowspan="3">60</td><td rowspan="6">16384</td><td>16</td><td rowspan="6">Horizontal/ Vertical</td><td>800
(at 50 to 250st)
755 (at 300st)</td><td>0.3</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>8</td><td>400
(at 50 to 250st)
377 (at 300st)</td><td>0.3</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>4</td><td>200
(at 50 to 250st)
188 (at 300st)</td><td>0.2</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td rowspan="3">100</td><td>16</td><td>800
(at 50 to 250st)
755 (at 300st)</td><td>0.3</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>8</td><td>400
(at 50 to 250st)
377 (at 300st)</td><td>0.3</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>4</td><td>200
(at 50 to 250st)
188 (at 300st)</td><td>0.2</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td rowspan="3">RA5R</td><td rowspan="3">60</td><td rowspan="3">16384</td><td>16</td><td rowspan="3">Horizontal/ Vertical</td><td>800
(at 50 to 250st)
755 (at 300st)</td><td>0.3</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>8</td><td>400
(at 50 to 250st)
377 (at 300st)</td><td>0.3</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>4</td><td>200
(at 50 to 250st)
188 (at 300st)</td><td>0.2</td><td>–</td><td>–</td><td>–</td></tr>
</table>

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS2 (Slider Type)	SA4C (Note)	20	16384	10	Horizontal/ Vertical	665	0.3	–	–	–
							High Accel/ Decel Type : 1.0	–	–	–
				5		330	0.3	–	–	–
							High Accel/ Decel Type : 1.0	–	–	–
				2.5		165	0.2	–	–	–
	SA4D (Note)	20	16384	10	Horizontal/ Vertical	665	0.3	–	–	–
				5		330	0.3	–	–	–
				2.5		165	0.2	–	–	–

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the off board tuning function, refer to the instruction manual for RC PC Software.

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS2 (Slider Type)	SA4R (Note)	20	16384	10	Horizontal/ Vertical	665	0.3	–	–	–
				5		330	0.3	–	–	–
				2.5		165	0.2	–	–	–
	SA5C (Note)	20	16384	20	Horizontal	1000 (at 50 to 550st) 980 (at 600st)	High Accel/ Decel Type : 0.8	–	–	–
					Vertical	800	0.2	–	–	–
				12	Horizontal/ Vertical	800 (at 50 to 450st) 760 (at 500st)	0.3	–	–	–
							High Accel/ Decel Type : 0.8	–	–	–
				6		400 (at 50 to 450st) 380 (at 500st)	0.3	–	–	–
							High Accel/ Decel Type : 0.8	–	–	–
				3		200 (at 50 to 450st) 190 (at 500st)	0.2	–	–	–
	SA5D (Note)	20	16384	12	Horizontal/ Vertical	800 (at 50 to 450st) 760 (at 500st)	0.3	–	–	–
				6		400 (at 50 to 450st) 380 (at 500st)	0.3	–	–	–
				3		200 (at 50 to 450st) 190 (at 500st)	0.2	–	–	–
	SA5R (Note)	20	16384	12	Horizontal/ Vertical	800 (at 50 to 450st) 760 (at 500st)	0.3	–	–	–
				6		400 (at 50 to 450st) 380 (at 500st)	0.3	–	–	–
				3		200 (at 50 to 450st) 190 (at 500st)	0.2	–	–	–
	SA6C (Note)	30	16384	20	Horizontal	1300 (at 50 to 500st) 1160 (at 550st) 990 (at 600st)	High Accel/ Decel Type : 1.0	–	–	–
					Vertical	800	0.2	–	–	–
				12	Horizontal/ Vertical	800 (at 50 to 450st) 760 (at 500st) 640 (at 550st) 540 (at 600st)	0.3	–	–	–
							High Accel/ Decel Type : 1.0	–	–	–
				6		400 (at 50 to 450st) 380 (at 500st) 320 (at 550st) 270 (at 600st)	0.3	–	–	–
							High Accel/ Decel Type : 1.0	–	–	–
				3		200 (at 50 to 450st) 190 (at 500st) 160 (at 550st) 135 (at 600st)	0.2	–	–	–

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the off board tuning function, refer to the instruction manual for RC PC Software.

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS2 (Slider Type)	SA6D (Note)	30	16384	12	Horizontal/ Vertical	800 (at 50 to 450st) 760 (at 500st) 640 (at 550st) 540 (at 600st)	0.3	–	–	–
				6		400 (at 50 to 450st) 380 (at 500st) 320 (at 550st) 270 (at 600st)	0.3	–	–	–
				3		200 (at 50 to 450st) 190 (at 500st) 160 (at 550st) 135 (at 600st)	0.2	–	–	–
	SA6R (Note)	30	16384	12	Horizontal/ Vertical	800 (at 50 to 450st) 760 (at 500st) 640 (at 550st) 540 (at 600st)	0.3	–	–	–
				6		400 (at 50 to 450st) 380 (at 500st) 320 (at 550st) 270 (at 600st)	0.3	–	–	–
				3		200 (at 50 to 450st) 190 (at 500st) 160 (at 550st) 135 (at 600st)	0.2	–	–	–
	SA7C (Note)	60	16384	16	Horizontal/ Vertical	800 (at 50 to 600st) 640 (at 700st) 480 (at 800st)	0.3	–	–	–
							High Accel/ Decel Type : 1.0	–	–	–
				8		400 (at 50 to 650st) 320 (at 700st) 240 (at 800st)	0.3	–	–	–
							High Accel/ Decel Type : 0.8	–	–	–
				4		200 (at 50 to 650st) 160 (at to 700st) 120 (at to 800st)	0.2	–	–	–
	SA7R (Note)	60	16384	16	Horizontal/ Vertical	800 (at 50 to 600st) 640 (at 700st) 480 (at 800st)	0.3	–	–	–
				8		400 (at 50 to 650st) 320 (at 700st) 240 (at 800st)	0.3	–	–	–
				4		200 (at 50 to 650st) 160 (at to 700st) 120 (at to 800st)	0.2	–	–	–

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the off board tuning function, refer to the instruction manual for RC PC Software.

