No.SFOD-OMT0010-B

Operation Manual

Product name

4-axis Step Motor Controller (Parallel I/O type)

MODEL/ Series/ Product Number

JXC73/83 Series

SMC Corporation

Contents

JXC73/83 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 10218-1992: 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.

JXC73/83 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 provide 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.**

2. Product Outline

2.1 Features

This controller uses predefined "step data" in which multiple data such as position or speed are included together as operation instructions to the actuator. An external PLC specifies the step data number to the controller and will start the operation based on the step data.

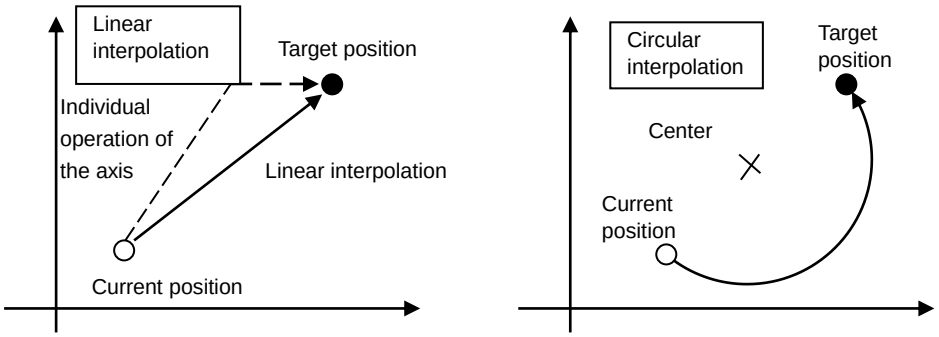
Feature of the controller.

- 4 axes speed tuning control

  Up to 4 axes speed tuning control is available for 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 travel speed of the locus and the centre position must be set.



- Return to origin

  All axes are possible to return to origin by using one “return to origin” signal (SETUP). The order of the return to origin operation is possible to specify by the 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 step data specified by the input of parallel I/O. It is possible to operate all axes by using 1 step.

- Data input method

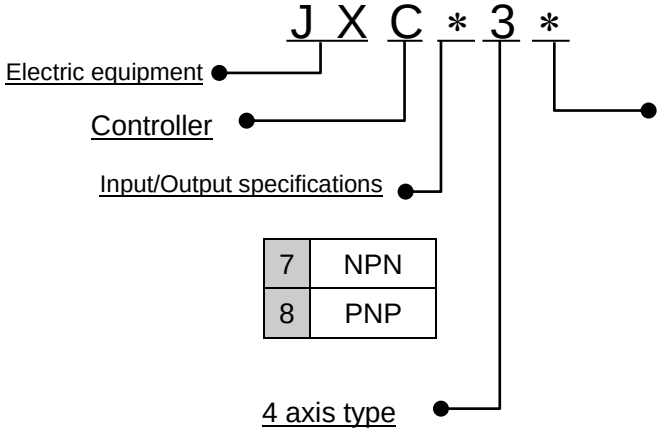
  It is possible to set the step data, parameters, monitor conditions, and reset alarms by communication via the USB port from a PC inwhich the controller setting software is installed.

⚠ 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.



Symbol	I/O cable[Note1)]	Mounting
1	1.5m	Direct mounting
2	1.5m	DIN rail
3	3m	Direct mounting
4	3m	DIN rail
5	5m	Direct mounting
6	5m	DIN rail
7	--	Direct mounting
8	--	DIN rail

Note 1) When I/O cable (1.5 to 5m) is selected, two I/O cables are included.

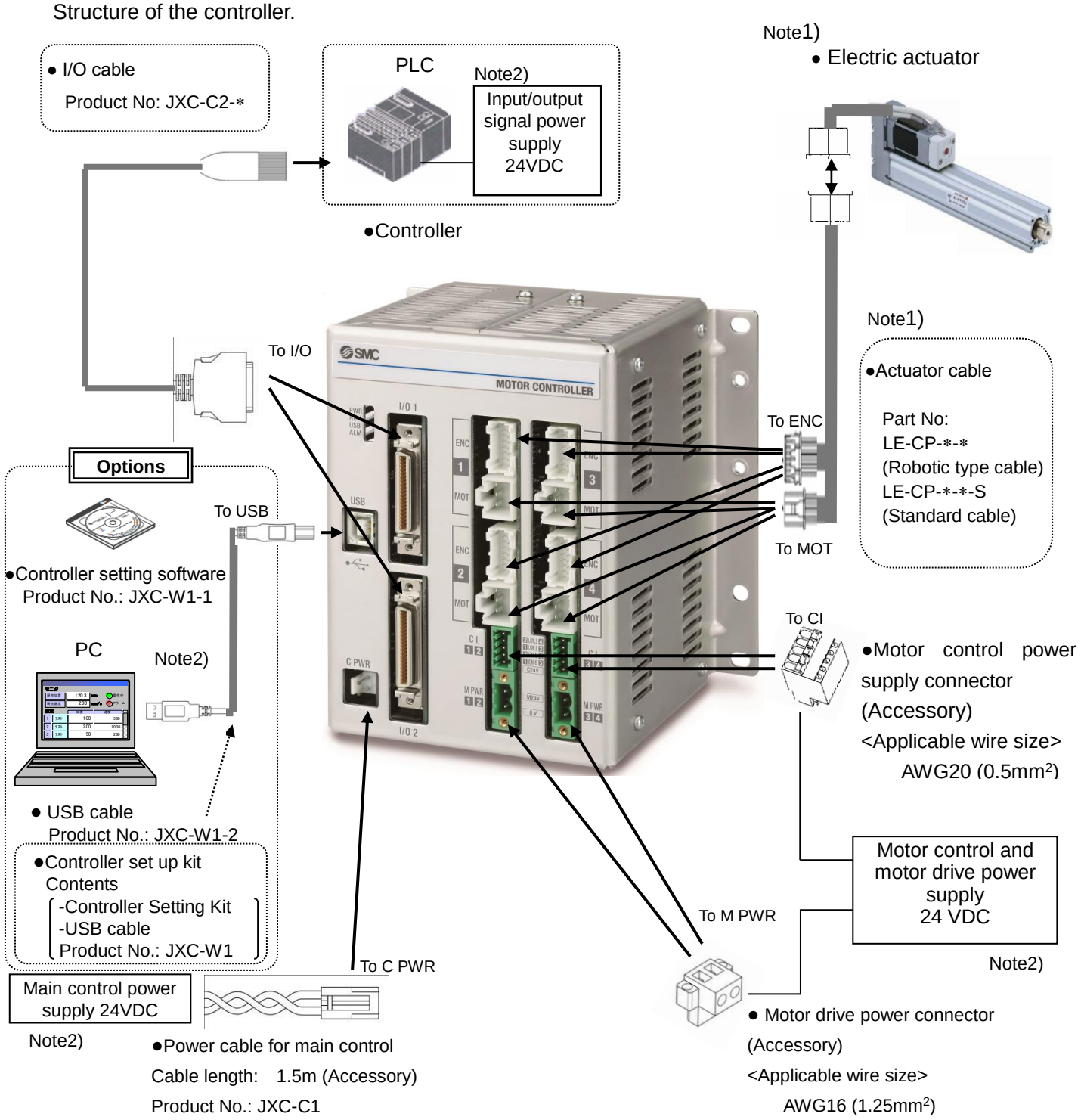
Applicable Actuator

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** Note2)
Electric Actuator Miniature Type **LEPY/LEPS Series**
Electric Gripper (2-Finger Type, 3-Finger Type) **LEH Series**

Note 2) The continuous rotation (360°) type is excluded.

2.3 Product configuration

Structure of the controller.



Note 1) Connected actuators should be ordered separately.

Note 2) PLC, PC and 24VDC power supply should be prepared by theuser.

⚠Wirning

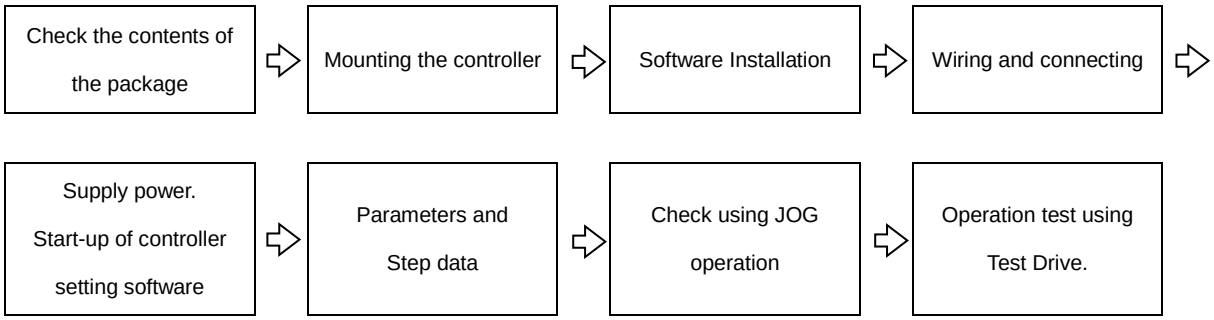
Refer to 12. Common Precautions for wiring and cable.
Use “USB cable (JXC-W1-2)” when communicating with a PC.

