



Operation Manual

Product name

3-axis Step Motor Controller (EtherNet / IP™ type)

MODEL/ Series/ Product Number

JXC92 Series



SMC Corporation

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JXC92 Series / Controller

1. Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of “Caution,” “Warning” or “Danger.” They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC)*1), and other safety regulations.

*1) ISO 4414: Pneumatic fluid power -- General rules relating to systems.

ISO 4413: Hydraulic fluid power -- General rules relating to systems.

IEC 60204-1: Safety of machinery -- Electrical equipment of machines. (Part 1: General requirements)

ISO 10218: Manipulating industrial robots -Safety.

etc.



Caution

Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.



Warning

Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.



Danger

Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

Warning

1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results.

The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product.

This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly.

The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.

2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.

3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.

2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.

3. An application which could have negative effects on people, property, or animals requiring special safety analysis.

4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.



JXC92 Series / Controller

1. Safety Instructions

Caution

1. The product is provided for use in manufacturing industries.

The product herein described is basically provided for peaceful use in manufacturing industries.

If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract, if necessary.

If anything is unclear, contact your nearest sales branch.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited Warranty and Disclaimer” and “Compliance Requirements”.

Read and accept them before using the product.

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first. *2)

Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.

2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.

This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.

3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

***2) Vacuum pads are excluded from this 1 year warranty.**

A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.

Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.

2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulation of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

Caution

SMC products are not intended for use as instruments for legal metrology.

Measurement instruments that SMC manufactures or sells have not been qualified by type approval tests relevant to the metrology (measurement) laws of each country.

Therefore, SMC products cannot be used for business or certification ordained by the metrology (measurement) laws of each country.

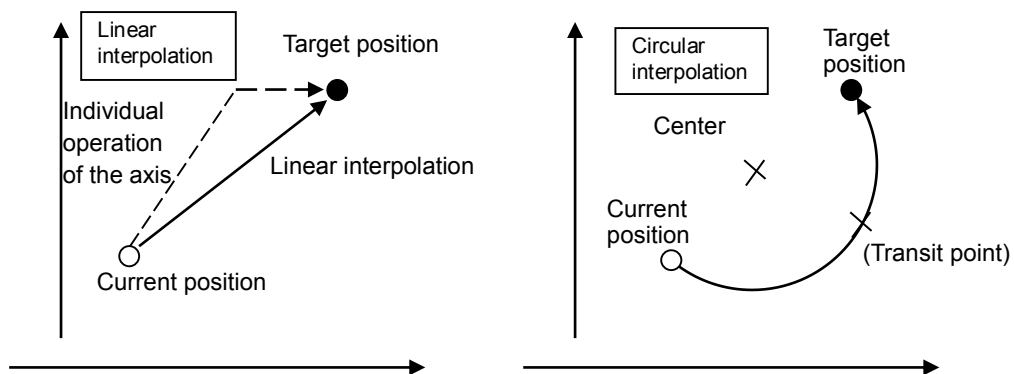
2. Product Outline

2.1 Features

The JXC93 uses operation instructions to control multiple actuators. The operation instructions are comprised of "step data" information, which contains actuator performance command data such as position, speed, or acceleration, etc. The step data is predefined in the controller setting software. An EtherNet/IP command, which specifies a step data number, is sent to the controller to start the operation based on the step data information.

Feature of the controller.

- EtherNet/IP type
Control by EtherNet/IP is possible.
- 3 axes speed tuning control
Up to 3 axes speed tuning control is available by specifying step data.
- Linear/ circular interpolation
Linear interpolation for up to 3 axes and circular interpolation between 2 axes are possible. Linear interpolation is possible by setting the target position and travel speed of the locus. For circular interpolation, the target position, the travel speed of the locus and the centre position or transit point must be set.



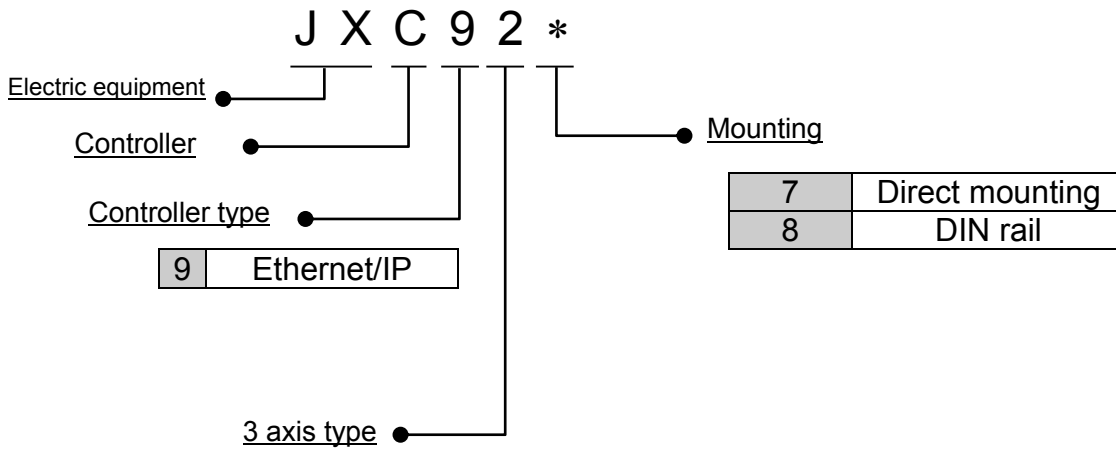
- Return to origin
All axes are possible to return to origin using one 'return to origin' signal (SETUP) from EtherNet/IP. The order of the return to origin operation is possible to specify by parameters.
- It is possible to set 512 steps of positioning or pushing operation in normal mode, and 2048 steps of positioning or pushing operation in extended mode.
Control the actuator according to the specified operation pattern by manipulating the memory allocated to the input/ output port such as INP signal and DRIVE signal from EtherNet/IP. It is possible to operate all axes by using 1 step.
- Data input method
It is possible to set the step data, parameters, monitor conditions, and reset alarms by communication via the USB port from a PC in which the controller setting software is installed.

Caution

Please keep this manual safe for future use. It will be necessary to refer to this manual along with the operation manuals for other actuators and controller setting software at installation and fault finding. Keep this operation manual accessible for reference.

2.2 How to Order

How to order is shown below.



Applicable Actuator

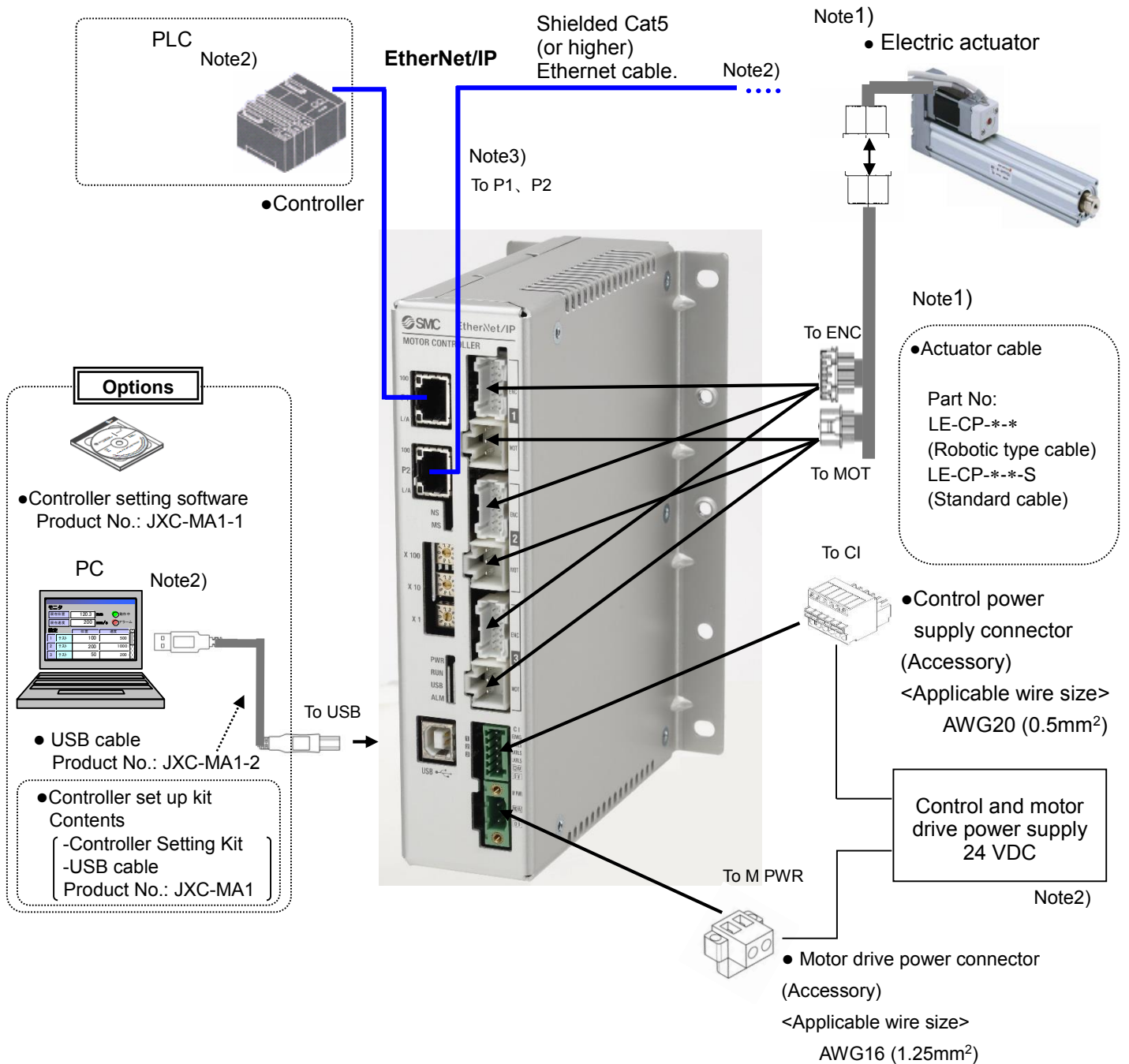
Electric Actuator	Rod Type	LEY Series
Electric Actuator	Rod Type with Guide	LEYG Series
Electric Actuator	Slider Type	LEF Series
Electric Slide Table		LES/LESH Series
Electric Rotary Table		LER Series
Electric Actuator	Miniature Type	LEPY/LEPS Series
Electric Gripper (2-Finger Type, 3-Finger Type)		LEH Series

Note) The actuator should be ordered separately, which will include the actuator cable.
(Example: LEFS16B-100B-S1)

Note) Refer to the SMC website for graphs of speed and transferred workload of electric actuators with the "LECPA" controller.

2.3 Product configuration

Structure of the controller.



Note 1) Connected actuators and actuator cables should be ordered separately.

Note 2) The PLC, shielded Cat 5 (or higher) Ethernet cable, PC and 24VDC power supply should be supplied by the user.

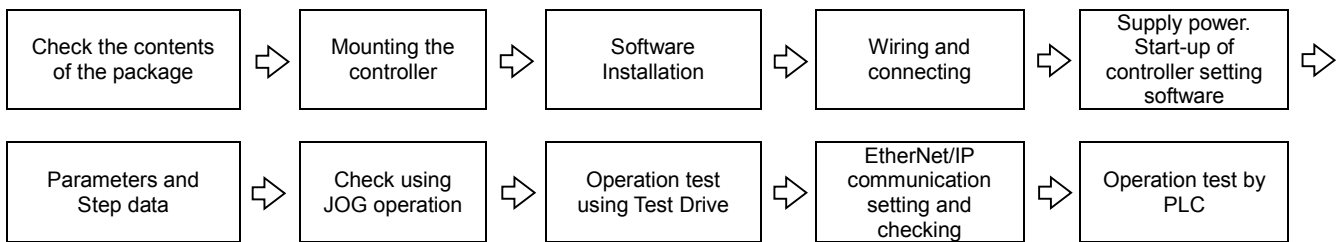
Note 3) Cable is possible to connect to either P1 or P2. Follow the topology of EtherNet/IP communication for further direction.

! Warnig

Refer to **14. Common Precautions for wiring and cable (P.97)**.
Use "USB cable (JXC-MA1-2)" when communicating with a PC.

3. Procedures to Trial run

Install, wire, set and perform a trial run for the controller referring to the procedure below when using the product for the first time.



For “Installation of the software”, refer to this operation manual and the Installation Manual for the controller setting software (No.JXC※-OMU0022). For “Start-up of controller setting software”, “Parameters and step data”, “Check using JOG operation” and “Operation test using Test Drive”, please refer to the setting software operation manual (No.JXC※-OMU0024).

When this controller is used for the first time after purchase, do not upload the default values in the controller.

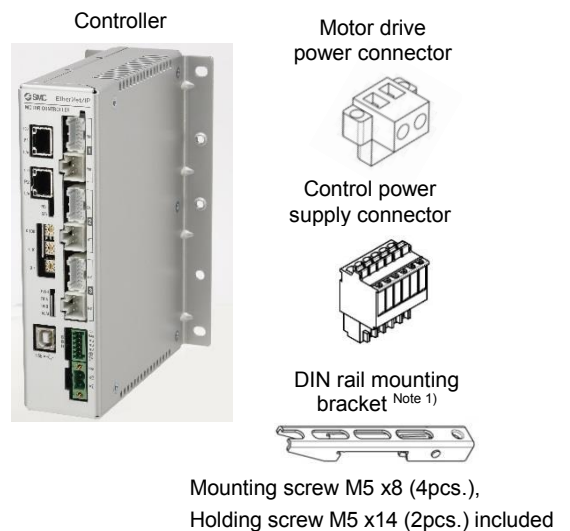
Please download the information which has been set by the controller setting software and use it.

3.1 Checking the contents of the package

After unpacking everything, check the description on the label to identify the controller and the number of accessories.

Product name	Quantity
Controller (JXC92*)	1 pc.
Motor drive power connector	1 pcs.
Control power supply connector	1 pcs.
DIN rail mounting bracket <small>Note 1)</small>	1 set

Note1) These items are included if you ordered by the part number for a set of controller.



[Options]

Controller setting kit (Product model No.: JXC-MA1)
(Controller setting software and USB cable are included.)



If any parts are missing or damaged, please contact your distributor.

3.2 Mounting the controller

Refer to [4.5 Mounting \(P.35\)](#) for instructions on how to mount the controller.

3.3 Install the setting software and the driver

Install the controller setting software and driver software on the PC to be used.

For details, refer to the Installation Manual for the controller setting software (No.JXC※-OMU0022).

3.4 Wiring and connection

Connect the cables to the controller.

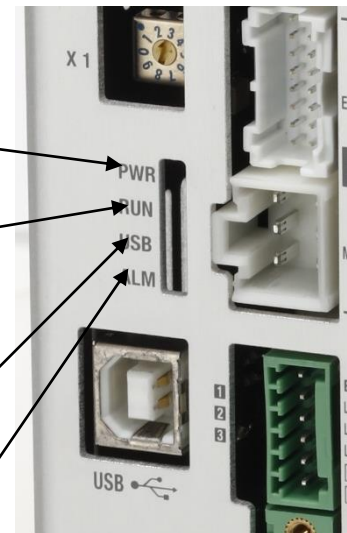
Refer to section [2.3 Product configuration \(P.9\)](#), [6.2 Wiring \(P.43\)](#), and [7. EtherNet/IP communication connector \(P.47\)](#) for wiring details.

3.5 Power supply, Start-up of controller setting software, setting date and time, Alarm and error check

(1) Supplying power

Supply power to the control and motor drive power supply.

LED and switch	Colour	Status
PWR	Green	ON: Power ON OFF: Power OFF
RUN	Green	ON: Operation over EtherNet/IP only. Flashing: Operation by the setting software only. OFF: No operation over EtherNet/IP or by the setting software.
USB	Green	ON: USB connected OFF: USB not connected
ALM	Red	ON: Alarm or error are generated OFF: Alarm and error are not generated



Check that the PWR LED is ON.

If the green PWR LED is not ON, check the wiring of the power supply and the power supply voltage.

(2) Start-up of controller setting software

Using a PC with the controller setting software installed, start the application "SMC / JXC Controller 14K" to start the setting software.

If the controller setting software is installed with the default setting, an icon will be created on the desk top. It is possible to start the setting software by double-clicking the icon.

When the setting software starts, the connection between the controller and PC is confirmed. The screen below will be displayed when the communication is established correctly.

However, when the setting software is started for the first time, this window will not appear.

When power is supplied to the controller for the first time, the title window will be displayed.

The following window will be displayed after setting the parameters of the controller and the connected actuator.



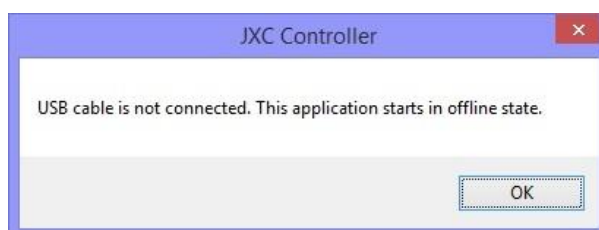
When "(Yes)" is selected the controller will start uploading (reading) step data and parameters.

The window below will appear.

by choosing "(N)". When "(No)" is selected the controller will start without uploading (reading) any step data or parameters. The window below will appear.



When the PC is not able to communicate with the controller, the following screen is displayed.



When select "OK", the title window will be displayed.

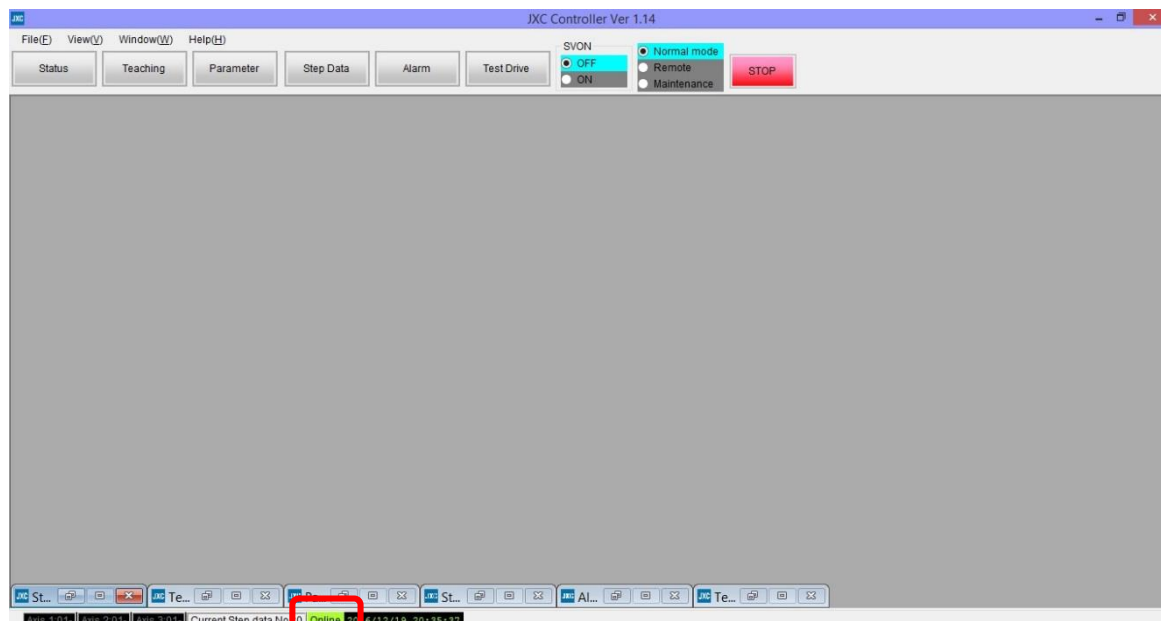
Caution

If this software starts up without uploading the parameters, or in the off-line state, the contents shown in the status window and the teaching window will not be correct.

Be sure to upload the parameters when referring to the status window or when operating the actuator.

Otherwise, it may cause injury or damage to the actuator or the user's system.

After the initial title window is displayed, the following main window will be displayed.



The communication status between the controller and PC is indicated at the bottom of the main window.

Display	Details
	Off-line state
	On-line state

When the PC is able to communicate with the controller, "On-line" status is established automatically.

If the communication is in the off-line state, the PC is not able to communicate with the controller. Please check the following.

- **Check that power is supplied to the controller at the correct voltage.**
- **Check that the controller and the PC are connected to each other via the communication cable.**
- **Check that the USB driver is installed correctly.**

(3) Setting date and time

It is necessary to set the date and time in order to record the time when an alarm or error is generated in the controller. After purchase, set the date and time using the controller setup software when power is supplied for the first time.

The procedure to set the date and time is described below.

Caution

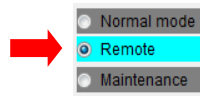
Once the date and time is set, the data will be maintained for 3 to 7 days even if the controller power supply is turned OFF.

When the above mentioned time has passed, while the controller power supply is turned OFF, the date and time previously set will be deleted. When the controller is turned ON next time, the default value (January 1st, 2000. 00:00:00) will be set.

Therefore, set the date and time again.

(a) Change to remote mode

Change the mode to remote mode in the main window. When the mode is changed to the remote mode, the motors of the connected actuators will turn ON.



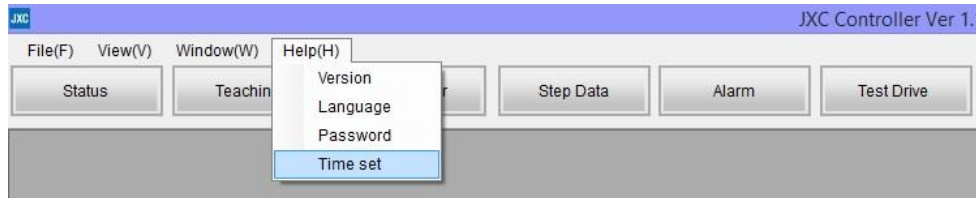
! Caution

When first using the controller, the alarms "Parameter is not registered (901)" and "No data Error (915)" will be generated in remote mode before any parameters and step data are downloaded.

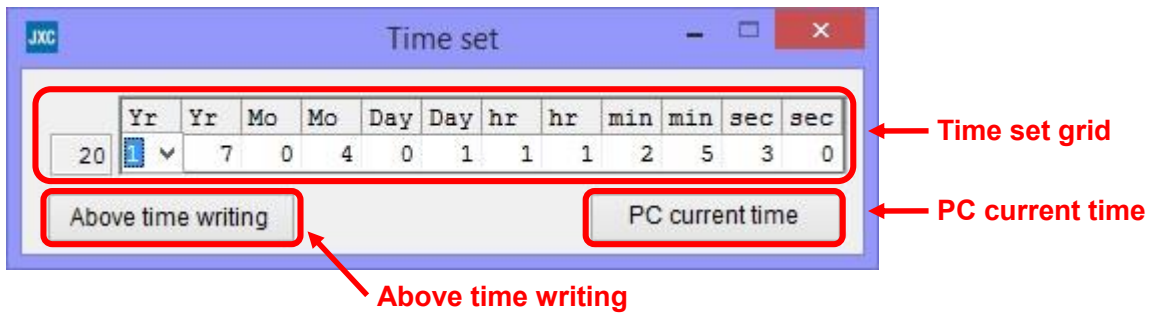
Although these errors are generated for the first date and time setting, the setting can be done.

(b) Setting of date and time

Select "Time set" from the "Help(H)" drop down menu of the main window.



The Time set window will be displayed.

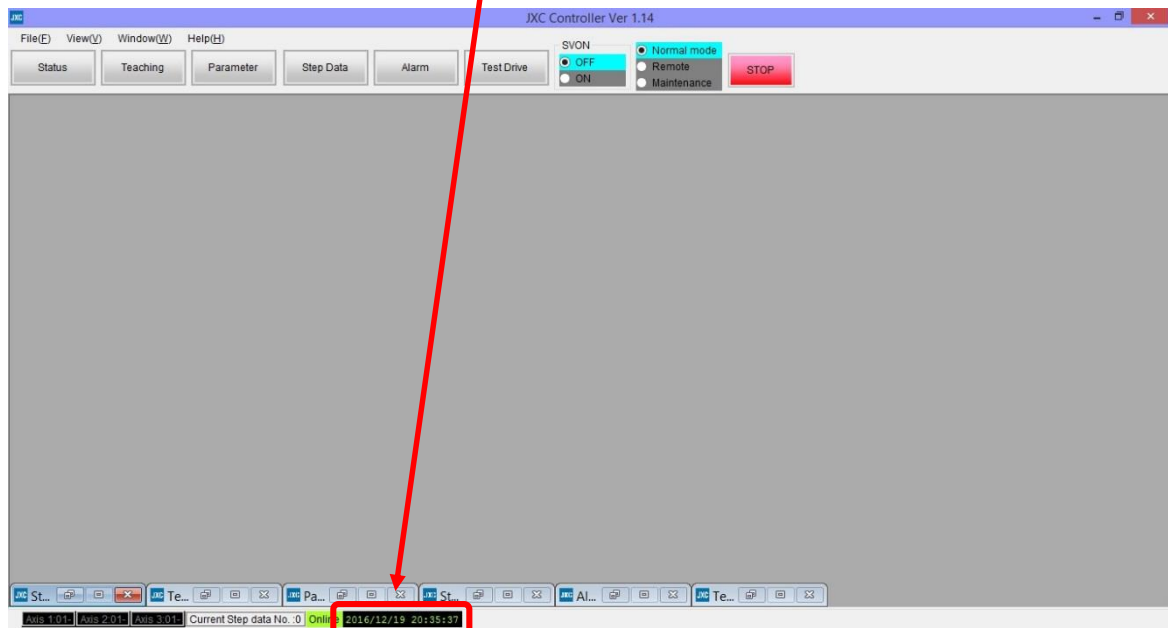


Set an arbitrary time or the PC current time.

When an arbitrary time is set, enter the time into the "time set grid", and set it by clicking the "Above time writing" button.

When the PC current time is to be set, set the time by clicking the "PC current time" button.

The time which has been set to the controller will be displayed at the lower part of the main window. Confirm that the time has been set correctly.



(4) Alarm and error check

If the Alarm button at the top of the main window of the setting software flashes red the alarm or error have been generated.



It is possible to check the details of the generated alarm or error by clicking the Alarm button. Refer to **13.2 Descriptions and countermeasures for abnormality (P.90)** for details of the countermeasures against the alarm or error, and reset the alarm and error.

! Caution

When the controller power is supplied for the first time, the alarm "No data Error (915)" will be generated. Download the parameters and step data before supplying power. The alarm will be reset when power is supplied again.

3.6 Parameters and Step data

When using for the first time or after changing the connected actuator, or when the settings of the controller or connected actuator have been changed, it is necessary to review the set parameters and step data.

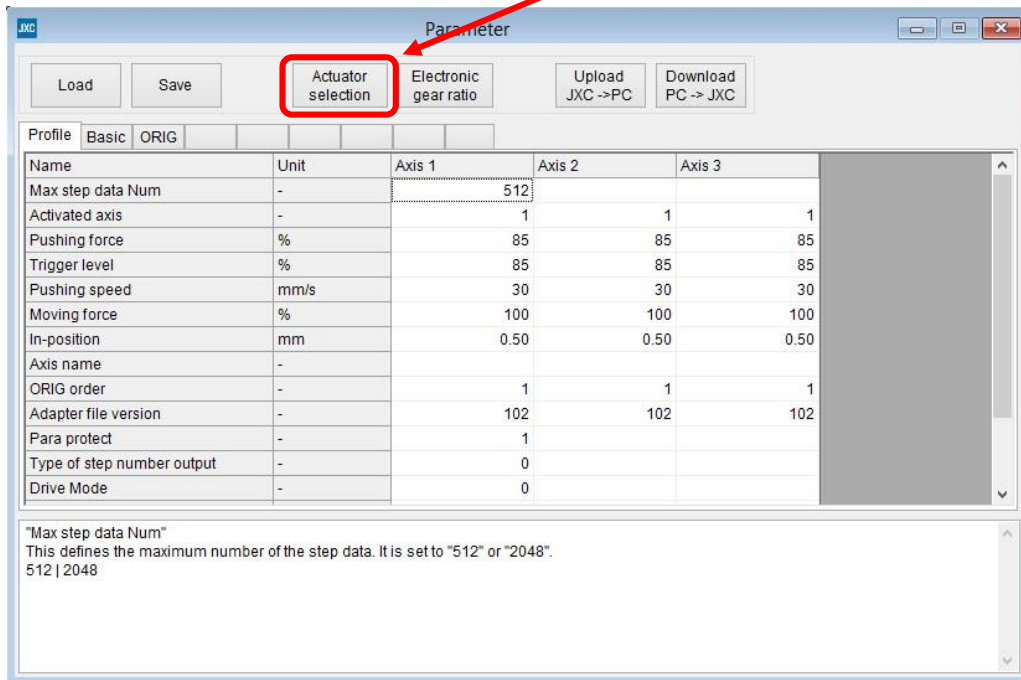
It is possible to display parameters and step data as shown below.

(1) Select the actuator

Select "View(V)" at the top of the main window, and check the parameters.

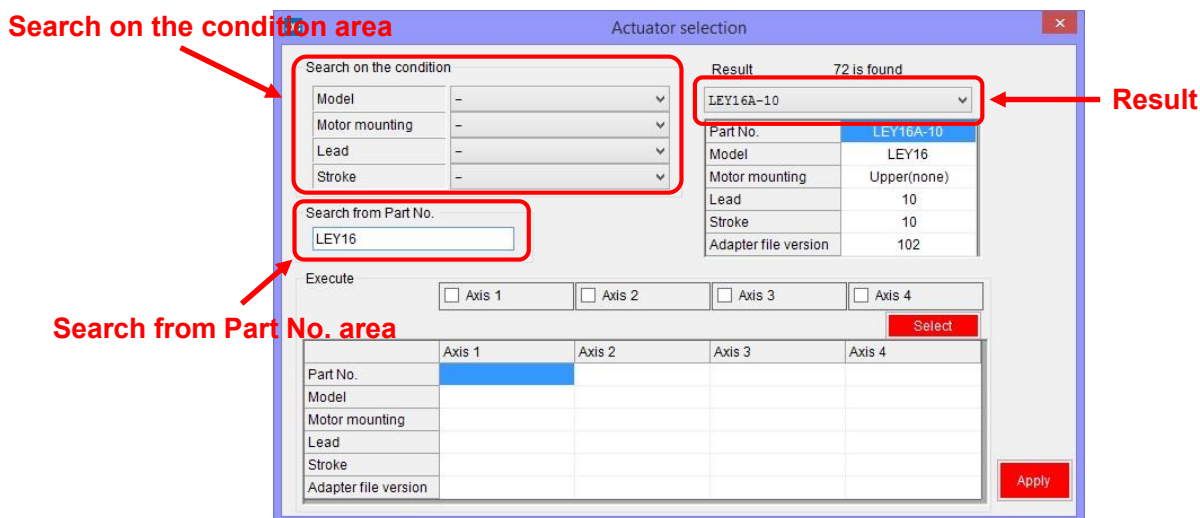


The Parameter window will be displayed. Select the "Actuator selection" button. The Actuator selection window will be displayed.



Input the part number of the actuators to be used by searching in the "Search from Part No. area" or in the "Search on the condition area".

A list of Part numbers of the actuators matching the conditions will be displayed by selecting the ▼ in the "Result" area. Select the actuator to be connected.



If the part number of the actuator to be used is already known, input the part number until stroke.

Example) When the LEY16RA-100BML is ordered, input 'LEY16RA-100'.

When the LER series is used, input the part number including the rotation angle.

Example) When the LERH30K-3L is ordered, input 'LERH30K-3'.

When there is no match in the results even when the stroke is input, the possible causes could be: -.

(a) No applicable stroke

Input the part number without the stroke. Select the closest model to the actuator being used, with a stroke which is longer than that of the actuator being used.

Example) When LEY16RA-75 is ordered, input 'LEY16RA-100'.

(b) For LEFSH (High precision type)

Input LEFS to search.

Example) When LEFSH25RH-300 is ordered, input 'LEFS25RH-300'

(c) When a Clean type (11-) or Secondary battery type (25A-) is ordered.

Search without inputting 11- or 25A-, and find the actuator to which 11- or 25A- is applicable.

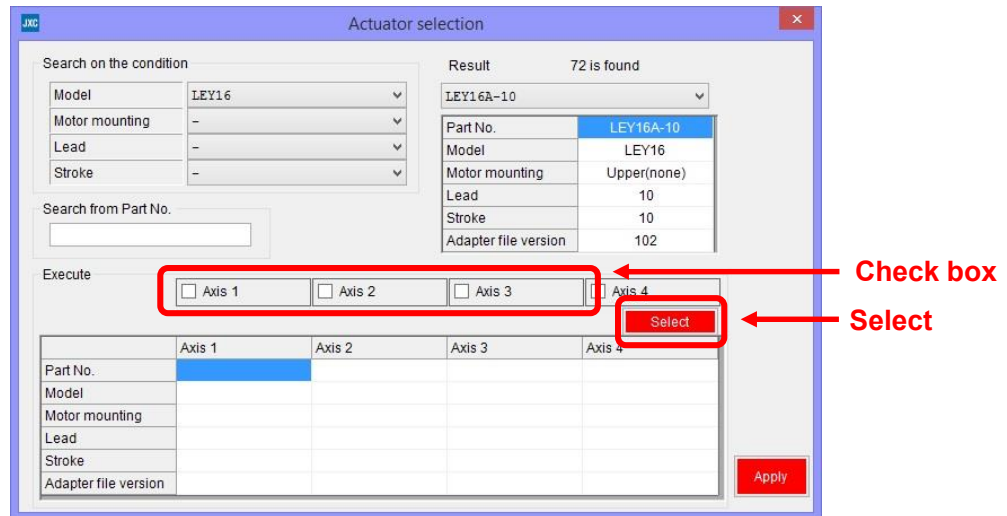
Example) When 11-LEFSH16A-100BR is ordered, input 'LEFS16A-100'

Caution

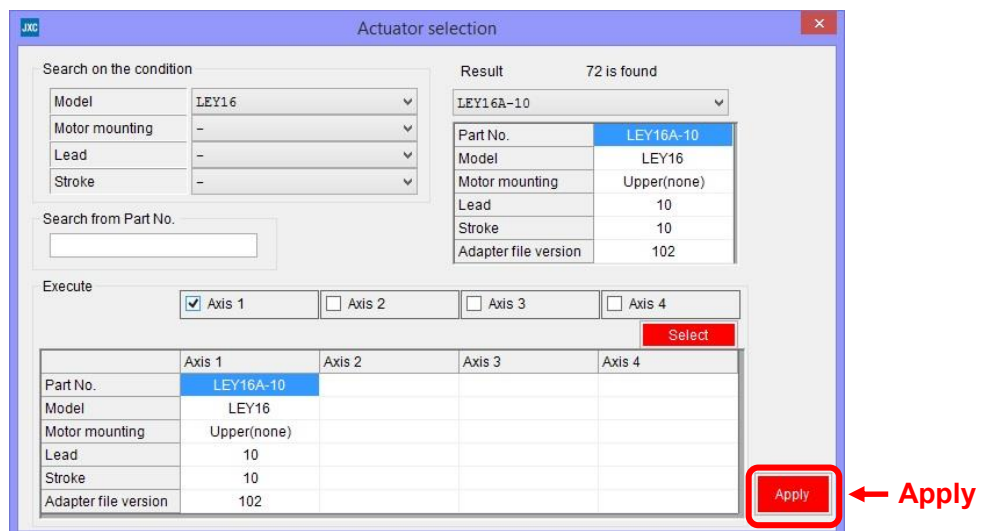
When the stroke parameter selected is longer than the stroke of the actuator to be used, the "position" input to the step data must not exceed the actuator stroke range.

When there is no actuator match, consult SMC.

Select the check box for the axis for which parameters are to be input (one or more boxes are possible to be selected). **Select the "Select" button.** Axis parameters will be displayed in the **Actuator selection window.** The values input here are for display only, and are not written to the controller.



Display the parameters for all axes. **Select the "Apply" button.** The parameters are copied to the parameter window table.



⚠ Caution

Copying does not write parameters to the controller. Be sure to download the parameters following the procedure in section **3.6 (2) Setting parameters (P.19)**.

(2) Setting parameters

Set the parameters such as for valid axis and electronic gear.