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS2 (Slider Type)	SS7C (Note)	60	16384	12	Horizontal/ Vertical	600 (at 50 to 500st) 470 (at to 600st)	0.3	–	–	–
				6		300 (at 50 to 500st) 230 (at to 600st)	0.3	–	–	–
	SS7R (Note)	60	16384	12	Horizontal/ Vertical	600 (at 50 to 500st) 470 (at to 600st)	0.3	–	–	–
				6		300 (at 50 to 500st) 230 (at to 600st)	0.3	–	–	–
	SS8C	100	16384	20	Horizontal/ Vertical	1000 (at 50 to 600st) 960 (at to 700st) 765 (at to 800st) 625 (at to 900st) 515 (at to 1000st)	0.3	–	–	–
				10		500 (at 50 to 600st) 480 (at to 700st) 380 (at to 800st) 310 (at to 900st) 255 (at to 1000st)	0.3	–	–	–
		150	16384	20	Horizontal/ Vertical	1000 (at 50 to 600st) 960 (at to 700st) 765 (at to 800st) 625 (at to 900st) 515 (at to 1000st)	0.3	–	–	–
				10		500 (at 50 to 600st) 480 (at to 700st) 380 (at to 800st) 310 (at to 900st) 255 (at to 1000st)	0.3	–	–	–

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the off board tuning function, refer to the instruction manual for RC PC Software.

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS2 (Slider Type)	SS8R	100	16384	20	Horizontal/ Vertical	1000 (at 50 to 600st) 960 (at to 700st) 765 (at to 800st) 625 (at to 900st) 515 (at to 1000st)	0.3	–	–	–
		150		10		500 (at 50 to 600st) 480 (at to 700st) 380 (at to 800st) 310 (at to 900st) 255 (at to 1000st)	0.3	–	–	–
RCS3 (Slider Type)	SA8 (Note)	100	16384	5	Horizontal/ Vertical	300 (at 50 to 650st) 260 (at to 700st) 230 (at to 750st) 200 (at to 800st) 180 (at to 850st) 170 (at to 900st) 150 (at to 950st) 135 (at to 1000st) 120 (at to 1050st) 110 (at to 1100st)	0.3	–	–	–
				10		600 (at 50 to 650st) 530 (at to 700st) 470 (at to 750st) 410 (at to 800st) 370 (at to 850st) 340 (at to 900st) 310 (at to 950st) 270 (at to 1000st) 250 (at to 1050st) 230 (at to 1100st)	0.5	–	–	–

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the off board tuning function, refer to the instruction manual for RC PC Software.

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS3 (Slider Type)	SA8 (Note)	100	16384	20	Horizontal/ Vertical	1200 (at 50 to 650st) 1070 (at to 700st) 940 (at to 750st) 840 (at to 800st) 750 (at to 850st) 670 (at to 900st) 610 (at to 950st) 550 (at to 1000st) 500 (at to 1050st) 460 (at to 1100st)	0.7	–	–	–
				30	Horizontal	1800 (at 50 to 650st) 1610 (at to 700st) 1420 (at to 750st) 1260 (at to 800st) 1120 (at to 850st) 1010 (at to 900st) 910 (at to 950st) 830 (at to 1000st) 760 (at to 1050st) 690 (at to 1100st)	1.0	–	–	–
					Vertical		0.7	–	–	–
		150	16384	10	Horizontal/ Vertical	600 (at 50 to 650st) 530 (at to 700st) 470 (at to 750st) 410 (at to 800st) 370 (at to 850st) 340 (at to 900st) 310 (at to 950st) 270 (at to 1000st) 250 (at to 1050st) 230 (at to 1100st)	0.5	–	–	–

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
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Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS3 (Slider Type)	SA8 (Note)	150	16384	20	Horizontal/ Vertical	1200 (at 50 to 650st) 1070 (at to 700st) 940 (at to 750st) 840 (at to 800st) 750 (at to 850st) 670 (at to 900st) 610 (at to 950st) 550 (at to 1000st) 500 (at to 1050st) 460 (at to 1100st)	0.7	–	–	–
				30	Horizontal	1800 (at 50 to 650st) 1610 (at to 700st) 1420 (at to 750st) 1260 (at to 800st) 1120 (at to 850st) 1010 (at to 900st) 910 (at to 950st) 830 (at to 1000st) 760 (at to 1050st) 690 (at to 1100st)	1.0	–	–	–
					Vertical		0.7	–	–	–
	SS8 (Note)	100	16384	5	Horizontal/ Vertical	300 (at 50 to 600st) 275 (at to 650st) 240 (at to 700st) 215 (at to 750st) 190 (at to 800st) 170 (at to 850st) 150 (at to 900st) 140 (at to 950st) 125 (at to 1000st)	0.3	–	–	–

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the off board tuning function, refer to the instruction manual for RC PC Software.

<table>
<tr><th>Actuator Series</th><th>Type</th><th>Motor Output
[W]</th><th>No. of Encoder Pluses</th><th>Lead
[mm]</th><th>Oriented Direction</th><th>Maximum Speed
[mm/s]</th><th>Maximum Acceleration/ Deceleration
[G]</th><th>Minimum Pressing Force
[N]</th><th>Maximum Pressing Force
[N]</th><th>Rated Pressing Speed
[mm/s]</th></tr>
<tr><td rowspan="4">RCS3
(Slider Type)</td><td rowspan="4">SS8
(Note)</td><td rowspan="4">100</td><td rowspan="4">16384</td><td>10</td><td rowspan="2">Horizontal/
Vertical</td><td>600
(at 50 to 600st)
550
(at to 650st)
485
(at to 700st)
430
(at to 750st)
385
(at to 800st)
345
(at to 850st)
310
(at to 900st)
280
(at to 950st)
255
(at to 1000st)</td><td>0.5</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>20</td><td>1200
(at 50 to 600st)
1105
(at to 650st)
970
(at to 700st)
860
(at to 750st)
770
(at to 800st)
690
(at to 850st)
625
(at to 900st)
565
(at to 950st)
515
(at to 1000st)</td><td>0.7</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td rowspan="2">30</td><td>Horizontal</td><td rowspan="2">1800
(at 50 to 600st)
1660
(at to 650st)
1460
(at to 700st)
1295
(at to 750st)
1155
(at to 800st)
1035
(at to 850st)
935
(at to 900st)
850
(at to 950st)
775
(at to 1000st)</td><td>1.0</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>Vertical</td><td>0.7</td><td>–</td><td>–</td><td>–</td></tr>
</table>

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
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Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS3 (Slider Type)	SS8 (Note)	150	16384	10	Horizontal/ Vertical	600 (at 50 to 600st) 550 (at to 650st) 485 (at to 700st) 430 (at to 750st) 385 (at to 800st) 345 (at to 850st) 310 (at to 900st) 280 (at to 950st) 255 (at to 1000st)	0.5	–	–	–
				20	Horizontal/ Vertical	1200 (at 50 to 600st) 1105 (at to 650st) 970 (at to 700st) 860 (at to 750st) 770 (at to 800st) 690 (at to 850st) 625 (at to 900st) 565 (at to 950st) 515 (at to 1000st)	0.7	–	–	–
				30	Horizontal	1800 (at 50 to 600st) 1660 (at to 650st) 1460 (at to 700st) 1295 (at to 750st) 1155 (at to 800st) 1035 (at to 850st) 935 (at to 900st) 850 (at to 950st) 775 (at to 1000st)	1.0	–	–	–
					Vertical		0.7	–	–	–

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the off board tuning function, refer to the instruction manual for RC PC Software.