⚠Caution

Connector “CI 3 4” must be connected even when axis 3 and 4 are not used. If not, a “Modbus Error” alarm will be generated.

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.SFOD-OMT0008). 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.SFOD-OMT0012).

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

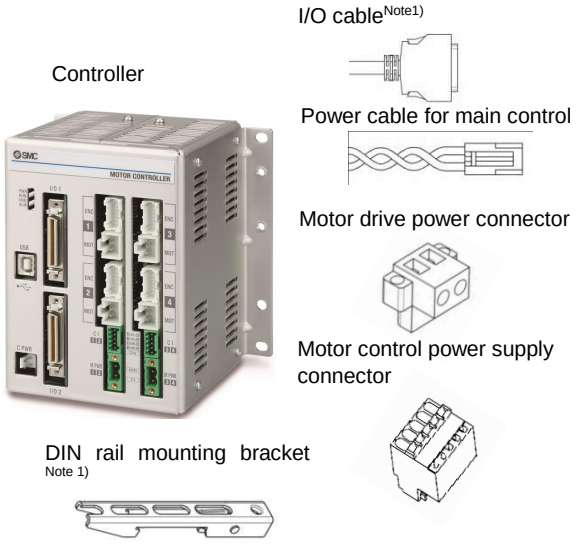
Please download the information which has been set by the controller setting software and use it.

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 (JXC∗3∗)	1 pc.
Power cable for main control (Length 1.5m)	1 pc.
Motor drive power connector	2 pcs.
Motor control power supply connector	2 pcs.
DIN rail mounting bracket Note 1)	1 set
I/O cable Note1)	2 pcs.

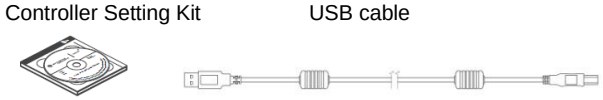
Note1) These items are included if you ordered by the part number for a set of controller.



[Options]

Controller setting kit (Product model No.: JXC-W1)

(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 **4.4 Mounting** 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.SFOD-OMT0008).

3.4 Wiring and connection

Connect the cables to the controller.

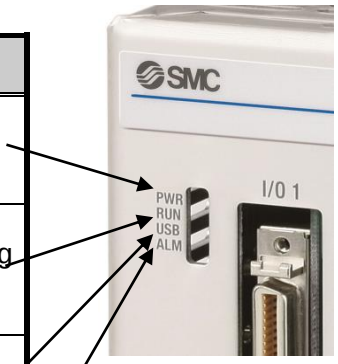
Refer to section **2.3 Product configuration**, **5.2 Wiring** and **6.4 Parallel I/O Wiring Example** for wiring details.

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

(1) Supplying power

After supplying power for the motor control and motor drive, turn on the power supply for the main control.

LED	Colour	Status
PWR	Green	ON: Power ON OFF: Power OFF
RUN	Green	ON: Operating Flashing: Operation by the setting software OFF: Not operated
USB	Green	ON: USB connected OFF: USB not connected
ALM	Red	ON: Alarm is generated OFF: Alarm is not generated



Check that thePWR LED is ON.

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

⚠ Caution

After supplying power for the motor control and motor drive, turn on the power supply for the main control. Otherwise a“Modbus Error”alarm will be generated.

(2) Start-up of controller setting software

Using a PC with the controller setting software installed, start the application “SMC / JXC Controller” to start the setting software.

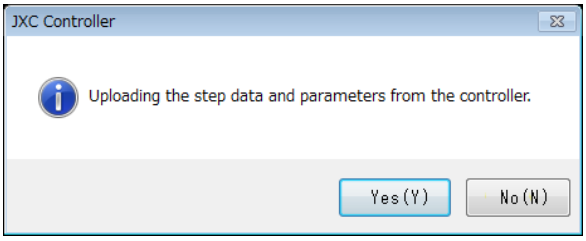
If the controller setting software is installed with the default setting, an icon will be created on the desk top. It is possible to start the setting software by double-clicking the icon.

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.

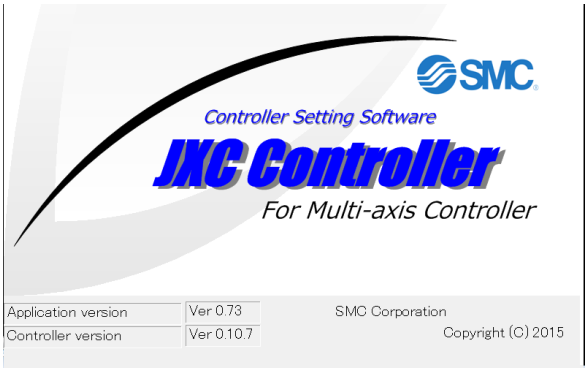
However, when the setting software is started for the first time, this window will not appear.

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

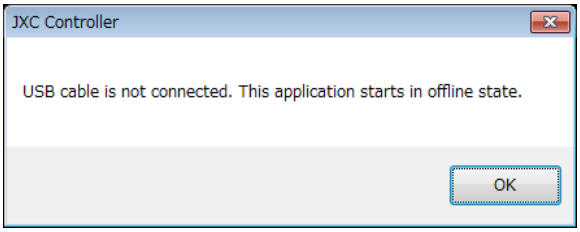
The following window will be displayed after setting the parameters of the controller and the connected actuator.



When selecting “No (N)”, the controller will start without uploading. The title window shown below will be displayed.

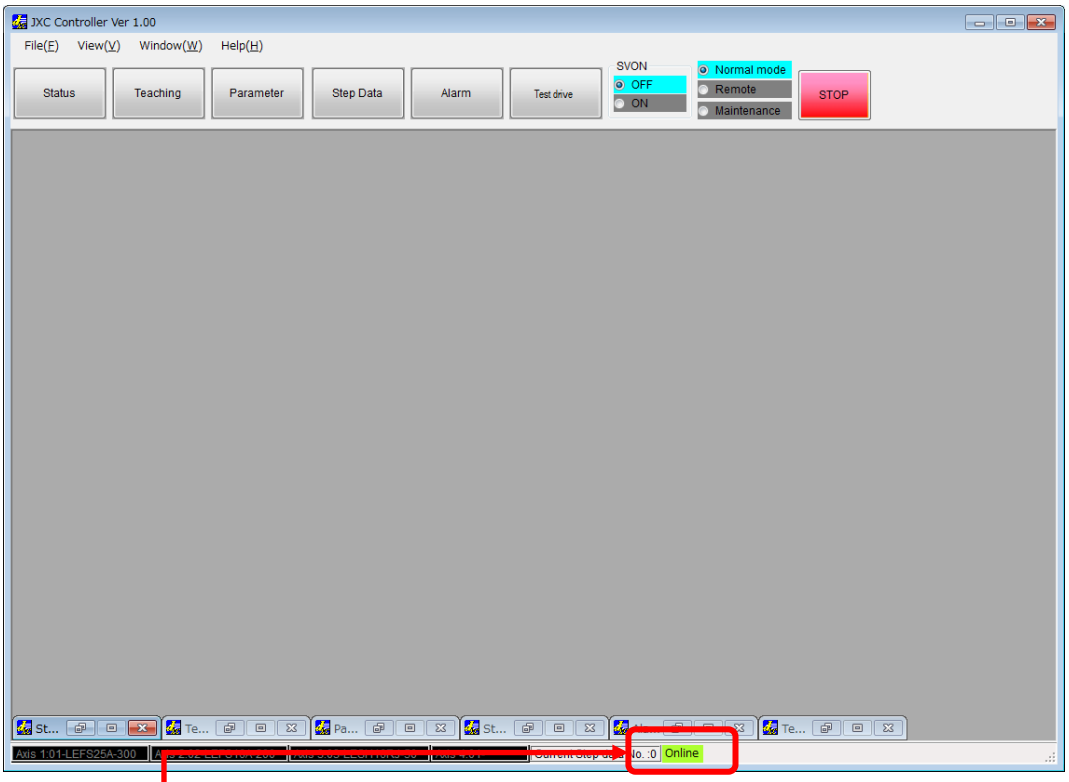


When the PC is not able to communicate with the controller, the following screen is displayed.