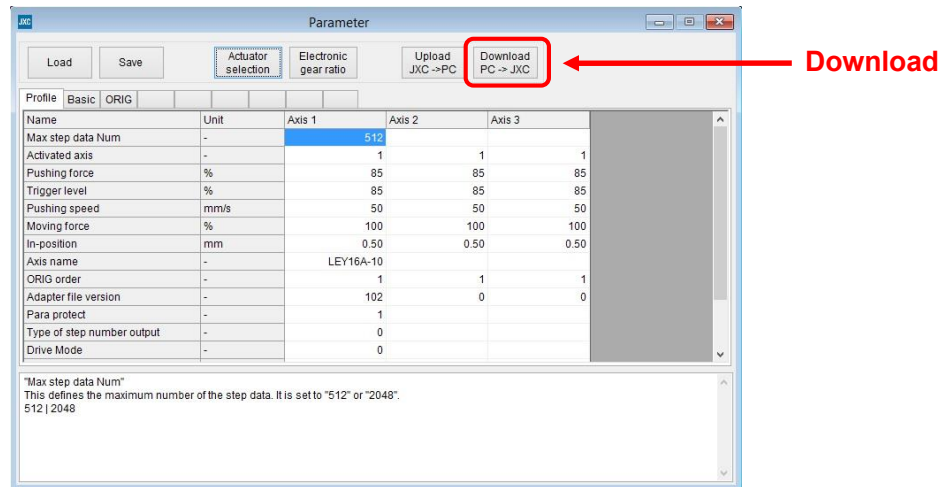
Check the parameters below and change them if necessary. For other items, refer to section

9. Setting Data Entry (P.52).

Parameter name		Input range	Outline																
Profile parameter	Max step data Num	512 or 2048	Maximum step data. Change if necessary.																
	Activated axis	0 or 1	Set the validity of the axes. Set "0" (invalid) when no actuator is connected. Set "1" (valid) when connected.																
	ORIG order	1 to 4	The order for axes to return to origin. The order is assigned from 1 to 4. Multiple axes are possible to return to origin simultaneously by setting the same order number.																
Basic parameter	Undefined No.11	1 to 4096	<p>Define the Electronic Gear. This parameter can be automatically calculated using the "electronic gear ratio setting". Refer to section 3.6 (3) Electronic gear ratio setting (P.21) for how to set the electronic gear ratio.</p> <p>Undefined No.11: Electronic gear (numerator) Undefined No.12: Electronic gear (denominator)</p> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">⚠ Caution</p> <p>When interpolation is performed for actuators of different lead, the travel distance per pulse must be the same. Otherwise do not change the distance.</p> <p>Set the electronic gear for the axes so that their travel distance is the same as the axis with the shortest lead. [Setting example]</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Axis</th> <th>Actuator</th> <th>Lead</th> <th>Electronic gear ratio</th> </tr> </thead> <tbody> <tr> <td>Axis 1</td> <td>LEY16C-300</td> <td>2.5mm</td> <td>1 / 1</td> </tr> <tr> <td>Axis 2</td> <td>LEY16B-300</td> <td>5mm</td> <td>1 / 2</td> </tr> <tr> <td>Axis 3</td> <td>LEY16A-300</td> <td>10mm</td> <td>1 / 4</td> </tr> </tbody> </table> <p>To adjust the travel distance of the axis with the shortest lead (Axis 1), calculate the other axes' (Axis 2 and 3) electronic gear ratio so that their "lead * electronic gear ratio" becomes 2.5 mm.</p> <p>Electronic Gear ratio = Lead of Axis 1/ Lead of Axis 2(or Axis 3) =2.5mm/5mm (or 2.5mm/10mm) =1/2 (or 1/4)</p> </div>	Axis	Actuator	Lead	Electronic gear ratio	Axis 1	LEY16C-300	2.5mm	1 / 1	Axis 2	LEY16B-300	5mm	1 / 2	Axis 3	LEY16A-300	10mm	1 / 4
	Axis		Actuator	Lead	Electronic gear ratio														
Axis 1	LEY16C-300	2.5mm	1 / 1																
Axis 2	LEY16B-300	5mm	1 / 2																
Axis 3	LEY16A-300	10mm	1 / 4																
Undefined No.12																			

After setting parameters, select the "Download" button in the parameter window. Parameters in the parameter window will be written to the controller. Writing is completed when the progress bar disappears and then the setting software is ready to operate.

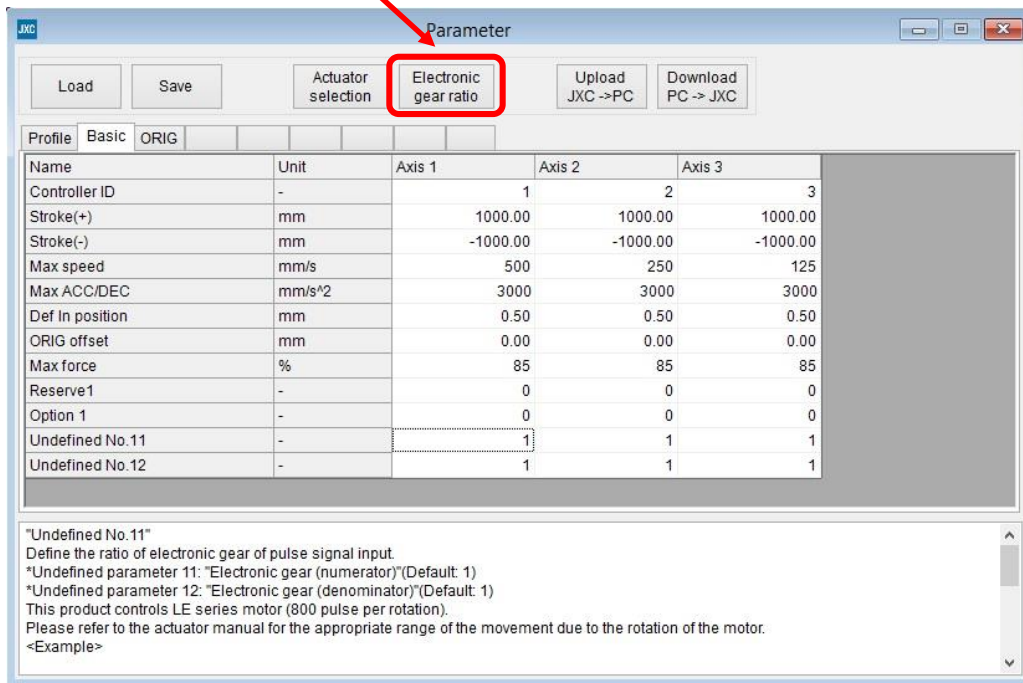
It is necessary to turn off the power to the controller and turn it on again. The downloaded parameters will become valid after turning the power on again.



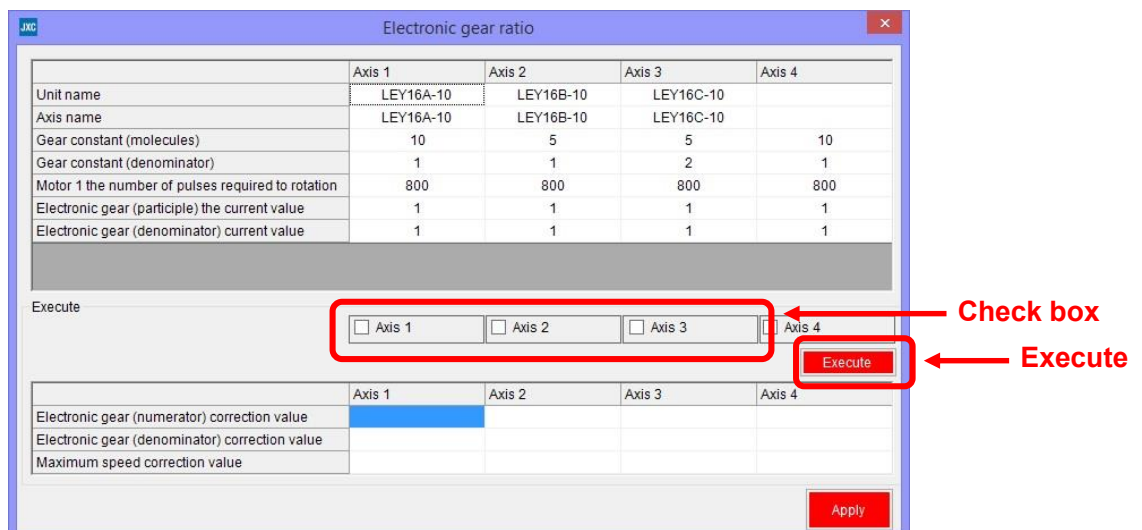
(3) Electronic gear ratio setting

When actuators with different lead (distance moved per 1 motor rotation) are connected for interpolation, the electronic gear ratio setting is required. The following are the descriptions on how to set the electronic gear ratio.

Click the "Electronic gear ratio" button in the Parameter window. The electronic gear ratio setting window will be displayed.



When the electronic gear ratio setting window is displayed, select the check box of the axes to be interpolated. Select the "Execute" button. In the columns of the selected axes, and the calculated value of the electronic gear ratio and maximum speed will be displayed.



Click the “Apply” button. The calculated value of the electronic gear ratio and maximum speed will be copied to the table in the parameter window.

Electronic gear ratio

	Axis 1	Axis 2	Axis 3	Axis 4
Unit name	LEY16A-10	LEY16B-10	LEY16C-10	
Axis name	LEY16A-10	LEY16B-10	LEY16C-10	
Gear constant (molecules)	10	5	5	10
Gear constant (denominator)	1	1	2	1
Motor 1 the number of pulses required to rotation	800	800	800	800
Electronic gear (participle) the current value	1	1	1	1
Electronic gear (denominator) current value	1	1	1	1

Execute

Axis 1 Axis 2 Axis 3 Axis 4

Execute

	Axis 1	Axis 2	Axis 3	Axis 4
Electronic gear (numerator) correction value	1	1	1	
Electronic gear (denominator) correction value	4	2	1	
Maximum speed correction value	125	125	125	

Apply ← Apply

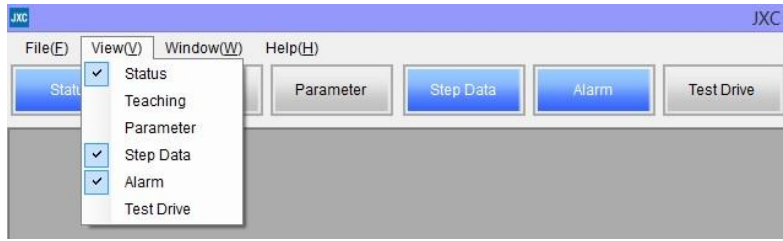
Caution

Copying does not write parameters to the controller. Be sure to perform a download following the procedure **3.6 (2) Setting parameters (P.19)**.

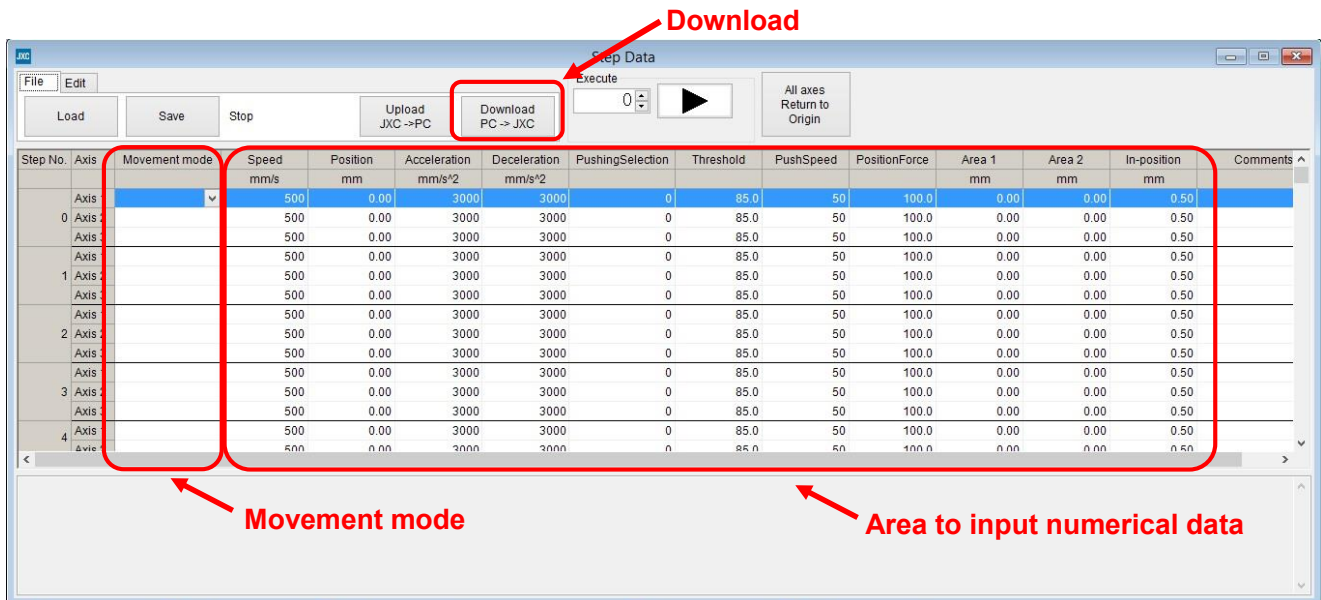
When the electronic gear is set based on automatic calculation, adjust the maximum speed of each axis to the speed of the slowest axis. For the adjustment, it is necessary to reconfirm parameters before using the positioning or pushing operation.

(4) Step data settings

Select "View(V)" at the top of the main window, and select "Step Data".



The Step data window will be displayed.



Select the “▼” button for the movement mode for the axis of the step number to be set. Select the movement mode shown in the list. Enter the necessary numerical data according to the selected movement mode.

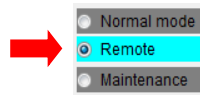
The setting is different depending on the movement mode. Refer to section [9.4 Step data \(P.57\)](#) for details.

After setting the step data, click the "Download" button of the Step Data window's "File" tab. The step data will be written to the controller. Writing is completed when the progress bar disappears and then the setting software is ready to operate.

3.7 Check using JOG operation

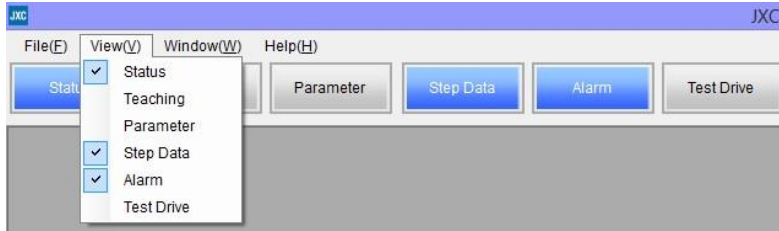
(1) Change to Remote mode

Change the mode to Remote mode at the top of the main window. The Servo will be turned on by selecting Remote mode.

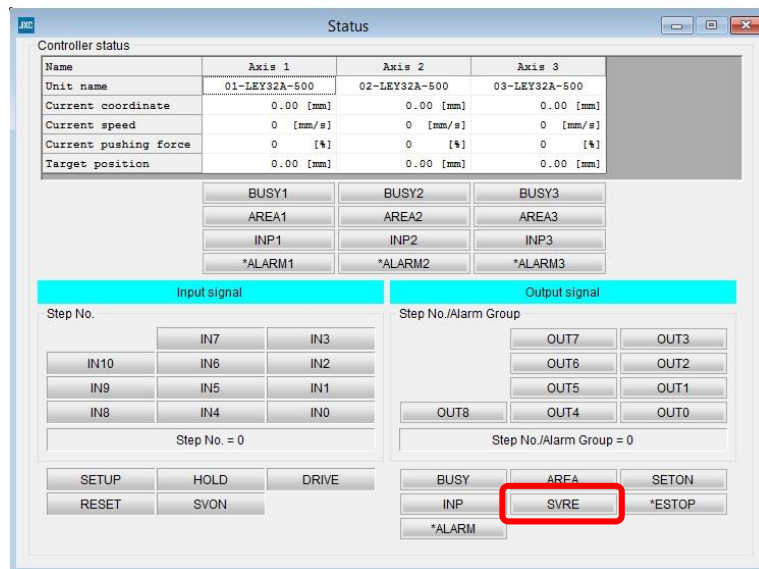


Confirm that the Servo is ON. (Confirm SVRE signal ON in the status window.)

Select "View(V)" at the top of the main window, and select "Status".



The Status window will be displayed. When the Servo is ON, the SVRE signal box will turn blue in the Output signal area.

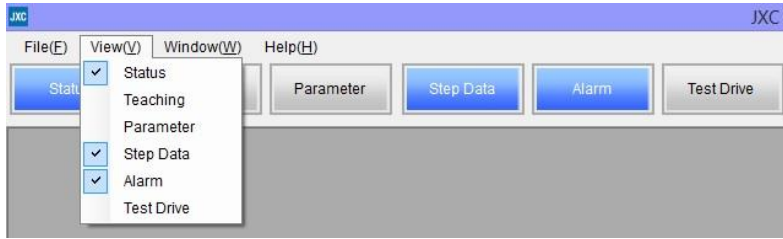


Caution

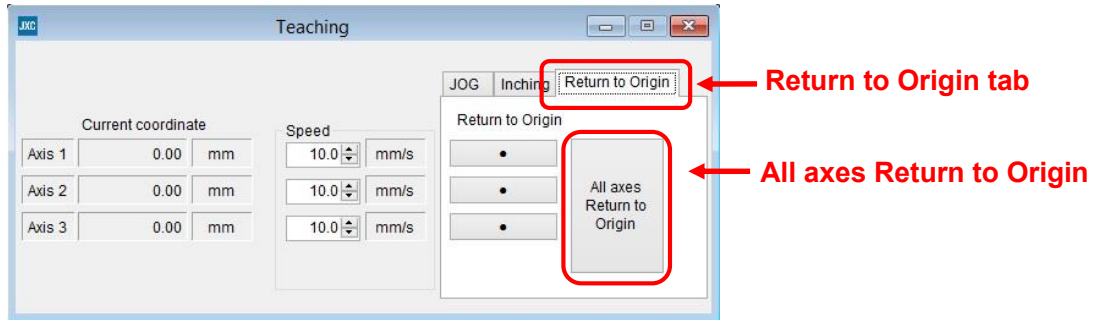
When the power is supplied, it may take up to 20 seconds from servo ON to SVRE signal ON, depending on the actuator position or the conditions.

(2) Return to origin

Select "View(V)" at the top of the main window, and select "Teaching".




The teaching window will be displayed.



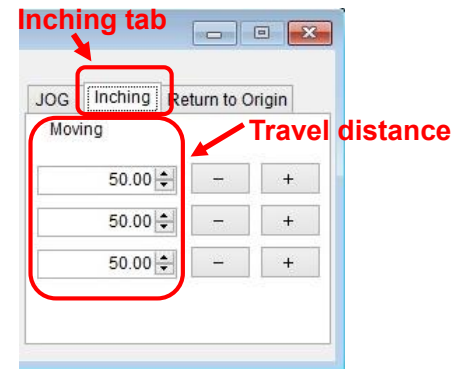
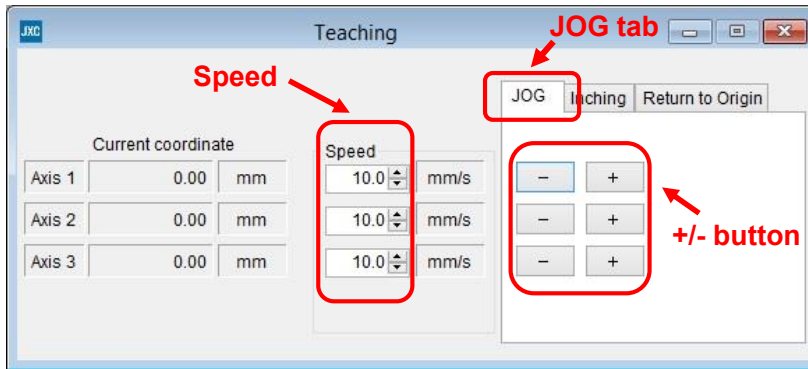
Select the "Return to Origin" tab. Select "Return to Origin(●)" or "All axes Return to Origin".

When the return to origin setting is completed, SETON signal is ON. Confirm that the output signal SETON turns blue in the status window.

 Caution
When a return to origin operation is made using the "Return to Origin (●)" for each axis, the SETON signal will not turn ON unless all the axes with the Profile parameter "Activated axis" set to 1 (valid) complete their return to the origin operation. Refer to 9. Setting Data Entry (P.52) for parameters.

(3) JOG or Inching

Select the "JOG" or "Inching" tab.



(a) JOG

Set the "Speed". The Position will move in the "+" or "-" direction as long as the "+" or "-" button is pressed.

(b) Inching

Set "Speed" for travel speed and "Moving" for travel distance. The Position will move in the "+" or "-" direction during setting.

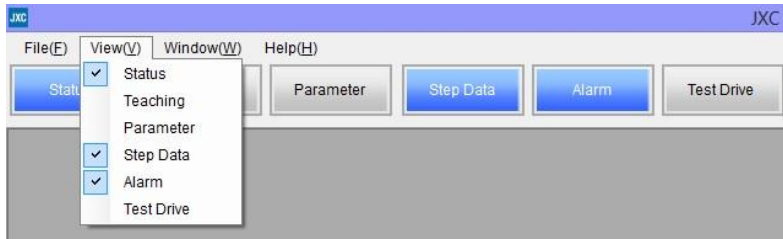
Confirm that the connected actuator travels at the speed or distance according to the connected actuator setting.

Caution

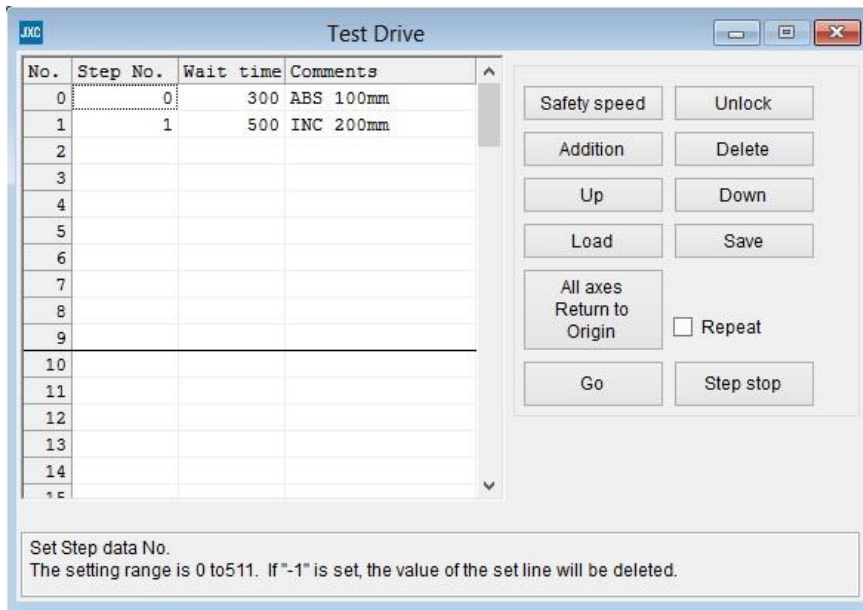
When perform return to origin operation, JOG function and Inching function for the first time, make sure that the parameter setting is correct.
When the electronic gear is set, make sure that the actuator travels for the set travel distance by performing the inching function.
It is possible that unexpected operation will result in accidents, injury, or damage to the system or actuator.

3.8 Operation test using Test Drive

Select "View(V)" at the top of the main window, and select "Test Drive".



The Test Drive window will be displayed.



It is possible to test the set step data in a specified order.

(1) Test Drive setting

Set the order of the step data number for testing in the test drive list window. The table below shows details of the items required.

Items	Details
No.	Line number.
Step No.	Step number to be executed. The set line is deleted by entering "-1".
Wait time	Wait time after the actuator has been operated by the step data, specified by the step number. Unit is msec. Setting range is 0 to 32767 msec.
Comments	Comments are possible to be entered. (Note that half-width comma "," cannot be used).

(2) Change to Remote mode

Turn on the Servo, referring to section [3.7 \(1\) Change to Remote mode \(P.24\)](#).

(3) Return to origin


Confirm that SVRE signal is ON, refer to section [3.7 \(1\) Change to Remote mode \(P.24\)](#). Then, select "All axes Return to Origin", and perform the "Return to origin" operation.

(4) Test drive starts

Confirm that SETON signal is ON, refer to section [3.7 \(2\) Return to origin \(P.25\)](#).

Test drive starts by pressing the "Go" button, based on the test drive list.

Test drive is completed when the correct operation is confirmed. If the operation was not as expected, then refer to section [3.6 \(4\) Step data settings \(P.23\)](#) to revise the settings.

 **Caution**

Do not disconnect the USB cable while executing step data.

The actuator will stop.

3.9 EtherNet/IP communication setting and checking

(1) Controller setting

It is necessary to set the IP address using the rotary switches of the controller.

Refer to **5.1 Controller setting (IP address setting) (P.38)** for details.

(2) PLC set up

It is necessary to set the PLC parameters. This is possible to do by using an EDS file for the configuration of the controller.

Refer to **5.2 PLC setting (Configuration) (P.39)** for details.

(3) LED Display

The status of the LEDs on the front of the controller matches the table below when the setting of the PLC and controller are completed properly and EtherNet/IP communication is established.

Description	LED status	Status
PWR	Green LED is ON	Power is supplied.
ALM	OFF	No alarm and error are generated.
MS	Green LED is ON	Operating normally
NS	Green LED is ON	EtherNet/IP communication is established.

Refer to **4.3 Parts Description (P.32)** for details of each LED.

EtherNet/IP communication between the PLC and controller is not established for cases other than "[NS] green LED is on" on the front surface of the controller. (LED is off, LED flashes in green or red, or the LED turns on red means communication problem has occurred).

Caution

When the communication between the PLC and controller is not established, eliminate the causes referring to **17. Troubleshooting (P.107)**.

3.10 Operation test by PLC

Refer to **8. Memory Map (P.48)** for the allocation of the memory.

Check the return to origin and positioning operations by outputting signals from the PLC. Refer to **11. Operation Instructions (P.78)** for directions.

4. Product Specifications

4.1 Basic Specifications

Item	Specifications	
Number of axes per controller	Max. 3-axis	
Controlled motor	Step motor (servo 24 VDC)	
Encoder	Incremental phase A / B (Encoder resolution 800 pulse / rotation)	
Power supply specification Note1)	<ul style="list-style-type: none"> •Control power supply Power supply voltage: 24VDC+/-10% Max. current consumption: 500 mA •Motor drive power supply Power supply voltage: 24VDC+/-10% Max. current consumption: Depends on connected actuator. Note2) 	
Serial communication	USB2.0 (Full Speed 12Mbps)	
Memory	Flash ROM	
LED indicator	LED description	Details
	PWR	Power supply status
	RUN	Operation status
	USB	USB connection status
	ALM	Alarm status
	NS	EtherNet/IP communication status
	MS	Controller status
	L/A	Data transmission status
100	EtherNet/IP communication speed	
Lock control	With forced lock-release terminal Note3)	
Cable length	Actuator cable: 20m maximum	
Cooling method	Natural air cooling	
Operating temperature range	0 to 40°C (No freezing)	
Operating humidity range	90% RH or less (No condensation)	
Storage temperature range	-10 to 60°C (No freezing)	
Storage humidity range	90% RH or less (No condensation)	
Insulation resistance	Between the external terminals and case 50MΩ (500 VDC)	
Weight	600 g (Direct mounting) 650 g (DIN rail mounting)	

Note 1) Do not use a power supply with "inrush current protection" for the motor drive power supply.

Note 2) Power consumption depends on the actuator connected. Refer to the actuator specifications for further details.

Note 3) Applicable to non-magnetizing lock.

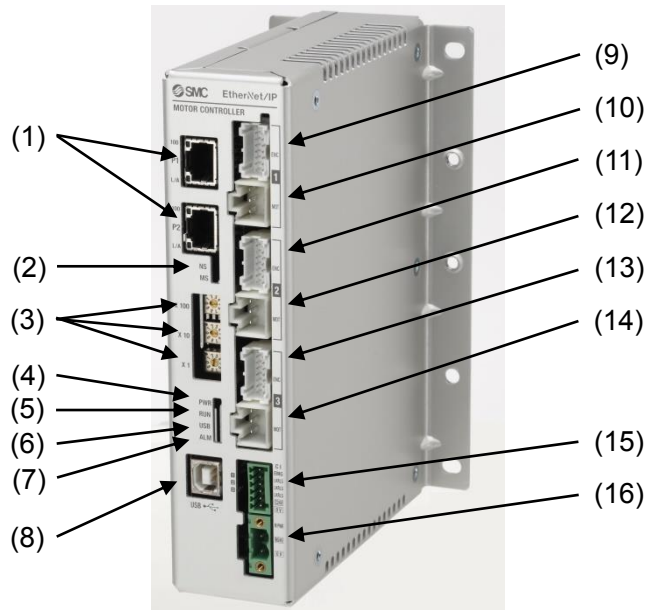
4.2 EtherNet/IP Specifications

Item	Specifications
Protocol	EtherNet/IP™ ^{note1)} (Conformance test version CT13)
Communication speed	10Mbps/100 Mbps (automatic negotiation)
Communication method	Full duplex/ Half duplex (automatic negotiation)
Setup file	EDS file
Occupied area	Input 16 bytes / Output 16 bytes
IP address setting range	Manual setting by rotary switches: From 192.168.1.1 to 254 Via DHCP server: Arbitrary address
Vendor ID	7h (SMC Corporation)
Product type	2Bh (Generic Device)
Product code	DEh

Note 1) EtherNet/IP™ is a trademark of ODVA.

4.3 Parts Description

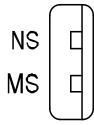
Detail of the controller parts.



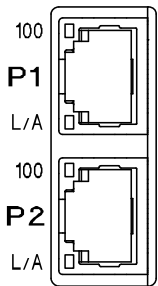
No.	Display	Description	Details	
1	P1, P2	EtherNet/IP communication connector	Connect Ethernet cable.	
2	MS, NS	Communication status LED	Display the status of the EtherNet/IP communication.	
3	x100 x10 x1	IP address setting switches	Switches to set the EtherNet/IP communication IP address (0 to 255) by X1, X10 and X100.	
4	PWR	Power supply LED (green)	OFF	Power supply OFF
			Green LED is ON	Power supply ON
5	RUN	Operating state LED (green)	OFF	Operation stopped (External control is not accepted)
			Green LED is ON	Operation by EtherNet/IP
			Green LED is flashing	Operation by USB communication
6	USB	USB LED (green)	OFF	USB not connected
			Green LED is ON	USB connected
7	ALM	Alarm LED (red)	OFF	No alarm and error
			Red LED is ON	Alarm or error condition
8	USB	Serial communication	Connect to a PC using a USB cable.	
9	ENC ¹	Encoder connector (16 pins)	Axis 1: Connect the actuator cable.	
10	MOT ¹	Motor power connector (6 pins)		
11	ENC ²	Encoder connector (16 pins)	Axis 2: Connect the actuator cable.	
12	MOT ²	Motor power connector (6 pins)		
13	ENC ³	Encoder connector (16 pins)	Axis 3: Connect the actuator cable.	
14	MOT ³	Motor power connector (6 pins)		
15	CI	Control power supply connector ^{Note)}	Control power supply(+), All axes stop(+), Axis 1 unlock(+), Axis 2 unlock(+), Axis 3 unlock(+), common(-)	
16	M PWR	Motor drive power connector ^{Note)}	Motor drive power supply(+), Motor drive power supply(-)	

Note) The connector is included. Refer to section [6. Power supply connector \(P.42\)](#).

Table below shows details of LED.



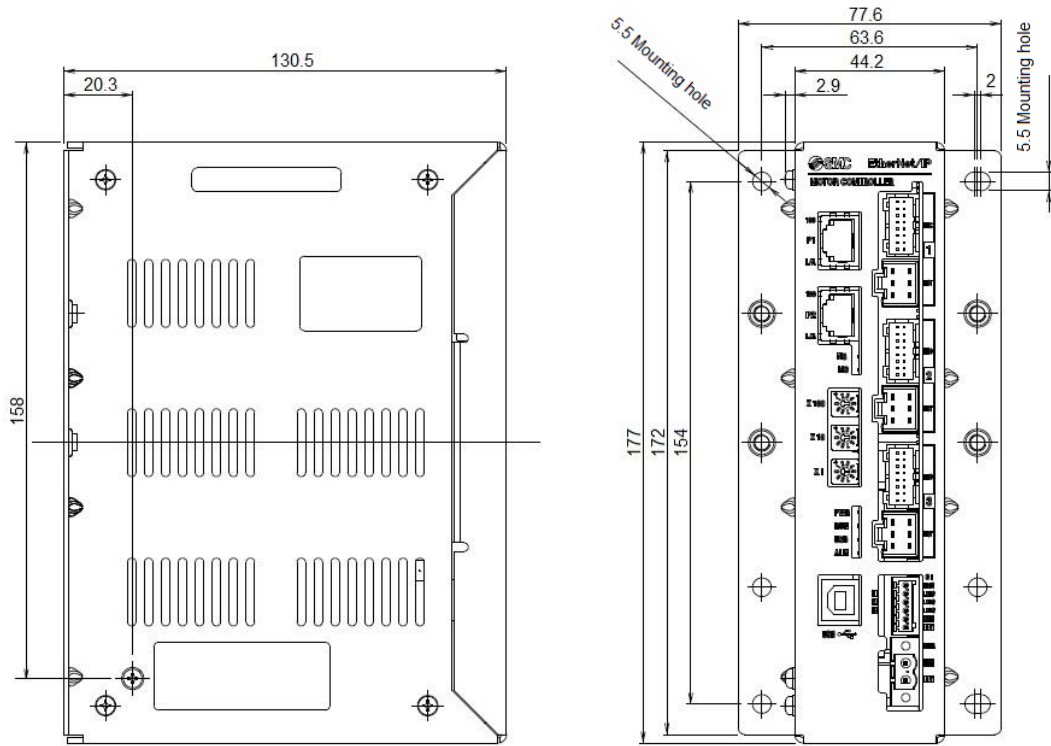
LED	Details		
NS	EtherNet/IP communication status	OFF	Control power supply is OFF or IP address is not set.
		Green LED is ON	EtherNet/IP connection is established.
		Green LED is flashing	EtherNet/IP connection is not established.
		Red LED is flashing	EtherNet/IP connection time out
		Red LED is ON	IP duplicated
MS	EtherNet/IP controller status	OFF	Control power supply is OFF
		Green LED is ON	Operating normally
		Green LED is flashing	Setting error
		Red LED is flashing	Recoverable error
		Red LED is ON	Unrecoverable error



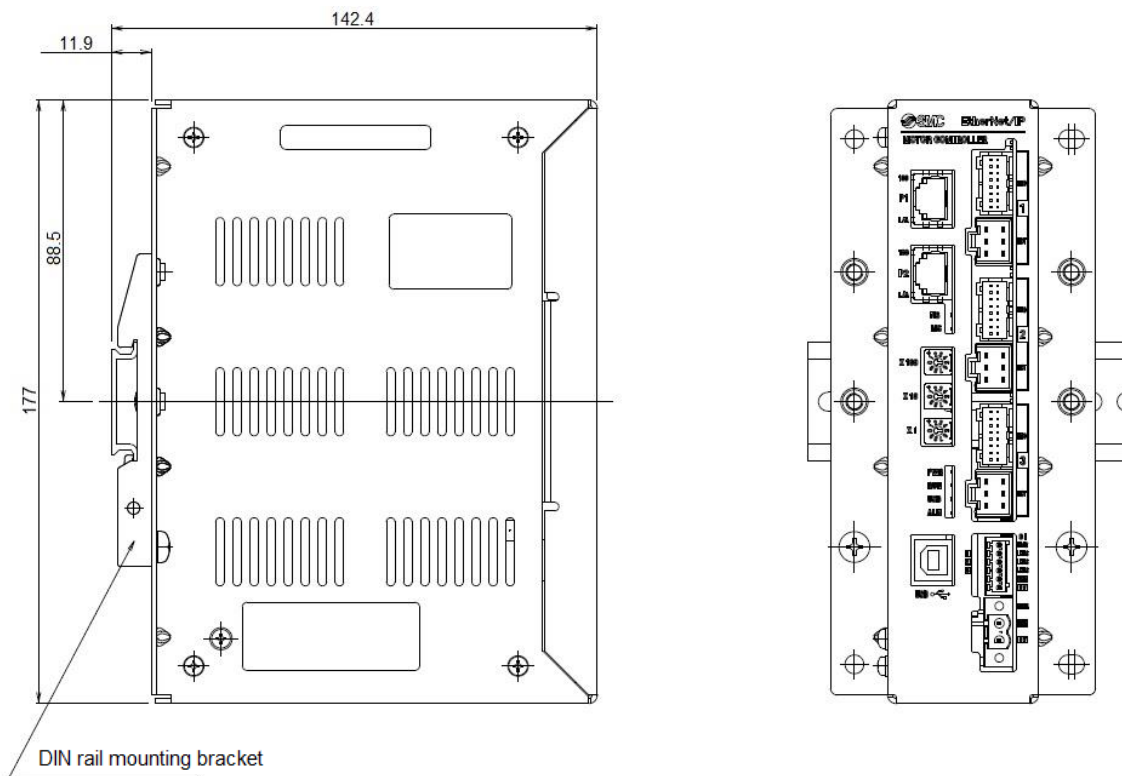
LED	Details		
P1-100	EtherNet/IP communication speed	OFF	10Mbps
		Orange LED is ON	100Mbps
P1-L/A	Data transmission status	OFF	Communication is not established. No data transmission.
		Green LED is ON	Communication established. No data transmission.
		Green LED is flashing	Communication is established. Data transmission in progress.
P2-100	EtherNet/IP communication speed	OFF	10Mbps
		Orange LED is ON	100Mbps
P2-L/A	Data transmission status	OFF	Communication is not established. No data transmission.
		Green LED is ON	Communication is established. No data transmission.
		Green LED is flashing	Communication is established. Data transmission in progress.

4.4 Dimensions

(1) Direct mounting



(2) DIN rail mounting



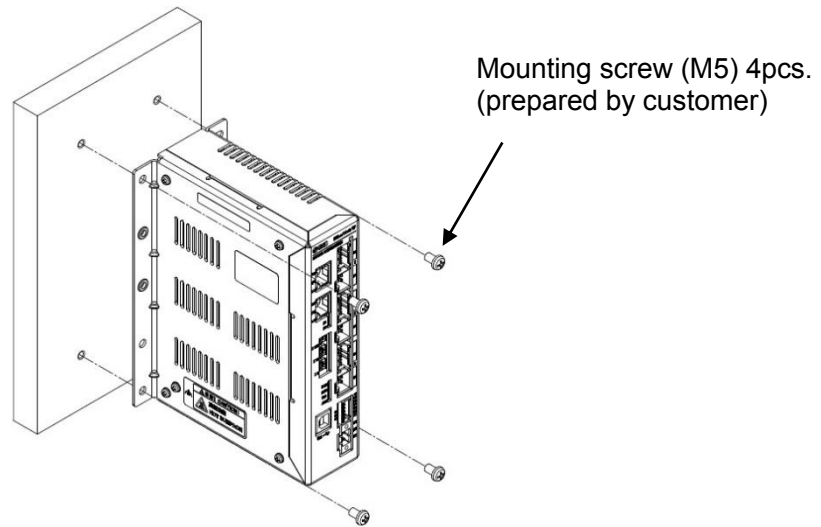
4.5 Mounting

(1) Mounting

There are two ways to mount the controller. (Direct mounting with screws and DIN rail mounting)

Controller mounting methods are shown below.