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS3CR (Slider Type)	SA8 (Note)	100	16384	5	Horizontal/ Vertical	300 (at 50 to 650st) 250 (at to 700st) 220 (at to 750st) 190 (at to 800st) 170 (at to 850st) 160 (at to 900st) 140 (at to 950st) 130 (at to 1000st) 120 (at to 1050st) 110 (at to 1100st)	0.3	–	–	–
				10		600 (at 50 to 650st) 500 (at to 700st) 440 (at to 750st) 390 (at to 800st) 350 (at to 850st) 320 (at to 900st) 290 (at to 950st) 260 (at to 1000st) 240 (at to 1050st) 220 (at to 1100st)	0.5	–	–	–
				20	Horizontal/ Vertical	1200 (at 50 to 650st) 1010 (at to 700st) 890 (at to 750st) 790 (at to 800st) 710 (at to 850st) 640 (at to 900st) 580 (at to 950st) 530 (at to 1000st) 480 (at to 1050st) 440 (at to 1100st)	0.7	–	–	–

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the off board tuning function, refer to the instruction manual for RC PC Software.

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS3CR (Slider Type)	SA8 (Note)	100	16384	30	Horizontal	1800 (at 50 to 650st) 1510 (at to 700st) 1340 (at to 750st) 1190 (at to 800st) 1070 (at to 850st) 960 (at to 900st) 870 (at to 950st) 790 (at to 1000st) 720 (at to 1050st) 660 (at to 1100st)	1.0	–	–	–
					Vertical		0.7	–	–	–
		150	16384	10	Horizontal/ Vertical	600 (at 50 to 650st) 500 (at to 700st) 440 (at to 750st) 390 (at to 800st) 350 (at to 850st) 320 (at to 900st) 290 (at to 950st) 260 (at to 1000st) 240 (at to 1050st) 220 (at to 1100st)	0.5	–	–	–
				20	Horizontal/ Vertical	1200 (at 50 to 650st) 1010 (at to 700st) 890 (at to 750st) 790 (at to 800st) 710 (at to 850st) 640 (at to 900st) 580 (at to 950st) 530 (at to 1000st) 480 (at to 1050st) 440 (at to 1100st)	0.7	–	–	–

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the off board tuning function, refer to the instruction manual for RC PC Software.

<table>
<tr><th>Actuator Series</th><th>Type</th><th>Motor Output
[W]</th><th>No. of Encoder Pluses</th><th>Lead
[mm]</th><th>Oriented Direction</th><th>Maximum Speed
[mm/s]</th><th>Maximum Acceleration/ Deceleration
[G]</th><th>Minimum Pressing Force
[N]</th><th>Maximum Pressing Force
[N]</th><th>Rated Pressing Speed
[mm/s]</th></tr>
<tr><td rowspan="4">RCS3CR
(Slider Type)</td><td rowspan="2">SA8
(Note)</td><td rowspan="2">150</td><td rowspan="2">16384</td><td rowspan="2">30</td><td>Horizontal</td><td rowspan="2">1800
(at 50 to 650st)
1510
(at to 700st)
1340
(at to 750st)
1190
(at to 800st)
1070
(at to 850st)
960
(at to 900st)
870
(at to 950st)
790
(at to 1000st)
720
(at to 1050st)
660
(at to 1100st)</td><td>1.0</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>Vertical</td><td>0.7</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td rowspan="2">SS8
(Note)</td><td rowspan="2">100</td><td rowspan="2">16384</td><td>5</td><td>Horizontal/ Vertical</td><td>300
(at 50 to 600st)
275
(at to 650st)
240
(at to 700st)
215
(at to 750st)
190
(at to 800st)
170
(at to 850st)
150
(at to 900st)
140
(at to 950st)
125
(at to 1000st)</td><td>0.3</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>10</td><td>Horizontal/ Vertical</td><td>600
(at 50 to 600st)
550
(at to 650st)
485
(at to 700st)
430
(at to 750st)
385
(at to 800st)
345
(at to 850st)
310
(at to 900st)
280
(at to 950st)
255
(at to 1000st)</td><td>0.5</td><td>–</td><td>–</td><td>–</td></tr>
</table>

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the off board tuning function, refer to the instruction manual for RC PC Software.

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS3CR (Slider Type)	SS8 (Note)	100	16384	20	Horizontal/ Vertical	1200 (at 50 to 600st) 1105 (at to 650st) 970 (at to 700st) 860 (at to 750st) 770 (at to 800st) 690 (at to 850st) 625 (at to 900st) 565 (at to 950st) 515 (at to 1000st)	0.7	–	–	–
				30	Horizontal	1800 (at 50 to 600st) 1660 (at to 650st) 1460 (at to 700st) 1295 (at to 750st) 1155 (at to 800st) 1035 (at to 850st) 935 (at to 900st) 850 (at to 950st) 775 (at to 1000st)	1.0	–	–	–
					Vertical		0.7	–	–	–
		150	16384	10	Horizontal/ Vertical	600 (at 50 to 600st) 550 (at to 650st) 485 (at to 700st) 430 (at to 750st) 385 (at to 800st) 345 (at to 850st) 310 (at to 900st) 280 (at to 950st) 255 (at to 1000st)	0.5	–	–	–

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the off board tuning function, refer to the instruction manual for RC PC Software.

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS3CR (Slider Type)	SS8 (Note)	150	16384	20	Horizontal/ Vertical	1200 (at 50 to 600st) 1105 (at to 650st) 970 (at to 700st) 860 (at to 750st) 770 (at to 800st) 690 (at to 850st) 625 (at to 900st) 565 (at to 950st) 515 (at to 1000st)	0.7	–	–	–
				30	Horizontal	1800 (at 50 to 600st) 1660 (at to 650st) 1460 (at to 700st) 1295 (at to 750st) 1155 (at to 800st) 1035 (at to 850st) 935 (at to 900st) 850 (at to 950st) 775 (at to 1000st)	1.0	–	–	–
					Vertical		0.7	–	–	–
RCS2 (Arm Type)	A4R	20	16384	10	Horizontal/ Vertical	330	0.2	–	–	–
				5		165	0.2	–	–	–
	A5R	20	16384	12	Horizontal/ Vertical	400	0.2	–	–	–
				6		200	0.2	–	–	–
	A6R	30	16384	12	Horizontal/ Vertical	400	0.2	–	–	–
				6		200	0.2	–	–	–
RCS2 (Gripper Type)	GR8	60	16384	Gear Ratio 1/5	–	400	0.3	–	–	–
RCS2 (Flat Type)	F5D	60	16384	16	Horizontal/ Vertical	800	0.3	–	–	–
				8		400	0.3	–	–	–
				4		200	0.2	–	–	–
		100		16		800	0.3	–	–	–
				8		400	0.3	–	–	–
				4		200	0.2	–	–	–

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the off board tuning function, refer to the instruction manual for RC PC Software.