When select “OK”, the title window will be displayed.

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.

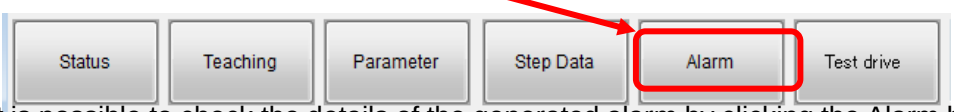
Display	Details
Offline	Off-line state
Online	On-line state

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) Alarm check

If the Alarm button at the top of the main window of the setting software flashes red an alarm has been generated.



It is possible to check the details of the generated alarm by clicking the Alarm button. Refer to **11.2 Alarms and countermeasures** for details of the countermeasures against the alarm, and reset the alarm.

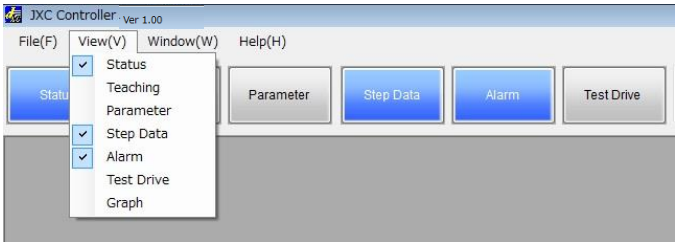
3.6 Parameters and Step data

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.

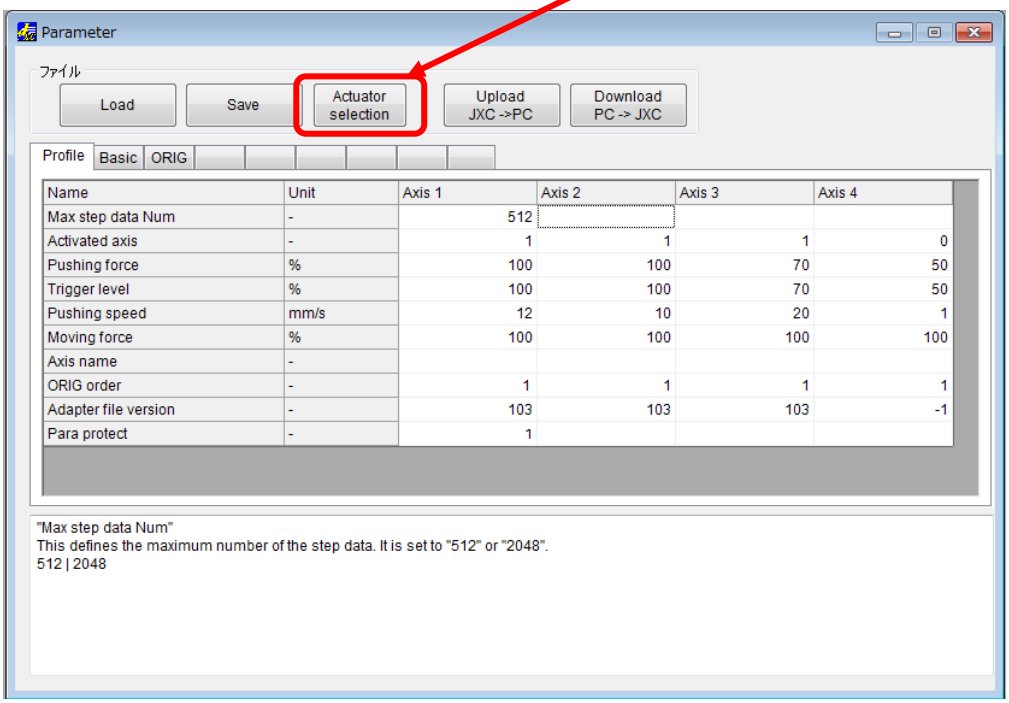
It is possible to display parameters and step data as shown below.

(1) Select the actuator

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

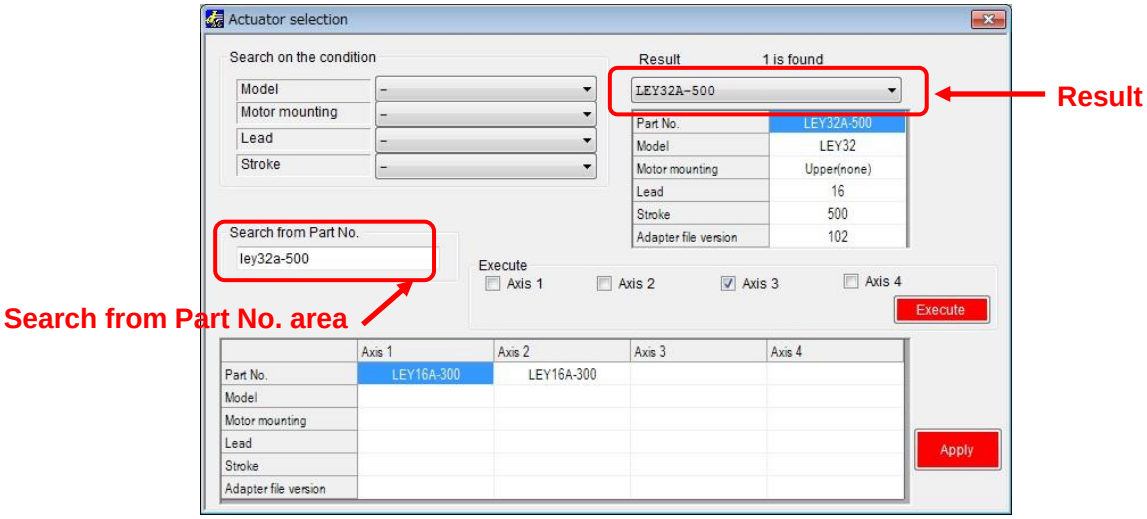


The Parameter window will be displayed.Select the "Actuator selection" button. The Actuator selection window will be displayed.



Input the partnumber of the actuator to be used in the “Search from Part No. area”.

A list of part numbers of the actuators matching the conditions will be displayed by clicking the "Result" button. 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 isordered, 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.

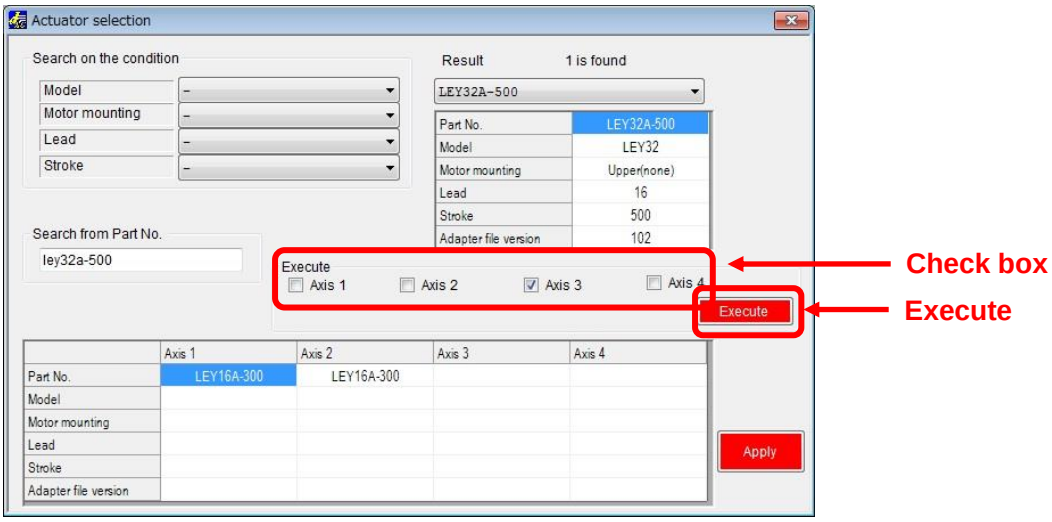
Example) When 11-LEFSH16A-100BR is ordered, input ‘LEFS16A-100’

⚠ Caution

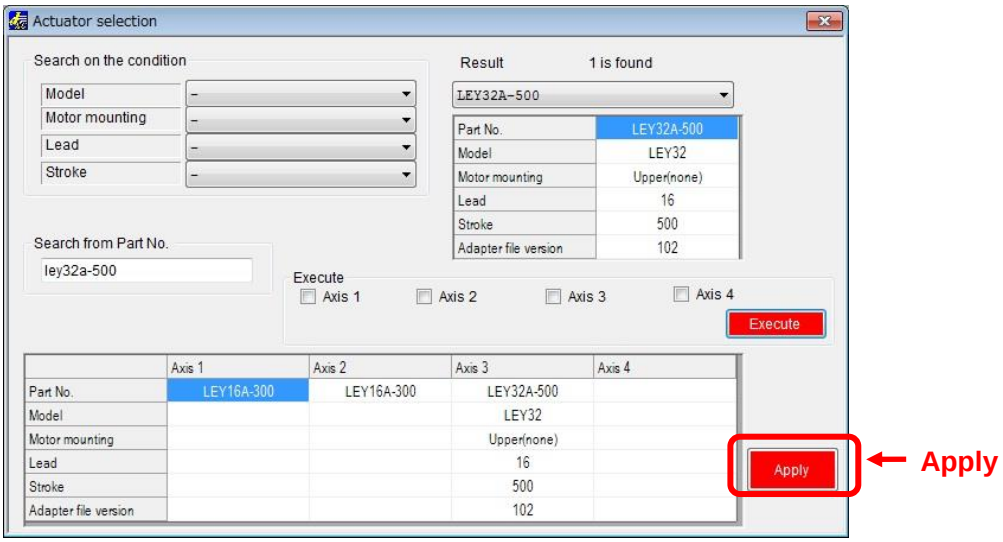
When the stroke parameter selected is longer than the stroke of the actuator to be used, the "position" input to the step data must not exceed the actuator stroke range.