(a) Direct Mounting with four M5 screws



(b) DIN rail mounting

The figure on the right shows how to mount the DIN rail mounting brackets.

Secure the DIN rail mounting bracket using the mounting screws (M5 x 8) 2 places on one side (4 places on both sides). (Appropriate tightening torque: 3.0Nm)

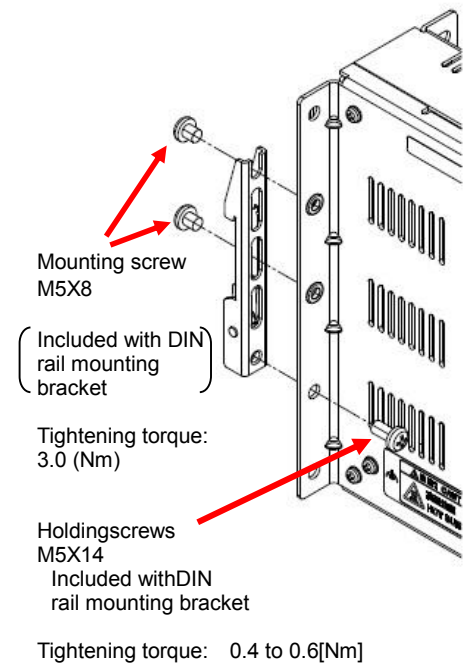
Secure the DIN rail mounting bracket using the holding screws (M5 x 14). 1 place on one side (2 places on both sides). Tighten for approximately 2 threads.

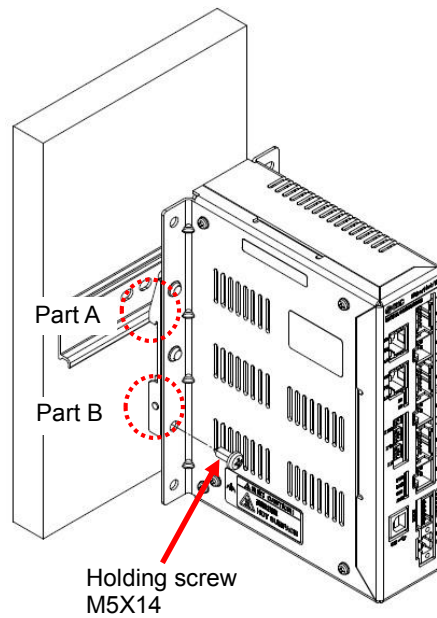
Do not tighten completely.

The figure below shows how to mount the controller to the DIN rail. Hook part A on to the DIN rail.

Press part B on to the DIN rail and tighten the holding screws (M5 x 14).

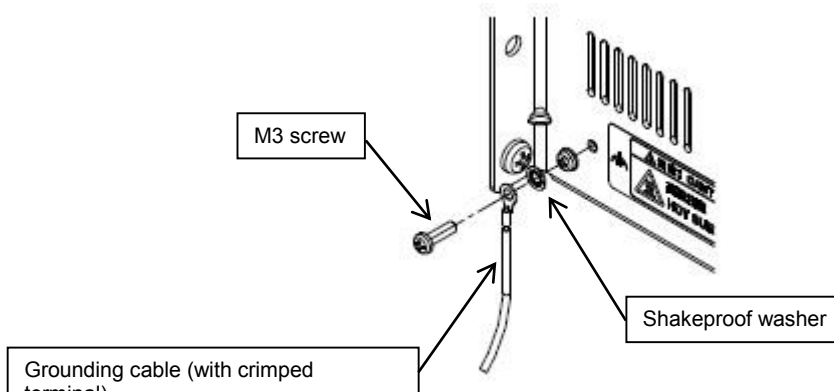
(Appropriate tightening torque: 0.4 to 0.6Nm)





(2) Grounding

Fit the grounding cable with crimped terminal between the M3 screw and shakeproof washer as shown below and tighten the screw.



⚠ Caution

The cable with crimped terminal and shakeproof washer must be prepared by the user.

The controller must be connected to Ground to reduce noise.

⚠ Caution

(1) A dedicated ground connection must be used. Grounding should be to a D-class ground (ground resistance of 100Ω or less).

(2) The cross sectional area of the grounding cable should be 2mm² minimum. The grounding point should be as near as possible to the controller, to keep the grounding cable as short as possible.

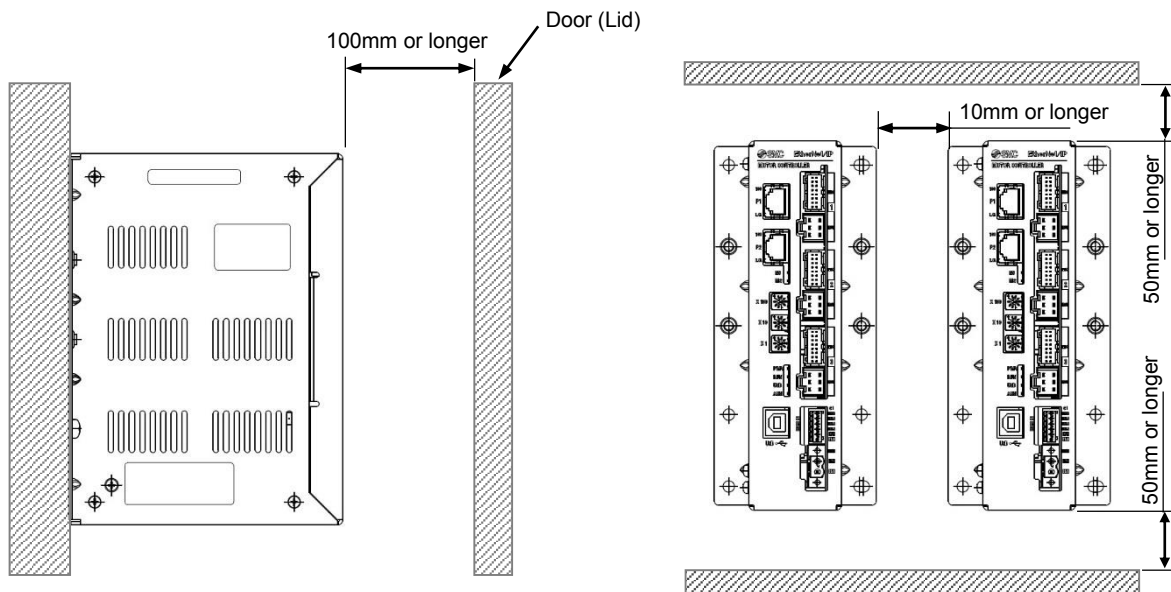
Dedicated grounding: Good

Shared grounding: Not acceptable

(3) Mounting location

Design the size of the control panel and the installation so that the temperature surrounding the controller is 40°C or less. Mount the controller vertically with 50 mm or more space at the top and bottom of the controller as shown below.

Establish the space more than 100mm between the front of the controller and a door (lid) so that the connectors are possible to connect and disconnect. Leave enough space between the controllers so that the operating temperature of the controllers remains within the specification range. Allow sufficient space for mounting. Avoid mounting the controller near a vibration source, such as a large electromagnetic contactor or no-fuse breaker on the same panel.



⚠ Caution

If the mounting surface for the controller is not flat or is uneven, excessive stress could be applied to the case, which could cause failure. Mount on a flat surface.

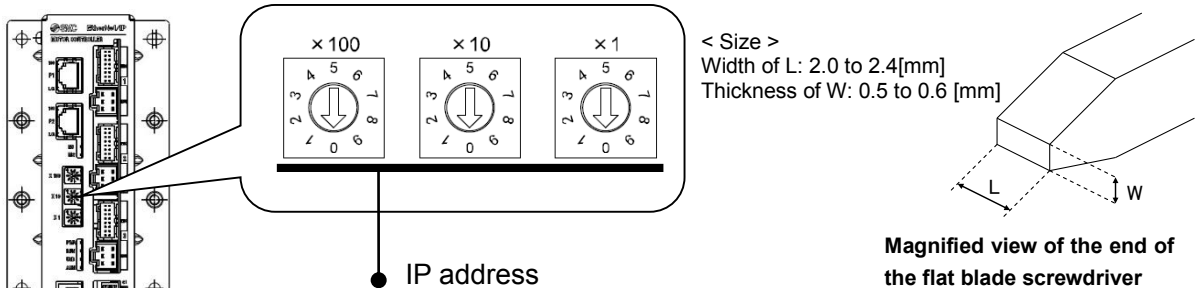
5. Initial Setting Method

Initial setting of the controller and PLC is necessary for the communication with EtherNet/IP.

5.1 Controller setting (IP address setting)

IP address setting is necessary to distinguish the controller on the EtherNet/IP network. IP address is set by the rotary switches of the controller. Turn OFF the power supply while setting the switch.

Use a flat blade watchmaker's screwdriver of the size shown below when setting the rotary switches.



Setup			IP address
x100	x10	x1	
0	0	0	Remote Control mode <small>Note 1)</small>
0	0	1	192.168.1.1 (Factory default value)
0	0	2	192.168.1.2
:	:	:	:
2	5	4	192.168.1.254
2	5	5	DHCP mode <small>Note 2)</small>
2	5	6	Unused
:	:	:	
9	9	9	

Note 1) The mode to respond to the commands below of BOOTP/DHCP Server provided by Rockwell Automation.

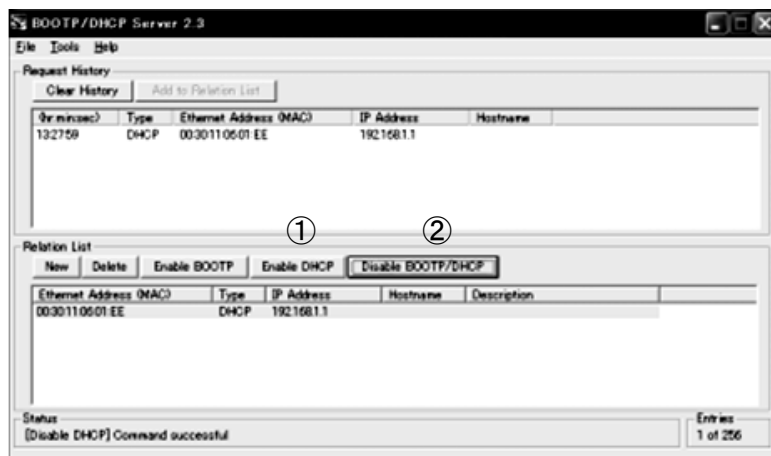
Enable DHCP (labeled 1 below)

Information including IP address can be obtained from BOOTP/DHCP Server. If the power is supplied again in this state, the controller tries to obtain the information including IP address again.

Disable BOOTP/DHCP (labeled 2 below)

Information including IP address is not obtained from BOOTP/DHCP Server. Previous setting can be held if power is supplied under this condition.

Note 2) Obtain IP address from DHCP Server. Obtained IP address is lost when power supply is cut.



Caution

If the controller IP address is unknown, change to DHCP mode and re-assign the correct IP address. When the DHCP server has assigned the correct address, turn off the power supply and return the unit to Remote control mode.
Upon power-up, the JXC91 will now be available using the address that was set whilst in DHCP mode.

5.2 PLC setting (Configuration)

Setting (configuration) of the PLC is necessary to establish EtherNet/IP communication with the controller.

It is possible to use an EDS file for the configuration of the controller. It is possible to download the EDS file designated for this controller by the URL shown below.

It is possible to download by the URL shown below the icons designated for this controller.

For the setting using EDS file, please refer to the operation manual of the PLC.

URL : <http://www.smcworld.com>

Documents/Download → Instruction Manuals → Electric Actuators → JXC92 → Configuration

File → jxc92_v10.zip

The content of jxc92_v10.zip file are as follows:

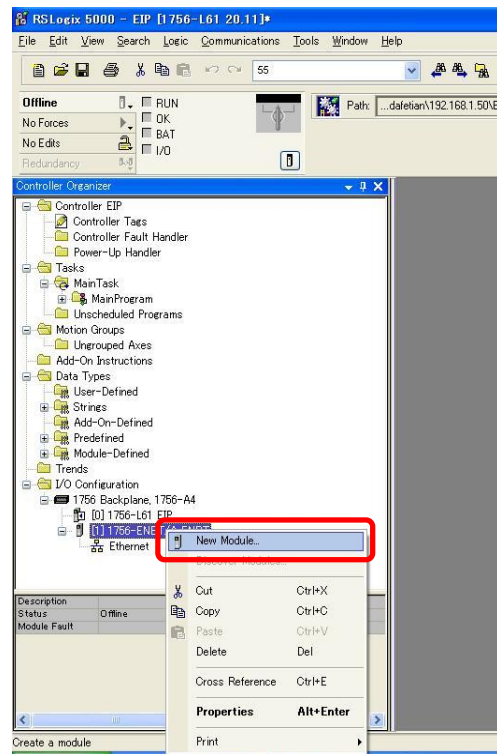
- EDS file jxc92_v10.eds
- Icons jxc92_1.ico

5.3 Setting of EtherNet/IP™ using RSLogix5000™

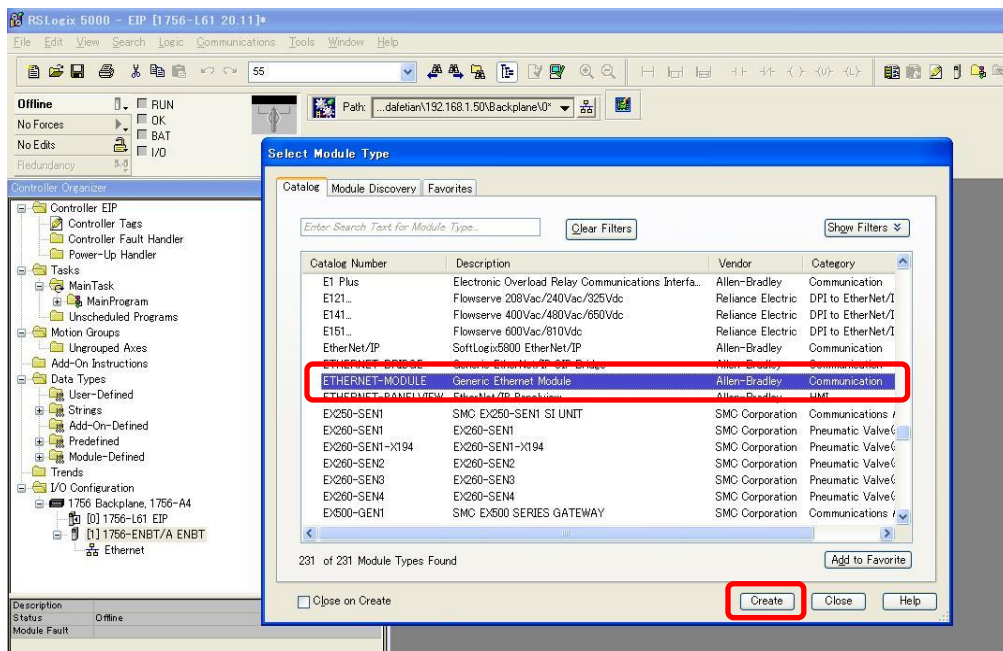
Method to connect the JXC92 to the Rockwell Automation EtherNet/IP™ module (master) is shown below. Refer to the Operation Manual of the RSLogix5000™ for the detailed operation.

*: This figure shows the display of Rockwell Automation software, RSLogix5000™.

- Select [EtherNet/IP™ module] in [I/O Configuration] folder, then select [New Module].



- The [Select Module] screen is displayed. Select [ETHERNET-MODULE Generic Ethernet Module], then select [Create].

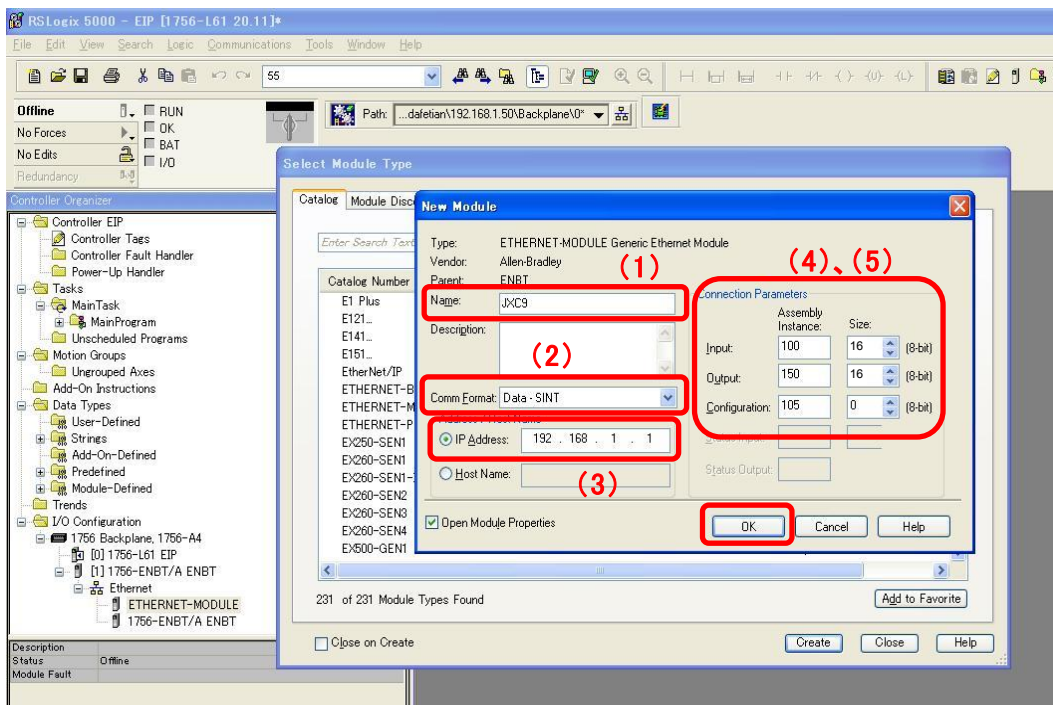


- [Module Properties] screen is displayed. Perform each setting.
 - (1) Name: Enter the required unit name.
 - (2) Comm Format: Select the data format of Connection Parameters.
 - (3) IP Address: Enter the IP address setting for the JXC92.
 - (4) Assembly Instance: Perform setting as shown below.

Item	Decimal
Comm Format	"Data-SINT"
Input	100
Output	150
Configuration	105

- (5) Size: Perform setting as shown below.

Item	Decimal
Comm Format	"Data-SINT"
Input	16 [bytes]
Output	16 [bytes]
Configuration	0 [bytes]



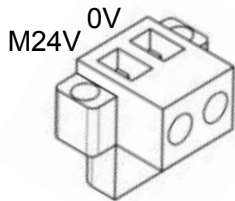
6. Power supply connector

6.1 Connector specifications

The power supply connector type included is shown below.

(1) Motor drive power connector : M PWR

Manufactured by Phoenix Contact (Part number MSTB2,5/2-STF-5,08)



Terminal	Function	Description
0V Note 1)	Motor drive power supply (-)	Power supply side (-) for motor drive.
M24V	Motor drive power supply (+)	Power supply side (+) for motor drive.

Note 1) Motor drive power supply (-) and control power supply (-) are connected in the controller.

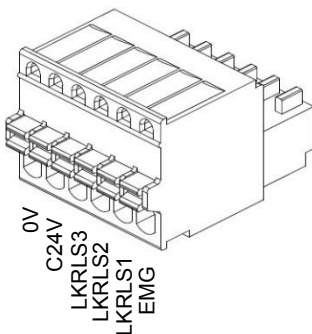
Prepare the electrical wiring according to the following specifications (to be prepared by the user).

Item	Specifications
Applicable wire size	Single, Stranded wire → AWG16(1.25mm ²) The rated temperature of the insulation coating should be 60°C or more.
Stripped wire length	

When the wire is inserted into the motor drive power connector, insert only the stripped part of the wire.

(2) Control power supply connector: CI

Manufactured by Phoenix Contact (Part number FK-MC0,5/6-ST-2,5)



Terminal	Function	Functional explanation
0V Note 1)	Control power supply (-)	Power supply side (-) for C24V, LKRLS and EMG.
C24V	Control power supply (+)	Power supply side (+) for control.
LKRLS3	Unlock(+)	Release the lock status (+) of Axis 3.
LKRLS2	Unlock(+)	Release the lock status (+) of Axis 2.
LKRLS1	Unlock(+)	Release the lock status (+) of Axis 1.
EMG	Stop(+)	Release the stop status (+) of All axes. (Normal operation by applying 24V.)

Note 1) Control power supply (-) and motor drive power supply (-) are connected in the controller.

Prepare the electrical wiring according to the following specifications (to be prepared by the user).

Item	Specifications
Applicable wire size	Single, Stranded wire → AWG20 (0.5mm ²) The rated temperature of the insulation coating should be 60°C or more.
Stripped wire length	

When the wire is inserted into the control power supply connector, insert only the stripped.

⚠ Caution

Do not connect multiple wires into one terminal.

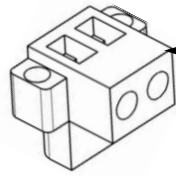
Contact failure or short circuit to adjacent wire may lead to malfunction or fire.

6.2 Wiring

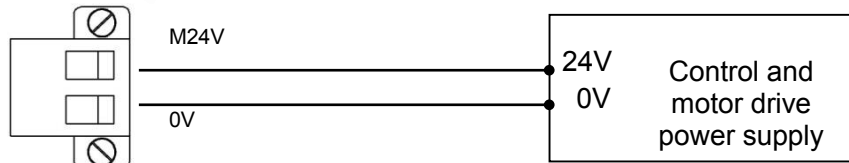
Connect the control and motor drive power supply while referring to (1) to (3) below, and then insert into the controller CI and M PWR.

(1) Wiring of the power supply connector

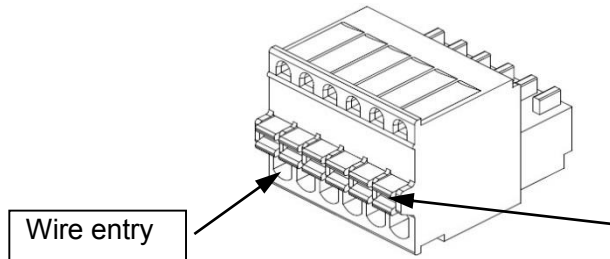
Connect the control and motor drive power supply 24V and 0V to the motor drive power connector M24V and 0V terminals.



M3 screw
Screw type terminal.
Loosen the screws using a flat blade screwdriver.
Insert the wires in the wire inlet.
Tightening torque: 0.5 to 0.6Nm

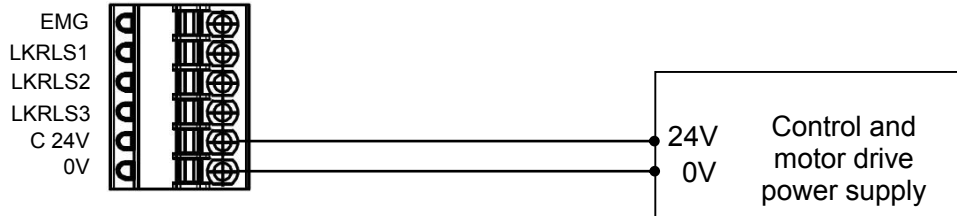


Connect the control and motor drive power supply 24V and 0V to the control power supply connector C24V and 0V terminals.



Open/close lever
Press the open/ close lever with a flat blade screwdriver and insert the wire into the wire entry.
- Dedicated flat blade screwdriver (recommended)
Phoenix Contact (Part No: SZS0.4×2.0)

Control power supply connector



! Caution

Do not use a power supply with “inrush current protection” for the control and motor drive power supply. The power supply capacity should be greater than the “Momentary maximum power consumption” of the actuator specifications.

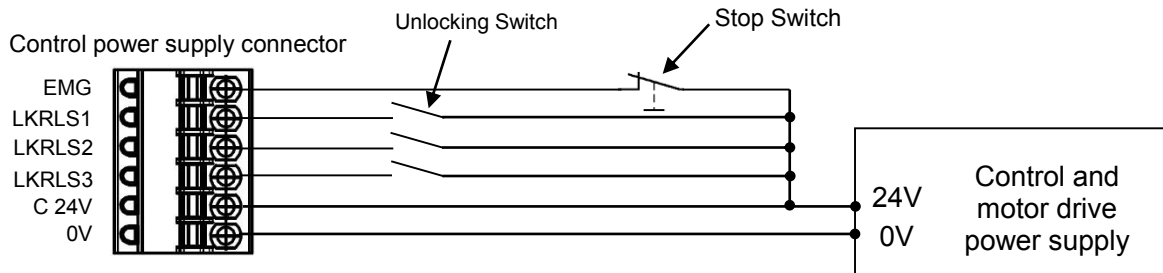
(2) Wiring of the stop switch

A Stop switch must be installed by the user to stop the actuator in abnormal situations.

Refer to **6.3 Wiring of shutdown circuit (P.45)** for wiring.

(3) Wiring of the lock release

Install an unlocking switch for adjustment or recovery during an emergency of the locking actuator. One side of the lock release switch must be connected to the 24V side of the control and motor drive power supply and the other is connected to the LKRLSx terminals of the control power supply connector. When the switch is closed, the controller/motor will be forcibly unlocked.



Caution

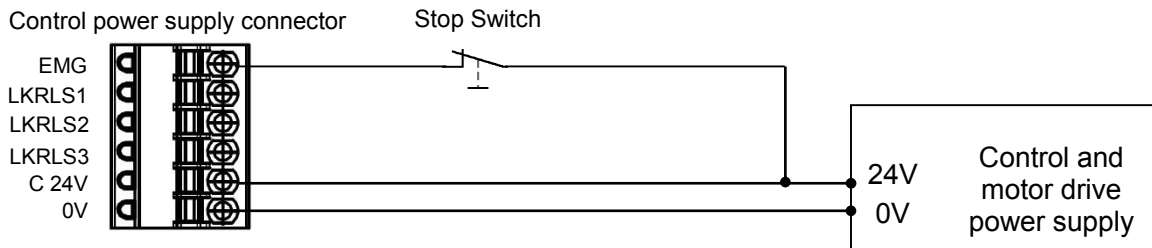
- (1) It is unnecessary to connect LK RLS terminal when the actuator does not have locking mechanism.
- (2) The LK RLS terminal is only used for adjustment and emergency return. It must not be energized during normal operation.
- (3) The lock release switch must be prepared by the user separately.

6.3 Wiring of shutdown circuit

The actuator stops its operation when the external shutdown switch is activated.

(1) Stop (Stop switch)

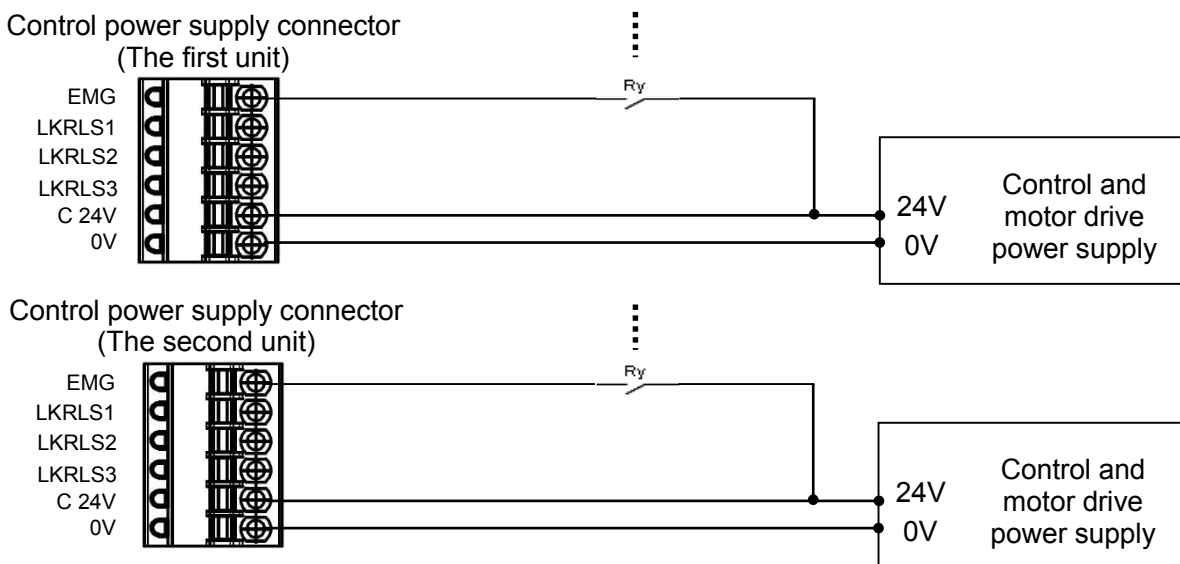
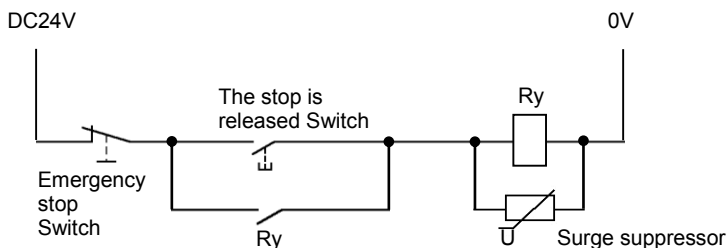
To stop the controller, connect the stop switch (B contact) between the control and motor drive power supply and the EMG terminal of the control power supply connector.



(2) Stop (Stop relay contact)

If there is a separate shutdown circuit for the whole installation or there are multiple controllers with different power supplies, connect a relay (B contact) between the control and motor drive power supply and the EMG terminal of the control power supply connector.

(Circuit example: The Figure below shows the stop status.)



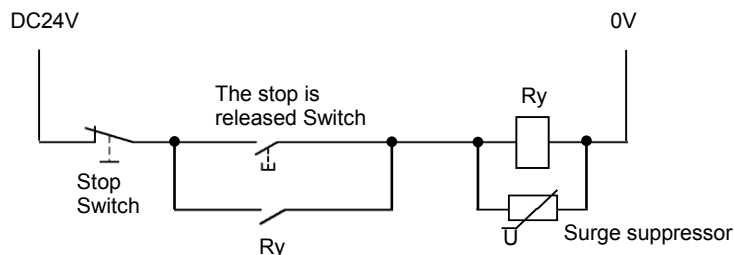
⚠ Caution

When the EMG input is turned off (0V) during operation, the corresponding actuator will stop with maximum deceleration and the servo will be turned off there after.

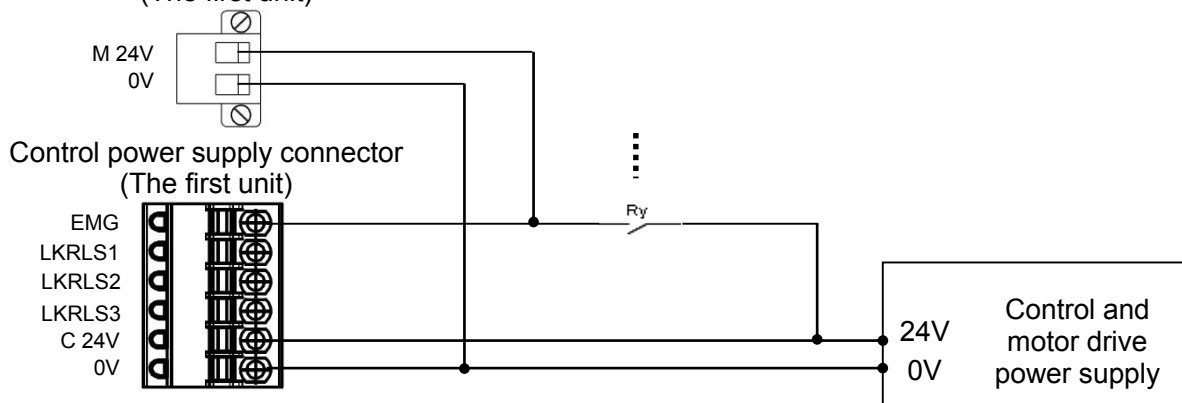
(3) Motor power shutdown (relay contact)

If it is necessary to have a circuit to shutdown the motor drive power externally, relay contacts should be placed between the control and motor drive power supply and the M24V of the motor drive power supply connector and the EMG terminal of the control power supply connector.

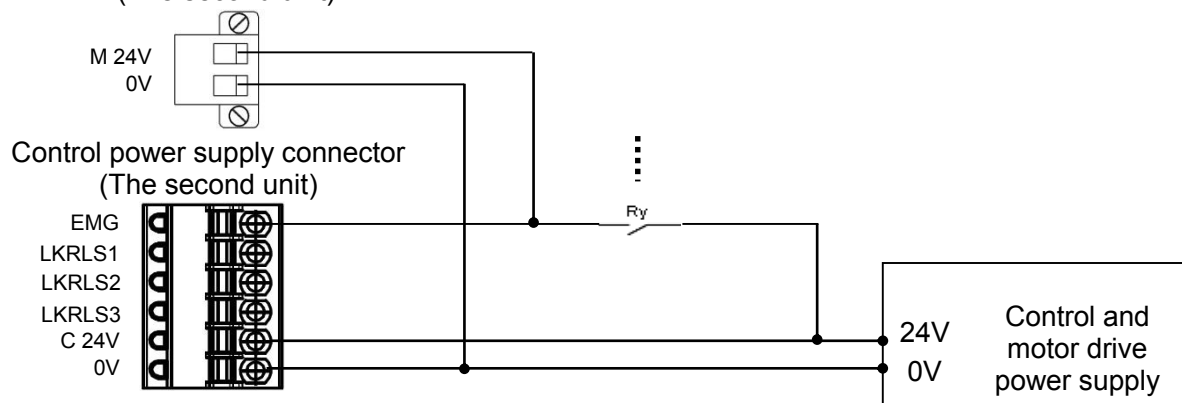
(Circuit example: The Figure below shows the stop status.)



Motor drive power supply connector
(The first unit)



Motor drive power supply connector
(The second unit)

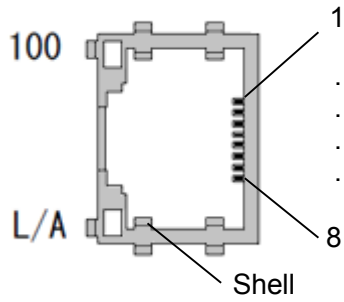


⚠ Wiring

- (1) If it is necessary to have a circuit to shutdown the motor drive power supply, relay contacts should be placed between the control and motor drive power supply and the M24V terminal of the motor drive power supply connector and the EMG terminal of the control power supply connector. The actuator may make unexpected movement.
- (2) Do not perform a return to origin operation (SETUP signal is ON) when the motor drive power supply (M24V) is disconnected.
The controller cannot recognize the correct origin point if a return to origin instruction is made with the motor drive power supply (M24V) disconnected.
- (3) Do not energize the LKRLSx terminal while the motor drive power supply (M24V) is disconnected.

7. EtherNet/IP communication connector

EtherNet/IP communication connector (P1 and P2) specifications are shown below.



Terminal	Function	Functional explanation
1	TX+	Sending (+)
2	TX-	Sending (-)
3	RX+	Receiving (+)
4	-	-
5	-	-
6	RX-	Receiving (-)
7	-	-
8	-	-

8. Memory Map

8.1 Memory allocation

Table below shows the allocation of memory.

(1) PLC input port signals (from the controller to PLC)

Byte	Bit							
	7	6	5	4	3	2	1	0
0	Reserve	AREA3	AREA2	AREA1	Reserve	BUSY3	BUSY2	BUSY1
1	Reserve	*ALARM3	*ALARM2	*ALARM1	Reserve	INP3	INP2	INP1
2	OUT7	OUT6	OUT5	OUT4	OUT3	OUT2	OUT1	OUT0
3	*ALARM	*ESTOP	SVRE	INP	SETON	AREA (OUT10)	BUSY (OUT9)	OUT8
4 to 15	Reserve							

(2) PLC output port signals (from the PLC to controller)

Byte	Bit							
	7	6	5	4	3	2	1	0
0	Reserve							
1	Reserve							
2	IN7	IN6	IN5	IN4	IN3	IN2	IN1	IN0
3	SVON	RESET	DRIVE	HOLD	SETUP	IN10	IN9	IN8
4 to 15	Reserve							

8.2 Signals

(1) PLC input port signals (from the controller to PLC)

Signal name	Description
BUSY1	Busy signal for Axis X. After the start of operation of the actuator, the signal is ON until the completion time (theoretical value) passed, and then OFF when the operation is stopped afterwards.
BUSY2	
BUSY3	
AREA1	Area signal for Axis 1
AREA2	Area signal for Axis 2
AREA3	Area signal for Axis 3
INP1	Positioning complete signal for Axis 1
INP2	Positioning complete signal for Axis 2
INP3	Positioning complete signal for Axis 3
*ALARM1	Alarm signal for Axis 1 ^{Note1)}
*ALARM2	Alarm signal for Axis 2 ^{Note1)}
*ALARM3	Alarm signal for Axis 3 ^{Note1)}

Note 1) Negative logic signal.