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS2 (Rotary Type)	RT6	60	16384	Gear Ratio 1/18	–	500 deg/s	–	–	–	–
	RT6R	60	16384	Gear Ratio 1/18	–	500 deg/s	–	–	–	–
	RT7R	60	16384	Gear Ratio 1/4	–	500 deg/s	–	–	–	–
	RTC8L	12	16384	Gear Ratio 1/24	–	750 deg/s	–	–	–	–
	RTC8HL	20	16384	Gear Ratio 1/15	–	1200 deg/s	–	–	–	–
				Gear Ratio 1/24	–	750 deg/s				
	RTC10L	60	16384	Gear Ratio 1/15	–	1200 deg/s	–	–	–	–
				Gear Ratio 1/24	–	750 deg/s				
	RTC12L	150	16384	Gear Ratio 1/18	–	800 deg/s				
				Gear Ratio 1/30	–	600 deg/s				
ISA ISPA (Slider Type)	SXM SYM	60	16384	16	Horizontal	960	1.0	–	–	–
					Vertical		0.7	–	–	–
				8	Horizontal	480	0.6	–	–	–
					Vertical		0.5	–	–	–
				4	Horizontal	240	0.5	–	–	–
					Vertical		0.3	–	–	–
	SZM	60	16384	8	Vertical	480	0.5	–	–	–
				4	Vertical	240	0.3	–	–	–

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISA ISPA (Slider Type)	MXM MYM	100	16384	30	Horizontal	1800 (at 100 to 700st) 1290 (at to 800st) 1045 (at to 900st) 8600 (at to 860st)	1.0	–	–	–
				20	Horizontal	1200 (at 100 to 700st) 860 (at to 800st) 695 (at to 900st) 570 (at to 1000st)	1.0	–	–	–
					Vertical		0.8	–	–	–
				10	Horizontal	600 (at 100 to 700st) 430 (at to 800st) 345 (at to 900st) 280 (at to 1000st)	0.6	–	–	–
					Vertical		0.5	–	–	–
				5	Horizontal	300 (at 100 to 700st) 215 (at to 800st) 170 (at to 900st) 140 (at to 1000st)	0.5	–	–	–
					Vertical		0.3	–	–	–
	MZM	100	16384	10	Vertical	600 (at 100 to 700st) 430 (at 800st) 345 (at 900st) 280 (at 1000st)	0.5	–	–	–
				5	Vertical	300 (at 100 to 700st) 215 (at 800st) 170 (at 900st) 140 (at 1000st)	0.3	–	–	–

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISA ISPA (Slider Type)	MXM MYM	200	16384	30	Horizontal	1800 (at 100 to 700st) 1290 (at to 800st) 1045 (at to 900st) 860 (at to 1000st)	1.0	–	–	–
					Vertical		1.0	–	–	–
				20	Horizontal	1200 (at 100 to 700st) 860 (at to 800st) 695 (at to 900st) 570 (at to 1000st)	1.0	–	–	–
					Vertical		0.8	–	–	–
				10	Horizontal	600 (at 100 to 700st) 430 (at to 800st) 345 (at to 900st) 280 (at to 1000st)	0.6	–	–	–
					Vertical		0.5	–	–	–
	MZM	200	16384	10	Vertical	600 (at 100 to 700st) 430 (at 800st) 345 (at 900st) 280 (at 1000st)	0.5	–	–	–
	MXMX	200	16384	30	Horizontal	1800 (at 800 to 1100st) 1650 (at 1200st) 1500 (at 1300st) 1425 (at 1400st) 1200 (at 1500st) 1050 (at 1600st) 900 (at 1700st) 825 (at 1800st) 750 (at 1900st) 675 (at 2000st)	0.3	–	–	–
				20	Horizontal	1200 (at 800 to 1100st) 1100 (at 1200st) 1000 (at 1300st) 950 (at 1400st) 800 (at 1500st) 700 (at 1600st) 600 (at 1700st) 550 (at 1800st) 500 (at 1900st) 450 (at 2000st)	0.3	–	–	–

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISA ISPA (Slider Type)	LXM LYM	200	16384	20	Horizontal	1200 (at 100 to 800st) 920 (at to 900st) 765 (at to 1000st) 645 (at to 1100st) 550 (at to 1200st)	1.0	–	–	–
					Vertical		0.8	–	–	–
				10	Horizontal	600 (at 100 to 800st) 460 (at to 900st) 380 (at to 1000st) 320 (at to 1100st) 270 (at to 1200st)	0.6	–	–	–
					Vertical		0.5	–	–	–
	LZM	200	16384	10	Vertical	600 (at 100 to 800st) 460 (at to 900st) 380 (at to 1000st) 320 (at to 1100st) 270 (at to 1200st)	0.5	–	–	–
	LXMX	200	16384	20	Horizontal	1200 (at 1000 to 1200st) 1150 (at 1300st) 1000 (at 1400st) 950 (at 1500st) 830 (at 1600st) 740 (at 1700st) 650 (at 1800st) 590 (at 1900st) 540 (at 2000st) 490 (at 2100st) 440 (at 2200st) 410 (at 2300st) 370 (at 2400st) 340 (at 2500st)	0.3	–	–	–
	LXUWX	200	16384	20	Horizontal	1200 (at 1000 to 1200st) 1150 (at 1300st) 1000 (at 1400st) 950 (at 1500st) 830 (at 1600st) 740 (at 1700st) 650 (at 1800st) 590 (at 1900st) 540 (at 2000st) 490 (at 2100st) 440 (at 2200st) 410 (at 2300st) 370 (at 2400st) 340 (at 2500st)	0.3	–	–	–

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISB ISPB (Slider Type)	SXM (Note)	50	16384	4	Horizontal	240 (at 100 to 600st) 165 (at to 700st) 130 (at to 800st) 100 (at to 900st)	0.5	–	–	–
					Vertical		0.4			
				8	Horizontal	480 (at 50 to 600st) 330 (at to 700st) 260 (at to 800st) 210 (at to 900st)	0.7	–	–	–
					Vertical		0.6			
				16	Horizontal	960 (at 50 to 600st) 655 (at to 700st) 515 (at to 800st) 415 (at to 900st)	1.2	–	–	–
					Vertical		0.8			
	SXL (Note)			4	Horizontal	240 (at 130 to 580st) 165 (at to 680st) 130 (at to 780st) 100 (at to 880st)	0.5	–	–	–
					Vertical		0.4			
				8	Horizontal	480 (at 130 to 580st) 330 (at to 680st) 260 (at to 780st) 210 (at to 880st)	0.7	–	–	–
					Vertical		0.6			
				16	Horizontal	960 (at 130 to 580st) 655 (at to 680st) 515 (at to 780st) 415 (at to 880st)	1.2	–	–	–
					Vertical		0.8			

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the off board tuning function, refer to the instruction manual for RC PC Software.