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 "Execute"** 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 "Execute" 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**.

(2) Setting parameters

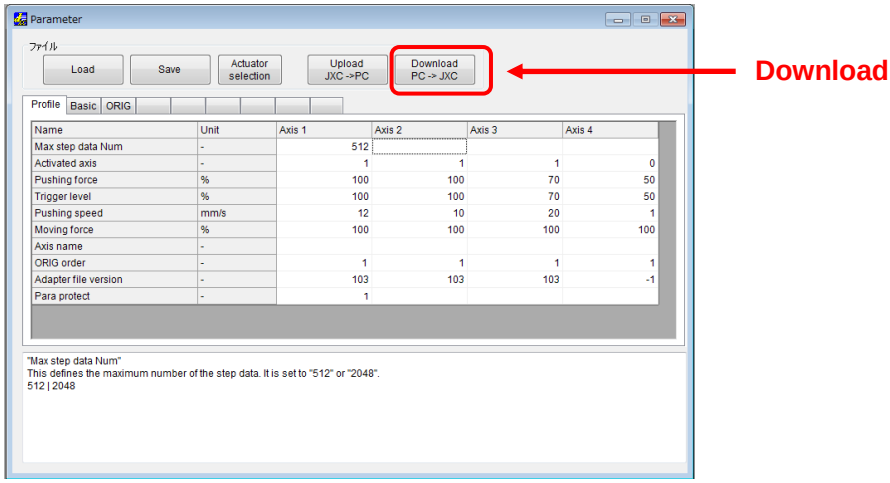
Set the parameters such as for valid axis and electronic gear.

Check the parameters below and change them if necessary. For other items, refer to section **7. Settings and Data Entry**.

<table>
<tr><th colspan="2">Parameter name</th><th>Input range</th><th>Outline</th></tr>
<tr><td rowspan="3">Profile parameter</td><td>Max step data Num</td><td>512 or 2048</td><td>Maximum step data. Change if necessary.</td></tr>
<tr><td>Activated axis</td><td>0 or 1</td><td>Set the validity of the axes. Set "0" (invalid) when no actuator is connected. Set "1" (valid) when connected.</td></tr>
<tr><td>ORIG order</td><td>1 to 4</td><td>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.</td></tr>
<tr><td rowspan="2">Basic parameter</td><td>Undefined No.11</td><td rowspan="2">1 to 4096</td><td rowspan="2">Define the Electronic Gear.
Undefined parameter No.11: Electronic gear (numerator)
Undefined parameter No.12: Electronic gear (denominator)
⚠ Caution
When interpolation is performed for actuators of different lead, the travel distance per pulse must be the same. Otherwise do not change the distance.
Set the electronic gear for Axis 2, 3 or 4 so that the travel distance for all of them are the same as Axis 1.
[Setting example]
<table>
<tr><th>Axis</th><th>Actuator</th><th>Lead</th><th>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>25/ 50</td></tr>
<tr><td>Axis 3</td><td>LEY16A-300</td><td>10mm</td><td>25/ 100</td></tr>
</table>
Set Axis 2 and 3 so that the travel distance becomes 2.5mm per 800 pulse.
Electronic Gear ratio
= Lead of Axis 1/ Lead of Axis 2(or Axis 3)
=2.5mm/5mm (or 2.5mm/10mm)
=25/50 (or 25/100)</td></tr>
<tr><td>Undefined No.12</td></tr>
</table>

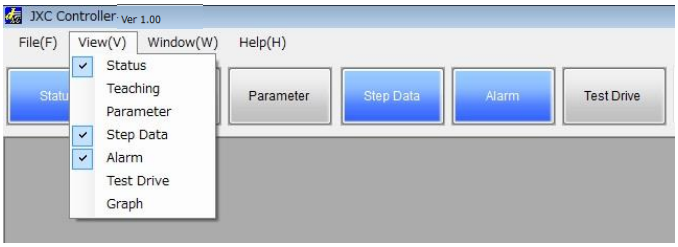
After setting parameters, select the "Download" button in the parameter window. Parameters in the parameter window will be written to the controller. Writing is completed when the progress bar disappears and then the setting software is ready to operate.

<u>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.</u>

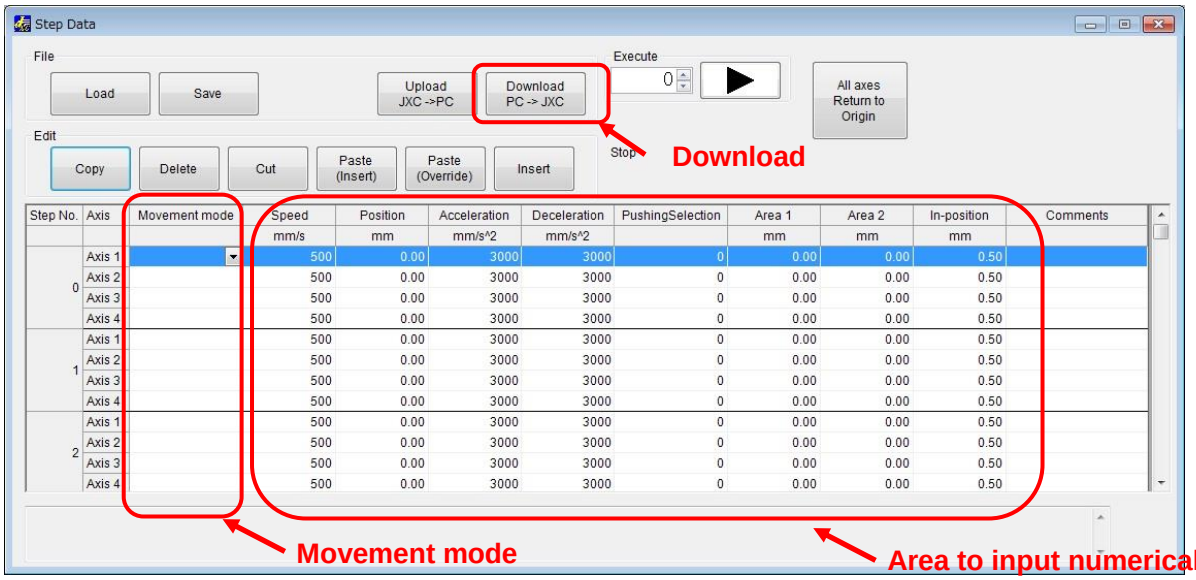


(3) Step data settings

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.

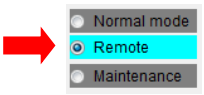
The setting is different depending on the movement mode. Refer to section **7.4 Step Data** for details.

After setting the step data, select the "Download" button in the step data window. The step data will be written to the controller. Writing is completed when the progress bar disappearsand then the setting software is ready to operate.