Signal name	Description						
OUT0	Output the number of ongoing step data.						
OUT1	When the operation is started and the DRIVE signal is turned ON, a Bit No. corresponding to the number of the active step data will be output from these terminals.						
OUT2	These signals will be updated with the rising or the falling edge of the DRIVE signal.						
OUT3	The signal can be set to be updated with the rising or with the falling edge of the DRIVE signal using "Type of step number output" in the Profile parameters. Refer to 9.1 Profile parameter (P.52) for details.						
OUT4							
OUT5	⚠ Caution						
OUT6	(1) When RESET signal is turned ON, these terminals are turned OFF.						
OUT7	(2) During an alarm or error, the signal outputs the abnormality group.						
OUT8	(3) When "1" is selected for the "Type of step number output" in the Profile parameters (update with the rising edge of the DRIVE signal), all of the OUT signals will be OFF while the DRIVE signal is ON.						
BUSY (OUT9)	Signal of during operation processing. Stays ON during one or more actuators pass the expected operation completion time (theoretical value). (The signal is ON when at least one of BUSY1 to BUSY3 is ON.) When the operation is interrupted during the positioning portion of a pushing operation, the signal stays ON until the operation is canceled. The Bit No is output during step data in extended mode. ^{Note 1)}						
AREA (OUT10)	The Area signal turns on when all actuators are within the area range. (Turns ON when all the signals of AREA1 to AREA3 are ON.) The Bit No is output during step data in extended mode. ^{Note 1)}						
SETON	Return to origin completion signal. SETON turns on when all axes have completed the return to origin operation.						
INP	Positioning complete signal INP turns on according to the conditions below. (Turns ON when all the signals of INP1 to INP3 are ON.) <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;">Movement mode</th> <th style="width: 80%;">Details</th> </tr> </thead> <tbody> <tr> <td>Positioning operation</td> <td>When the actuator enters within the range between the step data "position "+/- "In-position" after the positioning completion time (theoretical value), the INP signal will be turned ON.</td> </tr> <tr> <td>Pushing operation</td> <td>The INP signal turns ON when the pushing force exceeds the value set in the step data "Threshold".</td> </tr> </tbody> </table>	Movement mode	Details	Positioning operation	When the actuator enters within the range between the step data "position "+/- "In-position" after the positioning completion time (theoretical value), the INP signal will be turned ON.	Pushing operation	The INP signal turns ON when the pushing force exceeds the value set in the step data "Threshold".
Movement mode	Details						
Positioning operation	When the actuator enters within the range between the step data "position "+/- "In-position" after the positioning completion time (theoretical value), the INP signal will be turned ON.						
Pushing operation	The INP signal turns ON when the pushing force exceeds the value set in the step data "Threshold".						
SVRE	The Servo ON signal turns ON when the servo motor is ON. ^{Note 2)} The Servo ON signal turns OFF when the servo motor is OFF.						
*ESTOP	*ESTOP signal turns OFF when EMG signal stops. ^{Note 3)}						
*ALARM	*ALARM signal turns OFF when alarm or error are generated to one or more actuator. (The signal is OFF when at least one of *ALARM1 to *ALARM3 is OFF.) ^{Note 3)}						

Note 1) For BUSY and AREA signals, use BUSY1 to BUSY3 and AREA1 to AREA3.

Note 2) When power is supplied, it may take up to 20 seconds from turning ON the Servo (SVON signal) to SVRE signal turning ON, depending on the actuator position or conditions.

Note 3) Negative logic signal.

(2) PLC output port signals (from the PLC to controller)

Signal name	Description																		
IN0	Step data instruction Bit No.(Standard: When 512 is used) Step data instruction Bit No. (Input is instructed in the combination of IN0 to IN8.) Ex. (Assign step data No.3)→ “00000011” <table border="1" style="display: inline-table; vertical-align: middle;"> <thead> <tr> <th>IN8</th><th>IN7</th><th>IN6</th><th>IN5</th><th>IN4</th><th>IN3</th><th>IN2</th><th>IN1</th><th>IN0</th></tr> </thead> <tbody> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr> </tbody> </table> ← Binary code	IN8	IN7	IN6	IN5	IN4	IN3	IN2	IN1	IN0	0	0	0	0	0	0	0	1	1
IN8		IN7	IN6	IN5	IN4	IN3	IN2	IN1	IN0										
0		0	0	0	0	0	0	1	1										
IN1																			
IN2																			
IN3																			
IN4																			
IN5																			
IN6																			
IN7																			
IN8																			
IN9	Step data instruction extended mode bit No (Extended: 2048 is used)																		
IN10																			
SETUP	Command to Return to Origin Actuators return to origin based on the order of setting for return to origin. When SVRE signal is ON, the SETUP operation (return to origin) will be performed. During the SETUP operation, BUSY signal will be turned ON and after completion of the SETUP operation, SETON and INP signal will be turned ON.																		
HOLD	Pause of operation All axes in operation are paused. If HOLD signal is ON during operation, the speed decreases at maximum deceleration of the basic parameter until the actuator stops. The remaining stroke will be on hold as long as HOLD signal is ON and when HOLD signal is turned OFF, the actuator restarts to travel the remaining stroke. <div style="border: 1px solid black; padding: 5px; text-align: center;"> ⚠ Caution (1) Do not command SETUP or DRIVE signal while the HOLD signal is ON. The actuator may make an unintended movement. (2) While HOLD signal is ON, do not move the actuator position. Changing the residual travel distance may cause inconsistency with the target position. </div>																		
DRIVE	Operation instruction When the DRIVE signal is turned ON, the system scans "IN0" to "IN8" ("IN0" to "IN10" when the maximum number of steps is 2048) and starts the operation. The number of steps being operated is output to the OUT signal with the rising or the falling edge of the DRIVE signal.																		
RESET	Alarm reset and interruption of operation When RESET signal is turned ON during operation, the speed decreases at maximum deceleration of the basic parameter until the actuator stops. INP signal and OUT0 to OUT10 are OFF. (However, if the actuator is stopped within the in-position range, the INP signal will be turned ON). An Alarm is reset when the RESET signal is turned ON if an alarm has been generated. (Some alarms cannot be reset by the RESET command.) <div style="border: 1px solid black; padding: 5px; text-align: center;"> ⚠ Caution (1) Do not operate the SETUP or DRIVE signal while the RESET signal is ON. The actuator may make an unexpected movement. (2) If the RESET signal is ON during a return to origin operation, return to origin may not be available when the RESET signal is turned OFF. In this case, turn on the servo, and then turn on the SETUP signal. </div>																		
SVON	Servo ON instruction When SVON signal is ON, the servo motor for all axes will be turned ON. <small>Note1)</small> When SVON signal is OFF, the servo motor will be turned OFF.																		

Note 1) When power is supplied, it may take up to 20 seconds from Servo ON to SVRE signal ON, depending on the actuator position or conditions.

The table below shows the changes in the signal with respect to the state of the controller.

Status	Signal	BUSY	INP	SVRE	Lock	SETON	OUT0 to 8
Controller powered down [SVOFF] with no motion		OFF	OFF	OFF	Lock	OFF	OFF
Controller powered down [SVON] with no motion		OFF	OFF ^{Note1)}	ON	Unlock	OFF	OFF
During Return to origin		ON	OFF	ON	Unlock	OFF	OFF
The actuator is at the origin, on completion of [SETUP]		OFF	ON ^{Note1)}	ON	Unlock	ON	OFF
During movement by positioning/pushing operation		ON	OFF	ON	Unlock	ON	ON ^{Note2)}
The actuator is paused by [HOLD]		OFF	OFF ^{Note4)}	ON	Unlock	ON	ON ^{Note2)}
On completion of the positioning operation.		OFF	ON	ON	Unlock	ON	ON ^{Note2)}
Stopped due to pushing a workload in pushing operation.		OFF	ON	ON	Unlock	ON	ON ^{Note2)}
Stopped due to no detection of a workload in pushing operation.		OFF	OFF	ON	Unlock	ON	ON ^{Note2)}
Servo is OFF after return to origin.		OFF	OFF	OFF	Lock	ON	ON ^{Note3)}
EMG signal stop from the CI connector after the actuator is at the origin.		OFF	OFF	OFF	Lock	ON	OFF

Note1) The output turns on when the actuator is within the range defined in the basic parameter setup.

Note 2) The output is updated due to the transition of (OFF→ON or ON→OFF) of the DRIVE signal.

Note 3) Retain the previous state.

Note 4) The output turns on when the actuator is "In position" according to the step data.

9. Setting Data Entry

In order to move the actuator to a specific position, it is necessary to program the parameters and step data in the controller using a PC with the controller setting software installed. The data entered using the controller setting software will be stored in the memory of the controller.

9.1 Profile parameter

The "Profile parameter" is the setting data for the controller specifications.

Note: "XX" = Become effective just after storing in the controller

"X" = Become effective after restarting the controller

"-" = The parameter cannot be changed (fixed value)

Description	Input range	Explanation	Write
Max step data Num	512 or 2048	Set the maximum step data number	X
Activated axis	0 or 1	Validity of axes to be set in the controller. "Disabled" axis is ignored regardless of the connection with the actuator. 0: Disabled 1: Enabled	X
Pushing force	Fixed value	This is the fixed value for this controller. Do not change the setting. The maximum force for the pushing operation.	-
Trigger level	Fixed value	This is the fixed value for this controller. Do not change the setting.	-
Pushing speed	Fixed value	This is the fixed value for this controller. Do not change the setting. The maximum speed of movement for the pushing operation.	-
Moving force	Fixed value	This is the fixed value for this controller. Do not change the setting. The maximum force during the positioning operation.	-
In-position	Fixed value	This is the fixed value for this controller. Do not change the setting.	-
Axis name	Note1)	Define the axis name of the actuator.	X
ORIG order	1 to 4	The order from 1 to 4 is assigned to axes for the return to origin operation when all axes are to return to origin. The axes return to origin from 1 according to the order assigned. Multiple axes are possible to return to origin simultaneously by setting the same order number. [Setting example] (1) Axis 1: 1, Axis 2: 1, Axis 3: 2 The order of returning starts from Axis 1 and Axis 2, then Axis 3. (2) Axis 1: 1, Axis 2: 1, Axis 3: 1 Four axes return simultaneously. <div style="border: 1px solid black; padding: 5px; text-align: center;">⚠ Caution Simultaneous return to origin of 3 axes is not synchronous.</div>	X
Adapter file version	Fixed value	This is the fixed value for this controller. Do not change the setting.	-
Para protect	1 or 2	Set the range in which parameter and step data are possible to be changed. 1: Basic parameter + Return to origin parameter + Step data 2: Basic parameter + Return to origin parameter	X

Note1) The range varies depending on the actuator. Refer to the actuator operation manual for more details.

Description	Input range	Explanation	書込
Type of step number output	0 or 1	Setting for the update method of the step number output to the OUT signal. 0: Update with the rising edge of the DRIVE signal (initial value) 1: Update with the falling edge of the DRIVE signal <div style="border: 1px solid black; padding: 2px; text-align: center;">⚠ Caution</div> When "Update with the falling edge of the DRIVE signal" is chosen, all the OUT signals are OFF while the DRIVE signal is ON.	X
Drive Mode	0 or 10	Enable or disable of Hold control. When a new operation command (start up of DRIVE signal) is received during a step operation, Hold control executes the new received command after the completion of the current operation. 0: Disabled (initial value) 10: Enabled <div style="border: 1px solid black; padding: 2px; text-align: center;">⚠ Caution</div> (1) When "Disabled" is selected, a new operation command is ignored when it is given during operation. (2) When multiple new operation commands are given during operation when "Enabled" is selected, only the last command is executed.	X
Max driver board axes Num	Fixed value	This is the fixed value for this controller. Do not change the setting.	-
Position correction count	0 to 5	After the completion of a positioning operation, the deviation from the target position is calculated and the time for automatic correction is set. 0: No position correction (initial value) 1 to 5: Position correction (1 to 5 shows the times for correction) <div style="border: 1px solid black; padding: 2px; text-align: center;">⚠ Caution</div> Position will not be corrected during pushing operation.	X
Position correction wait time	1 to 1000	When position correction is selected, set the wait time for the next correction after the completion of the last correction. [Unit: :ms]	X
Linear interpolation limit	Fixed value	This is the fixed value for this controller. Do not change the setting.	-

Note1) The range varies depending on the actuator. Refer to the actuator operation manual for more details.

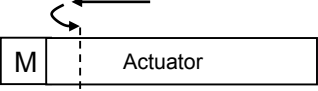
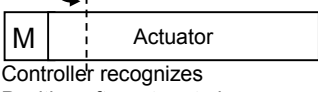
9.2 Basic parameter

The “Basic parameter” is the data to define the operating conditions of the controller, conditions of the actuator, etc.

Activation: “XX” = Become effective just after storing in the controller

“X” = Become effective after restarting the controller

“-” = The parameter cannot be changed (fixed value).

Description	Input range	Explanation	Write
Controller ID	Fixed value	This is a fixed value for this controller. Do not change the setting.	-
Stroke(+)	Note1)	Define the positive (+) limit of the position. [Unit: mm] Any value greater than the [stroke(+)] value cannot be entered in the “Position” field data of the step data setup.	XX
Stroke(-)	Note1)	Define the negative (-) limit of the position. [Unit: mm] Any value less than the [stroke(-)] value cannot be entered in the “Position” field data of the step data setup.	XX
Max speed	Note1)	Define the maximum limit of speed. [Unit: mm/s] Any value greater than the [Max speed] value cannot be entered in the “Speed” field data of the step data setup.	-
Max ACC/DEC	Note1)	Define the maximum limit of acceleration or deceleration. [Unit:mm/s ²] Any value greater than the [Max ACC/DEC] value cannot be entered in the step data. This setting also defines the deceleration when the actuator is stopped by the “HOLD” and “RESET” signals.	-
Def In position	Note1)	Set the INP output range to Origin Position after a Return to Origin. [Unit: mm]	XX
ORIG offset	Note1)	<p>Define the position of the actuator after the Return to origin operation. [Unit: mm]</p> <ul style="list-style-type: none"> ■ The ORIG offset is 0 (mm)  <p>Controller recognizes position after return to home position (0mm)</p> <ul style="list-style-type: none"> ■ The ORIG offset is 100 (mm).  <p>Controller recognizes Position after return to home position (100mm)</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p style="text-align: center;">⚠ Caution</p> <p>If the value for the “ORIG offset” is changed, the “Stroke (+)” and “Stroke (-)” in the basic parameters should be checked.</p> </div>	XX
Max force	Note1)	Set the maximum possible force for "Pushing Force" in the step data.	XX
Option 1	Fixed value	This is a fixed value for this controller. Do not change the setting.	-

Note1) The range varies depending on the actuator. Refer to the actuator operation manual for more details.

Description	Input range	Explanation	Write																																
Undefined No.11	1 to 4096	<p>Define the electronic Gear. This parameter can be automatically calculated using the "electronic gear ratio setting". Refer to section 3.6 (3) Electronic gear ratio setting (P.21) for details.</p> <ul style="list-style-type: none"> - Undefined No.11: "Electronic Gear (numerator)" - Undefined No.12: "Electronic Gear (denominator)" <p>This product controls the LE series motor (800 pulse per rotation). Please refer to Supplement 1. Actuator Specifications (P.112) for the travel distance of the motor per rotation.</p> <p>[Setting example]</p> <p>(1) "Electronic Gear (numerator): 1", "Electronic Gear (denominator): 1" → The motor makes one turn when 800 pulses are input.</p> <p>(2) "Electronic Gear (numerator): 1", "Electronic Gear (denominator): 2" → The motor makes one turn when 1600 pulses are input.</p> <p>(3) "Electronic Gear (numerator): 2", "Electronic Gear (denominator): 1" → The motor makes one turn when 400 pulses are input.</p> <p>"Electronic Gear (numerator): 1", "Electronic Gear (denominator): 1" is recommended. If other values are entered, vibration or noise of the actuator could result.</p> <p>When "0" is set, it is recognized as "1". When a value greater than "4097" is set, it is recognized as "4096".</p>	X																																
Undefined No.12	1 to 4096	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #cccccc;"> <th colspan="4" style="text-align: center;"> Caution</th> </tr> </thead> <tbody> <tr> <td colspan="4">When interpolation is performed for the actuators of different leads, the travel distance per pulse must be the same. Do not change the distance otherwise.</td> </tr> <tr> <td colspan="4">Set the electronic gear of other axes so that the travel distance per pulse is the same as the axis with the shortest lead.</td> </tr> <tr> <td colspan="4">[Setting example]</td> </tr> <tr> <th style="width: 15%;">Axis</th> <th style="width: 30%;">Actuator</th> <th style="width: 15%;">Lead</th> <th style="width: 40%;">Electronic gear ratio</th> </tr> <tr> <td>Axis 1</td> <td>LEY16C - 300</td> <td>2.5mm</td> <td>1 / 1</td> </tr> <tr> <td>Axis 2</td> <td>LEY16B-300</td> <td>5mm</td> <td>1 / 2</td> </tr> <tr> <td>Axis 3</td> <td>LEY16A-300</td> <td>10mm</td> <td>1 / 4</td> </tr> </tbody> </table> <p>Adjust the electronic gear ratio in order to travel the same distance per pulse of the axis with the shortest lead (Axis 1). Calculate the other axes' (Axis 2 and 3) electronic gear so that their "lead x electronic gear ratio" becomes 2.5 mm.</p> <p>Electronic Gear ratio = Lead of Axis 1/ Lead of Axis 2(or Axis 3) =2.5mm/5mm (or 2.5mm/10mm) =1/2 (or 1/4)</p>	Caution				When interpolation is performed for the actuators of different leads, the travel distance per pulse must be the same. Do not change the distance otherwise.				Set the electronic gear of other axes so that the travel distance per pulse is the same as the axis with the shortest lead.				[Setting example]				Axis	Actuator	Lead	Electronic gear ratio	Axis 1	LEY16C - 300	2.5mm	1 / 1	Axis 2	LEY16B-300	5mm	1 / 2	Axis 3	LEY16A-300	10mm	1 / 4	X
Caution																																			
When interpolation is performed for the actuators of different leads, the travel distance per pulse must be the same. Do not change the distance otherwise.																																			
Set the electronic gear of other axes so that the travel distance per pulse is the same as the axis with the shortest lead.																																			
[Setting example]																																			
Axis	Actuator	Lead	Electronic gear ratio																																
Axis 1	LEY16C - 300	2.5mm	1 / 1																																
Axis 2	LEY16B-300	5mm	1 / 2																																
Axis 3	LEY16A-300	10mm	1 / 4																																

Note1) The range varies depending on the actuator. Refer to the actuator operation manual for more details.

9.3 Return to origin parameter

The "Return to origin parameter" is the setting data for the return to origin operation.

Activation: "XX" = Become effective just after storing in the controller

"X" = Become effective after restarting the controller

"-" = The parameter cannot be changed (fixed value).

Description	Input range	Explanation	Write
ORIG direction	1 or 2	Set the direction of Return to origin operation. 1: CW 2: CCW	X
ORIG mode	1 to 3	Set the mode of the Return to origin operation. 1: ORIG Press 2: Return to origin with sensor-1 3: Return to origin with sensor-2	XX
ORIG limit	Note1)	The pushing force limit at which to set the origin.	XX
ORIG time	Fixed value	This is a fixed value for this controller. Do not change the setting.	-
ORIG speed	Note1)	The allowable speed to move to the origin.	XX
ORIG ACC/DEC	Note1)	The acceleration and deceleration when moving to the origin.	XX
Creep speed	Fixed value	This is a fixed value for this controller. Do not change the setting.	-
ORIG sensor	0 to 6	Setting of the ORIG sensor. 0: Disable the origin sensor (for this case, only a pushing operation to return to origin is enabled). 1: The origin sensor [2-wire] polarity is contact "a". 2: The origin sensor [2-wire] polarity is contact "b". 3: The origin sensor [3-wire, PNP] polarity is contact "a". 4: The origin sensor [3-wire, PNP] polarity is contact "b". 5: The origin sensor [3-wire, NPN] polarity is contact "a". 6: The origin sensor [3-wire, NPN] polarity is contact "a".	XX
ORIG SW DIR	Fixed value	This is a fixed value for this controller. Do not change the setting.	-
Undefined No.21	Fixed value	This is a fixed value for this controller. Do not change the setting.	-

Note1) The range varies depending on the actuator. Refer to the actuator operation manual for more details.

9.4 Step data

A "step data" is the data set to define the movement of the actuator. Total of 512 step data (12 attributes per step) are possible to handle by this controller. (When "2048" is set for "Max step data Num" in the Profile parameter, up to 2048 steps are possible to be use).

Each step data will become effective as soon as it is recorded into the controller.




(Example) Step data on the PC (controller setting software) screen

Step No.	Axis	Movement mode	Speed (mm/s)	Position (mm)	Acceleration (mm/s ²)	Deceleration (mm/s ²)	Pushing Selection (%)	Threshold (%)	Push Speed (mm/s)	Position Force (%)	Area 1 (mm)	Area 2 (mm)	In-position (mm)
0	Axis 1	Absolute	100	200.00	1000	1000	0	0	30	100	6.0	12.0	0.5
	Axis 2	Absolute	50	100.00	1000	1000	0	0	30	100	6.0	12.0	0.5
	Axis 3	Absolute	50	100.00	1000	1000	0	0	30	100	6.0	12.0	0.5
1	Axis 1	Relative	500	800.00	1000	1000	50	50	35	100	0	0	10.0
	Axis 2	Relative	500	900.00	1000	1000	50	50	35	100	0	0	10.0
	Axis 3	Relative	500	900.00	1000	1000	50	50	35	100	0	0	10.0

Step Data details

Description	Input range	Explanation																														
Step No.	0 to 2047	Number of step data. 3 lines (4 lines partially) of data per step.																														
Axis	Axis 1 to Axis 3	Set the axis to be used (ENC 1 MOT to ENC 3 MOT).																														
Movement mode	8 types (Refer to the table on the right)	Set the mode of movement to the target position.																														
		<table border="1"> <thead> <tr> <th>Movement mode</th> <th>Pushing operation</th> <th>Details</th> </tr> </thead> <tbody> <tr> <td>Blank</td> <td>×</td> <td>Data invalid (No process) Set blank for the axis which does not travel.</td> </tr> <tr> <td>Absolute</td> <td>○</td> <td>Move the actuator to the absolute position.</td> </tr> <tr> <td>Relative</td> <td>○</td> <td>Move the actuator to a relative position.</td> </tr> <tr> <td>LIN- A</td> <td>×</td> <td>Move the actuator (3 axes) to the absolute position with linear interpolation.</td> </tr> <tr> <td>LIN- I</td> <td>×</td> <td>Move the actuator (3 axes) to a relative position with linear interpolation.</td> </tr> <tr> <td>CIR- R</td> <td>×</td> <td>Set Axis 1 as X and Axis 2 as Y. Move the actuator clockwise with circular interpolation. Specify the target position and rotation centre from the current position by relative coordinates.</td> </tr> <tr> <td>CIR- L</td> <td>×</td> <td>Set Axis 1 as X and Axis 2 as Y. Move the actuator counterclockwise with circular interpolation. Specify the target position and rotation centre from the current position by relative coordinates.</td> </tr> <tr> <td>SYN- I</td> <td>×</td> <td>Move the actuator to the relative position with speed tuning control.</td> </tr> <tr> <td>CIR- 3</td> <td>×</td> <td>Set Axis 1 as X and Axis 2 as Y. Move the actuator with 3 points circular interpolation. Specify the target position and passing point from the current position by relative coordinates.</td> </tr> </tbody> </table>	Movement mode	Pushing operation	Details	Blank	×	Data invalid (No process) Set blank for the axis which does not travel.	Absolute	○	Move the actuator to the absolute position.	Relative	○	Move the actuator to a relative position.	LIN- A	×	Move the actuator (3 axes) to the absolute position with linear interpolation.	LIN- I	×	Move the actuator (3 axes) to a relative position with linear interpolation.	CIR- R	×	Set Axis 1 as X and Axis 2 as Y. Move the actuator clockwise with circular interpolation. Specify the target position and rotation centre from the current position by relative coordinates.	CIR- L	×	Set Axis 1 as X and Axis 2 as Y. Move the actuator counterclockwise with circular interpolation. Specify the target position and rotation centre from the current position by relative coordinates.	SYN- I	×	Move the actuator to the relative position with speed tuning control.	CIR- 3	×	Set Axis 1 as X and Axis 2 as Y. Move the actuator with 3 points circular interpolation. Specify the target position and passing point from the current position by relative coordinates.
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		CIR- R	×	Set Axis 1 as X and Axis 2 as Y. Move the actuator clockwise with circular interpolation. Specify the target position and rotation centre from the current position by relative coordinates.																												
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CIR- 3	×	Set Axis 1 as X and Axis 2 as Y. Move the actuator with 3 points circular interpolation. Specify the target position and passing point from the current position by relative coordinates.																														
Speed	From minimum value to "Max speed" of basic parameter ^{Note1)}	The speed to move to the target position. (Unit: mm/s) Refer to (1) to (5) on page 53 for the speed setting for movement mode.																														
Position	"Stroke (-)" to "Stroke (+)" in the basic parameters	Set the target position (Unit: mm) Refer to (1) to (5) on page 53 for position setting for movement mode.																														

Note1) The range varies depending on the actuator. Refer to the actuator operation manual for more details.

Description	Input range	Explanation									
Acceleration	1 to "Max ACC/DEC" in the basic parameters	Set the acceleration to reach to travel speed. (Unit:mm/s ²) Refer to (1) to (5) on page 53 for acceleration speed setting for movement mode.									
Deceleration	1 to "Max ACC/DEC" in the basic parameters	Set the deceleration from travel speed to stop. (Unit:mm/s ²) Refer to (1) to (5) on page 53 for deceleration speed setting for movement mode.									
Pushing Selection	Note1)	<p>The setting to define the pushing operation or the positioning operation. For the pushing operation, the value specifies the force as a percentage of the maximum force (Unit: %). * The maximum force depends on the actuator. Please refer to the manual and the rated force of the actuator.</p> <table border="1"> <thead> <tr> <th>Value</th> <th>Movement mode</th> <th>Details</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Positioning operation</td> <td>The actuator moves to the position specified in the "Position".</td> </tr> <tr> <td>1 to 100</td> <td>Pushing operation</td> <td>The actuator moves to the position specified in the "Position" and then, performs a pushing action with a force not higher than the set force.</td> </tr> </tbody> </table>	Value	Movement mode	Details	0	Positioning operation	The actuator moves to the position specified in the "Position".	1 to 100	Pushing operation	The actuator moves to the position specified in the "Position" and then, performs a pushing action with a force not higher than the set force.
Value	Movement mode	Details									
0	Positioning operation	The actuator moves to the position specified in the "Position".									
1 to 100	Pushing operation	The actuator moves to the position specified in the "Position" and then, performs a pushing action with a force not higher than the set force.									
Threshold	Note1)	<p>A condition where the INP signal during pushing operation is on. [Unit: %] When the actuator generates a force above this value, the INP signal will turn ON. This parameter is set to the value of the pushing force or lower. For the positioning operation, this value is ignored.</p>									
Push Speed	Note1)	<p>The moving speed for the pushing operation. [Unit:mm/s] If this Speed is too high, it may cause damage to the actuator or workpiece due to impacts. Therefore, enter a value within the range appropriate for the actuator. Please refer to the actuator manual for the appropriate range of the speed. For the positioning operation, this value is ignored.</p>									
Position Force	Note1)	<p>The setting to define the maximum torque during the positioning operation. [Unit: %] Enter a value within the range appropriate for the actuator. Refer to the actuator manual for the appropriate speed range</p> <table border="1"> <thead> <tr> <th colspan="2"> Caution</th> </tr> </thead> <tbody> <tr> <td colspan="2">When "SYN-I" is selected in the step data operation , the value of this parameter is fixed.</td> </tr> </tbody> </table>	 Caution		When "SYN-I" is selected in the step data operation , the value of this parameter is fixed.						
 Caution											
When "SYN-I" is selected in the step data operation , the value of this parameter is fixed.											
Area 1	"Step data "Area 2" from "Stroke (-)" in the basic parameters	<p>The setting to define the conditions where the AREA signal will be turned ON (Unit: mm) If the current position is within the range between the Area1 and Area2, the AREA signal will be turned ON. If Area1= Area2= 0, the AREA signal will be turned OFF.</p>									
Area 2	Step data "Area 1" to "Stroke(+)" in the basic parameters										
In-position	Note1)	<p>The In-position function is different for the pushing operation and the positioning operation.</p> <ul style="list-style-type: none"> ●Positioning operation: Positioning range (Unit: mm) ●Pushing operation: Pushing range (Unit: mm) <table border="1"> <thead> <tr> <th>Movement mode</th> <th>Details</th> </tr> </thead> <tbody> <tr> <td>Positioning operation</td> <td>This setting defines the In-position, where the INP signal will be turned ON. When the actuator moves to within a distance from the target position, the INP signal will be turned ON.</td> </tr> <tr> <td>Pushing operation</td> <td>This setting defines the distance pushed by the actuator during the pushing operation. When the actuator has exceeded this distance, the pushing operation will end. If this occurs, the INP signal will not be turned ON. The INP signal turns ON when the pushing force exceeds the value set in the step data "Threshold".</td> </tr> </tbody> </table>	Movement mode	Details	Positioning operation	This setting defines the In-position, where the INP signal will be turned ON. When the actuator moves to within a distance from the target position, the INP signal will be turned ON.	Pushing operation	This setting defines the distance pushed by the actuator during the pushing operation. When the actuator has exceeded this distance, the pushing operation will end. If this occurs, the INP signal will not be turned ON. The INP signal turns ON when the pushing force exceeds the value set in the step data "Threshold".			
Movement mode	Details										
Positioning operation	This setting defines the In-position, where the INP signal will be turned ON. When the actuator moves to within a distance from the target position, the INP signal will be turned ON.										
Pushing operation	This setting defines the distance pushed by the actuator during the pushing operation. When the actuator has exceeded this distance, the pushing operation will end. If this occurs, the INP signal will not be turned ON. The INP signal turns ON when the pushing force exceeds the value set in the step data "Threshold".										

Note1) The range varies depending on the actuator. Refer to the actuator operation manual for more details.

Different settings for each movement mode are shown below.

(1) ABS

Step No.	Axis	Movement mode	Speed (mm/s)	Position (mm)	Acceleration (mm/s ²)	Deceleration (mm/s ²)	Pushing Selection (%)	Threshold (%)	Push Speed (mm/s)	Position Force (%)	Area 1 (mm)	Area 2 (mm)	In-position (mm)
0	Axis 1	Absolute	100	200.00	1000	1000	0	0	35	100	6.0	12.0	0.5
	Axis 2	Absolute	50	100.00	1000	1000	0	0	35	100	6.0	12.0	0.5
	Axis 3	Absolute	100	100.00	1000	1000	50	50	35	100	0.0	0.0	5.0

Positioning: Target position (Absolute position)
Pushing: Position of pushing start (Absolute position)

0: Positioning operation
1 to 100: Pushing operation

Positioning: In-position
Pushing: Max.pushing distance

(2) INC

Step No.	Axis	Movement mode	Speed (mm/s)	Position (mm)	Acceleration (mm/s ²)	Deceleration (mm/s ²)	Pushing Selection (%)	Threshold (%)	Push Speed (mm/s)	Position Force (%)	Area 1 (mm)	Area 2 (mm)	In-position (mm)
0	Axis 1	Relative	100	200.00	1000	1000	0	0	35	100	6.0	12.0	0.5
	Axis 2	Relative	50	100.00	1000	1000	0	0	35	100	6.0	12.0	0.5
	Axis 3	Relative	100	100.00	1000	1000	50	50	35	100	0.0	0.0	5.0

Positioning: Target position (Relative position)
Pushing: Position of pushing start (Relative position)

0: Positioning operation
1 to 100: Pushing operation

Positioning: In-position
Pushing: Max.pushing distance

(3) LIN-A / LIN-I

Step No.	Axis	Movement mode	Speed (mm/s)	Position (mm)	Acceleration (mm/s ²)	Deceleration (mm/s ²)	Pushing Selection (%)	Threshold (%)	Push Speed (mm/s)	Position Force (%)	Area 1 (mm)	Area 2 (mm)	In-position (mm)
0	Axis 1	LIN-A	100	200.00	1000	1000	-	-	-	100	6.0	12.0	0.5
	Axis 2	LIN-A	-	100.00	-	-	-	-	-	100	6.0	12.0	0.5
	Axis 3	LIN-A	-	100.00	-	-	-	-	-	100	0.0	0.0	0.5

Composite speed

Composite acceleration and deceleration speed

Target position (Absolute position) ^{Note 1}

Note 1) For LIN-I, the specified target position is a relative position.

(4) CIR-R / CIR-L / CIR-3

Step No.	Axis	Movement mode	Speed (mm/s)	Position (mm)	Acceleration (mm/s ²)	Deceleration (mm/s ²)	Pushing Selection (%)	Threshold (%)	Push Speed (mm/s)	Position Force (%)	Area 1 (mm)	Area 2 (mm)	In-position (mm)
0	Axis 1	CIR-R	100	100.00	1000	1000	-	-	-	100	0.0	0.0	0.5
	Axis 2	CIR-R	-	100.00	-	-	-	-	-	100	0.0	0.0	0.5
	Axis 3	_Note 1)	-	50.00	-	-	-	-	-	100	0.0	0.0	0.5
	Axis 4	_Note 1)	-	50.00	-	-	-	-	-	100	0.0	0.0	0.5

Composite speed

Composite acceleration and deceleration speed

Target position
(Relative position)

Rotation centre or transit point
(Relative position)

Note 1) For CIR-R, CIR-L and CIR-3, Axis 1 and Axis 2 are the subjects for interpolation. Do not perform the setting for 3rd. axis.

Note 2) Set the rotation centre to CIR-R or CIR-L and set the transit point to CIR-3.

(5) SYN-I

Step No.	Axis	Movement mode	Speed (mm/s)	Position (mm)	Acceleration (mm/s ²)	Deceleration (mm/s ²)	Pushing Selection (%)	Threshold (%)	Push Speed (mm/s)	Position Force (%)	Area 1 (mm)	Area 2 (mm)	In-position (mm)
0	Axis 1	SYN-I	100	100.00	1000	1000	-	-	-	100	0.0	0.0	0.5
	Axis 2	SYN-I	-	-	-	-	-	-	-	100	0.0	0.0	0.5
	Axis 3	SYN-I	-	-	-	-	-	-	-	100	0.0	0.0	0.5

Target position of all speed tuning control axes
(Relative position)

⚠ Caution

- (1) It is not possible to set more than one movement method in one step data.
- (2) Simultaneous operation of the step data such as "To give different command to the 3rd. axis during circular interpolation" or "Each axis operates differently at the same time" is not possible.

10. Description of operation

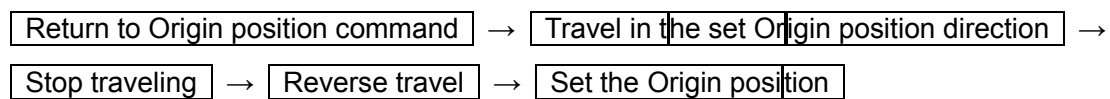
10.1 Return to origin

After entering the step data, it is necessary to perform a return to origin operation before positioning the actuator. (To ensure the position of origin)

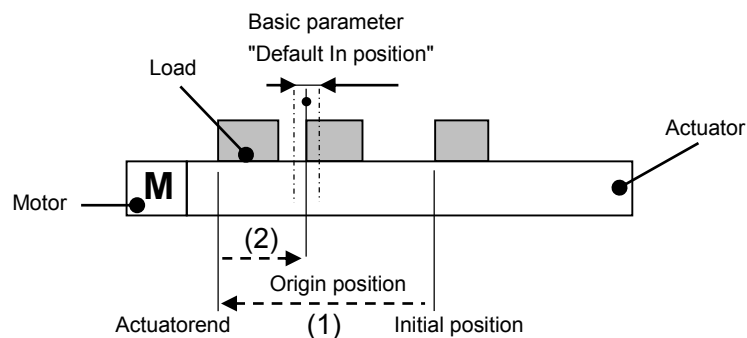
The actuator moves in the Return to origin direction (*dependent on the actuator) from the initial position at the moment of power-on. Refer to (1) in the figure below.

When the actuator reaches its travel limit and pauses for a short time, the controller recognizes the position as the actuator travel limit. Then, the actuator travels from that position in the opposite direction to the origin at low speed for a specified travel distance (this varies depending on the actuator type). Refer to (2) in the figure below.

The position after the travel is specified as the origin.



Return to Origin position reference example



⚠ Caution

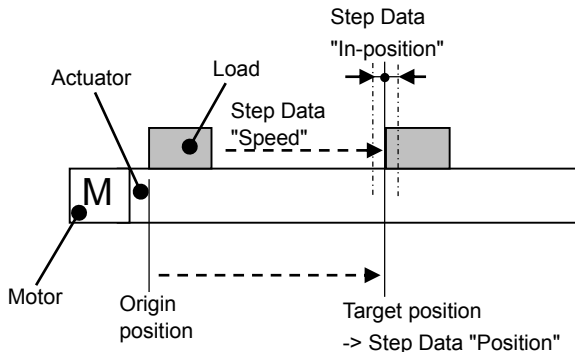
The Return to origin direction is dependent upon the actuator.

10.2 Positioning Operation

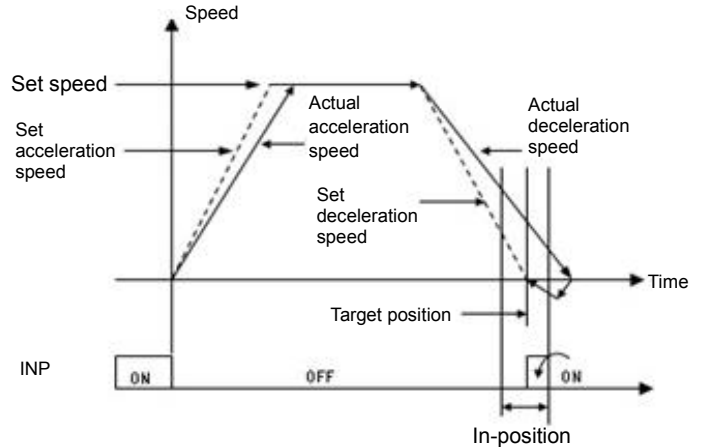
When the "Pushing selection" step data is "0" for a Positioning operation.