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISB ISPB (Slider Type)	MXM (Note)	100 200	16384	5	Horizontal	300 (at 100 to 700st) 215 (at to 800st) 170 (at to 900st) 140 (at to 1000st) 115 (at to 1100st)	0.5	–	–	–
					Vertical		0.4			
				10	Horizontal	600 (at 100 to 700st) 430 (at to 800st) 345 (at to 900st) 280 (at to 1000st) 230 (at to 1100st)	0.7	–	–	–
					Vertical		0.6			
				20	Horizontal	1200 (at 100 to 700st) 860 (at to 800st) 695 (at to 900st) 570 (at to 1000st) 460 (at to 1100st)	1.2	–	–	–
					Vertical		1.0			
				30	Horizontal/ Vertical	1800 (at 100 to 700st) 1290 (at to 800st) 1045 (at to 900st) 860 (at to 1000st) 690 (at to 1100st)	1.2	–	–	–

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
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Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISB ISPB (Slider Type)	MXL (Note)	100 200	16384	5	Horizontal	300 (at 120 to 670st) 215 (at to 770st) 170 (at to 870st) 140 (at to 970st) 115 (at to 1070st)	0.5	–	–	–
					Vertical		0.4			
				10	Horizontal	600 (at 120 to 670st) 430 (at to 770st) 345 (at to 870st) 280 (at to 970st) 230 (at to 1070st)	0.7	–	–	–
					Vertical		0.6			
				20	Horizontal	1200 (at 120 to 670st) 860 (at to 770st) 695 (at to 870st) 570 (at to 970st) 460 (at to 1070st)	1.2	–	–	–
					Vertical		1.0			
				30	Horizontal/ Vertical	1800 (at 120 to 670st) 1290 (at to 770st) 1045 (at to 870st) 860 (at to 970st) 690 (at to 1070st)	1.2	–	–	–

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
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Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISB ISPB (Slider Type)	MXMX	200	16384	20	Horizontal	1200 (at800 to 1100st) 1100 (at to 1200st) 1000 (at to 1300st) 950 (at to 1400st) 800 (at to 1500st) 700 (at to 1600st) 600 (at to 1700st) 550 (at to 1800st) 500 (at to 1900st) 450 (at to 2000st)	0.4	–	–	–
				30	Horizontal	1800 (at800 to 1100st) 1650 (at to 1200st) 1500 (at to 1300st) 1425 (at to 1400st) 1200 (at to 1500st) 1050 (at to 1600st) 900 (at to 1700st) 825 (at to 1800st) 750 (at to 1900st) 675 (at to 2000st)	0.4	–	–	–

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISB ISPB (Slider Type)	LXM (Note)	200	16384	10	Horizontal	600 (at 100 to 800st) 460 (at to 900st) 380 (at to 1000st) 320 (at to 1100st) 270 (at to 1200st) 220 (at to 1300st)	0.7	–	–	–
					Vertical		0.6			
				20	Horizontal	1200 (at 100 to 800st) 920 (at to 900st) 765 (at to 1000st) 645 (at to 1100st) 550 (at to 1200st) 440 (at to 1300st)	1.2	–	–	–
					Vertical		1.0			
				40	Horizontal/ Vertical	2400 (at 100 to 800st) 1840 (at to 900st) 1530 (at to 1000st) 1290 (at to 1100st) 1100 (at to 1200st) 880 (at to 1300st)	1.2	–	–	–

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
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<table>
<tr><th>Actuator Series</th><th>Type</th><th>Motor Output
[W]</th><th>No. of Encoder Pluses</th><th>Lead
[mm]</th><th>Oriented Direction</th><th>Maximum Speed
[mm/s]</th><th>Maximum Acceleration/ Deceleration
[G]</th><th>Minimum Pressing Force
[N]</th><th>Maximum Pressing Force
[N]</th><th>Rated Pressing Speed
[mm/s]</th></tr>
<tr><td rowspan="5">ISB
ISPB
(Slider Type)</td><td rowspan="5">LXL
(Note)</td><td rowspan="5">200</td><td rowspan="5">16384</td><td rowspan="2">10</td><td rowspan="2">Horizontal
Vertical</td><td rowspan="2">600
(at 120 to 770st)
460
(at to 870st)
380
(at to 970st)
320
(at to 1070st)
270
(at to 1170st)
220
(at to 1270st)</td><td>0.7</td><td rowspan="2">–</td><td rowspan="2">–</td><td rowspan="2">–</td></tr>
<tr><td>0.6</td></tr>
<tr><td rowspan="2">20</td><td rowspan="2">Horizontal
Vertical</td><td rowspan="2">1200
(at 120 to 770st)
920
(at to 870st)
765
(at to 970st)
645
(at to 1070st)
550
(at to 1170st)
440
(at to 1270st)</td><td>1.2</td><td rowspan="2">–</td><td rowspan="2">–</td><td rowspan="2">–</td></tr>
<tr><td>1.0</td></tr>
<tr><td>40</td><td>Horizontal/
Vertical</td><td>2400
(at 120 to 770st)
1840
(at to 870st)
1530
(at to 970st)
1290
(at to 1070st)
1100
(at to 1170st)
880
(at to 1270st)</td><td>1.2</td><td>–</td><td>–</td><td>–</td></tr>
</table>

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the off board tuning function, refer to the instruction manual for RC PC Software.