3.7 Check using JOG operation

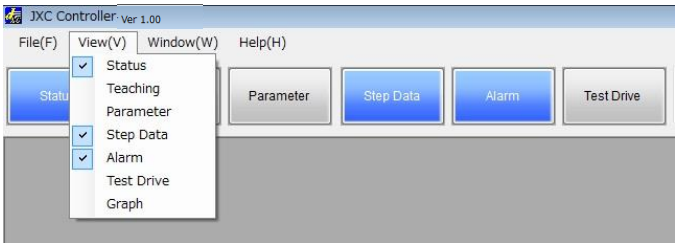
(1) Change to Remote mode

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

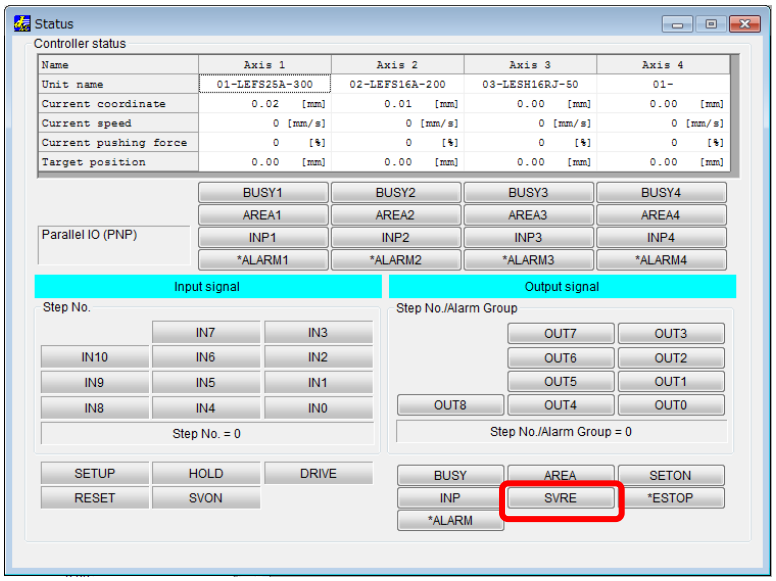


Confirm that the Servo is ON. (Confirm SVRE ON in the status window.)

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 box will turn blue in the Output signal area.



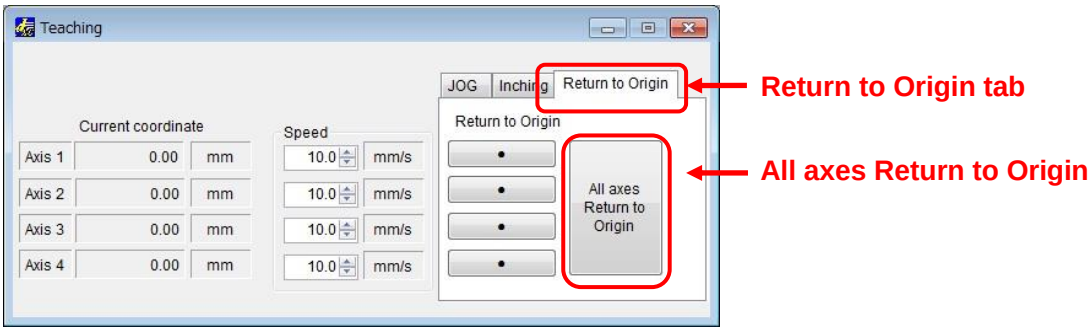
⚠ Caution

When the power is supplied, it may take up to 20 seconds from servo ON input to SVRE ON output, 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.

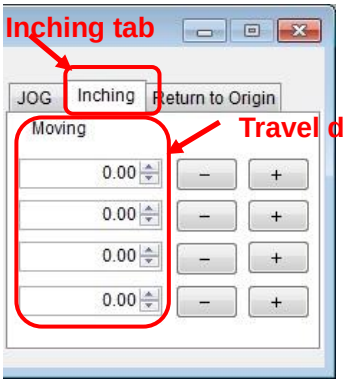


Select the “Return to Origin” tab. Select “Return to Origin(●)” or “All axes Return to Origin”.

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

(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

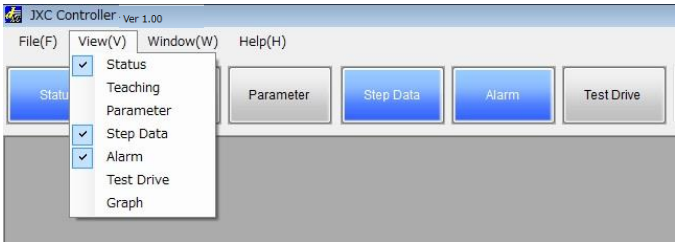
Set "Speed" for travel speed and "Moving" for travel distance. The Position will move in the "+" or "-" direction during setting.

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

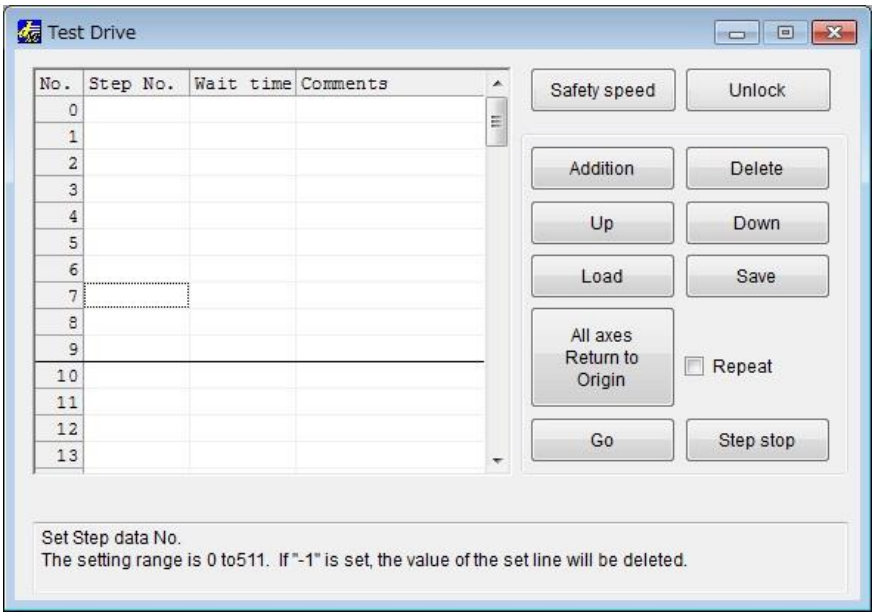
⚠ Caution
When perform return to origin operation, JOG function and Inching function for the first time, make sure that the parameter setting is correct. When the electronic gear is set, make sure that the actuator travels for the set travel distance by performing the inching function. It is possible 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.**

(3) Return to origin

Confirm that SVRE output is ON, refer to section **3.7 (1) Change to Remote mode**. Then, select "All axes Return to Origin", and perform the “Return to origin” operation.

(4) Test drive starts

Confirm that SETON output is ON, refer to section **3.7 (2) Return to origin**.

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 (3) Step data settings** to revise the settings.

⚠ Caution
Do not disconnect the USB cable while executing step data. The actuator will stop.

4. Product Specifications

4.1 Basic Specifications

Basic specifications of the product.

Item	Specifications
Number of axes per controller	Max. 4 axis
Controlled motor	Step motor (servo 24 VDC)
Controlled encoder	Incremental phase A / B (Encoder resolution 800 pulse / rotation)
Power supply specification Note1)	•Main control power supply Power supply voltage: 24VDC+/-10% Max. current consumption: 300mA •Motor drive and motor control power supply Power supply voltage: 24VDC+/-10% Max. current consumption: Depends on connected actuator. Note2)
Parallel input	16 inputs (Optically isolated)
Parallel output	32 outputs (Optically isolated)
Serial communication	USB2.0 (Full Speed 12Mbps)
Memory	Flash ROM and EEPROM
LED indicator	PWR (green), RUN (green), USB (green), ALM (red)
Lock control	With forced lock-release terminal Note3)
Cable length	I/O cable: 5 m maximum Actuator cable: 20 m maximum
Cooling method	Natural air cooling
Operating temperature range	0 to 40ºC (No freezing)
Operating humidity range	90% RH or less (No condensation)
Storage temperature range	-10 to 60ºC (No freezing)
Storage humidity range	90% RH or less (No condensation)
Insulation resistance	Between the external terminals and case 50MΩ (500 VDC)
Weight	1050 g (Direct mounting) 1100 g (DIN rail mounting)

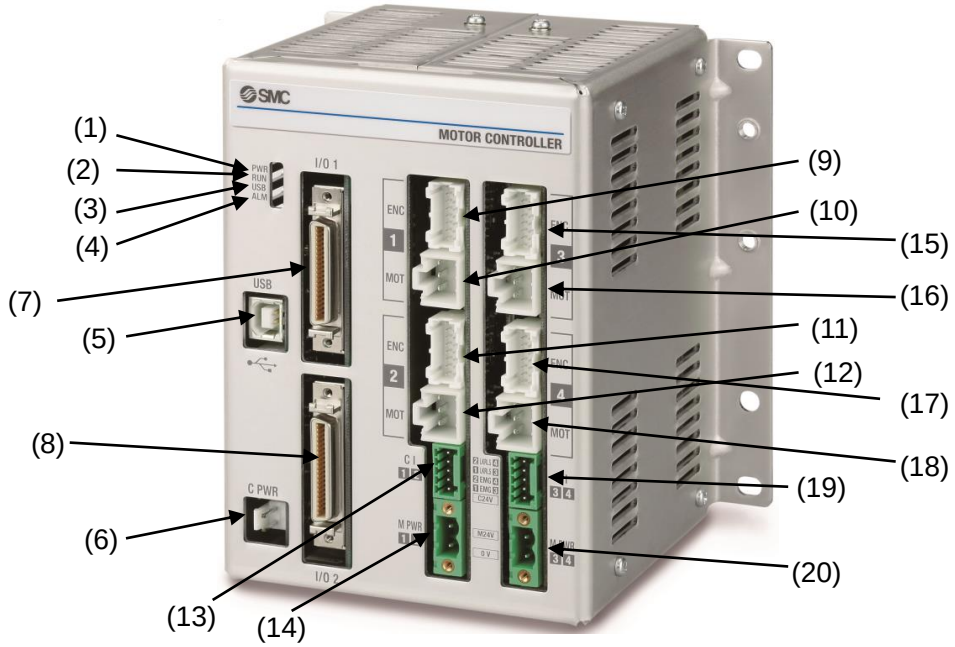
Note 1) Do not use a power supply with "inrush currentprotection" for the motor drive power and motor control power supply.