The actuator moves to the target position specified by the step data "Position."

● Positioning Operation (Example)



● Positioning operation [Speed/Position] (Example)



Example) After a Return to origin, move the 3 axes from the origin to a 50mm position at 100mm/s (Step No.1). Next, move the actuator to a 100mm position by moving it 5 times consecutively, 10mm at a time, at a speed of 50 mm/s (Step No. 2).

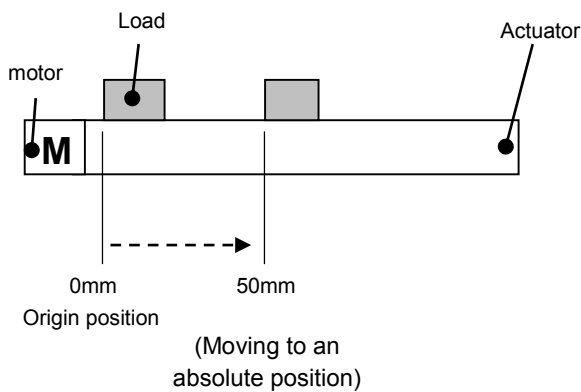
Step Data Setting Example

Step No.	Axis	Movement mode	Speed (mm/s)	Position (mm)	Acceleration (mm/s ²)	Deceleration (mm/s ²)	Pushing Selection (%)	Threshold (%)	Push Speed (mm/s)	Position Force (%)	Area 1 (mm)	Area 2 (mm)	In-position (mm)
1	Axis 1	Absolute	100	50.00	1000	1000	0	0	35	100	0.0	0.0	0.5
	Axis 2	Absolute	100	50.00	1000	1000	0	0	35	100	0.0	0.0	0.5
	Axis 3	Absolute	100	50.00	1000	1000	0	0	35	100	0.0	0.0	0.5
2	Axis 1	Relative	50	10.00	1000	1000	0	0	35	100	0.0	0.0	0.5
	Axis 2	Relative	50	10.00	1000	1000	0	0	35	100	0.0	0.0	0.5
	Axis 3	Relative	50	10.00	1000	1000	0	0	35	100	0.0	0.0	0.5

Movement (ex.) Same operation for 3 axes

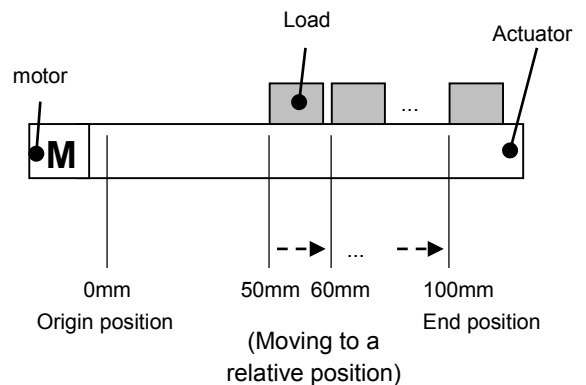
Step No.1 positioning operation (Example)

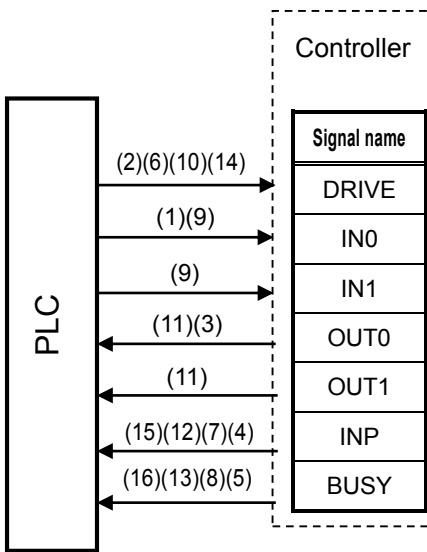
Axis 1 to Axis 3



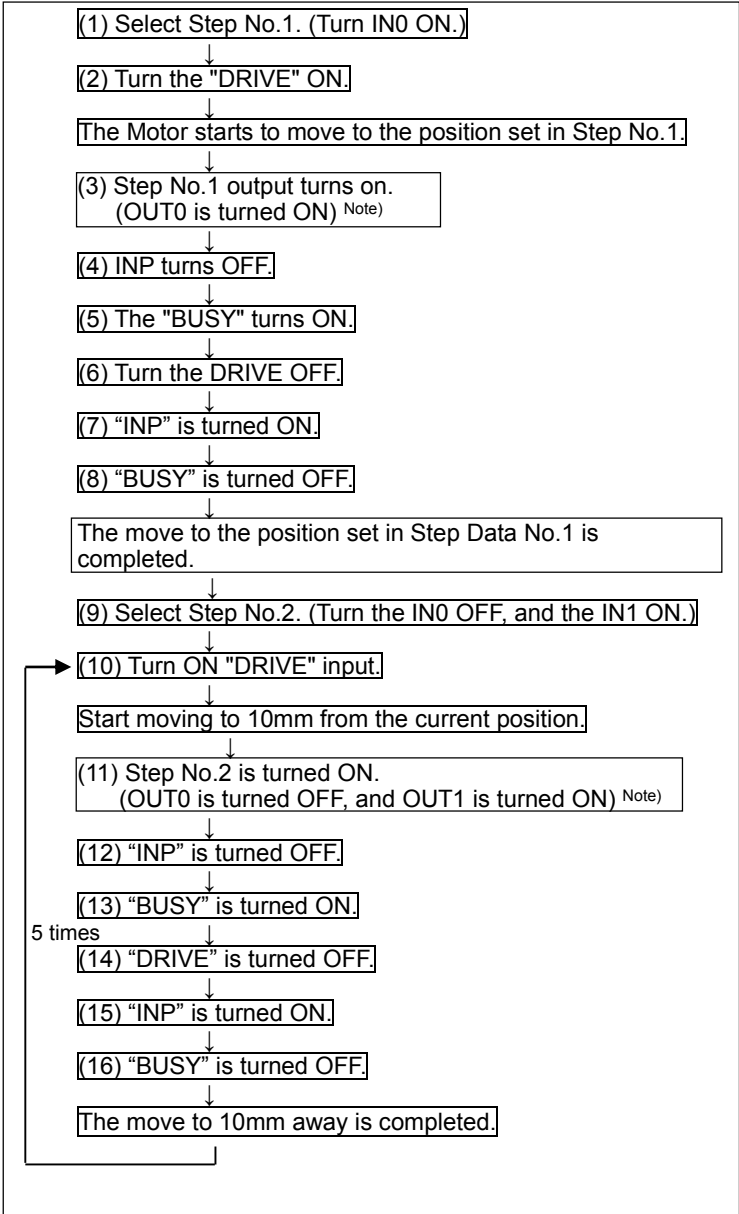
Step No.2 positioning operation (Example)

Axis 1 to Axis 3





Flow chart (Reference)



Note) Profile parameter "Step number output type" is "0" (update with the rising edge of the DRIVE signal)
 When the "Step number output type" is set to "1", the timing of ON/OFF of the signal for OUT0 and OUT1 is different.

10.3 Pushing Operation

The pushing operation is active when the value of "Pushing Selection" in the Step data is set to "1" or more.

First a positioning operation is performed to the "Target" position and according to the "Speed" set in the step data. The pushing operation starts from this "Position" for a maximum distance defined by the "Positioning width".

The actuator pushes the load with a force no more than the maximum force set for the "Pushing Selection" in the step data.

(1) Successful pushing operation

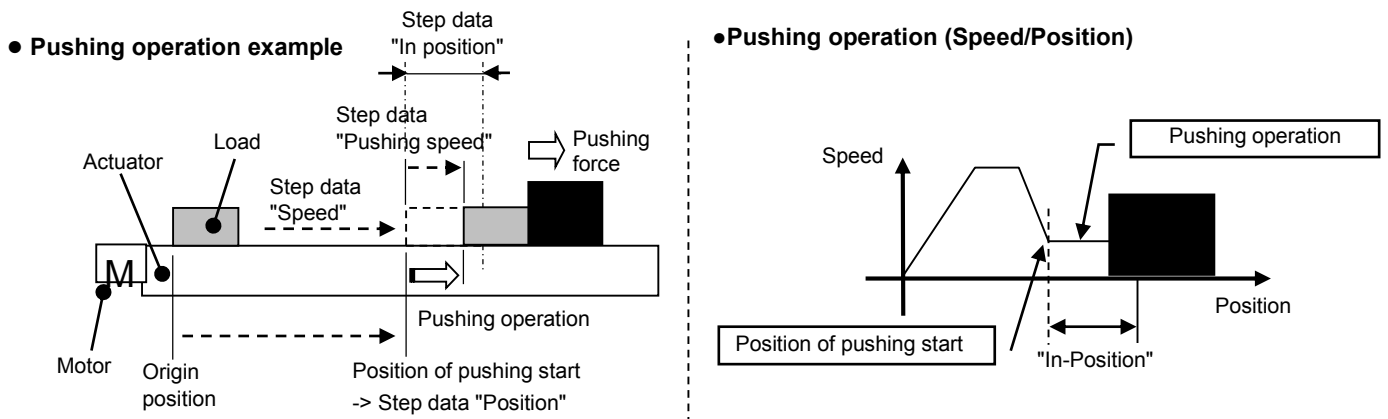
During the pushing operation, if the pushing force is greater than the value specified by the "Threshold" set in the step data for a specified time, the INP signal will be turned ON. The pushing force applied is set in the step data and continues even after the INP signal is ON.

It is regarded that the pushing operation is completed successfully when two of the conditions below are satisfied.

Condition 1) The BUSY signal is OFF

and

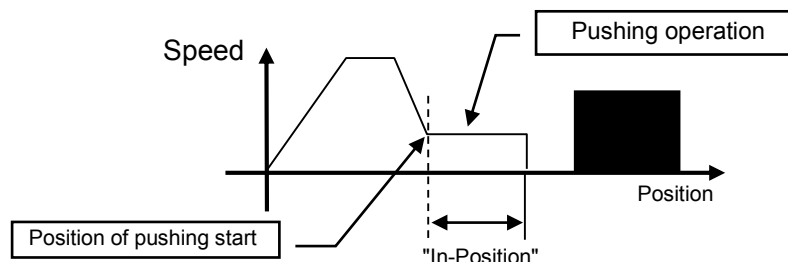
Condition 2) The INP signal is ON



(2) Unsuccessful Pushing operation (not pushing).

If the pushing operation is not completed even after the actuator moves over the range specified in the step data from the target position (the starting point of the pushing operation), the operation will be completed.

In such a case, the INP and BUSY signals will be turned OFF.



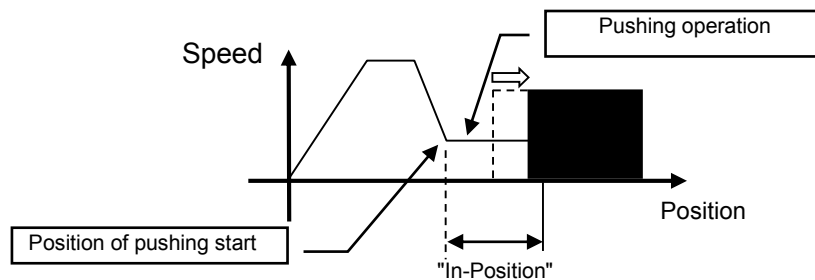
(3) Movement of the workpiece after completing the pushing operation

(a) The workpiece moves in the pushing direction.

After completing the pushing operation, if the reaction force from the workpiece becomes smaller, the actuator may move with a force smaller than that specified in the "Threshold" of the step data.

In this case, the INP signal will be turned OFF and the actuator moves within the positioning range according to the balance of the force.

During the pushing operation, if the pushing force is higher than the value defined by the "Threshold" in the step data for a specified time, the INP signal will be turned ON again.

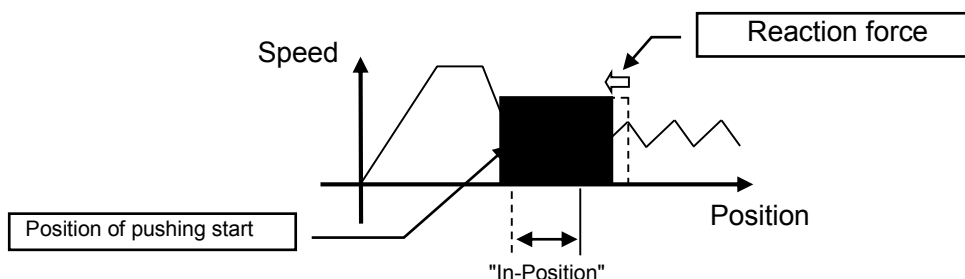


(b) Movement of the workpiece in the direction opposite to the pushing direction

(The actuator is pushed back since the reaction force from the workpiece is too large.)

After completing the pushing operation, if the reaction force from the workpiece becomes larger, the actuator may be pushed back. In this case, while the INP signal is ON, the actuator will be pushed back to the point where the reaction force and the actuator pushing force are balanced (pushed back toward the position of pushing start).

The alarm "Reacting force is outside limit when pushing. Position is unstable. (096)" is generated when the actuator is pushed back further than the pushing start position.



Example) After a Return to origin, move 3 axes from the origin to 100mm position at 100mm/s.

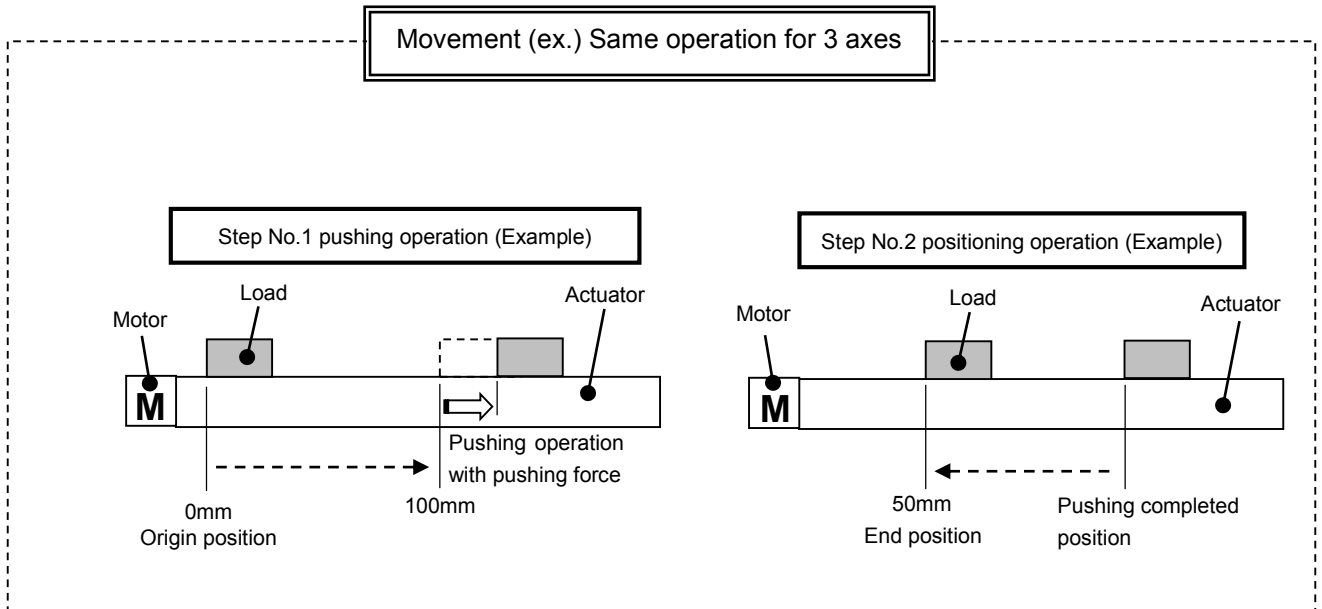
From the 100mm position, pushing for a maximum of 5mm at a speed of 10mm/s (step data:

Pushing speed) at 50% or lower of thrust (step data: Threshold) (Step No.1).

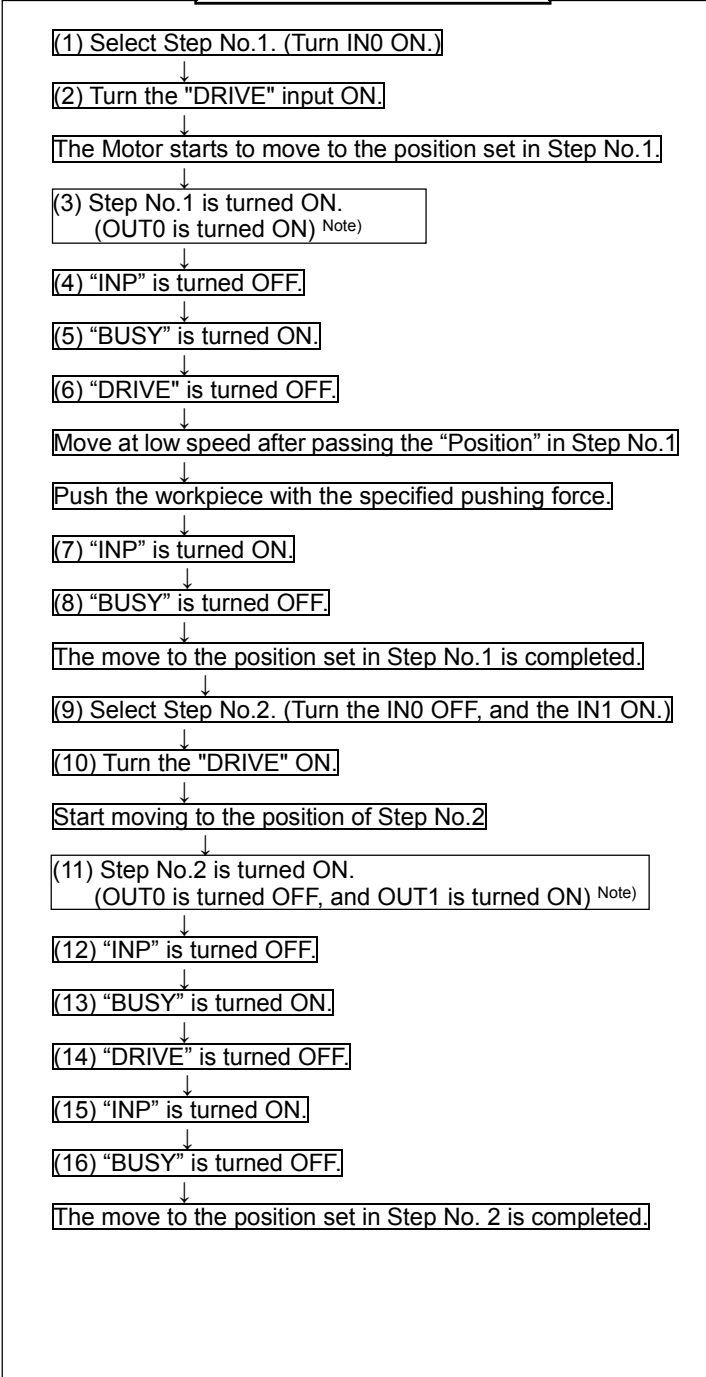
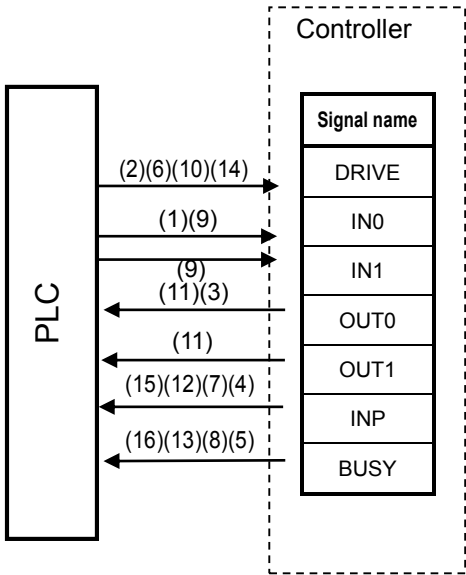
Then, move 3 axes to 50 mm position from the origin at 50mm/s from the Pushing completed position (position where "INP" is ON) (Step No.2).

Step Data Setting Examples

Step No.	Axis	Movement mode	Speed (mm/s)	Position (mm)	Acceleration (mm/s ²)	Deceleration (mm/s ²)	Pushing Selection (%)	Threshold (%)	Push Speed (mm/s)	Position Force (%)	Area 1 (mm)	Area 2 (mm)	In-position (mm)
1	Axis 1	Absolute	100	100.00	1000	1000	50	40	10	100	0.0	0.0	5.0
	Axis 2	Absolute	100	100.00	1000	1000	50	40	10	100	0.0	0.0	5.0
	Axis 3	Absolute	100	100.00	1000	1000	50	40	10	100	0.0	0.0	5.0
2	Axis 1	Absolute	50	50.00	1000	1000	0	0	10	100	0.0	0.0	0.5
	Axis 2	Absolute	50	50.00	1000	1000	0	0	10	100	0.0	0.0	0.5
	Axis 3	Absolute	50	50.00	1000	1000	0	0	10	100	0.0	0.0	0.5



Flow chart (Reference)

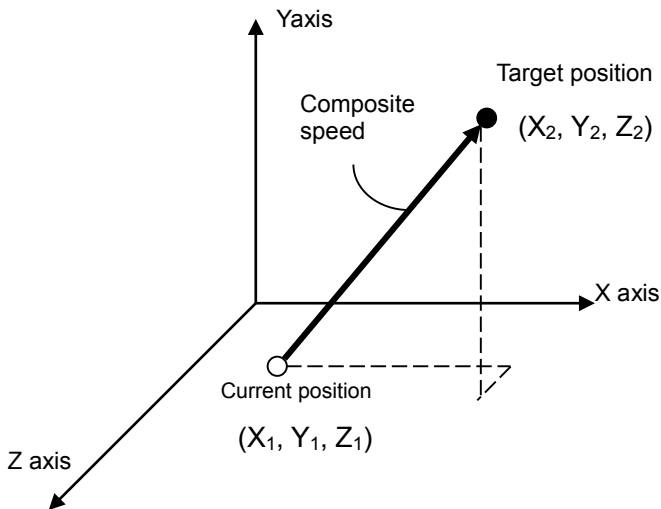


Note) Profile parameter "Step number output type" is "0" (update with the rising edge of the DRIVE signal)
 When the "step number output type" is set to "1", the timing of ON/OFF of the signal for OUT0 and OUT1 is different.

10.4 Linear interpolation

Move axes in a straight line from the current position at a defined "Speed" (composite speed for the speed of each axis) to a "Position" set in the step data. The speed of each axis is calculated using the formulae below.

There are two types of linear interpolation. LIN-A to specify absolute coordinates and LIN-I to specify relative coordinates. A pushing operation cannot be used.



[Axis speed calculation]

$$\text{Composite travel distance} = \sqrt{(X_2 - X_1)^2 + (Y_2 - Y_1)^2 + (Z_2 - Z_1)^2}$$

$$\text{X axis speed} = ((X_2 - X_1) / \text{Composite travel distance}) \times \text{Composite speed}$$

$$\text{Y axis speed} = ((Y_2 - Y_1) / \text{Composite travel distance}) \times \text{Composite speed}$$

$$\text{Z axis speed} = ((Z_2 - Z_1) / \text{Composite travel distance}) \times \text{Composite speed}$$

⚠ Caution

Setting of the electronic Gear is necessary when actuators with different lead are used. If the electronic Gear is not set, the step data operation may not be performed. Refer to section **3.6 Parameters and Step data (P.16)** for the calculation of the electronic Gear.

⚠ Caution

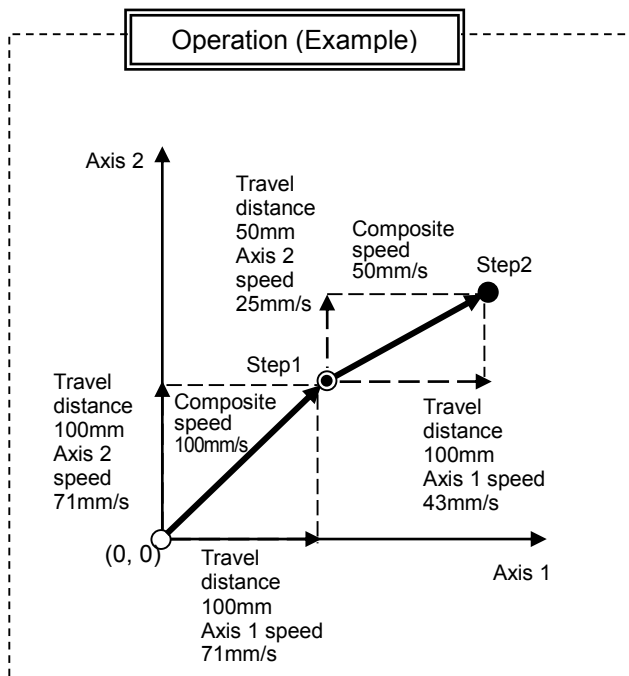
The speed of the actuator may be outside of the specification range depending on the step data. Calculate the speed of each axis before operation, and confirm that the speed is within the minimum and maximum speed specified.

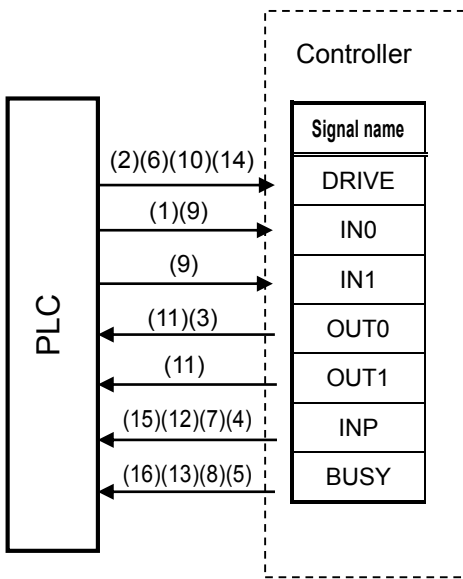
Example) After a Return to origin, move from the origin position at 100mm/s of composite speed to a point at 100mm on Axis 1 and 100mm on Axis 2 (Step No.1).

Then, move from the current position at 50mm/s of composite speed to a point at 100mm on Axis 1 and 50mm on Axis 2 (Step No.2).

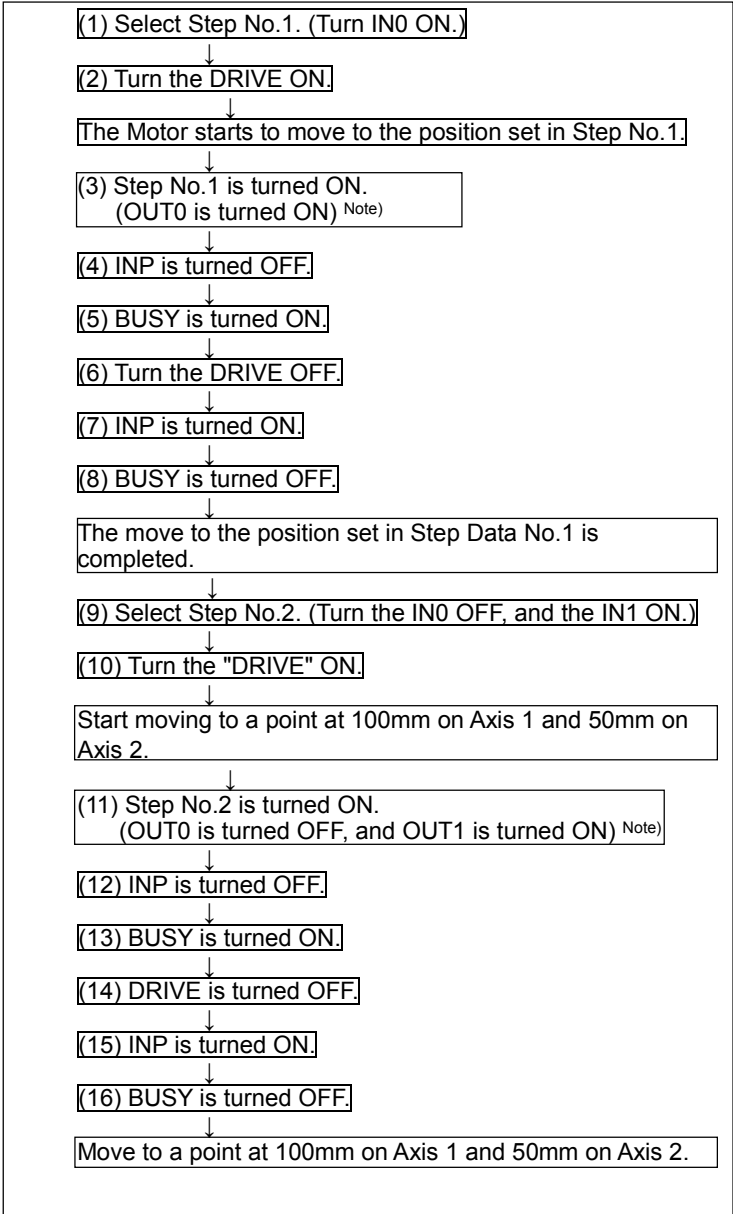
Step Data Setting Examples

Step No.	Axis	Movement mode	Speed (mm/s)	Position (mm)	Acceleration (mm/s ²)	Deceleration (mm/s ²)	Pushing Selection (%)	Threshold (%)	Push Speed (mm/s)	Position Force (%)	Area 1 (mm)	Area 2 (mm)	In-position (mm)
1	Axis 1	LIN-A	100	100.00	1000	1000	-	-	-	100	0.0	0.0	0.5
	Axis 2	LIN-A	-	100.00	-	-	-	-	-	100	0.0	0.0	0.5
	Axis 3	-	-	0.00	-	-	-	-	-	100	0.0	0.0	0.5
2	Axis 1	LIN-I	50	100.00	1000	1000	-	-	-	100	0.0	0.0	0.5
	Axis 2	LIN-I	-	50.00	-	-	-	-	-	100	0.0	0.0	0.5
	Axis 3	-	-	0.00	-	-	-	-	-	100	0.0	0.0	0.5





Flow chart (Reference)



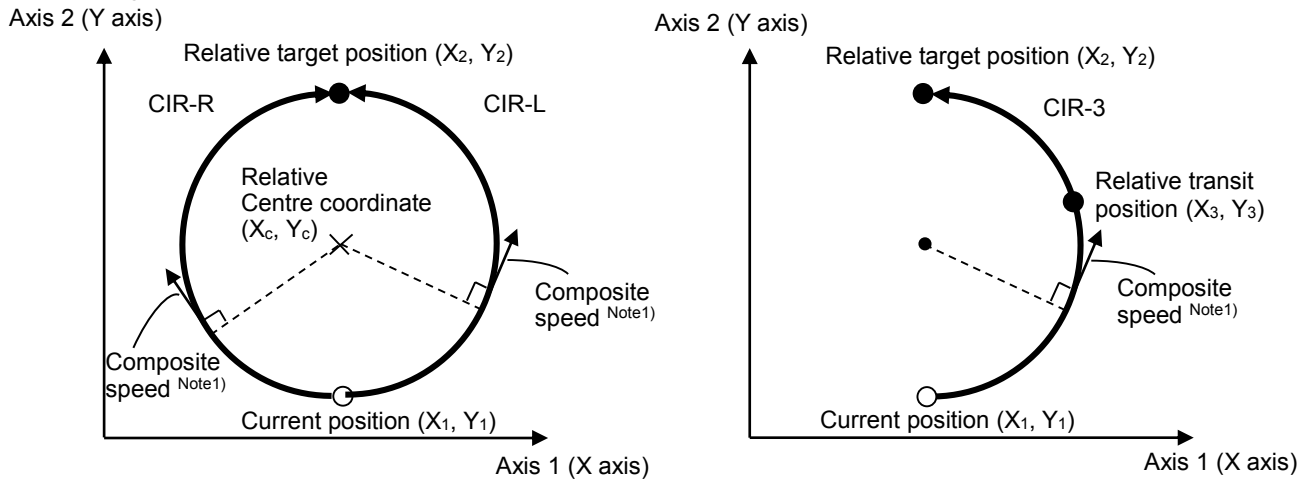
Note) Profile parameter "Step number output type" is "0" (update with the rising edge of the DRIVE signal)
 When the "step number output type" is set to "1", the timing of ON/OFF of the signal for OUT0 and OUT1 is different.

10.5 Circular interpolation

For circular interpolation, the 1st axis is assigned to X axis and the 2nd. axis is to Y axis. By assigning the relative target position, relative centre coordinate or transit point, circular movement is made clockwise (CIR-R) or counterclockwise (CIR-L), or an arc is made by 3 points (CIR-3). Each axis travels at a speed lower than the composite speed.

When using circular interpolation the composite speed should be lower than the maximum speed of the actuator and lower than the maximum speed of the other actuators used.

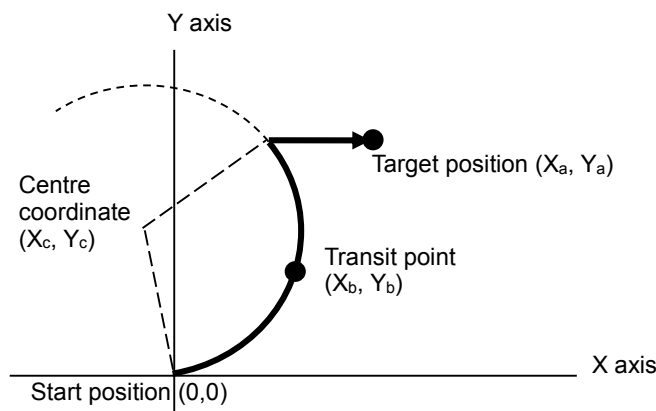
The pushing operation and circular interpolation of Axis 3 cannot be used.



Note1) Composite speed varies from approx. 0.7 to 1.1 times more than the composition speed of setting depending on the arc angle.

Set the target position on the arc composed by the current position and the centre coordinates or the arc composed by the current position and a transit point.

When the target position does not exist on the arc composed by the current position and central coordinate or transit point, the target position is reached by linear movement of X or Y axes at the end of the operation (Figure below).



Caution

Setting of the electronic Gear is necessary when actuators with different a lead are used.

If the electronic gear is not set, the step data operation may not be produced.

Refer to section **3.6 Parameters and Step data (P.16)** for the calculation of the electronic Gear.

Caution

When mode CIR-R/L/3 is repeatedly used, there will be an accumulated error in the achieved position due to the motor resolution.

Use the instruction ABS once or twice every 2 or 3 times of using mode CIR-R/L/3 for correcting the positional accuracy.

Caution

The following are precautions for setting step data.

- 1) For circular interpolation the composite speed used should be lower than the maximum speed of the actuator and lower than the maximum speed of the other actuators used.
- 2) Set the target position on the arc composed by the current position and the centre coordinates or the arc composed by the current position and a transit point.
- 3) Do not set the rotation centre position to (0, 0).
- 4) For 3 points circular interpolation (CIR-3), do not set the target position or the transit point to (0, 0). Circular interpolation for complete circle cannot be set.
- 5) When the coordinates of current position, target position and transit position are linear, 3 points circular interpolation (CIR-3) cannot be set.

Example) After a Return to origin, move from the origin position at 100 mm/s to a point 30mm on Axis 1 and 10mm on Axis 2 (Step No.1).

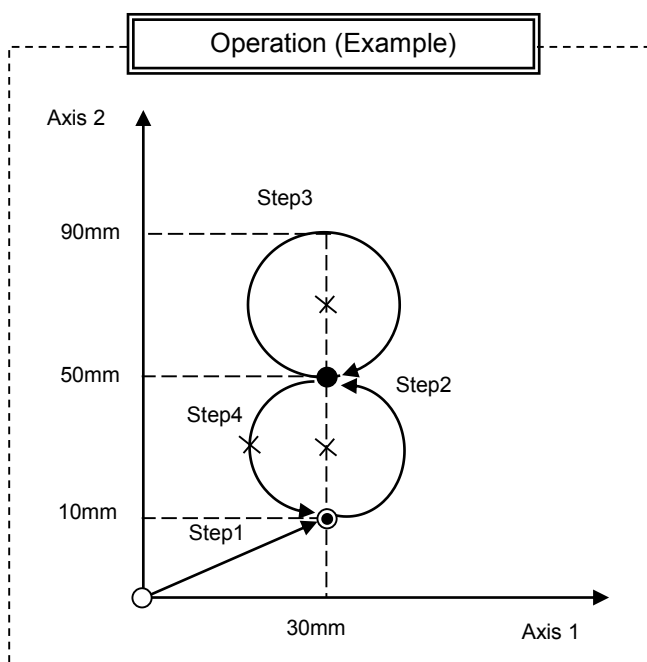
Move from the current position using counterclockwise circular interpolation movement at 100 mm/s composite speed to a point 0mm on Axis 1 and 40mm on Axis 2 (Step No.2: Centre 1st. axis 0 mm, 2nd. axis 20 mm).