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISB ISPB (Slider Type)	LXMX LXUWX	200	16384	20	Horizontal	1200 (at 1000 to 1200st) 1150 (at to 1300st) 1000 (at to 1400st) 950 (at to 1500st) 830 (at to 1600st) 740 (at to 1700st) 650 (at to 1800st) 590 (at to 1900st) 540 (at to 2000st) 490 (at to 2100st) 440 (at to 2200st) 410 (at to 2300st) 370 (at to 2400st) 340 (at to 2500st)	0.4	–	–	–

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISDB ISPDB (Slider Type)	S(Note)	60	16384	4	Horizontal	240 (at 100 to 500st) 230 (at to 550st) 200 (at to 600st) 170 (at to 650st) 150 (at to 700st) 135 (at to 750st) 120 (at to 800st)	0.5	–	–	–
					Vertical		0.4			
				8	Horizontal	480 (at 100 to 500st) 460 (at to 550st) 400 (at to 600st) 345 (at to 650st) 305 (at to 700st) 270 (at to 750st) 240 (at to 800st)	0.7	–	–	–
					Vertical		0.6			
				16	Horizontal	960 (at 100 to 500st) 920 (at to 550st) 795 (at to 600st) 690 (at to 650st) 610 (at to 700st) 540 (at to 750st) 480 (at to 800st)	1	–	–	–
					Vertical		0.8			
	M(Note)	100 200	16384	5	Horizontal	300 (at 100 to 600st) 270 (at to 650st) 240 (at to 700st) 215 (at to 750st) 190 (at to 800st) 170 (at to 850st) 155 (at to 900st) 140 (at to 950st) 130 (at to 1000st) 120 (at to 1050st) 110 (at to 1100st)	0.5	–	–	–
					Vertical		0.4			

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
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Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISDB ISPDB (Slider Type)	M(Note)	100 200	16384	10	Horizontal	600 (at 100 to 600st) 545 (at to 650st) 480 (at to 700st) 430 (at to 750st) 380 (at to 800st) 345 (at to 850st) 310 (at to 900st) 285 (at to 950st) 260 (at to 1000st) 240 (at to 1050st) 220 (at to 1100st)	0.7	–	–	–
					Vertical		0.6			
				20	Horizontal	1200 (at 100 to 600st) 1085 (at to 650st) 960 (at to 700st) 855 (at to 750st) 765 (at to 800st) 690 (at to 850st) 625 (at to 900st) 570 (at to 950st) 520 (at to 1000st) 475 (at to 1050st) 440 (at to 1100st)	1	–	–	–
					Vertical		1			

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the off board tuning function, refer to the instruction manual for RC PC Software.

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISDB ISPDB (Slider Type)	M(Note)	100 200	16384	30	Horizontal	1800 (at 100 to 600st) 1630 (at to 650st) 1440 (at to 700st) 1280 (at to 750st) 1150 (at to 800st) 1035 (at to 850st) 935 (at to 900st) 850 (at to 950st) 780 (at to 1000st) 715 (at to 1050st) 660 (at to 1100st)	1	–	–	–
					Vertical		1			
ISDB ISPDB (Slider Type)	MX	200	16384	20	Horizontal	1200 (at 800 to 1100st) 1100 (at to 1200st) 1000 (at to 1300st) 950 (at to 1400st) 800 (at to 1500st) 700 (at to 1600st)	0.4	–	–	–
				30	Horizontal	1800 (at 800 to 1100st) 1650 (at to 1200st) 1500 (at to 1300st) 1425 (at to 1400st) 1200 (at to 1500st) 1050 (at to 1600st)	0.4	–	–	–

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the off board tuning function, refer to the instruction manual for RC PC Software.

<table>
<tr><th>Actuator Series</th><th>Type</th><th>Motor Output
[W]</th><th>No. of Encoder Pluses</th><th>Lead
[mm]</th><th>Oriented Direction</th><th>Maximum Speed
[mm/s]</th><th>Maximum Acceleration/ Deceleration
[G]</th><th>Minimum Pressing Force
[N]</th><th>Maximum Pressing Force
[N]</th><th>Rated Pressing Speed
[mm/s]</th></tr>
<tr><td rowspan="4">ISDB
ISPDB
(Slider Type)</td><td rowspan="4">L(Note)</td><td rowspan="4">200</td><td rowspan="4">16384</td><td rowspan="2">10</td><td>Horizontal</td><td rowspan="2">600
(at 100 to 650st)
585
(at to 700st)
520
(at to 750st)
470
(at to 800st)
425
(at to 850st)
385
(at to 900st)
350
(at to 950st)
320
(at to 1000st)
295
(at to 1050st)
275
(at to 1100st)
255
(at to 1150st)
235
(at to 1200st)
220
(at to 1250st)
205
(at to 1300st)</td><td rowspan="2">1</td><td rowspan="2">–</td><td rowspan="2">–</td><td rowspan="2">–</td></tr>
<tr><td>Vertical</td></tr>
<tr><td rowspan="2">20</td><td>Horizontal</td><td rowspan="2">1200
(at 100 to 650st)
1165
(at to 700st)
1045
(at to 750st)
940
(at to 800st)
850
(at to 850st)
770
(at to 900st)
705
(at to 950st)
645
(at to 1000st)
595
(at to 1050st)
545
(at to 1100st)
505
(at to 1150st)
470
(at to 1200st)
440
(at to 1250st)
410
(at to 1300st)</td><td>1</td><td rowspan="2">–</td><td rowspan="2">–</td><td rowspan="2">–</td></tr>
<tr><td>Vertical</td><td>1</td></tr>
</table>

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the off board tuning function, refer to the instruction manual for RC PC Software.

<table>
<tr><th>Actuator Series</th><th>Type</th><th>Motor Output
[W]</th><th>No. of Encoder Pluses</th><th>Lead
[mm]</th><th>Oriented Direction</th><th>Maximum Speed
[mm/s]</th><th>Maximum Acceleration/ Deceleration
[G]</th><th>Minimum Pressing Force
[N]</th><th>Maximum Pressing Force
[N]</th><th>Rated Pressing Speed
[mm/s]</th></tr>
<tr><td rowspan="4">ISDB
ISPDB
(Slider Type)</td><td rowspan="2">L (Note)</td><td rowspan="2">200</td><td rowspan="2">16384</td><td rowspan="2">40</td><td>Horizontal</td><td rowspan="2">1800
(at 100 to 800st)
1700
(at to 850st)
1540
(at to 900st)
1410
(at to 950st)
1290
(at to 1000st)
1185
(at to 1050st)
1095
(at to 1100st)
1015
(at to 1150st)
940
(at to 1200st)
875
(at to 1250st)
815
(at to 1300st)</td><td>1</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>Vertical</td><td>1</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td rowspan="2">LX</td><td rowspan="2">200</td><td rowspan="2">16384</td><td>20</td><td>Horizontal</td><td>1200
(at 1000 to 1200st)
1150
(at to 1300st)
1000
(at to 1400st)
950
(at to 1500st)
830
(at to 1600st)</td><td>0.4</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>40</td><td>Horizontal</td><td>1800
(at to 1500st)
1660
(at to 1600st)</td><td>0.4</td><td>–</td><td>–</td><td>–</td></tr>
</table>

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the off board tuning function, refer to the instruction manual for RC PC Software.