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 Parts Description

Detail of the controller parts.

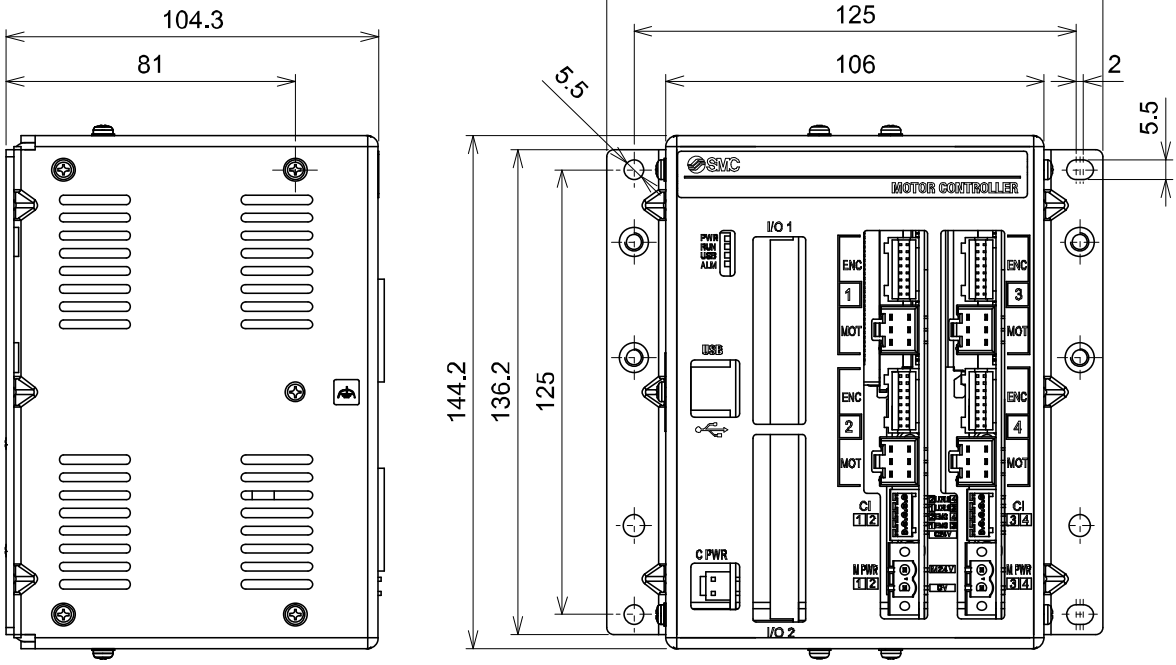


No.	Display	Description	Details
1	PWR	Power supply LED (green)	Power supply ON: LED is ON Power supply OFF: LED is OFF
2	RUN	Operating LED (green)	Operation by parallel I/O: LED is ON Operation by USB communication: LED is Flashing Stop: LED is OFF
3	USB	USB LED (green)	USB connected: LED is ON USB not connected: LED is OFF
4	ALM	Alarm LED (red)	Alarm condition: LED is ON No alarm: LED is OFF
5	USB	Serial communication	Connect to a PC using a USB cable.
6	C PWR	Main control power supply connector (2 pin)Note)	Main control power supply (+)(-)
7	I/O 1	Parallel I/O connector (40 pins)	Connect to the PLC using an I/O cable.
8	I/O 2	Parallel I/O connector (40 pins)	Connect to the PLC using an I/O cable.
9	ENC1	Encoder connector (16 pins)	Axis 1: Connect the actuator cable.
10	MOT1	Motor power connector (6 pins)	
11	ENC2	Encoder connector (16 pins)	Axis 2: Connect the actuator cable.
12	MOT2	Motor power connector (6 pins)	
13	CI 1 2	Motor control power supply connectorNote)	Motor control power supply(+), Axis 1 stop(+), Axis 1 unlock(+), Axis 2 stop(+), Axis 2 unlock (+)
14	M PWR 1 2	Motor drive power connector Note)	Axis 1, Axis 2 Motor drive power (+), common(-)
15	ENC3	Encoder connector (16 pins)	Axis 3: Connect the actuator cable.
16	MOT3	Motor power connector (6 pins)	
17	ENC4	Encoder connector (16 pins)	Axis 4: Connect the actuator cable.
18	MOT4	Motor power connector (6 pins)	
19	CI 3 4	Motor control power supply connectorNote)	Motor control power supply(+), Axis 3 stop(+), Axis 3 unlock(+), Axis 4 stop(+), Axis 4 unlock (+)
20	M PWR 3 4	Motor drive power connector Note)	Axis 3, Axis 4 Motor drive power (+), common(-)

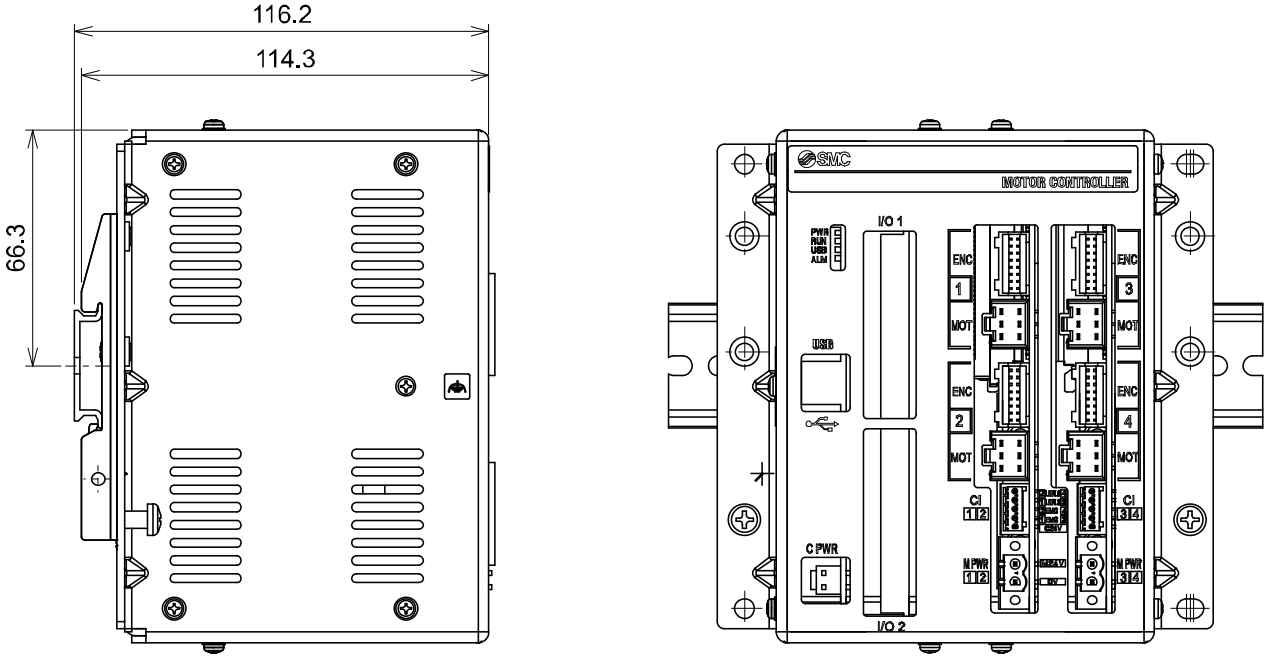
Note) The connector is included. Refer to section **5. Power supply connector**.