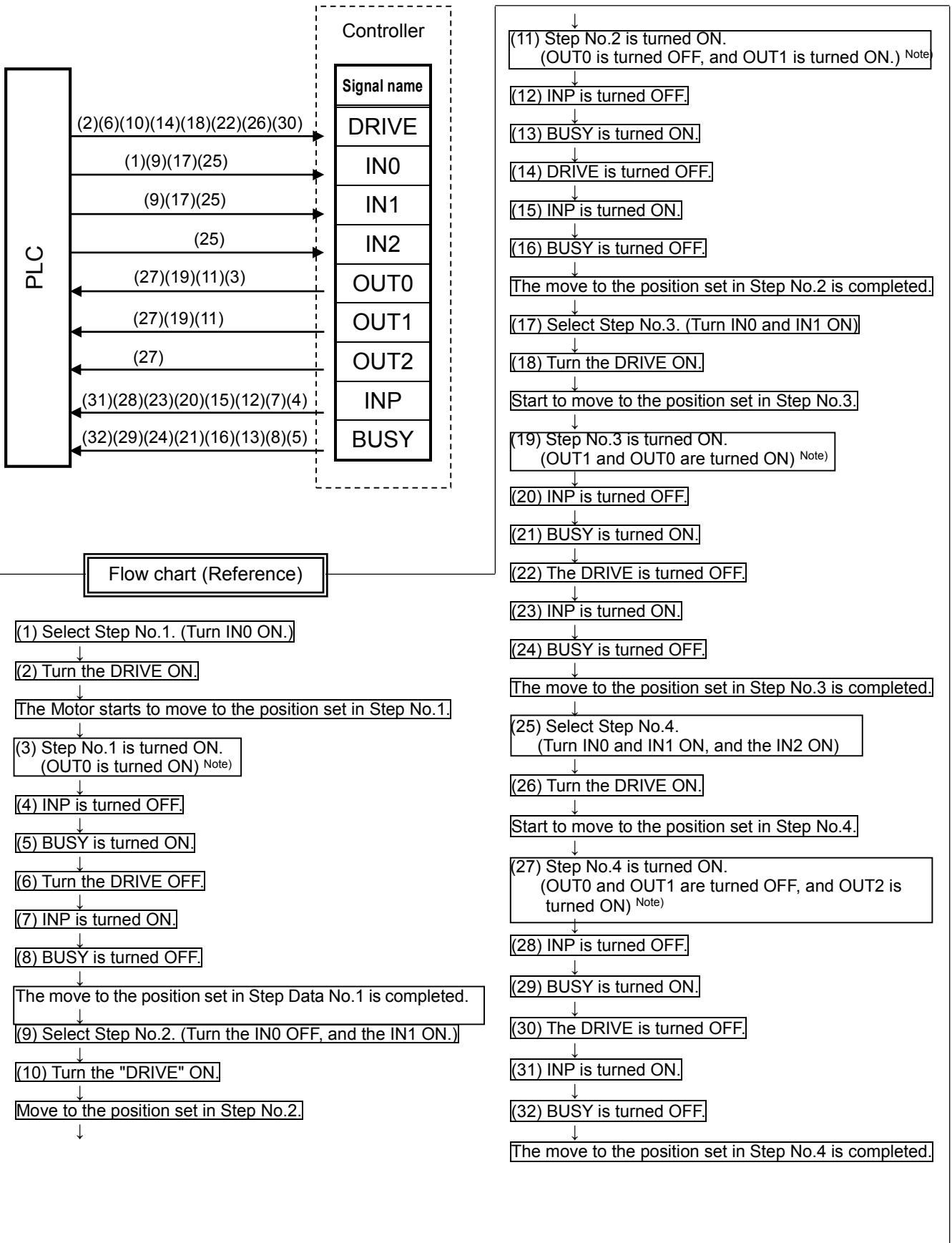
Make one clockwise rotation movement at 100 mm/s of composite speed (Step No.3: Centre 1st. axis 0 mm, 2nd. axis 20 mm).

Then, from the current position, the object is brought into circular interpolation movement to the position (1st. axis 0 mm, 2nd. axis -40 mm) at 100 mm/s of composite speed (Step No.4: transit point 1st. axis -20 mm, 2nd. axis -20 mm).

Step Data Setting Example

Step No.	Axis	Movement mode	Speed (mm/s)	Position (mm)	Acceleration (mm/s ²)	Deceleration (mm/s ²)	Pushing Selection (%)	Threshold (%)	Push Speed (mm/s)	Position Force (%)	Area 1 (mm)	Area 2 (mm)	In-position (mm)
1	Axis 1	ABS	100	30.00	1000	1000	-	-	-	100	0.0	0.0	0.5
	Axis 2	ABS	100	10.00	1000	1000	-	-	-	100	0.0	0.0	0.5
	Axis 3	-	-	-	-	-	-	-	-	100	0.0	0.0	0.5
2	Axis 1	CIR-L	100	0.00	1000	1000	-	-	-	100	0.0	0.0	0.5
	Axis 2	CIR-L	-	40.00	-	-	-	-	-	100	0.0	0.0	0.5
	Axis 3	-	-	0.00	-	-	-	-	-	100	0.0	0.0	0.5
	Axis 4	-	-	20.00	-	-	-	-	-	100	0.0	0.0	0.5
3	Axis 1	CIR-R	100	0.00	1000	1000	-	-	-	100	0.0	0.0	0.5
	Axis 2	CIR-R	-	0.00	-	-	-	-	-	100	0.0	0.0	0.5
	Axis 3	-	-	0.00	-	-	-	-	-	100	0.0	0.0	0.5
	Axis 4	-	-	20.00	-	-	-	-	-	100	0.0	0.0	0.5
4	Axis 1	CIR-3	100	0.00	1000	1000	-	-	-	100	0.0	0.0	0.5
	Axis 2	CIR-3	-	-40.00	-	-	-	-	-	100	0.0	0.0	0.5
	Axis 3	-	-	-20.00	-	-	-	-	-	100	0.0	0.0	0.5
	Axis 4	-	-	-20.00	-	-	-	-	-	100	0.0	0.0	0.5





Note) Profile parameter "Step number output type" is "0" (update with the rising edge of the DRIVE signal)
 When the "step number output type" is set to "1", the timing of ON/OFF of the signal for OUT0, OUT1 and OUT2 is different.

10.6 Speed tuning control

When an (main) axis is delayed due to external load, the speed of other (slave) axes is controlled. Not the synchronization of the position of the main axis and slave axis. Pushing operation cannot be used.

Caution

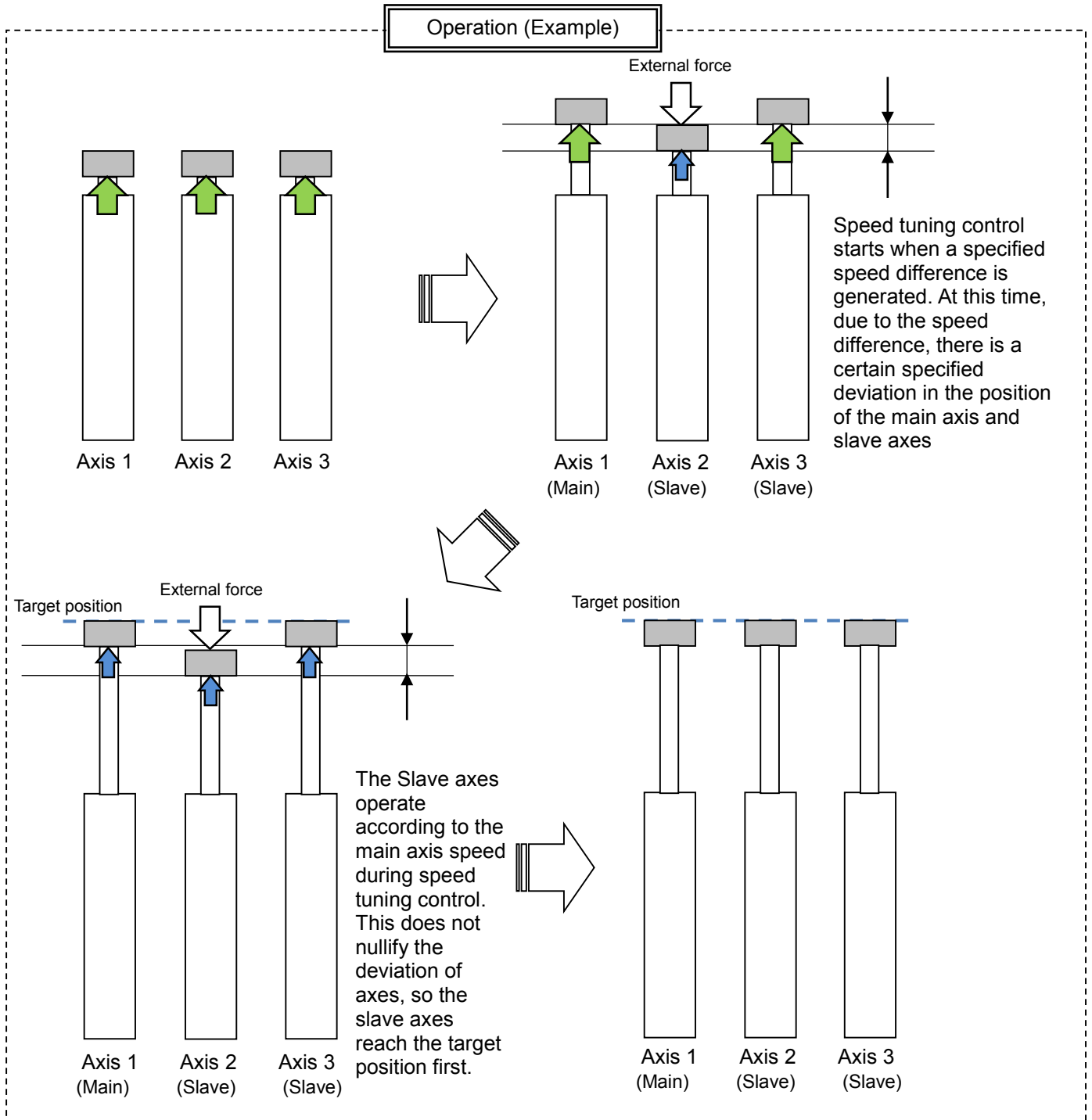
- (1) Actuators with a different lead cannot be used. Use the same type of actuators with the same lead and stroke.**
- (2) The minimum speed for speed tuning control is different from the minimum actuator speed.**
Refer to **Supplement 1. Actuator Specifications (P.112)** for the specifications of the actuators.
- (3) When an external force is applied to the slave axis, which is higher than the force applied to the main axis during operation, the speed cannot be tuned for the slave axis.**
Once the main axis is fixed, the relationship of speed between the main axis and the slave axis is fixed until the completion of the step data operation. Therefore, a new speed cannot be tuned to the new reduced speed of the slave axis.
- (4) Speed is not tuned during deceleration.**
The timing of deceleration start or level of deceleration depends on the load and operating conditions of the actuators.
- (5) If the external force applied to the main axis is removed during operation, the main axis speed may overshoot.**
During speed tuning control, the speed of the main axis is controlled so that it is close to the set speed. (The speed of the slave axis is controlled to tune with the actual speed of the main axis)
So, if the external force is removed after the condition in which the main axis continues failing to respond to the set speed, the main axis speed may exceed the set speed rapidly due to the accumulated deviation.
- (6) Speed cannot be tuned to the axis whose speed exceeds the set speed due to external force (case 5), etc.**
Speed tuning control starts when the actual speed becomes slower than the set speed. So, it does not start when the set speed is exceeded.
- (7) When an external force is applied to multiple axes simultaneously, it is possible that the speed of the slave axis which receives the external force decreases.**
Even if an external force is applied to multiple axes, only 1 axis is assigned as the main axis. Therefore, the speed of the the slave axes being applied with external force which are not assigned as a main axis may decrease due to accumulated deviation.
- (8) When an external force is applied to the axes unevenly, and the main axis speed exceeds the set speed rapidly, it may take time for the speed of the slave axes to be tuned with the main axis speed.**
If an external force is applied and the movement delay is generated at an early stage, that axis becomes the main axis.
When the main axis overshoots due to the accumulated deviation, other axes try to tune with the main axis within the set speed.
Therefore, it takes time for them to be tuned.

Please design and construct the system taking these cautions into consideration.

Example) After returning to origin, move all axes by speed tuning control from the origin to 200 mm point at 100 mm/s. (Step Data No.0 is used for this operation).

Step Data Setting Example

Step No.	Axis	Movement mode	Speed (mm/s)	Position (mm)	Acceleration (mm/s ²)	Deceleration (mm/s ²)	Pushing Selection (%)	Threshold (%)	Push Speed (mm/s)	Position Force (%)	Area 1 (mm)	Area 2 (mm)	In-position (mm)
1	Axis 1	SYN-I	100	200.00	1000	1000	-	-	-	100	0.0	0.0	0.5
	Axis 2	SYN-I	-	-	-	-	-	-	-	100	0.0	0.0	0.5
	Axis 3	SYN-I	-	-	-	-	-	-	-	100	0.0	0.0	0.5



10.7 PLC output signal response time

The PLC output signal response time includes the following factors.

- 1) Controller signal scan time
- 2) Delay due to signal analysis
- 3) Delay due to command analysis

Both PLC processing delay and controller scan delay are generated. Ensure that more than 2 times the communication cycle time is maintained between signals.

10.8 Methods of interrupting operation

There are three methods of interrupting the operation and stopping the actuator during a positioning operation or pushing operation, as shown below. The state after the interruption varies, therefore use the method appropriate to the application.

- Stop using the EMG signal

If the EMG signal is turned OFF during operation, the actuator will decelerate and stop, the servo will turn OFF which means the stopped position is not held. (For an actuator with lock, the position is held by the lock function).

The residual travel distance will be reset.

- Stop using the RESET signal

If the RESET signal is turned ON during operation, the actuator will decelerate and stop, and the stopped position is held. (The servo does not turn OFF).

The residual travel distance will be reset.

- Stop using the HOLD signal

If the HOLD signal is turned ON during operation, the actuator will decelerate and stop. The actuator will resume travel for the residual distance when the HOLD signal is turned OFF.

Caution

If the operation is stopped using the RESET signal, all OUT signals will turn OFF.

11. Operation Instructions

11.1 Outline of the Operation instruction

The controller is possible to operate by selecting the step data in the controller using the EtherNet/IP. Refer to the next section for details of the input/ output signal timing and control procedures.

11.2 Operation procedure

Please refer to the following "Procedure" and "Timing chart" for each operation.

(1) From power on to Return to origin

- Procedure -

(a) Turn the power supply ON



(b) The *ALARM turns ON.
*ESTOP is turned ON.



(c) SVON is turned ON.



(d) SVRE is turned ON.
INP is turned ON.

[The time taken for SVRE and INP to turn on depends on the actuator type and the operating conditions. (When power is supplied, it may take up to 20 seconds from servo ON to SVRE ON.)
[Actuator (with lock) is unlocked.]



(e) Turn SETUP is ON.

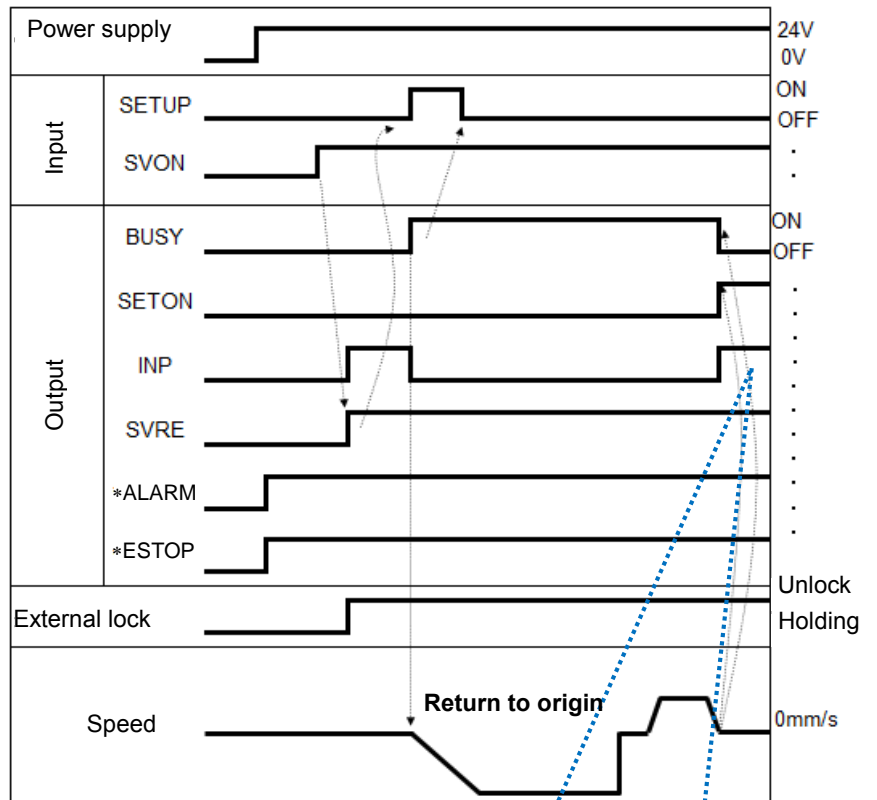


(f) BUSY is turned ON and INP is turned OFF (Starts the operation).



(g) Return to origin is completed when the BUSY is turned OFF and SETON and INP turns ON.

- Timing chart -



All valid axes turn on on completion of a return to origin.

The "*ALARM" and "*ESTOP" are expressed as negative-logic circuit.

(2) Positioning operation 1

Profile parameter "Type of step number output" is "0" (update with the rising edge of the DRIVE signal)

- Procedure -

- Timing chart -

(a) Output the step data

No.(INx).



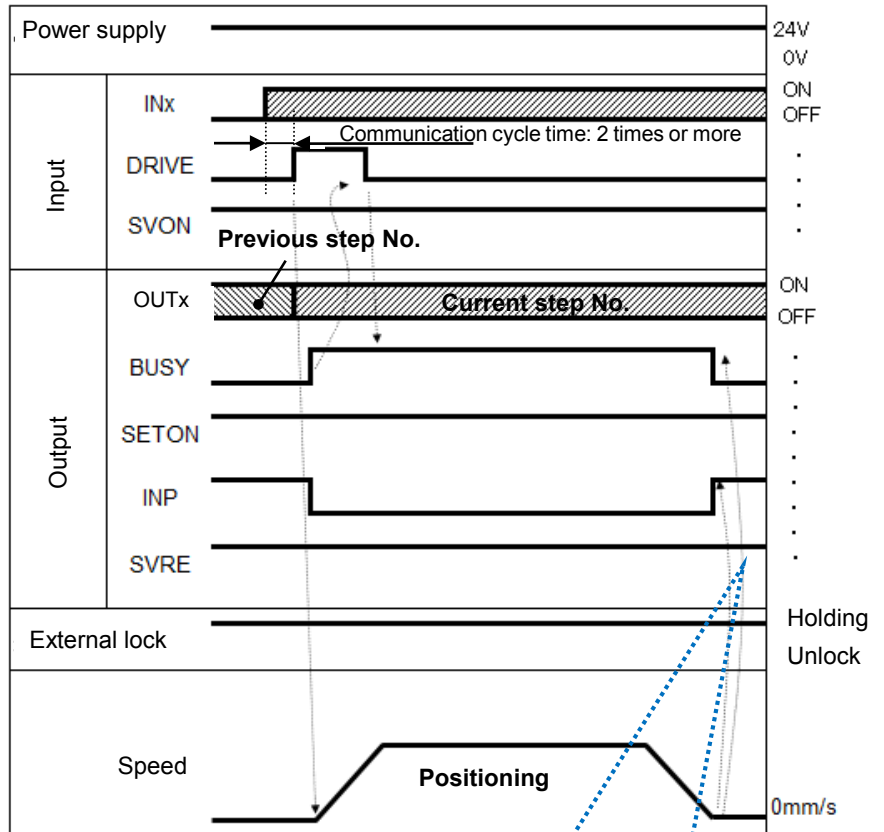
(b) Turn the DRIVE is ON. The step data No. (OUTx) will be input.



(c) The BUSY turns ON and INP turns OFF. (The positioning movement will start.)



(d) When the INP is turned ON and BUSY is turned OFF, the positioning operation is completed.



The INP signal is ON when all valid axes are within the positioning range after the positioning completion time (theoretical value) has lapsed. The BUSY signal turns OFF when the positioning completion time (theoretical value) has lapsed.

⚠ Caution

Design the system so that no obstacles exist adjacent to the target position which may stop the actuators.

If the actuator is stopped by an obstacle adjacent to the target position during a positioning, the positioning operation will be completed (INP: ON, BUSY: OFF). If an operation instruction follows this, the positional offset from the target position of the previous operation will be reflected in the following operation. However the offset is possible to be corrected by using the ABS instruction twice or more.

(3) Positioning operation 2

Profile parameter "Type of step number output" is "1" (update with the falling edge of the DRIVE signal)

- Procedure -

- Timing chart -

(a) Output the step data

No.(INx).



(b) Turn the DRIVE is ON.



(c) The BUSY turns ON and

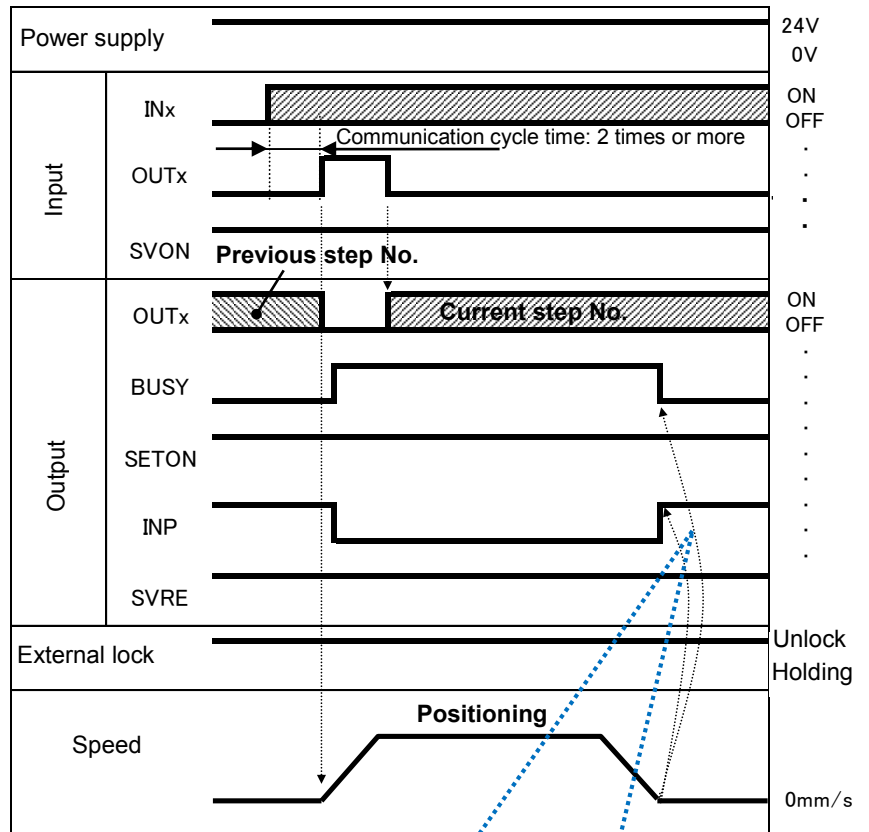
INP turns OFF. (The positioning movement will start.)



(d) Turn the DRIVE is OFF. The step data No. (OUTx) will be input.



(e) When the INP is turned ON and BUSY is turned OFF, the positioning operation is completed.



The INP signal is ON when all valid axes are within the positioning range after the positioning completion time (theoretical value) has lapsed.
The BUSY signal turns OFF when the positioning completion time (theoretical value) has lapsed.

⚠ Caution

When "1" is selected for the "Type of step number output" in Profile parameters (update with the falling edge of the DRIVE signal), all of the OUT signals are OFF while the DRIVE signal is ON.

⚠ Caution

Design the system so that no obstacles exist adjacent to the target position which may stop the actuators.

If the actuator is stopped by an obstacle adjacent to the target position during a positioning, the positioning operation will be completed (INP: ON, BUSY: OFF). If an operation instruction follows this, the positional offset from the target position of the previous operation will be reflected in the following operation. However the offset is possible to be corrected by using the ABS instruction twice or more.

(4) Pushing operation

- Procedure -

- Timing chart -

(a) Output the step data No. (INx).



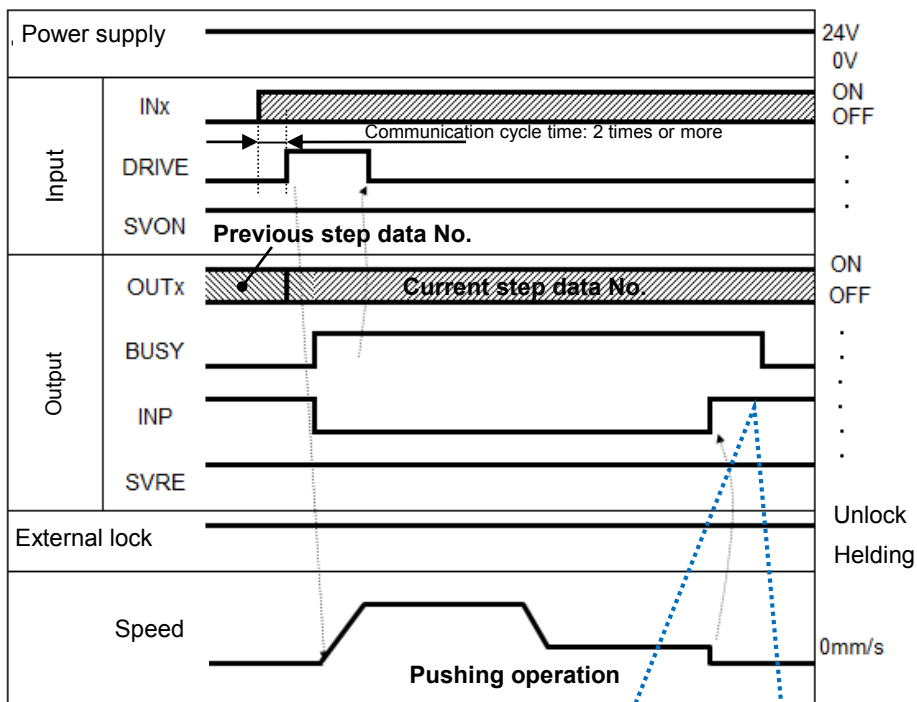
(b) Turn the DRIVE ON. The step data No. (OUTx) will be input.



(c) The BUSY turns ON and INP turns OFF. (Pushing starts).



(d) The pushing operation is complete when INP is ON and BUSY is OFF. (The force set as the "Pushing Selection" in the step data will be generated).



The INP will turn ON when a force greater than "Trigger level" set in the profile parameter is generated. The BUSY signal turns OFF after the pushing completion time (theoretical value) has lapsed.

⚠ Caution

- 1) If the movement is interrupted during positioning of the pushing operation, an alarm "Failed to achieve set position in set time limit. (149)" will be generated.
- 2) If an operation is instructed after the pushing operation is completed ((d) above), a positional offset will be generated.
Correct the offset by performing the ABS instruction twice or more.
- 3) When the "Type of step number output" is set to "1", the timing of ON/OFF of OUT signal is different. All of the OUT signals are OFF while the DRIVE signal is ON.

(5) HOLD

- Procedure -

(a) The HOLD is turned ON during a movement operation (when the BUSY is ON).



(b) The BUSY turns OFF. (The actuator will stop).

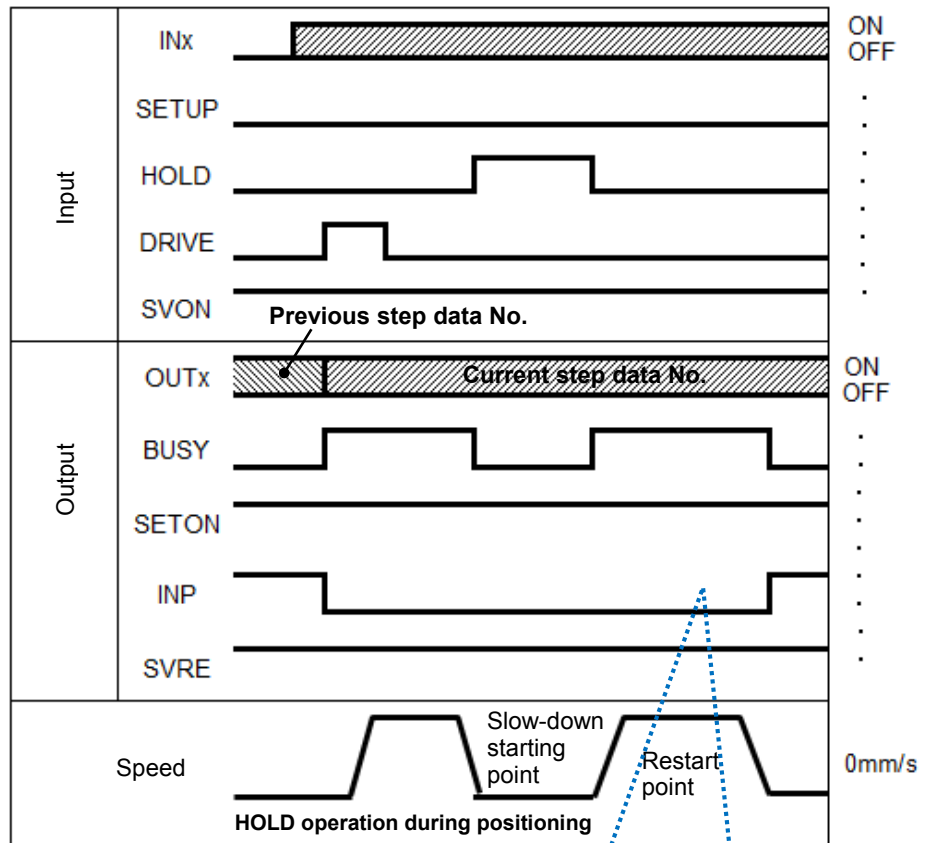


(c) The HOLD turn OFF.



(d) The BUSY will turn ON. (The Operation will restart)

- Timing chart -



Paused INP signal is ON when the actuators are within +/- "Positioning range" of the target position.

⚠ Caution

When the "Type of step number output" is set to "1", the timing of ON/OFF of the OUT signal is different. All of the OUT signals are OFF while the DRIVE signal is ON.

(6) RESET

[Alarm reset]

- Procedure -

(a) Generation of an alarm (*ALARM signal is OFF, OUTx signal corresponding to the abnormality group is ON.)

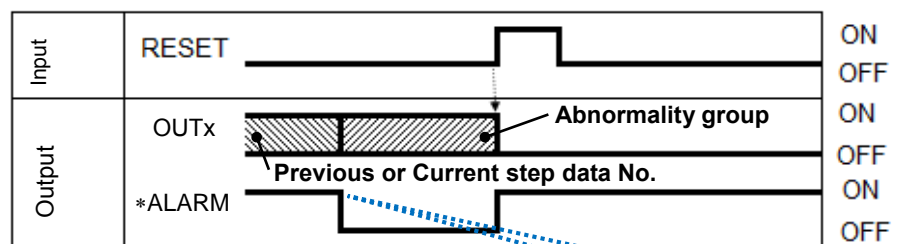


(b) The RESET is turned ON.



(c) As *ALARM is ON, OUTx is OFF. (The alarm is deactivated).

- Timing chart -



*ALARM is displayed in negative logic. In case of abnormality group E, the power supply for the control and motor drive must be applied again to reset the alarm.

[Reset of operation]

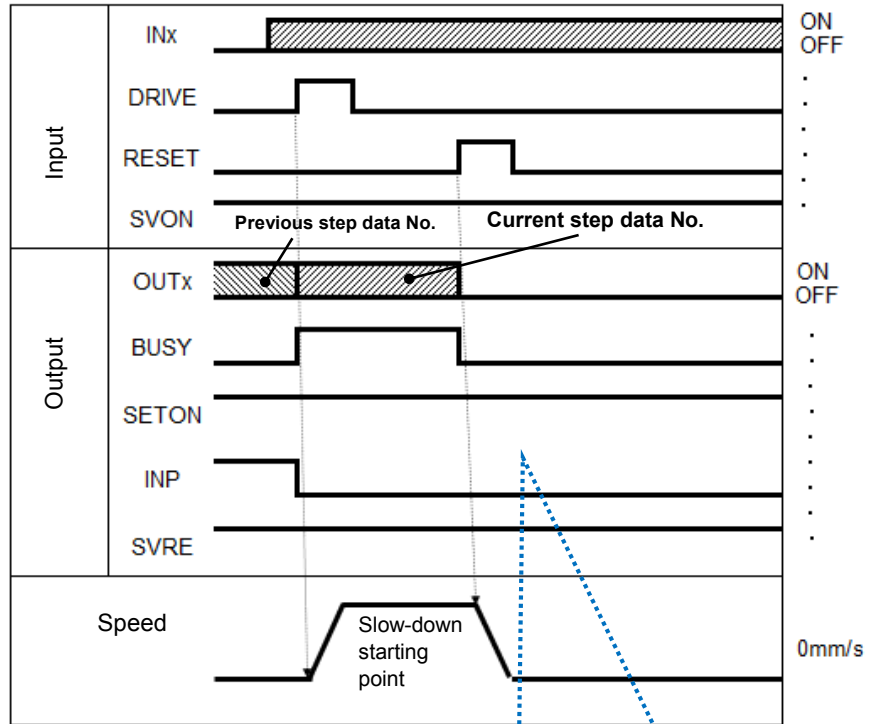
- Procedure -

(a) The RESET is turned ON during a movement operation (when the BUSY is ON).



(b) The BUSY is OFF and OUTx is OFF. (The actuator will stop).

- Timing chart -



⚠ Caution

When the "Type of step number output" is set to "1", the timing of ON/OFF of the OUT signal is different. All of the OUT signals are OFF while the DRIVE signal is ON.

(7) STOP

- Procedure

- (a) The Stop (EMG) input is OFF during an operation (when the BUSY is ON).
(Stop command)

↓

- (b) The *ESTOP will turn OFF.

↓

- (c) The BUSY will turn OFF. (The actuator will stop).
The SVRE will turn OFF.

[The actuator (with lock) will be locked.]

↓

- (d) The stop (EMG) input is turned ON.
(The stop release command)

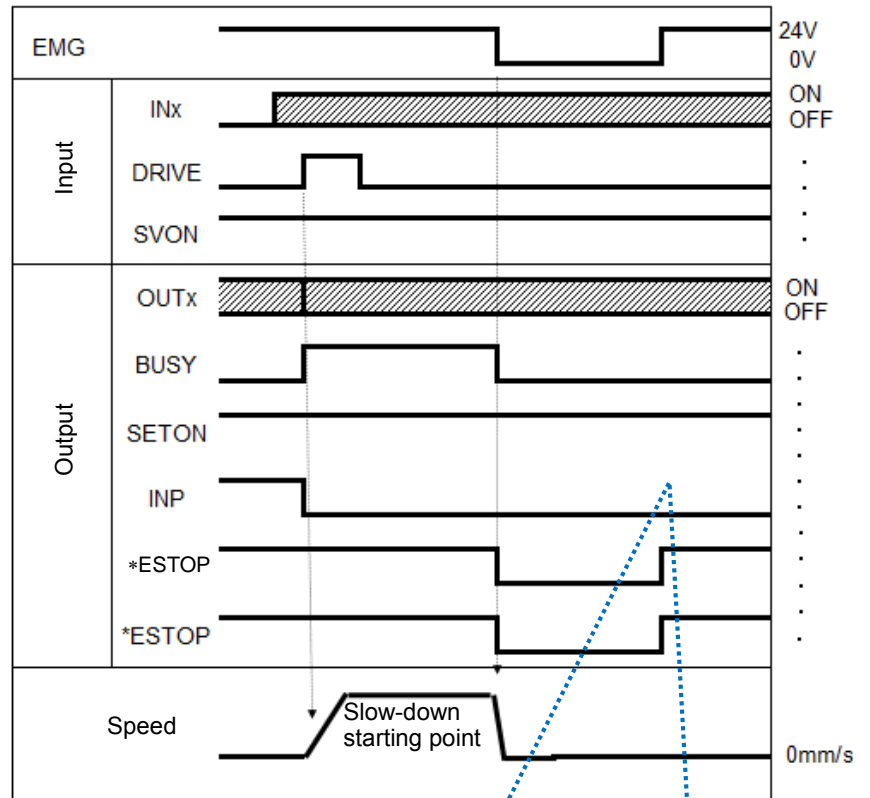
↓

- (e) The *ESTOP will turn ON.

SVRE is turned ON.

[The actuator (with lock) will be unlocked.]

- Timing charge -



The INP signal is OFF when the EMG input is OFF.
The EMG turns ON (Stop release), and the INP signal turns ON when the actuators are within +/- "Positioning range" of the target position.

*ALARM is displayed in negative logic.
When "Stop (EMG) is 0V" in the timing chart, the stop is activated.

⚠ Caution

When the "Type of step number output" is set to "1", the timing of ON/OFF of the OUT signal is different. All of the OUT signals are OFF while the DRIVE signal is ON.