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISDBCR ISPDBCR (Slider Type)	S(Note)	60	16384	4	Horizontal	240 (at 100 to 500st) 230 (at to 550st) 200 (at to 600st) 170 (at to 650st) 150 (at to 700st) 135 (at to 750st) 120 (at to 800st)	0.5	–	–	–
					Vertical		0.4			
				8	Horizontal	480 (at 100 to 500st) 460 (at to 550st) 400 (at to 600st) 345 (at to 650st) 305 (at to 700st) 270 (at to 750st) 240 (at to 800st)	0.7	–	–	–
					Vertical		0.6			
				16	Horizontal	960 (at 100 to 500st) 920 (at to 550st) 795 (at to 600st) 690 (at to 650st) 610 (at to 700st) 540 (at to 750st) 480 (at to 800st)	1	–	–	–
					Vertical		0.8			

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Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISDBCR ISPDBCR (Slider Type)	M(Note)	100 200	16384	5	Horizontal	300 (at 100 to 600st) 270 (at to 650st) 240 (at to 700st) 215 (at to 750st) 190 (at to 800st) 170 (at to 850st) 155 (at to 900st) 140 (at to 950st) 130 (at to 1000st) 120 (at to 1050st) 110 (at to 1100st)	0.5	–	–	–
					Vertical		0.4			
				10	Horizontal	600 (at 100 to 600st) 545 (at to 650st) 480 (at to 700st) 430 (at to 750st) 380 (at to 800st) 345 (at to 850st) 310 (at to 900st) 285 (at to 950st) 260 (at to 1000st) 240 (at to 1050st) 220 (at to 1100st)	0.7	–	–	–
					Vertical		0.6			

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the off board tuning function, refer to the instruction manual for RC PC Software.

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISDBCR ISPDBCR (Slider Type)	M(Note)	100 200	16384	20	Horizontal	1200 (at 100 to 600st) 1085 (at to 650st) 960 (at to 700st) 855 (at to 750st) 765 (at to 800st) 690 (at to 850st) 625 (at to 900st) 570 (at to 950st) 520 (at to 1000st) 475 (at to 1050st) 440 (at to 1100st)	1	–	–	–
					Vertical		1			
				30	Horizontal	1800 (at 100 to 600st) 1630 (at to 650st) 1440 (at to 700st) 1280 (at to 750st) 1150 (at to 800st) 1035 (at to 850st) 935 (at to 900st) 850 (at to 950st) 780 (at to 1000st) 715 (at to 1050st) 660 (at to 1100st)	1	–	–	–
					Vertical		1			

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Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISDBCR ISPDBCR (Slider Type)	MX	200	16384	20	Horizontal	1200 (at 800 to 1100st) 1100 (at to 1200st) 1000 (at to 1300st) 950 (at to 1400st) 800 (at to 1500st) 700 (at to 1600st) 600 (at to 1700st) 550 (at to 1800st) 500 (at to 1900st) 450 (at to 2000st)	0.4	–	–	–
				30	Horizontal	1800 (at 800 to 1100st) 1650 (at to 1200st) 1500 (at to 1300st) 1425 (at to 1400st) 1200 (at to 1500st) 1050 (at to 1600st) 900 (at to 1700st) 825 (at to 1800st) 750 (at to 1900st) 675 (at to 2000st)	0.4	–	–	–

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISDBCR ISPDBCR (Slider Type)	L (Note)	200	16384	10	Horizontal	600 (at 100 to 650st) 585 (at to 700st) 520 (at to 750st) 470 (at to 800st) 425 (at to 850st) 385 (at to 900st) 350 (at to 950st) 320 (at to 1000st) 295 (at to 1050st) 275 (at to 1100st) 255 (at to 1150st) 235 (at to 1200st) 220 (at to 1250st) 205 (at to 1300st)	1	–	–	–
					Vertical		1			
				20	Horizontal	1200 (at 100 to 650st) 1165 (at to 700st) 1045 (at to 750st) 940 (at to 800st) 850 (at to 850st) 770 (at to 900st) 705 (at to 950st) 645 (at to 1000st) 595 (at to 1050st) 545 (at to 1100st) 505 (at to 1150st) 470 (at to 1200st) 440 (at to 1250st) 410 (at to 1300st)	1	–	–	–
					Vertical		1			

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the off board tuning function, refer to the instruction manual for RC PC Software.

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISDBCR ISPDBCR (Slider Type)	L (Note)	200	16384	40	Horizontal	1800 (at 100 to 800st) 1700 (at to 850st) 1540 (at to 900st) 1410 (at to 950st) 1290 (at to 1000st) 1185 (at to 1050st) 1095 (at to 1100st) 1015 (at to 1150st) 940 (at to 1200st) 875 (at to 1250st) 815 (at to 1300st)	1	–	–	–
					Vertical		1			

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
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Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISDBCR ISPDBCR (Slider Type)	LX	200	16384	20	Horizontal	1200 (at 1000 to 1200st) 1150 (at to 1300st) 1000 (at to 1400st) 950 (at to 1500st) 830 (at to 1600st) 740 (at to 1700st) 650 (at to 1800st) 590 (at to 1900st) 540 (at to 2000st) 490 (at to 2100st) 440 (at to 2200st) 410 (at to 2300st) 370 (at to 2400st) 340 (at to 2500st)	0.4	—	—	—
				40	Horizontal	1800 (at 1000 to 1500st) 1660 (at to 1600st) 1480 (at to 1700st) 1300 (at to 1800st) 1180 (at to 1900st) 1080 (at to 2000st) 980 (at to 2100st) 880 (at to 2200st) 820 (at to 2300st) 740 (at to 2400st) 680 (at to 2500st)	0.4	—	—	—

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
SSPA	SXM	200	16384	10	Horizontal	600 (at 100 to 600st) 560 (at to 650st) 490 (at to 700st) 440 (at to 750st) 390 (at to 800st) 350 (at to 850st) 320 (at to 900st) 290 (at to 950st) 260 (at to 1000st) 240 (at to 1050st) 220 (at to 1100st)	0.7	–	–	–
					Vertical		0.6	–	–	–
				20	Horizontal	1200 (at 100 to 600st) 1120 (at to 650st) 990 (at to 700st) 880 (at to 750st) 780 (at to 800st) 710 (at to 850st) 640 (at to 900st) 580 (at to 950st) 530 (at to 1000st) 480 (at to 1050st) 440 (at to 1100st)	1.0	–	–	–
					Vertical		1.0	–	–	–
				30	Horizontal	1800 (at 100 to 600st) 1680 (at to 650st) 1480 (at to 700st) 1320 (at to 750st) 1180 (at to 800st) 1060 (at to 850st) 960 (at to 900st) 870 (at to 950st) 790 (at to 1000st) 730 (at to 1050st) 670 (at to 1100st)	1.2	–	–	–
					Vertical		1.2	–	–	–