4.3 Dimensions

(1) Direct mounting



(2) DIN rail mounting



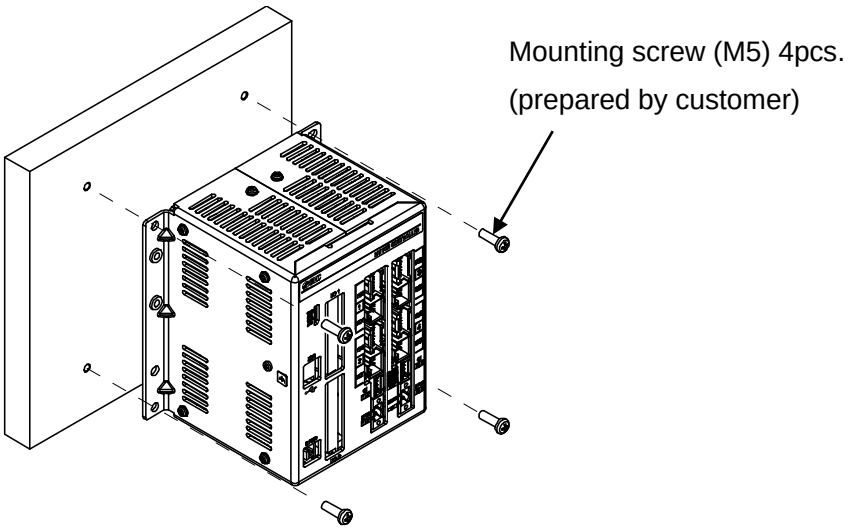
4.4 Mounting

(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



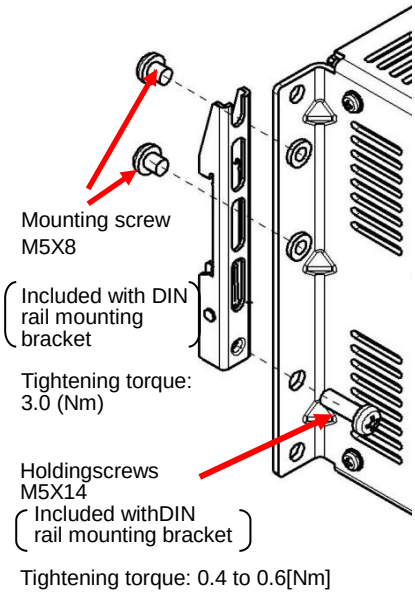
(b) DIN rail mounting

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

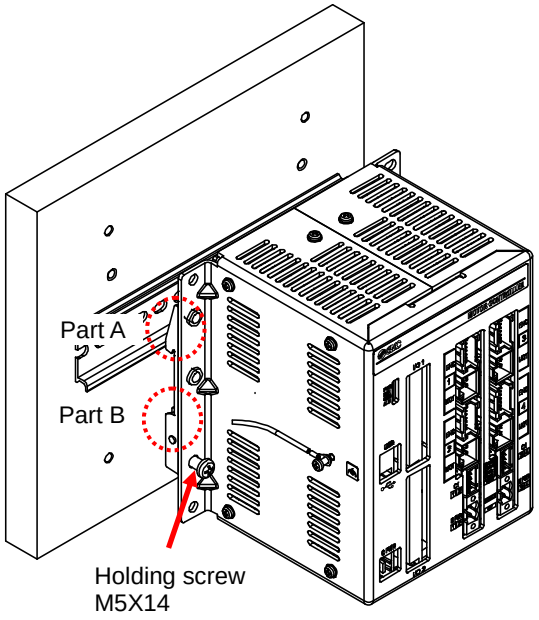
Secure the DIN rail mounting bracket using the mounting screws (M5 x 8) 2 places on one side (4 places on both sides). (Appropriate tightening torque: 3.0Nm)

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.

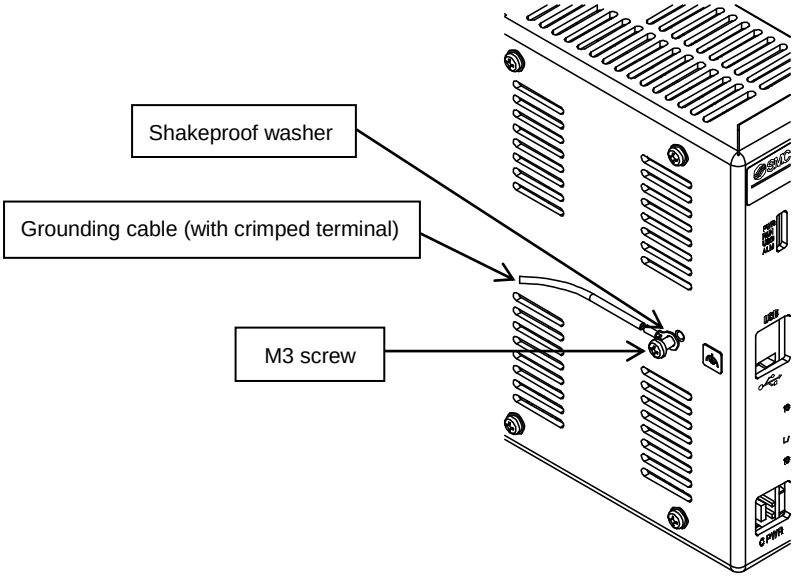


The figure below shows how to mount the controller to the DIN rail. Hook part A on to the DIN rail. Press part B on to the DIN rail and tighten the holding screws (M5 x 14). (Appropriate tightening torque: 0.4 to 0.6Nm)



(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.

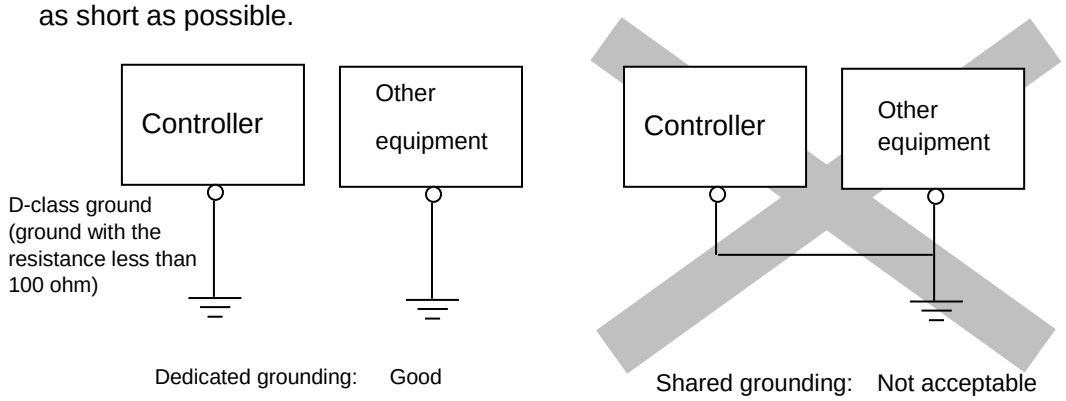
The controller must be connected to Ground to reduce noise.

⚠ 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 2mm^2 minimum.

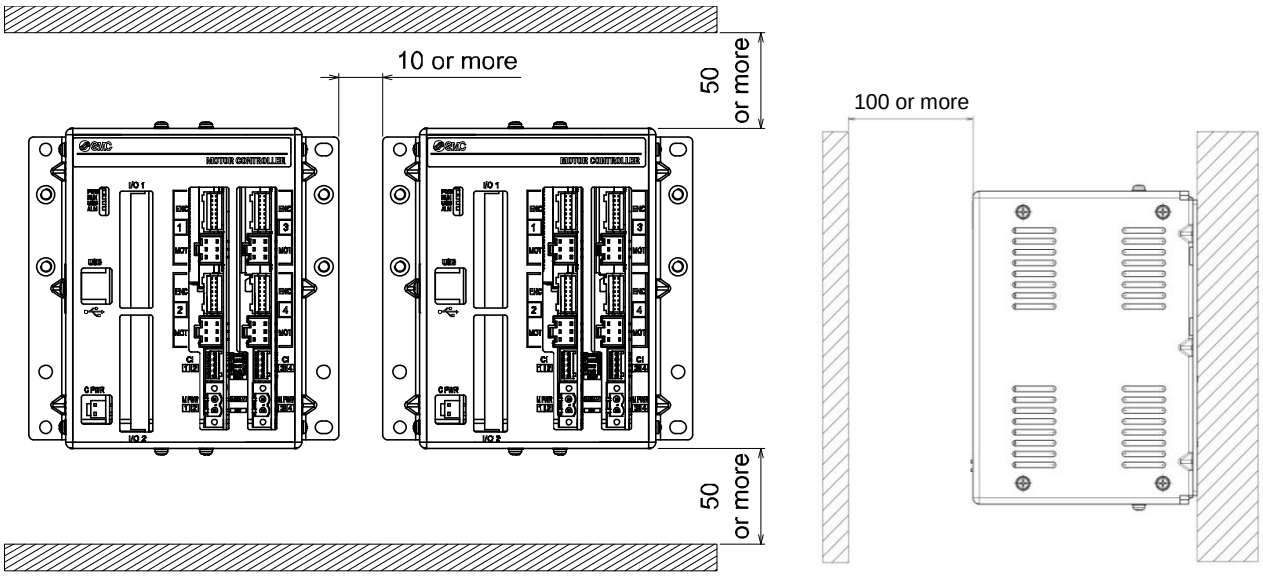
The grounding point should be as near as possible to the controller, to keep the grounding cable as short as possible.