(8) Area output

-Procedures-

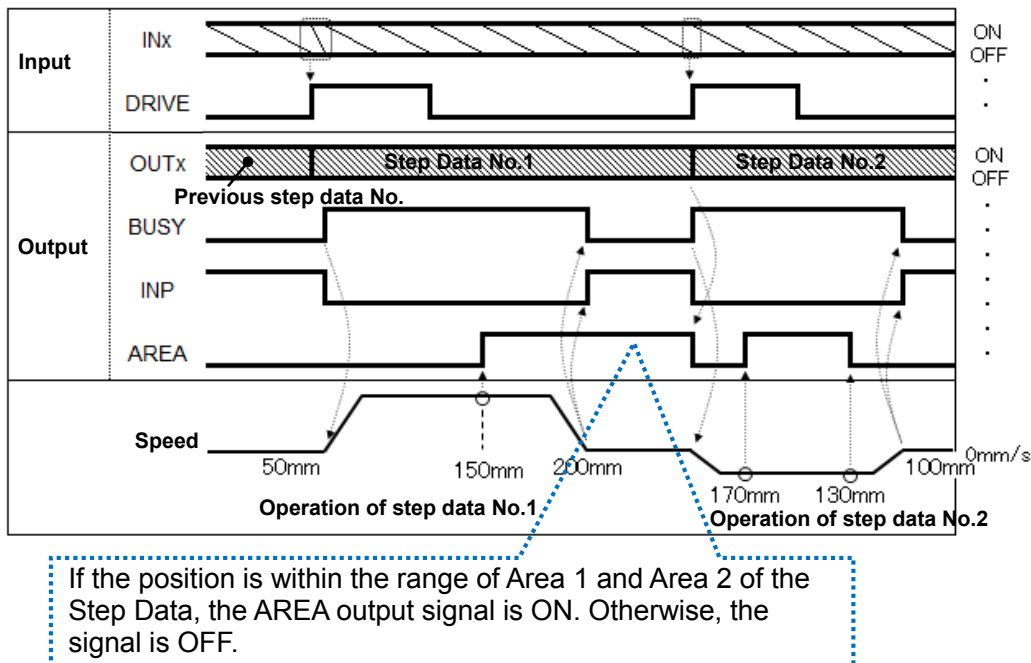
- (a) Output the Step data No. (INx).
- (b) Turn the "DRIVE" ON. Step data No. 1 (OUTx) will be input.
- (c) The BUSY will turn ON and INP will turn OFF (the positioning operation will start).
- (d) The AREA of step data No.1 turns ON (at 150mm from the origin point).
- (e) The BUSY will turn OFF and INP will turn ON. (Positioning operation of step data No.1 is completed).
- (f) Output the step data No. 2 (INx).
- (g) Turn the "DRIVE" ON. Step data No. 2 (OUTx) will be input.
- (h) The AREA will turn OFF. The BUSY will turn ON and INP will turn OFF. (The positioning operation will start).
- (i) The AREA for step data No.2 will turn ON (at 170mm from the origin point).
- (j) The AREA for step data No.2 will turn OFF (at 130mm from the origin point).
- (k) The BUSY will turn OFF and INP will turn ON. (Positioning operation of step data No.2 is completed).

- Timing chart -

Initial position: 50mm

↓
Step data No.1 operation (Position: 200mm, Area 1: 150mm, Area 2: 250mm)

↓
Step data No.2 operation (Position: 100mm, Area 1: 130mm, Area 2: 170mm)



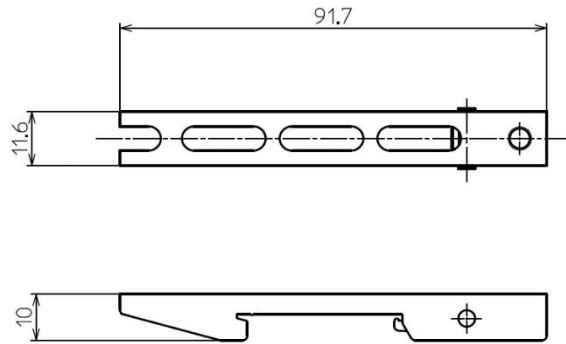
⚠ Caution

When the "Type of step number output" is set to "1", the timing of ON/OFF of the OUT signal is different. All of the OUT signals are OFF while the DRIVE signal is ON.

12. Accessories

12.1 DIN rail mounting bracket

JXC-Z1



Included with the controller

Description	Size	Qty.
Cross recessed round head screw	M5x8	4 pcs.
	M5x14	2 pcs.

12.2 Controller Set up kit

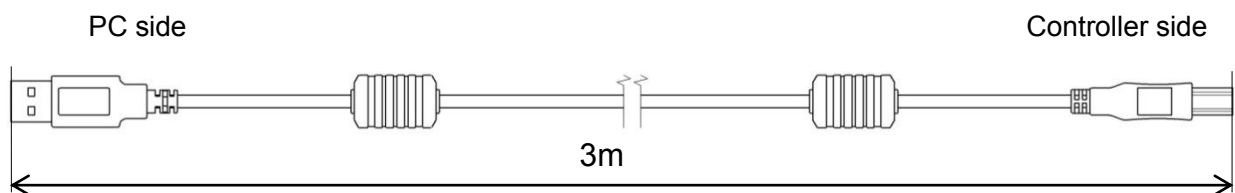
JXC-MA1^{Note 1)}

Contents

(1) Controller set up software (CD-ROM) Product No.: JXC-MA1-1^{Note 1)}



(2) USB cable (A-B type) Product No.: JXC-MA1-2



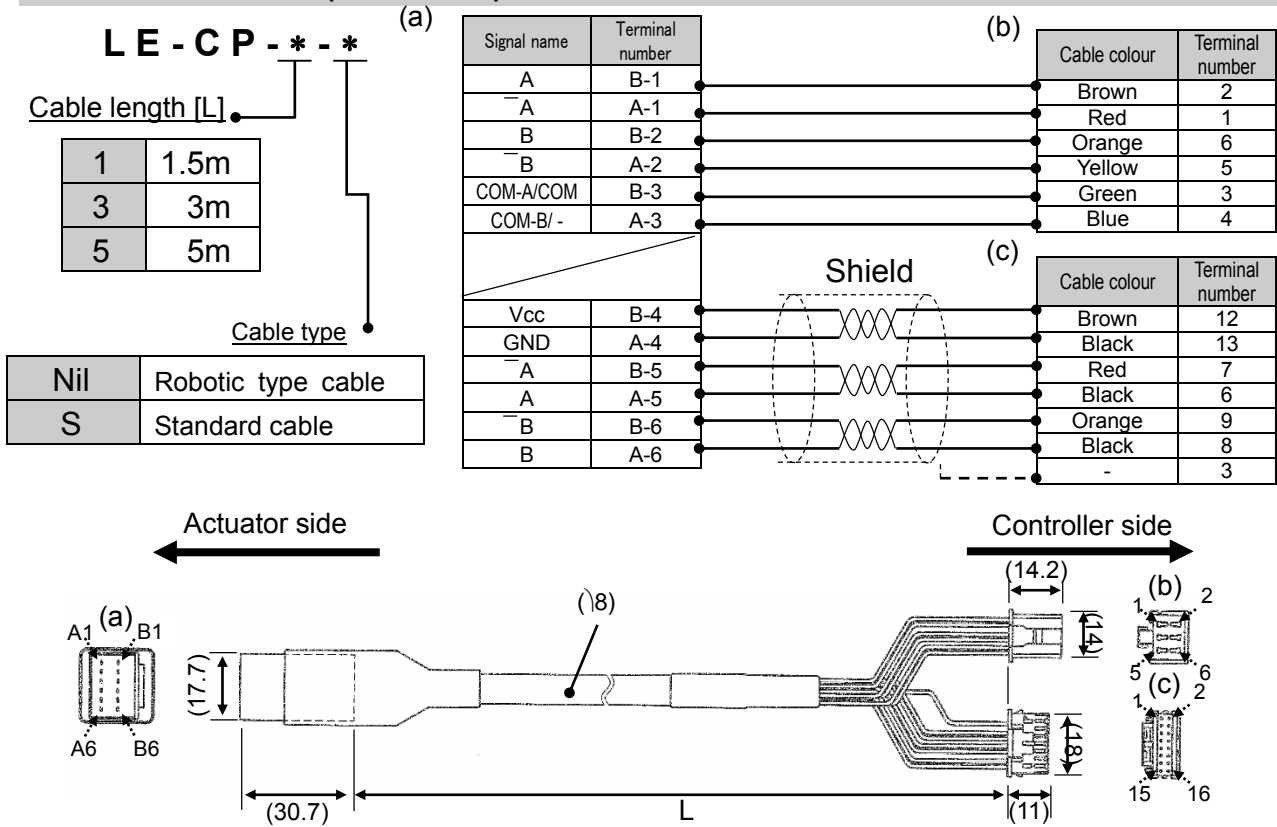
Operating environment

Compatible OS <small>Note 2)</small>	Windows®7 (32bit or 64bit) Microsoft .NET Framework 2.0 is necessary.
	Windows®8.1 (32bit or 64bit) Microsoft .NET Framework 3.5 is necessary.
Hard disk space	50MB or more
Interface	USB port (USB1.1 or USB 2.0)

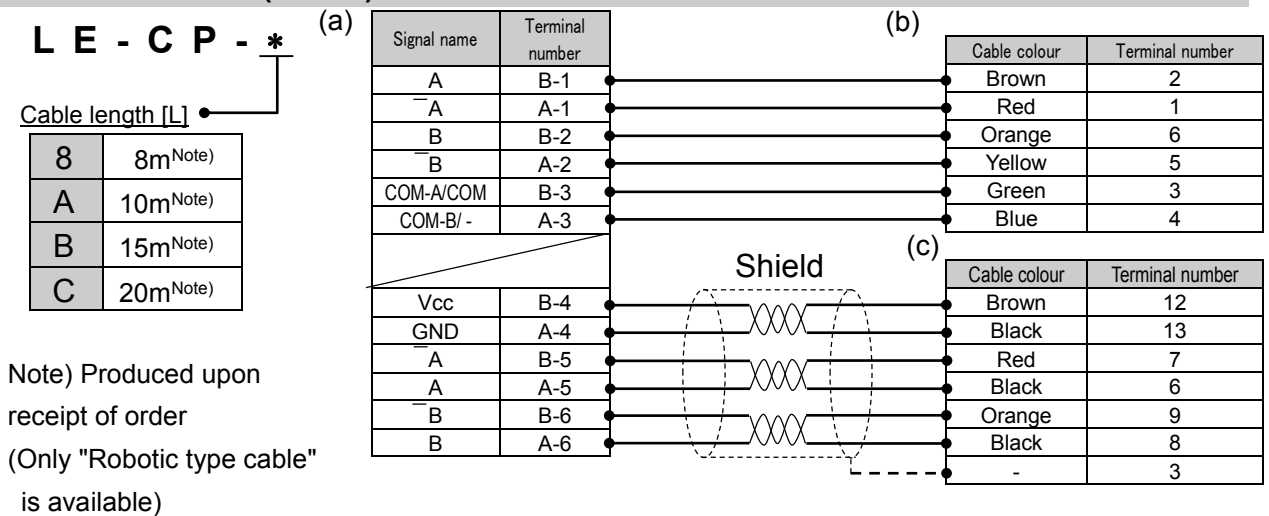
Note 1) The 4-axis Step Motor Controller Setting Software is included in the Controller Set up kit.

Note 2) Windows® is the registered trademark of United States Microsoft Corporation.

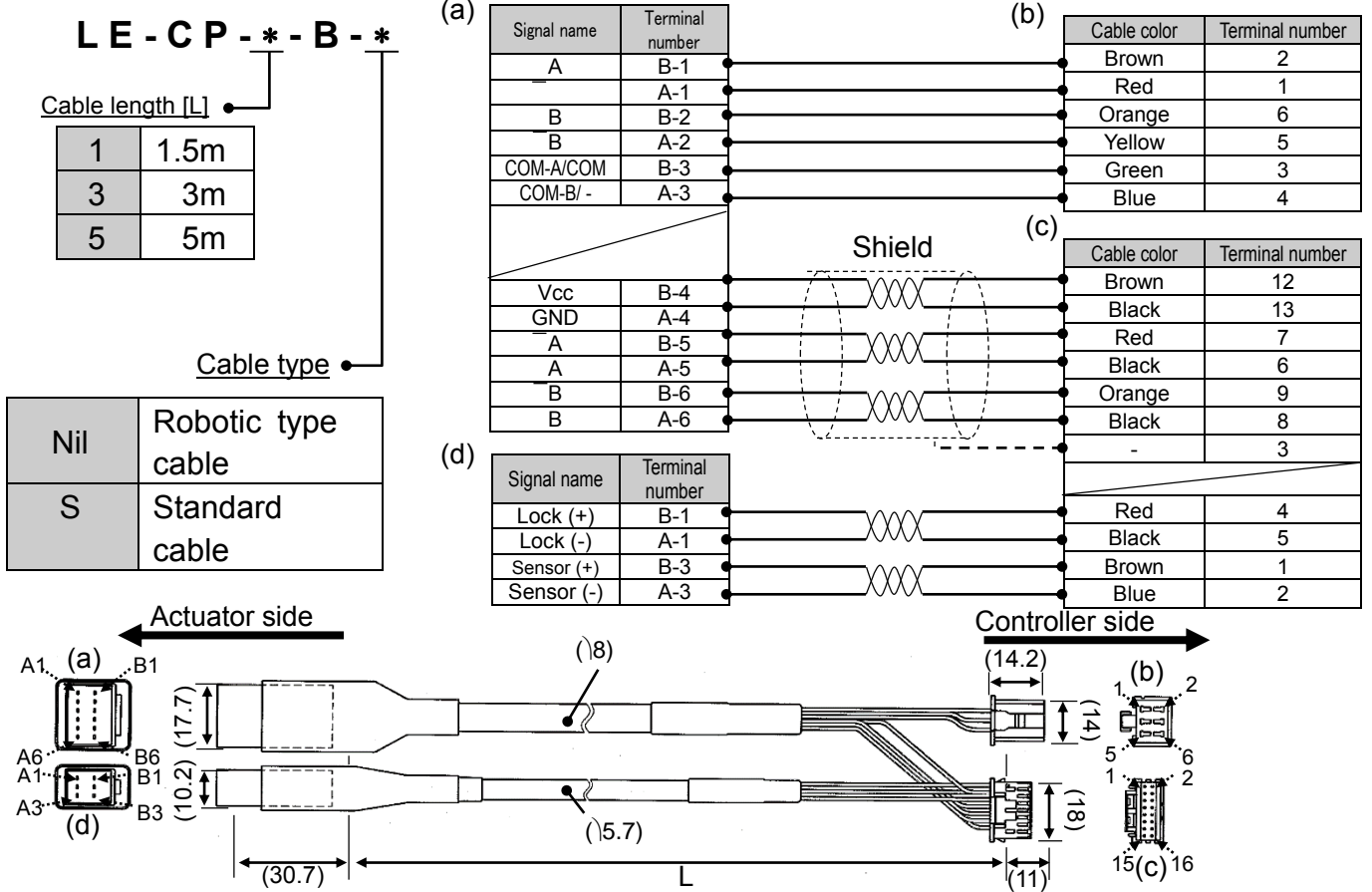
12.3 Actuator cable (5m or less)



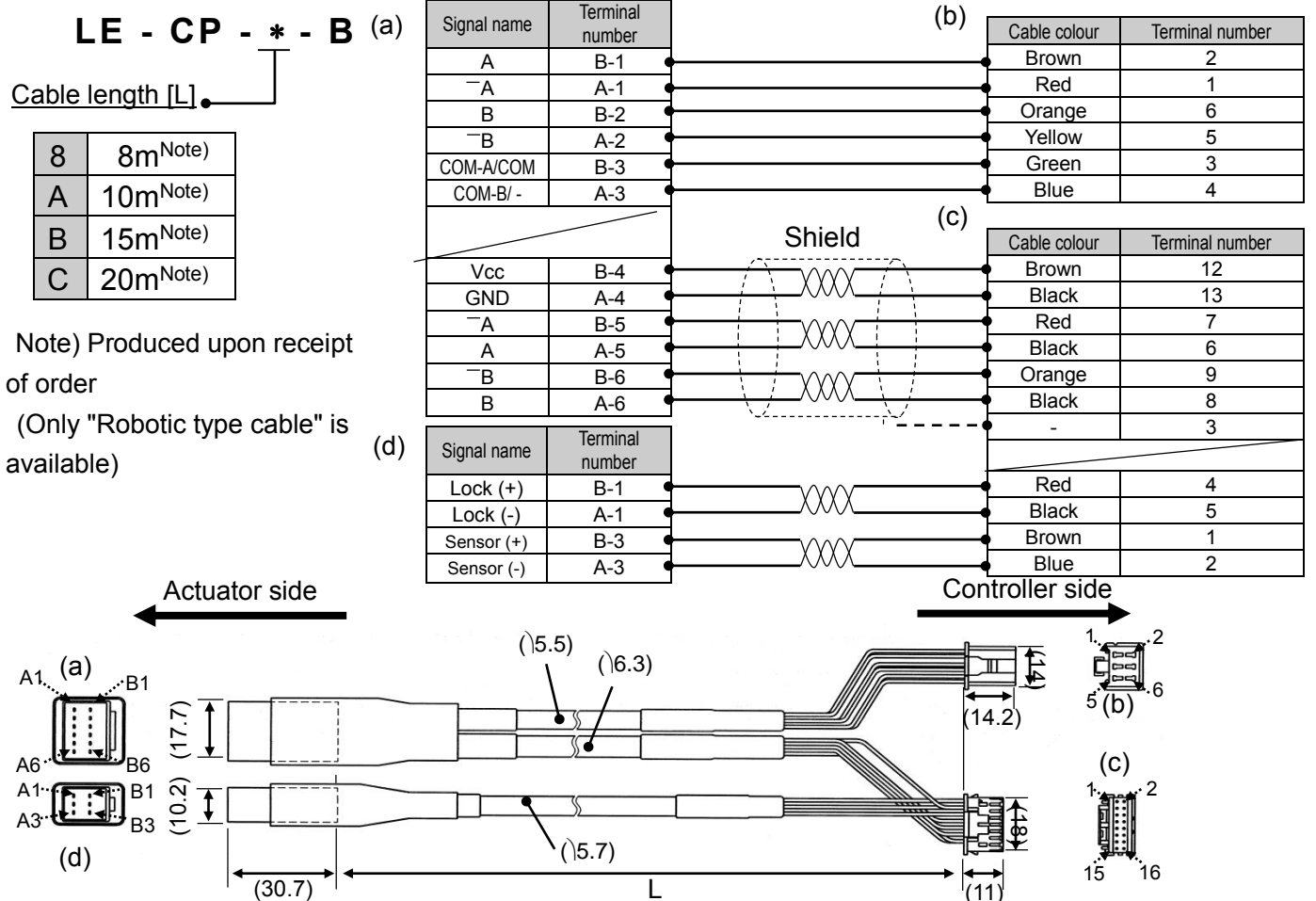
12.4 Actuator cable (8-20m)



12.5 Actuator cable [For sensor/ with lock (5m or less)]



12.6 Actuator cable [For sensor/ with lock (8-20m)]



13. Abnormality detection

The controller generates an alarm or an error when an abnormality is detected.

Details of the alarm or error can be checked using a PC (using the controller setting software).

Refer to the manuals of the Controller Setting Software (No. JXC*-OMU0023) for details of the alarms and errors.

When an alarm or an error is generated, deactivate the alarm or the error after troubleshooting and correcting the abnormality with reference to **13.2 Descriptions and countermeasures for abnormality (P.90)**. Alarms and errors are divided into two types. One type can be cleared by outputting the RESET signal. The other type cannot be cleared unless the power supply for control and motor drive are turned off.

13.1 Abnormality group and PLC input port signals

The controller outputs a signal which can tell the type of the abnormality when problems are detected. Abnormality group is categorized in 4 groups from OUT0 to OUT3.

Refer to the table below for the combination of the abnormality group and the PLC input signals.

Abnormality group	PLC Input port signals				
	*ALARM	OUT0	OUT1	OUT2	OUT3
Abnormality group B	OFF	OFF	ON	OFF	OFF
Abnormality group C	OFF	OFF	OFF	ON	OFF
Abnormality group D	OFF	OFF	OFF	OFF	ON
Abnormality group E	OFF	OFF	OFF	OFF	OFF

*ALARM is displayed in negative logic.

After the detection of an abnormality, SVRE or SETON signals are output according to the contents of the abnormality, as shown below.

Abnormality group	PLC Input port signals		How to start test run.
	SVRE	SETON	
Abnormality group B	No change	No change	RESET is ON
Abnormality group C	No change	No change	RESET is ON
Abnormality group D	OFF	No change	RESET is ON
Abnormality group E	OFF	OFF	Turn off the control and motor drive power supplies → Turn on again

- Procedure to restart -



1. RESET signal is ON → SVRE signal: will automatically turn ON (if SVON signal is ON when RESET signal is ON)
2. SETUP signal is ON → Instruction to restart after a Return to origin is completed.







13.2 Descriptions and countermeasures for abnormality




(1) Controller system abnormality (error)





Name of the controller setting software (code)	Group	How to deactivate	Alarms and countermeasures
Parameter is not registered (901)	E	Turn off the control and motor drive power supplies.	<p>< Details > This is generated when the servo is ON (SVON signal is ON) but parameters are not set.</p> <p><Countermeasure> Download appropriate parameters, and then turn on the power supply.</p>
Step data is not registered (902)	B	RESET is ON	<p>< Details > An alarm is generated when the step data is executed without step data setting.</p> <p><Countermeasure> Download the step data to the controller.</p>
System Error (910)	E	Turn off the control and motor drive power supplies.	<p>< Details > System error occurred. There is a possibility of damage to the controller or a malfunction due to noise.</p> <p><Countermeasure> If the alarm is still generated when the power is reapplied, please contact SMC.</p>
SDRAM Error (911)	E	Turn off the control and motor drive power supplies.	<p>< Details > Abnormality concerning SDRAM.</p> <p><Countermeasure> Please contact SMC.</p>
FROM Error (912)	E	Turn off the control and motor drive power supplies.	<p>< Details > Abnormality concerning FROM.</p> <p><Countermeasure> Please contact SMC.</p>
Modbus Error (913)	E	Turn off the control and motor drive power supplies.	<p>< Details > This alarm is generated when an abnormality is found in the Modbus communication. There is a possibility of damage to the controller or malfunction due to noise.</p> <p><Countermeasure> If the alarm is still generated when the power is reapplied, please contact SMC.</p>
Module Error (914)	E	Turn off the control and motor drive power supplies.	<p>< Details > An alarm is generated when a module error is confirmed. There is a possibility of damage to the controller or a malfunction due to noise.</p> <p><Countermeasure> If the alarm is still generated when the power is reapplied, please contact SMC.</p>
No data Error (915)	E	Turn off the control and motor drive power supplies.	<p>< Details > This is generated when the parameters are not set.</p> <p><Countermeasure> Download appropriate parameters, and then turn on the power supply.</p>

(2) Driver system abnormality (alarm)

Name of the controller setting software (code)	Group	How to deactivate	Alarms and countermeasures
Step data value is wrong (048)	B	RESET is ON	<p>< Details > The step data or parameter is incorrect for the following parameter assignable range. [Settable range] (1) Profile parameter "Trigger level" ≤ Profile parameter "Pushing force" (2) "Pushing force" of Profile parameters > 0 (3) Minimum speed of actuator ≤ Step data "Push speed" ≤ Step data "Speed" (4) Step data "Push speed" ≤ Maximum pushing speed of the actuator (5) Profile parameter "Pushing force" ≥ Minimum pushing force of the actuator (6) Basic parameter "Max force" ≥ Minimum pushing force of the actuator (7) Basic parameter "Maxi force" ≥ Profile parameter "Trigger level".</p> <hr/> <p><Countermeasure> Modify the step data and parameter settings</p> <div style="border: 1px solid black; padding: 5px; text-align: center;">  Caution </div> <p>Please refer to the actuator manual or the catalogue for the max/min pushing force/speed for the actuator.</p>
Parameter value is wrong (049)	B	RESET is ON	<p>< Details > The parameter is incorrect for the following parameter assignable range. [Settable range] (1) Stroke (-) < Stroke (+) (2) Parameter "Max pushing force" < maximum pushing force of the actuator</p> <hr/> <p><Countermeasure> Modify the basic parameter settings.</p> <div style="border: 1px solid black; padding: 5px; text-align: center;">  Caution </div> <p>Please refer to the actuator manual or the catalogue for the max pushing force for the actuator.</p>
Set step data is not registered on list. (051)	B	RESET is ON	<p>< Details > For an operation for a specific step data number, the requested number of the step data is not registered. (When operation is commanded through a PLC, this alarm will be generated depending on the output signal interval and the holding time of the signals)</p> <hr/> <p><Countermeasure> (1) Make sure that the "Movement mode" of the step data is not "Blank (disabled)". (2) Both PLC processing delay and controller scan delay are generated. Ensure that more than 2 times the communication cycle time should be maintained between the output signals.</p>

Name of the controller setting software (code)	Group	How to deactivate	Alarms and countermeasures	
Set stroke is outside stroke limit. (052)	B	RESET is ON	<p>< Details > This is generated when an operation which exceeds Basic parameter "Stroke (+)" or "Stroke (-)" is commanded. (Including JOG operation after a Return to origin)</p> <p><Countermeasure> Make sure that the basic parameters "Stroke (+)" and "Stroke (-)" are consistent with the distance of the actuator movement specified in the step data.</p> <table border="1" data-bbox="655 517 1406 562"> <tr> <td style="text-align: center;"> Caution</td> </tr> </table> <p>If the step data operation method is a "relative movement", note the location where the operation starts and the distance moved. If the location is outside the stroke range when power is supplied, this alarm will be generated. Move the table to within the stroke range, and supply power.</p>	 Caution
 Caution				
Reacting force is outside limit when pushing. Position is unstable. (096)	C	RESET is ON	<p>< Details > During the pushing operation, the actuator is pushed back beyond the pushing start position.</p> <p><Countermeasure> Increase the distance from the pushing start position to the object being pushed or increase the pushing force.</p>	
Return to ORIG did not complete in the set time. (097)	C	RESET is ON	<p>< Details > Return to origin was not completed within the set time.</p> <p><Countermeasure></p> <ul style="list-style-type: none"> - If the ORIG mode is "1: Return to origin by pushing force", the controller parameter "model" and the actual actuator model may not match. Check the parameters. Also, the motor shaft may be loose. Please refer to the actuator operation manual. - If the ORIG mode is "2, 3: Return to origin with sensor", check that the sensor mounting and the cable connection of the sensor are correct. 	
DRIVE is ON when SVRE is OFF (098)	C	RESET is ON	<p>< Details > This is generated when the Return to origin, step data number operation or a JOG operation is commanded when the servo is OFF.</p> <p><Countermeasure> Start the operation when the servo motor is ON (SVRE signal is ON).</p>	
DRIVE is ON when SETON is OFF (099)	C	RESET is ON	<p>< Details > Step data number operation is commanded before the completion of the Return to origin.</p> <p><Countermeasure> Turn ON the operation after the completion of the Return to the origin (SETON signal is ON).</p> <table border="1" data-bbox="655 1675 1406 1720"> <tr> <td style="text-align: center;"> Caution</td> </tr> </table> <p>The SETON signal is not ON unless all axes with Profile parameter "Active axis" set to "1: enabled" complete their Return to origin. Check the parameter setting.</p>	 Caution
 Caution				

Name of the controller setting software (code)	Group	How to deactivate	Alarms and countermeasures																				
ORIG switch direction (103)	C	RESET is ON	<p>< Details > The origin sensor does not respond correctly when a Return to origin operation is performed with the origin sensor. An Alarm is generated depending on the set value of the Return to origin parameter.</p> <table border="1" data-bbox="651 387 1444 1391"> <thead> <tr> <th colspan="2" data-bbox="651 387 1013 465">Return to origin parameter value</th> <th data-bbox="1013 387 1444 465">Alarm conditions</th> </tr> <tr> <th data-bbox="651 465 831 506">ORIG mode</th> <th data-bbox="831 465 1013 506">ORIG sensor</th> <th data-bbox="1013 465 1444 506"></th> </tr> </thead> <tbody> <tr> <td data-bbox="651 506 831 801" rowspan="3">1: Return to origin by pushing force</td> <td data-bbox="831 506 1013 546">0: No sensor</td> <td data-bbox="1013 506 1444 546">(No alarm will be generated).</td> </tr> <tr> <td data-bbox="831 546 1013 674">1,3,5: Sensor A contact</td> <td data-bbox="1013 546 1444 674">The end of the stroke of the actuator is reached and the sensor has been OFF since the return to origin operation started.</td> </tr> <tr> <td data-bbox="831 674 1013 801">2,4,6: Sensor B contact</td> <td data-bbox="1013 674 1444 801">The end of the stroke of the actuator is reached and the sensor has been ON since the return to origin operation started.</td> </tr> <tr> <td data-bbox="651 801 831 1391" rowspan="3">2,3: Sensor Return to origin</td> <td data-bbox="831 801 1013 880">0: No sensor</td> <td data-bbox="1013 801 1444 880">Right after inputting a command of return to origin.</td> </tr> <tr> <td data-bbox="831 880 1013 1137">1,3,5: Sensor A contact</td> <td data-bbox="1013 880 1444 1137">- The end of the stroke of the actuator is reached and the sensor has been OFF since the return to origin operation started, or - The end of the stroke of the actuator is reached after the sensor had turned ON before the return to origin operation started.</td> </tr> <tr> <td data-bbox="831 1137 1013 1391">2,4,6: Sensor B contact</td> <td data-bbox="1013 1137 1444 1391">- The end of the stroke of the actuator is reached and the sensor has been ON since the return to origin operation started, or - The end of the stroke of the actuator is reached after the sensor had turned OFF before the return to origin operation started.</td> </tr> </tbody> </table> <p><Countermeasure> -If the ORIG mode is "1: Return to origin by pushing force" Set the return to origin sensor at 0. -If the ORIG mode is "2, 3: Return to origin with sensor" Set the return to origin sensor in accordance with the sensor specifications. Also, check that the sensor mounting and the cable connection of the sensor are correct.</p>	Return to origin parameter value		Alarm conditions	ORIG mode	ORIG sensor		1: Return to origin by pushing force	0: No sensor	(No alarm will be generated).	1,3,5: Sensor A contact	The end of the stroke of the actuator is reached and the sensor has been OFF since the return to origin operation started.	2,4,6: Sensor B contact	The end of the stroke of the actuator is reached and the sensor has been ON since the return to origin operation started.	2,3: Sensor Return to origin	0: No sensor	Right after inputting a command of return to origin.	1,3,5: Sensor A contact	- The end of the stroke of the actuator is reached and the sensor has been OFF since the return to origin operation started, or - The end of the stroke of the actuator is reached after the sensor had turned ON before the return to origin operation started.	2,4,6: Sensor B contact	- The end of the stroke of the actuator is reached and the sensor has been ON since the return to origin operation started, or - The end of the stroke of the actuator is reached after the sensor had turned OFF before the return to origin operation started.
Return to origin parameter value		Alarm conditions																					
ORIG mode	ORIG sensor																						
1: Return to origin by pushing force	0: No sensor	(No alarm will be generated).																					
	1,3,5: Sensor A contact	The end of the stroke of the actuator is reached and the sensor has been OFF since the return to origin operation started.																					
	2,4,6: Sensor B contact	The end of the stroke of the actuator is reached and the sensor has been ON since the return to origin operation started.																					
2,3: Sensor Return to origin	0: No sensor	Right after inputting a command of return to origin.																					
	1,3,5: Sensor A contact	- The end of the stroke of the actuator is reached and the sensor has been OFF since the return to origin operation started, or - The end of the stroke of the actuator is reached after the sensor had turned ON before the return to origin operation started.																					
	2,4,6: Sensor B contact	- The end of the stroke of the actuator is reached and the sensor has been ON since the return to origin operation started, or - The end of the stroke of the actuator is reached after the sensor had turned OFF before the return to origin operation started.																					
Speed exceeded set value (144)	D	RESET and SVON is ON	<p>< Details > The motor speed has exceeded the specified value, possibly due to an external force, etc.</p> <p><Countermeasure> Make improvements to ensure that the motor speed will not exceed the maximum speed of the actuator.</p> <table border="1" data-bbox="651 1816 1444 1928"> <tr> <td data-bbox="651 1816 1444 1861" style="text-align: center;"> Caution</td> </tr> <tr> <td data-bbox="651 1861 1444 1928">Please refer to the actuator manual or the catalogue for the maximum speed of the actuator.</td> </tr> </table>	 Caution	Please refer to the actuator manual or the catalogue for the maximum speed of the actuator.																		
 Caution																							
Please refer to the actuator manual or the catalogue for the maximum speed of the actuator.																							

Name of the controller setting software (code)	Group	How to deactivate	Alarms and countermeasures
Actuator power supply voltage is outside set range. (145)	D	RESET and SVON is ON	<p>< Details > The motor power supply voltage is detected in the controller to be outside of the specified range. The controller will check the lower limit of the motor power supply voltage only when the servo is ON.</p> <p><Countermeasure> Check the voltage supplied to the motor drive power supply (M24V).</p> <div style="border: 1px solid black; padding: 2px; text-align: center;">  Caution </div> <p>If the power supply is a type with “inrushcurrent protection”, a voltage drop may cause an alarm during acceleration/ deceleration.</p> <p>< Details > The alarm may be caused by regenerative power depending on the method of operation of the actuator.</p> <p><Countermeasure> Check if the operating condition of the actuator is within the specification range.</p> <div style="border: 1px solid black; padding: 2px; text-align: center;">  Caution </div> <p>Please refer to the actuator manual or the catalogue for the method of operation of the actuator.</p>
Controller temperature exceeded set range. (146)	D	RESET and SVON is ON	<p>< Details > The temperature around the power element of the controller is too high.</p> <p><Countermeasure> Make improvements so that the temperature around the controller is kept appropriate.</p>
Controller supply voltage is outside set range. (147)	D	RESET and SVON is ON	<p>< Details > The power supply voltage for control detected by the controller is outside of the specified range.</p> <p><Countermeasure> Check the control power supply voltage connected to the controller.</p> <div style="border: 1px solid black; padding: 2px; text-align: center;">  Caution </div> <p>If the power supply has “inrush-current protection”, a voltage drop may cause an alarm during acceleration/deceleration.</p> <p>< Details > The alarm may be caused by regenerative power depending on the method of operation of the actuator.</p> <p><Countermeasure> Check if the operating condition of the actuator is within the specification range.</p> <div style="border: 1px solid black; padding: 2px; text-align: center;">  Caution </div> <p>Please refer to the actuator manual or the catalogue for the method of operation of the actuator.</p>
Current limit is exceeded (148)	D	RESET and SVON is ON	<p>< Details > The output current accumulated value has exceeded the specified value.</p> <p><Countermeasure> Check if the travel of the actuator was interrupted. Also, make sure that the load, speed, acceleration and deceleration are within the specifications of the actuator.</p>

Name of the controller setting software (code)	Group	How to deactivate	Alarms and countermeasures
Failed to achieve set position in set time limit. (149)	D	RESET and SVON is ON	<p>< Details > The target position was not reached within the set time limit.</p> <p><Countermeasure> Check if the actuator travel has been interrupted. Also, make sure that the load, speed, acceleration and deceleration are within the range of the actuator.</p>
(Position error Alarm) Position error counter overflow (151)	D	RESET and SVON is ON	<p>< Details > Position deviation counter in the controller has overflowed.</p> <p><Countermeasure> Check if the actuator travel has been interrupted. Also, make sure that the load, speed, acceleration and deceleration are within the range of the actuator.</p>
Encoder error (192)	E	Turn off the control and motor drive power supplies.	<p>< Details > An abnormality occurred in communication with the encoder.</p> <p><Countermeasure> Check the actuator cable connection.</p>
Unable to find motor phase in set time. (193)	E	Turn off the control and motor drive power supplies.	<p>< Details > Positioning of the polarity is not completed properly. (When the servo motor is turned on (SVON signal is ON) for the first time after the power is supplied, the actuator needs to move a little to find the motor phase. If this actuator movement is prevented, an alarm will be generated).</p> <p><Countermeasure> Make sure there are no obstructions that interfere with the actuator movement and then turn on the servo motor (SVON signal is ON).</p>
Output current limit exceeded set value (194)	E	Turn off the control and motor drive power supplies.	<p>< Details > The Output current in the power supply circuit is abnormally high.</p> <p><Countermeasure> Check if the actuator cable or connector is short-circuited. In addition, make sure that the actuator is compatible with the controller.</p>
Current sensor abnormality has occurred. (195)	E	Turn off the control and motor drive power supplies.	<p>< Details > An abnormality with the current sensors is detected, which is recognized when the controller is initialized.</p> <p><Countermeasure> Confirm the combination of the controller and the actuator is correct. If the alarm is still generated when the power is reapplied, please contact SMC.</p>
Position error overflowed (196)	E	Turn off the control and motor drive power supplies.	<p>< Details > Position deviation counter in the controller has overflowed during the return to origin.</p> <p><Countermeasure> Check if the travel of the actuator was interrupted. Also, make sure that the load, speed, acceleration and deceleration are within the specifications of the actuator.</p>

Name of the controller setting software (code)	Group	How to deactivate	Alarms and countermeasures
Memory abnormality has occurred (197)	E	Turn off the control and motor drive power supplies.	<p>< Details > A memory abnormality in the controller.</p> <hr/> <p><Countermeasure> If the alarm is still generated when the power is applied again, please contact SMC.</p>
WDT by the error detection -1 (198)	E	Turn off the control and motor drive power supplies.	<p>< Details > The CPU is not operating correctly. (It is possible that the CPU or surrounding circuits have failed, or the CPU is malfunctioning due to electrical noise).</p> <hr/> <p><Countermeasure> If the alarm is still generated when the power is reapplied, please contact SMC.</p>
Communication error in the driver board (205)	E	Turn off the control and motor drive power supplies.	<p>< Details > The CPU is not operating correctly. (It is possible that the CPU or surrounding circuits have failed, or the CPU is malfunctioning due to electrical noise).</p> <hr/> <p><Countermeasure> If the alarm is still generated when the power is reapplied, please contact SMC.</p>
WDT by the error detection -2 (206)	E	Turn off the control and motor drive power supplies.	<p>< Details > The CPU is not operating correctly. (It is possible that the CPU or surrounding circuits have failed, or the CPU is malfunctioning due to electrical noise).</p> <hr/> <p><Countermeasure> If the alarm is still generated when the power is reapplied, please contact SMC.</p>

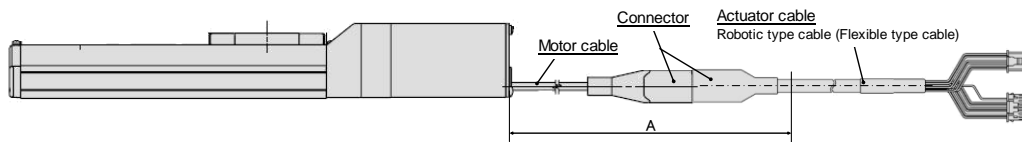
14. Common Precautions for wiring and cable

⚠ Warning

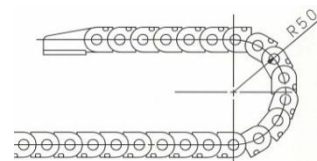
1. **Adjustment, mounting, inspection or wiring should never be carried out before disconnecting the power supply to the product. Electric shock, malfunction and damage can result.**
2. **Do not disassemble the cable. Use only specified cables.**
3. **Do not connect or disconnect the cable or connector with the power on.**

⚠ Caution

1. **Wire the connector securely. Do not apply any voltage to the terminals other than those specified in the Operation Manual.**
2. **Wire the connector securely.**
Check for correct connector wiring and polarity.
3. **Take appropriate measures against noise.**
Noise in a signal line may cause malfunction. As a countermeasure, high voltage and low voltage cables should be separated, and keep wiring lengths short, etc.
4. **Do not route wires or cables together with power or high voltage cables.**
The product may malfunction due to interference and surge voltages. Route the wires of the product separately from power or high voltage cables.
5. **Take care that actuator movement does not damage cables.**
6. **Operate with cables secured. Avoid bending cables at sharp angles where they enter the product.**
7. **Avoid twisting, folding, rotating or applying an external force to the cable. Also avoid operating at sharp angles.**
Risk of electric shock, broken wires, contact failure and loss of control of the product can occur.
8. **Fix the motor cable protruding from the product in place before using.**
The motor cable is not robotic type cable and can be damaged when moved.
Do not place Part A in the diagram below in a flexible cable duct.