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
SSPDACR	S	200	16384	10	Horizontal	600 (at 100 to 550st) 540 (at to 600st) 480 (at to 650st) 430 (at to 700st) 380 (at to 750st) 340 (at to 800st) 310 (at to 850st) 280 (at to 900st) 260 (at to 950st) 240 (at to 1000st) 220 (at to 1050st) 200 (at to 1100st)	0.7	–	–	–
					Vertical		0.6	–	–	–
				20	Horizontal	1100 (at 100 to 550st) 1090 (at to 600st) 970 (at to 650st) 860 (at to 700st) 770 (at to 750st) 690 (at to 800st) 630 (at to 850st) 570 (at to 900st) 520 (at to 950st) 480 (at to 1000st) 440 (at to 1050st) 400 (at to 1100st)	1.0	–	–	–
					Vertical		1.0	–	–	–
				30	Horizontal	1600 (at 100 to 600st) 1450 (at to 650st) 1290 (at to 700st) 1160 (at to 750st) 1040 (at to 800st) 940 (at to 850st) 860 (at to 900st) 780 (at to 950st) 720 (at to 1000st) 660 (at to 1050st) 610 (at to 1100st)	1.2	–	–	–
					Vertical		1.2	–	–	–

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
NS	SXMS-A	60	16384	12	Horizontal	720	0.8	–	–	–
	SXMM-A	60	16384	12	Horizontal	720	0.8	–	–	–
	SZMS-A	60	16384	12	Vertical	600	0.7	–	–	–
	SZMM-A	60	16384	12	Vertical	600	0.7	–	–	–
	MXMS	200	16384	30	Horizontal	1800	1.0	–	–	–
				20		1200	0.8	–	–	–
	MXMM	200	16384	30	Horizontal	1800	1.0	–	–	–
				20		1200	0.8	–	–	–
	MXMXS	200	16384	30	Horizontal	1800	0.3	–	–	–
				20		1200	0.3	–	–	–
	MZMS	200	16384	20	Vertical	1000	0.5	–	–	–
	MZMM	200	16384	20	Vertical	1000	0.5	–	–	–
IF	SA	60	16384	35	Horizontal	1750	0.3	–	–	–
		100			Horizontal		0.3	–	–	–
	MA	200	16384	35	Horizontal	1750	0.3	–	–	–
FS	NM	60	16384	25	Horizontal	1250	0.3	–	–	–
		100			Horizontal		0.3	–	–	–
	WM	100	16384	25	Horizontal	1250	0.3	–	–	–
		200			Horizontal		0.3	–	–	–
RS	30	30	16384	Gear Ratio 1/50	–	360	–	–	–	–
				Gear Ratio 1/100		180		–	–	–
	60	60		Gear Ratio 1/50		360	–	–	–	–
				Gear Ratio 1/100		180		–	–	–

Chapter 10 Warranty

10.1 Warranty Period

One of the following periods, whichever is shorter:
- 18 months after shipment from our factory
- 12 months after delivery to a specified location

10.2 Scope of the Warranty

Our products are covered by warranty when all of the following conditions are met. Faulty products covered by warranty will be replaced or repaired free of charge:
(1) The breakdown or problem in question pertains to our product as delivered by us or our authorized dealer.
(2) The breakdown or problem in question occurred during the warranty period.
(3) The breakdown or problem in question occurred while the product was in use for an appropriate purpose under the conditions and environment of use specified in the instruction manual and catalog.
(4) The breakdown or problem in question was caused by a specification defect or problem, or by the poor quality of our product.

Note that breakdowns due to any of the following reasons are excluded from the scope of warranty:
[1] Anything other than our product
[2] Modification or repair performed by a party other than us (unless we have approved such modification or repair)
[3] Anything that could not be easily predicted with the level of science and technology available at the time of shipment from our company
[4] A natural disaster, man-made disaster, incident or accident for which we are not liable
[5] Natural fading of paint or other symptoms of aging
[6] Wear, depletion or other expected result of use
[7] Operation noise, vibration or other subjective sensation not affecting function or maintenance

Note that the warranty only covers our product as delivered and that any secondary loss arising from a breakdown of our product is excluded from the scope of warranty.

10.3 Honoring the Warranty

As a rule, the product must be brought to us for repair under warranty.

10.4 Limited Liability

(1) We shall assume no liability for any special damage, consequential loss or passive loss such as a loss of expected profit arising from or in connection with our product.
(2) We shall not be liable for any program or control method created by the customer to operate our product or for the result of such program or control method.

10.5 Conditions of Conformance with Applicable Standards/Regulations, Etc., and Applications

(1) If our product is combined with another product or any system, device, etc., used by the customer, the customer must first check the applicable standards, regulations and/or rules. The customer is also responsible for confirming that such combination with our product conforms to the applicable standards, etc. In such a case we will not be liable for the conformance of our product with the applicable standards, etc.

(2) Our product is for general industrial use. It is not intended or designed for the applications specified below, which require a high level of safety. Accordingly, as a rule our product cannot be used in these applications. Contact us if you must use our product for any of these applications:
   [1] Medical equipment pertaining to maintenance or management of human life or health
   [2] A mechanism or mechanical equipment intended to move or transport people (such as a vehicle, railway facility or aviation facility)
   [3] Important safety parts of mechanical equipment (such as safety devices)
   [4] Equipment used to handle cultural assets, art or other irreplaceable items

(3) Contact us at the earliest opportunity if our product is to be used in any condition or environment that differs from what is specified in the catalog or instruction manual.

10.6 Other Items Excluded from Warranty

The price of the product delivered to you does not include expenses associated with programming, the dispatch of engineers, etc. Accordingly, a separate fee will be charged in the following cases even during the warranty period:
   [1] Guidance for installation/adjustment and witnessing of test operation
   [2] Maintenance and inspection
   [3] Technical guidance and education on operating/wiring methods, etc.
   [4] Technical guidance and education on programming and other items related to programs

Change History

Revision Date	Revision Description
2012.09.	First Edition
2013.02	Edition 1D Note corrected
2014.05	Edition 1F Pg. 40 Add a noise filter recommended
2014.07	Edition 1G Note corrected

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