9. **Select “Robotic type cables” when deflecting actuator-cables repeatedly. Do not put cables into a flexible moving tube with a radius smaller than the specified value (minimum 50mm).**
Risk of electric shock, wire damage, contact failure and loss of control of the product can occur if “Standard cables” are used in case of inflecting the cables repeatedly.



10. **Confirm correct wiring of the product.**
Insulation failure (interference with another circuit, poor insulation between terminals etc.) could introduce excessive voltage or current to the controller or its peripheral devices and damage them.
11. **The Speed/ pushing force may vary, depending on the cable length, load and mounting conditions etc.**
If the cable length exceeds 5m, the speed/ pushing force will decrease by a maximum of 10% per 5m. (If cable length is 15m: Maximum 20% reduction.)

[Transport]

⚠ Caution

1. **Do not carry or swing the product by the motor or the cable.**

15. Electric Actuators / Common Precautions

15.1 Design and Selection

Warning

1. Read the Operation Manual before using the product.

Handling or usage/operation other than that specified in the Operation Manual may lead to breakage and product failure.

Any damage attributed to use beyond the specifications is not guaranteed.

2. There is a possibility of dangerous sudden action by the product if sliding parts of machinery are twisted due to external forces, etc.

In such cases, human injury may occur, such as catching hands or feet in the machinery, or damage to the machinery itself may occur. The machinery should be designed to avoid such dangers.

3. A protective cover is recommended to minimize the risk of personal injury.

If a driven object and moving parts of the product are in close proximity, personal injury may occur. Design the system to avoid contact with the human body.

4. Securely tighten all stationary parts and connected parts so that they will not become loose.

When the product operates with high frequency or is installed where there is a lot of vibration, ensure that all parts remain secure.

5. Consider a possible loss of power source.

Take measures to prevent injury and equipment damage in the case of a power supply failure.

6. Consider the behavior of an emergency stop of the whole system.

Design the system so that human injury and/or damage to machinery and equipment will not be caused, when it is stopped by a safety device for abnormal conditions such as a power outage or a manual emergency stop of the whole system.

7. Consider the action when operation is restarted after an emergency stop or abnormal stop of the whole system.

Design the system so that human injury or equipment damage will not occur upon restart of operation of the whole system.

8. Prohibition of Disassembly and Modification

Do not disassemble the product or make any modifications, including additional machining. This may cause human injury and/or an accident.

9. Do not use the controller stop signal, "EMG" as an emergency stop for the system.

The controller stop signal "EMG" is to be used only for decelerating and stopping the actuator. Design the system with a separate emergency stop circuit which conforms with the relevant safety standards.

10. When using for vertical applications, it is necessary to build in a safety device.

The rod may fall due to the weight of the work.

The safety device should not interfere with normal operation of the machine.

Caution

1. Use the product for the maximum usable stroke.

The product will be damaged if it is used with a stroke exceeding the maximum stroke. Refer to the specifications of the product.

2. When the product repeatedly cycles with partial strokes, operate it at a full stroke at least once a day or every 1,000 strokes.

Otherwise, lubrication can be lost.

3. Do not use the product in applications where excessive external force or impact force is applied.

The product can be damaged. Components, including the motor, are manufactured to precise tolerances, so the slightest deformation may cause faulty operation or seizure.

4. Return to origin cannot be carried out during operating.

5. Refer to a common auto switch (Best Pneumatics No 2), when an auto switch is built and used within the system.

15.2 Mounting

Warning

- 1. Read and understand the Operation Manual before installing and operating the product. Keep the manual in a safe place for future reference.**
- 2. Observe the tightening torque for the mounting screws.**
Tighten screws to the recommended torque for mounting the product.
- 3. Do not make any alterations to this product.**
Alterations made to this product may lead to a loss of durability and damage to the product, which can lead to human injury and damage to other equipment and machinery.
- 4. When using an external guide, the guide axis should be parallel to the actuator axis.**
There will be damage/excessive wear on the lead screw if the external guide is not parallel.
- 5. When an external guide is used, connect the moving parts of the actuator and the load in such a way that there is no interference at any point within the stroke.**
Do not scratch or dent the sliding parts of the actuator tube or piston rod etc., by striking them with other objects. Components are manufactured to precise tolerances, so the slightest deformation may cause faulty operation.
- 6. Prevent the seizure of rotating parts (pins, etc.) by applying lubricating grease.**
- 7. Do not use the product before verifying that the equipment can operate properly.**
After mounting or repair, connect the power supply to the product and perform appropriate functional inspections to check it is mounted properly.
- 8. Cantilever**
When the actuator is operated at high speeds while it is fixed at one end and free at the other end (flange type, foot type, double clevis type, direct mount type), a bending moment may act on the actuator due to vibration generated at the stroke end, which can damage the actuator. In such a case, install a support bracket to suppress the vibration of the actuator body or reduce the speed so that the actuator does not vibrate. Use a support bracket also when moving the actuator body or when a long stroke actuator is mounted horizontally and fixed at one end.
- 9. When mounting the actuator or attaching to the work piece, do not apply strong impact or large moment.**
If an external force above the allowable moment is applied, it may cause looseness in the guide unit, an increase in sliding resistance or other problems.
- 10. Ensure sufficient space for maintenance activities.**
When installing the products, allow access for maintenance.

15.3 Handling Precautions

Warning

- 1. Do not touch the motor while in operation.**
The surface temperature of the motor can increase to approx. 90 °C to 100 °C due to operating conditions. Energizing alone may also cause this temperature increase. Do not touch the motor when in operation as it may cause burns.
- 2. If abnormal heating, smoking or fire, etc., occurs in the product, immediately shut off the power supply.**
- 3. Immediately stop operation if abnormal operation noise or vibration occurs.**
If abnormal operation noise or vibration occurs, the product may have been mounted incorrectly. Unless operation of the product is stopped for inspection, the product can be seriously damaged.
- 4. Never touch the rotating part of the motor or moving part of the actuator while in operation.**
- 5. When installing, adjusting, inspecting or performing maintenance on the product, controller and related equipment, shut off the power supply to each of them. Then, lock it so that no one other than the person can turn the power on, or implement measures such as a safety plug.**

6. In the case of the actuator that has a servo motor (24VDC), the “motor phase detection step” is done by inputting the servo on signal just after the controller power is turned on. The “motor phase detection step” moves the table/rod for the distance of one screw-lead maximum.
(The motor rotates in the reverse direction if the table hits an obstacle such as the end stop damper.) Take the “motor phase detection step” into consideration for the installation and operation of this actuator.

Caution

- 1. For the controller, set parameters which are appropriate to the connected actuators.**
Operation with inappropriate parameters may cause failure of the controller or actuator, or damage to the user's systems.
- 2. Check the product for the following points before operation.**
 - a) Damage to power supply line and signal line
 - b) Looseness of the connector to the power and signal lines
 - c) Looseness of the actuator/cylinder and controller/driver mounting
 - d) Abnormal operation
 - e) Emergency stop of the whole system
- 3. When more than one person is performing work, decide on the procedures, signals, measures for emergency and how to start the operation after the measures taken. Also, designate a person to supervise work other than those performing work.**
- 4. Actual speed of the product will be changed by the workload.**
Before selecting a product, check the catalog for the instructions regarding selection and specifications.
- 5. Do not apply a load, impact or resistance, in addition to a transferred load during the “Return to Origin” operation.**
When performing return to origin by pushing force, additional force will cause displacement of the origin position since it is based on detected motor torque.
- 6. Do not remove the name plate.**
- 7. An operation test should be carried out using a low speed. Start operation using the predefined speed after confirming there is no problems.**

[Grounding]

Warning

- 1. Provide a good earth connection to the actuator.**
- 2. The earth should be a dedicated earth connection. Class D dedicated grounding should be used. (Ground resistance 100Ω or less)**
- 3. The earth cable length should be as short as possible.**

[Unpacking]

Caution

- 1. Check that the received product is as ordered.**
If a different product is installed, other than that ordered, injury or damage can result.

15.4 Operating environment

Warning

1. Avoid use in the following environments.

- a) Locations where a large amount of dust and cutting chips are airborne.
- b) Locations where the ambient temperature is outside the range of the temperature specification (refer to specifications).
- c) Locations where the ambient humidity is outside the range of the humidity specification (refer to specifications).
- d) Locations where corrosive gas, flammable gas, seawater, water and steam are present.
- e) Locations where strong magnetic or electric fields are generated.
- f) Locations where direct vibration or impact is applied to the product.
- g) Areas that are dusty, or are exposed to splashes of water and oil drops.
- h) Areas exposed to direct sunlight (ultraviolet ray).
- i) Environment at an altitude of 1000 meters or higher.
Heat dissipation and withstand voltage will decrease. Contact SMC for details.

2. Do not use in an environment where the product is directly exposed to liquid, such as cutting oils.

If cutting oils, coolant or oil mist contaminates the product, failure or increased sliding resistance can result.

3. Install a protective cover when the product is used in an environment directly exposed to foreign matter such as dust, cutting chips and spatter.

Play or increased sliding resistance can result.

4. Provide a protective cover if the product is used in direct sunlight.

5. Shield the product if there is a heat source nearby.

When there is a heat source surrounding the product, the radiated heat from the heat source can increase the temperature of the product beyond the operating temperature range.

6. Grease oil can be reduced due to the external environment and operating conditions. The lubrication performance may deteriorate and shorten the life of the product.

[Storage]

Warning

1. Do not store the product with direct contact to rain or water drops. Do not store the product where it is exposed to harmful gases or liquid.
2. Store in an area that is shaded from direct sunlight and has a temperature and humidity within the specified range (-10°C to 60°C and 35 to 85%. No condensation or freezing.)
3. Do not apply vibration or impact to the product during storage.

15.5 Maintenance and Precautions

Warning

1. Do not disassemble or repair the product.

Fire or electric shock can result.

2. Before modifying or checking the wiring, the voltage should be checked with a tester 5 minutes after the power supply is turned off.

Electric shock can result.

Caution

1. Perform maintenance inspection according to the procedure indicated in the Operation Manual.

Incorrect handling can cause an injury, damage or malfunction of equipment and machinery.

2. Removal of product

When equipment is serviced, first confirm that measures are in place to prevent dropping of work pieces and run-away of equipment, etc, then cut the power supply to the system. When machinery is restarted, check that operation is normal with actuators in the proper positions.

3. The actuator cable must be removed when manually operating the actuator.

If the sliding part is moved while the actuator and the controller are connected, the actuator will not move smoothly because the induced voltage of the motor is applied to the controller. An induced voltage may damage the controller when the actuator is used at high frequency.

[Lubrication]

Caution

1. The product has been lubricated for life at the manufacturer's and does not require lubrication in service.

Contact SMC if lubrication is to be applied.

15.6 Precautions for actuator with lock

Warning

1. Do not use the lock as a safety lock or a control that requires a locking force.

The lock used for the product with a lock is designed to prevent dropping of work pieces.

2. When the actuator is mounted in a non- horizontal position, use actuators with lock.

This may cause damage to the internal parts of the controller. If the actuator is not equipped with a lock, the actuator will move and drop the work piece when the power is removed.

3. "Measures against drops" means preventing a work piece from dropping due to its weight when the product operation is stopped and the power supply is turned off.

4. Do not apply an impact load or strong vibration while the lock is activated.

If an external impact load or strong vibration is applied to the product, the lock will lose its holding force and damage to the sliding part of the lock or reduced lifetime can result. The same situations will happen when the lock slips due to a force over the thrust of the product, as this accelerates the wear to the lock.

5. Do not apply liquid or oil and grease to the lock or its surrounding.

If liquid or oil and grease is applied to the sliding part of the lock, its holding force will reduce significantly.

6. Take measures against drop and check that safety is assured before mounting, adjustment and inspection of the product.

If the lock is released with the product mounted vertically, a work piece can drop due to its weight.

7. When the actuator is operated manually (when SVRE output signal is off), supply 24 VDC to the [LKRLS] terminal of the power supply connector.

If the product is operated without releasing the lock, wear of the lock sliding surface will be accelerated, causing a reduction in the holding force and the life of the locking mechanism.

8. Do not supply 24VDC constantly to the [LKRLS] terminal.

Stop supplying supply 24 VDC to the [LKRLS] terminal during normal operation. If power is supplied to the [LKRLS] terminal continuously, the lock will be released, and workpieces may be dropped at stop (EMG).

For details of wiring please refer to the operation manual for the controller (JXC series).

16. Controller and Peripheral Devices / Specific Product Precautions

16.1 Design and selection

Warning

1. Use the specified voltage.

Otherwise, malfunction and damage to the controller may result.

If the applied voltage is lower than the specified voltage, it is possible that the load cannot be moved due to an internal voltage drop. Check the operating voltage before use.

2. Do not operate beyond the specifications.

Fire, malfunction or actuator damage can result. Check the specifications before use.

3. Install an emergency stop circuit.

Install an emergency stop outside of the enclosure so that it can stop the system operation immediately and intercept the power supply.

4. Establish a back up system such as multiple system of equipment and devices or fail safe design in advance.

5. If fire or personal injury is expected due to abnormal heat generation, ignition, smoking of the product, etc., cut off the power supply for this product and the system immediately.

6. During a return to origin or while deviation is accumulated (the operation is interrupted by an obstacle), the emergency stop of the actuator is not available even if "RESET" is input. Therefore, when an automatic operation is executed by/from the external equipment (PLC), please take a measure so that the manual or automatic stop can be performed by the controller stop (EMG) terminal.

Refer to [6.3 Wiring of shutdown circuit \(P.45\)](#) for EMG input terminal and wiring)

It may cause injury, accident or damage to the actuator or the user's system.

16.2 Handling Precautions

Warning

- 1. The inside of the controller and its connector should not be touched.**
It may cause an electric shock or damage to the controller.
- 2. Do not perform operation or setting of this equipment with wet hands.**
It may cause an electric shock.
- 3. A product that is damaged or missing any components should not be used.**
Electric shock, fire, and injury can result.
- 4. For the controller, set parameters which are appropriate to the connected actuators.**
Operation with inappropriate parameters may cause failure of the controller or actuator, or damage to the user's systems.
- 5. Be careful not to be caught or hit by the workpiece while the actuator is moving.**
It may cause an injury.
- 6. Do not connect the power supply to the product until it is confirmed that the workpiece movement area is safe.**
The movement of the workpiece may cause an accident.
- 7. Do not touch the product when it is energized and for some time after power has been disconnected, as it can be very hot.**
It may cause burns due to the high temperature.
- 8. Check for voltage using a tester at least 5 minutes after power-off when performing installation, wiring and maintenance.**
Electric shock, fire, and injury can result.
- 9. Do not use the product in an area where it could be exposed to dust, metallic powder, machining chips, or splashes of water, oil or chemicals.**
A failure or malfunction can result.
- 10. Do not use the product in an area where a magnetic field is generated.**
It will cause failure or malfunction.
- 11. Do not install the product in an environment where flammable gas, explosive or corrosive gas, liquids or other substances are present.**
It could lead to fire, explosion and corrosion.
- 12. Avoid radiant heat from large heat sources such as direct sunlight or hot furnaces.**
It will cause failure of the controller or its peripheral devices.
- 13. Do not use the product in an environment subjected to cyclic temperature changes.**
It will cause failure of the controller or its peripheral devices.
- 14. Do not use in a location where surges are generated.**
When there are units that generate a large amount of surge around the product (for example solenoid type lifters, high frequency induction furnaces, motors, etc.), this may cause deterioration or damage to the product's internal circuit. Avoid surge generation and crossed lines.
- 15. Do not install the product in an environment subjected to vibration and impact.**
It will cause failure or malfunction.
- 16. If this product is used in conjunction with a relay or solenoid valve, use a type with a surge absorbing element built-in.**
- 17. Do not fix multiple axes to the workpiece.**
It may cause injury; or damage to the actuator or the user's system.

16.3 Mounting

Warning

- 1. The controller and its peripheral devices should be installed on a fire-proof material.**
Direct installation on or near a flammable material may cause fire.
- 2. Do not install this product in a location subject to vibration and impact.**
A failure and malfunction can result.
- 3. Take measures so that the operating temperature of this controller and its peripheral devices are within the range of the specifications.**
Also, this controller should be installed with at least 50mm space between each side of it and other structures or components.
It may cause a malfunction of the controller and its peripheral devices and a fire.
- 4. Do not mount the controller and its peripheral devices near to a large electromagnetic contactor or no-fuse breaker which generates vibration on the same panel. Mount them on different panels, or keep the controller and its peripheral devices away from such a vibration source.**
- 5. The controller and its peripheral devices should be installed on a flat surface.**
If the mounting surface is distorted or not flat, excessive force may be applied to the housing, etc. causing malfunction.

16.4 Wiring

Warning

- 1. Do not damage the cable or apply a heavy object or pinch the cable. Avoid repeatedly bending or stretching the cable.**
It may cause an electric shock, fire, or breaking of wire.
- 2. Wire correctly.**
Incorrect wiring could damage the controller or its peripheral devices depending on the seriousness.
- 3. Do not perform wiring while the power is on.**
It can damage the controller or its peripheral devices could be damaged, causing malfunction.
- 4. Do not carry this product by holding its cables.**
It may cause an injury or damage to the product.
- 5. Do not route wires or cables together with power or high voltage cables.**
The wires to the controller or its peripheral devices can be interrupted with noise or induced surge voltage from power lines or high-voltage lines, causing malfunction.
Route the wires of the product separately from power or high voltage cables.
- 6. Verify the insulation of wiring.**
Insulation failure (interference with another circuit, poor insulation between terminals etc.) could introduce excessive voltage or current to the controller or its peripheral devices and damage them.

16.5 Power supply

Caution

- 1. Use a power supply with low noise between lines and between power and ground.**
In cases where noise is high, use an isolation transformer.
- 2. The power supplies for the controller power and the I/O signal power should be separate, and both Power supplies should not be of the “in-rush current limiting type”.**
If the power supply is “inrush-current control”, a voltage drop may be caused during the acceleration of the actuator.
- 3. Take appropriate measures to prevent lightning surges. Ground the surge absorber for lightning separately from the ground connection for the controller and its peripheral devices.**

16.6 Grounding

Warning

- 1. Ensure that the product is grounded to allow the noise tolerance of the controller.**
Otherwise it may cause an electric shock or fire.
- 2. A dedicated Ground connection must be used.**
Grounding should be to a D-class ground connection. (Ground resistance 100Ω or less)
- 3. The grounding point should be as near as possible to the controller to keep the cable length short.**
- 4. In the unlikely event that malfunction is caused by the ground connection, it may be disconnected.**

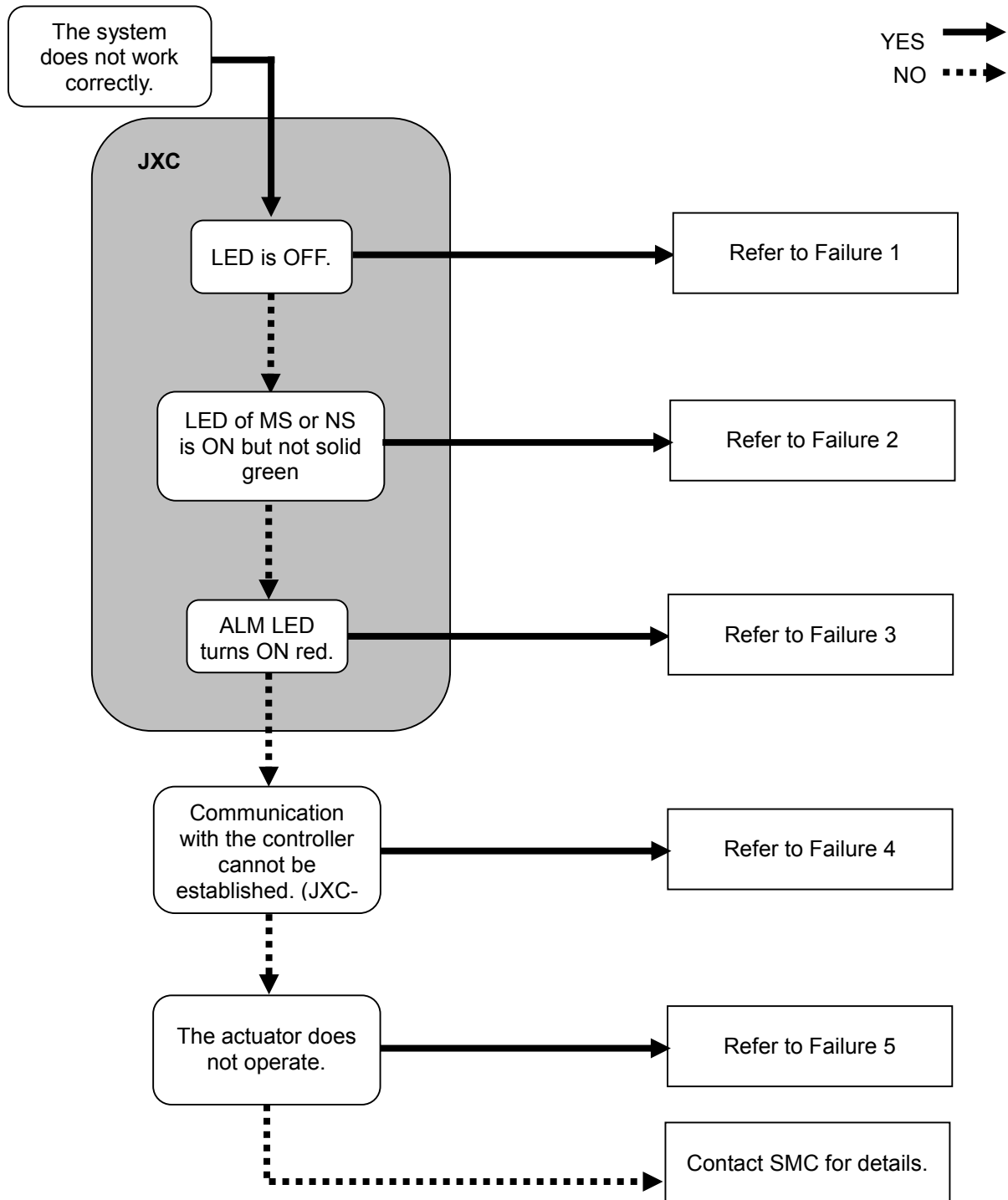
16.7 Maintenance

Warning

- 1. Perform maintenance checks periodically.**
Confirm wiring and screws are not loose.
Loose screws or wires may cause unexpected malfunction.
- 2. Conduct an appropriate functional inspection and test after completing maintenance.**
In case of any abnormalities (if the actuator does not move, etc.), stop the operation of the system.
Otherwise, an unexpected malfunction may occur and it will become impossible to ensure safety.
Give an emergency stop instruction to confirm safety.
- 3. Do not disassemble, modify or repair this controller or the peripheral devices.**
- 4. Do not put anything conductive or flammable inside of the controller.**
Fire or explosion can result.
- 5. Do not perform an insulation resistance test or insulation withstand voltage test.**
- 6. Ensure sufficient space for maintenance.**
Design the system to allow the required space for maintenance.

17. Troubleshooting

When any failure occurs with this product, the following chart can be used to identify the cause of the failure. When none of the causes in the troubleshooting can be confirmed, it is presumed that the product is faulty and normal operation can only be recovered by the replacement of a part. It is possible that this product may be damaged due to the operating conditions (applications). Please contact SMC to discuss appropriate measures.



Problem No.	Problem	Possible causes	Investigation method and location of possible causes	Countermeasures
1	LED is OFF.	Power fault	Check if the controller PWR LED (green) is OFF.	Use an appropriate voltage and power supply capacity in reference to the operation manual of the actuator and controller connected. → 2.3 Product configuration (P.9) → 4. Product Specifications (P.30)
		Incorrect wiring	Check for incorrect wiring, broken wire or short circuit of the power supply connector.	Please correct the wiring in reference to Controller Operation Manual. → 2.3 Product configuration (P.9) → 6. Power supply connector (P.42)
2	MS or NS is ON or flashing	MS: Green LED flashes	(1) Setting error (2) PLC has stopped operating, or the communication is idling.	(1) Set up configuration configuration correctly. (2) Set PLC in RUN status.
		MS: Red LED flashes	Recoverable error	Set up the configuration correctly. → 5.2 PLC setting (Configuration) (P.39)
		MS: Red LED is on	Unrecoverable error	Stop using the product. Contact your sales representative.
		NS: OFF	IP address not set	Set the IP address correctly. → 5.1 Controller setting (IP address setting) (P.38)
		NS: Green LED flashes	Communication not established	Check the following and restart. • Signal line from PLC is connected correctly. • Communication speed of PLC is appropriate. • Wire the communication line away from the noise source.
		NS: Red LED flashes	Communication timeout	Check the following and restart. • Signal line from PLC is connected correctly. • Communication speed of PLC is appropriate. • Wire the communication line away from the noise source.
	NS: Red LED is on	IP address has been duplicated	Reset IP address which has not been used yet. → 5.1 Controller setting (IP address setting) (P.38)	
3	ALM is on	Alarm generated	If it is, check the type of alarm referring to this manual.	Refer to the controller operation manual and take appropriate measures. → 13. Abnormality detection (P.89) .

Problem No.	Problem	Possible causes	Investigation method and location of possible causes	Countermeasures
4	Communication fault (JXC-MA1)	The USB driver is not installed	Check that the USB driver for the USB cable is installed.	Install the USB driver for the USB cable. Details of the installation procedure are shown in the Installation Manual for JXC-MA1 setting software.
		Connection failure	Please confirm the connection status.	Confirm the correct connection of motor controller (JXC), USB cable and PC. For example, communication cannot be established if the connector has been damaged. Confirm the power supply of the motor controller (JXC) has been turned on. Communication cannot be established if the power supply is off. If any external equipment (PLC or measurement hardware), other than the motor controller (JXC) is connected to the PC, disconnect them. (There is a possibility that the other equipment may interfere with the communication)
5	Does not operate at all.	Lock release error	When the unlock switch is turned ON or OFF there is an unlocking sound made.	If there is no sound of lock release, the lock brake may be broken. → If the problem persists, please contact SMC.
		External equipment failure	Check that the PLC connected to the controller operates correctly. Test operation of the controller on its own.	Refer to the controller operation manual and take appropriate measures. → 8.1 Memory allocation (P.48)
		Unsuitable spec.	Check if the product model, power supply specification and parameter settings of the controller are appropriate for the connected actuator.	Check that the product number of the actuator matches with the controller parameters. Check that the power specifications are correct. → 4. Product Specifications (P.30)
	Operation stops intermittently	Incorrect wiring	Is the wiring connected correctly? Refer to the controller operation manual to confirm wiring, and check for broken wires and short-circuits.	Correct the wiring so that the input/output of each signal is performed appropriately. → 2.3 Product configuration (P.9) → 8.1 Memory allocation (P.48)
		Electric noise	Connect to Ground correctly. Avoid bundling the cables.	Refer to the controller operation manual and take appropriate measures. → 4.5 Mounting (P.35)

Problem No.	Problem	Possible causes	Investigation method and location of possible causes	Countermeasures
5	Operation stops intermittently	Incorrect parameters	Check that the parameter values are correct. Check if the appropriate parameters are used for the actuator.	Take appropriate measures according to this manual. → 9. Setting Data Entry (P.52)
		Voltage drop	Check for a temporary voltage drop in the power supply? (If there is a temporary voltage drop in the power supply, the EMG terminal of the control power connector will turn OFF so the actuator will stop. However, this stop will be released when the voltage recovers.)	There is a possibility of a momentary voltage drop because the capacity of the power supply is insufficient, or if the power supply is "inrush-current control" type. If necessary, replace the power supply. → 4. Product Specifications (P.30)
		Failure of pushing operation.	Check that "INP" turns ON during a pushing operation. (If completion of the pushing operation is detected by "INP", the PLC cannot confirm completion)	Check "INP" signal before the energy saving mode is turned ON. → 8.1 Memory allocation (P.48)
		Unsuitable spec.	Check if the product model, power supply specification and parameter setting of the controller are appropriate for the connected actuator.	Check if the product number of the actuator matches with the controller parameters. Check if the power specifications are correct. → 4. Product Specifications (P.30)
		Signal timing	Check the timing of the signal from the PLC to the controller.	Both PLC processing delay and controller scan delay are generated. Ensure that more than 2 times the communication cycle time should be maintained between signals. → 10.7 PLC output signal response time (P.77)
	The actuator does not move to the correct position.	Incorrect origin position	If it is a pushing operation, repeat return to origin operations several times to check if the actuator returns to the origin correctly. Perform the Return to Origin position operation several times to check the Origin position.	Take measures to make the actuator operate normally (remove foreign matter that interferes with the actuator movement, etc.)
		Incorrect parameters	Check that the parameter values are appropriate and the program is correct. Review the maximum speed, the maximum acceleration and the maximum deceleration of the actuator.	Modify the parameters and test the operation. → 9. Setting Data Entry (P.52)
		Unsuitable specification	Check if the product model, power supply specification and parameter setting of the controller are appropriate for the connected actuator	Check that the product number of the actuator matches with the controller parameters. Check that the power specifications are correct. → 4. Product Specifications (P.30)

Problem No.	Problem	Possible causes	Investigation method and location of possible causes	Countermeasures
5	The actuator does not move correctly.	Incorrect wiring	Is the wiring connected correctly? Refer to the controller operation manual to confirm wiring, and check for broken wires and short-circuits.	Correct the wiring so that the input/output of each signal is performed appropriately. → 2.3 Product configuration (P.9) → 8.1 Memory allocation (P.48)
		Unsuitable specification	Check if the product model, power supply specification and parameter setting of the controller are appropriate for the connected actuator	Check that the product number of the actuator matches with the controller parameters. Check that the power specifications are correct. → 4. Product Specifications (P.30)
		Signal timing	Check the timing of the signal from the PLC to the controller.	Both PLC processing delay and controller scan delay are generated. Ensure that more than 2 times the communication cycle time should be maintained between signals. → 10.7 PLC output signal response time (P.77)
		Data not stored correctly	Check whether data (step data, parameter) is written correctly. Do not turn off the controller power supply or remove the USB cable while data is being stored.	Input correct data (step data, parameter) again and confirm operation. → 9. Setting Data Entry (P.52)
	Speed not achieved	Incorrect parameters	Check that the parameter values are correct. Review the maximum speed and the maximum acceleration and deceleration of the actuator.	Modify the values of the parameters and test the operation. → 9. Setting Data Entry (P.52)
		Operation pattern is not suitable.	Check if a trapezoidal acceleration/deceleration is programmed for the actuator operation. In case of such operation, the actuator may start slowing down before it reaches the maximum speed.	Modify the setting to make the moving distance longer or the acceleration larger. → 9. Setting Data Entry (P.52)
		Unsuitable specification	Check if the product model, power supply specification and parameter setting of the controller are appropriate for the connected actuator	Check that the product number of the actuator matches with the controller parameters. Check that the power specifications are correct. → 4. Product Specifications (P.30)
		Voltage drop	Check for a temporary voltage drop in the power supply? (If there is a temporary voltage drop in the power supply, the EMG terminal of control power connector will turn OFF so the actuator will stop. However, this stop will be released when the voltage recovers.)	There is a possibility of a momentary voltage drop because the capacity of the power supply is insufficient, or if the power supply is "inrush-current control" type. If necessary, replace the power supply. → 4. Product Specifications (P.30)

Supplement 1. Actuator Specifications

Supplement 1.1 Initial setting of LEY/LEYG series

Model	LEY16/LEYG16			LEY25/LEYG25			LEY32/LEYG32			LEY40/LEYG40		
Lead symbol	A	B	C	A	B	C	A	B	C	A	B	C
Lead [mm]	10	5	2.5	12	6	3	16	8	4	16	8	4
Stroke (mm)	300	300	300	400	400	400	500	500	500	500	500	500
Max. speed [mm/s]	500	250	125	500	250	125	500	250	125	300	150	75
Min. speed [mm/s] (Independent and interpolation)	15	8	4	18	9	5	24	12	6	24	12	6
Min. speed [mm/s] (Speed tuning control)	22	12	6	26	13	7	34	17	9	34	17	9

Supplement 1.2 Initial setting of LEFS series

Model	LEFS16		LEFS25									
Lead symbol	A	B	H			A			B			
Lead [mm]	10	5	20			12			6			
Stroke (mm)	500	500	500	600	700	800	600	700	800	600	700	800
Max. speed [mm/s]	500	250	100	900	630	550	500	420	330	250	230	180
Min. speed [mm/s] (Independent and interpolation)	10	5	20			12			6			
Min. speed [mm/s] (Speed tuning control)	17	9	33			20			10			

Model	LEFS32										
Lead symbol	H			A			B				
Lead [mm]	24			16			8				
Stroke (mm)	600	700	800	900	1000	800	900	1000	800	900	1000
Max. speed [mm/s]	1200	930	750	610	500	500	410	340	250	200	170
Min. speed [mm/s] (Independent and interpolation)	24			16			8				
Min. speed [mm/s] (Speed tuning control)	39			26			13				

Model	LEFS40						
Lead symbol	H	A			B		
Lead [mm]	30	20			10		
Stroke (mm)	1200	1000	1100	1200	1000	1100	1200
Max. speed [mm/s]	500	500	410	340	250	200	170
Min. speed [mm/s] (Independent and interpolation)	30	20			10		
Min. speed [mm/s] (Speed tuning control)	49	33			17		

Supplement 1.3 Initial setting of LES(H) series

Model	LES(H)8		LES(H)16		LES(H)25	
Lead symbol	J	K	J	K	J	K
Lead [mm]	8	4	10	5	16	8
Max. speed [mm/s]	400	200	400	200	400	200
Min. speed [mm/s] (Independent and interpolation)	20	10	20	10	20	10
Min. speed [mm/s] (Speed tuning control)	25	13	27	14	30	15

Supplement 1.4 Initial setting of LEP series

Model	LEP*8			LEP*16		
Lead symbol	J		K	J		K
Lead [mm]	8		4	10		5
Stroke (mm)	Others	25	-	Others	25	-
Max. speed [mm/s]	300	250	150	350	250	200
Min. speed [mm/s] (Independent and interpolation)	20		10	20		10
Min. speed [mm/s] (Speed tuning control)	25		13	27		14

Supplement 1.5 Initial setting of LEFB series

Model	LEFB16	LEFB25	LEFB32
Lead symbol	T		
Lead [mm]	48		
Max. speed [mm/s]	1100	1400	1500
Min. speed [mm/s] (Independent and interpolation)	48		
Min. speed [mm/s] (Speed tuning control)	78		

Supplement 1.6 Initial setting of LER series

Model	LER10		LER30		LER50	
Lead symbol	J	K	J	K	J	K
Lead [mm]	12	8	12	8	12	7.5
Max. speed [mm/s]	420	280	420	280	420	280
Min. speed [mm/s] (Independent and interpolation)	30	20	30	20	30	20
Min. speed [mm/s] (Speed tuning control)	38	25	38	25	38	25

Supplement 1.7 Initial setting of LEH series

Model	LEHZ(J)10	LEHZ(J)16	LEHZ(J)20	LEHZ(J)25	LEHZ32	LEHZ40
Lead symbol	K					
Lead [mm]	251/73 (3.438)	249/77 (3.234)	246/53 (4.642)	243/48 (5.063)	242/39 (6.205)	254/43 (5.907)
Max. speed [mm/s]	80	80	100	100	120	120
Min. speed [mm/s] (Independent and interpolation)	5	5	5	5	5	5
Min. speed [mm/s] (Speed tuning control)	8	8	8	9	9	9

Model	LEHF10	LEHF20	LEHF32	LEHF40
Lead symbol	K			
Lead [mm]	40/15 (2.667)	50/15 (3.333)	70/16 (4.375)	70/16 (4.375)
Max. speed [mm/s]	80	100	100	100
Min. speed [mm/s] (Independent and interpolation)	5	5	5	5
Min. speed [mm/s] (Speed tuning control)	7	8	8	8

Model	LEHS10	LEHS20	LEHS32	LEHS40
Lead symbol	K			
Lead [mm]	255/76 (3.355)	235/56 (4.196)	235/40 (5.875)	235/40 (5.875)
Max. speed [mm/s]	70	80	100	120
Min. speed [mm/s] (Independent and interpolation)	5	5	5	5
Min. speed [mm/s] (Speed tuning control)	8	8	9	9

Trademark

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Revision history

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Note: Specifications are subject to change without prior notice and any obligation on the part of the manufacturer.

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