(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

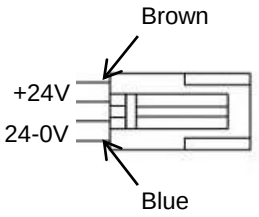
If the mounting surface for the controller is not flat or is uneven, excessive stress could be applied to the case, which could cause failure. Mount on a flat surface.

5. Power supply connector

5.1 Connector specifications

The power supply connector type included is shown below.

(1) Main control power supply connector: C PWR



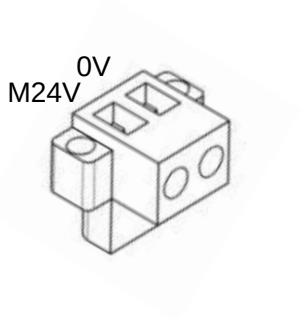
Terminal	Function	Description
+24V	Main control power supply (+)	Power supply (+) for main control.
24-0V	Main control power supply (-)	Power supply (-) for main control.

Use the power cable for main control, JXC-C1.

Specifications of the cable are as follows.

Item	Specifications
Electric wire size	Stranded wire → AWG20 (0.5mm^2) O.D. of sheath →ϕ1.76
Wire sheath colour	+24V:Brown 24-0V: Blue

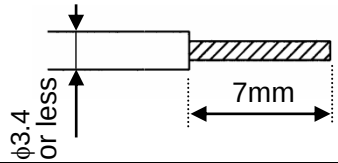
(2) Motor drive power connector: M PWR



Terminal	Function	Description
0V	Motor power (-)	Power supply (-) common for M24V terminal, C24V terminal, EMG terminal and LKRLS terminal
M24V	Motor power (+)	Motor drive power supply (+) for Axis 1 and 2 or Axix 3 and 4.

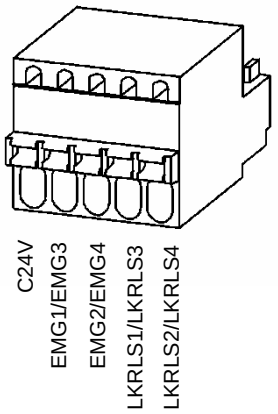
Manufactured by Phoenix Contact (Part number MSTB2,5/2-STF-5,08)

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^{o}C or more.
Stripped wire length	

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

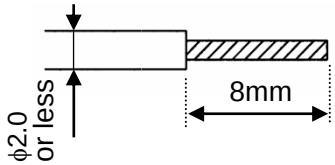
(3) Motor control power supply connector: CI



Terminal	Function	Functional explanation
C24V	Motor control power supply (+)	Power supply side (+) for motor control.
EMG1/EMG3	Stop(+)	Release the stop status (+) of Axis 1 or Axis 3. (Normal operation by applying 24V.)
EMG2/EMG4	Stop(+)	Release the stop status (+) of Axis 2 or Axis 4. (Normal operation by applying 24V.)
LKRLS1/LKRLS3	Unlock(+)	Release the lock status (+) of Axis 1 or Axis 3.
LKRLS2/LKRLS4	Unlock(+)	Release the lock status (+) of Axis 2 or Axis 4.

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

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^{o}C or more.
Stripped wire length	

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

⚠Caution

Do not connect multiple wires into one terminal.

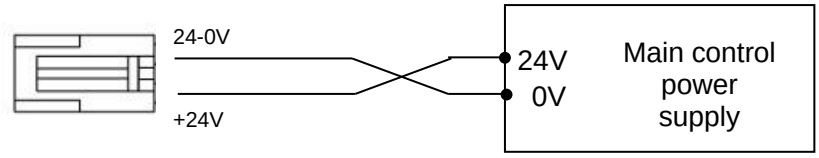
Contact failure or short circuit to adjacent wire may lead to malfunction or fire.

5.2 Wiring

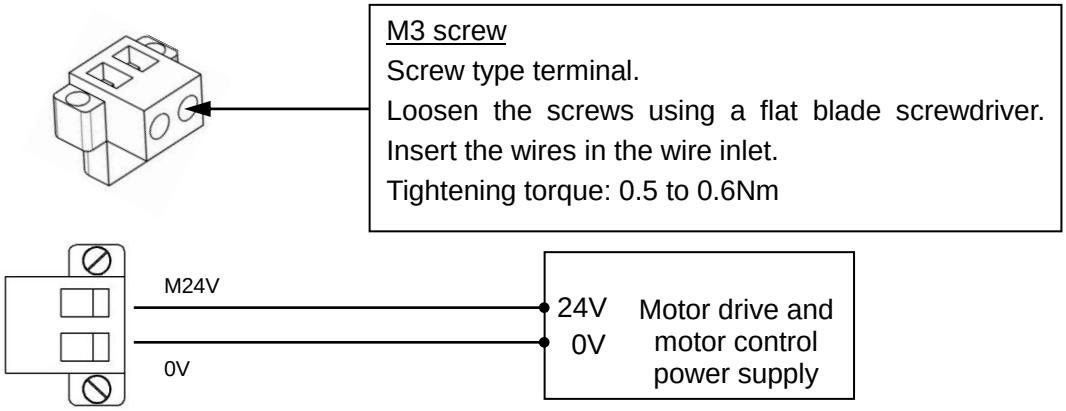
Connect the main control power supply, motor drive and motor control power supply while referring to (1) to (3) below, and then insert into the controller C PWR, CI and M PWR.

(1) Wiring of the power supply connector

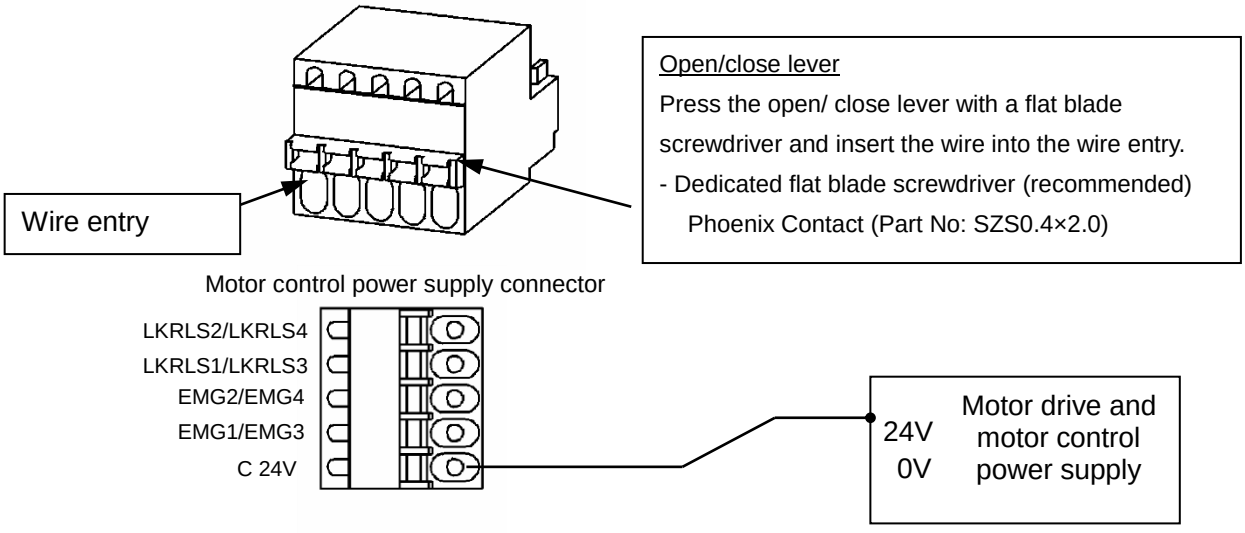
Connect the main control power supply 24V and 0V to the main control power supply connector +24V and 24-0V terminals.



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



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



⚠ Caution

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

(2)Connector ‘CI3 4’ must be connected even when Axis 3 and 4 are not used.
If not, a "Modbus Error" alarm will be generated.

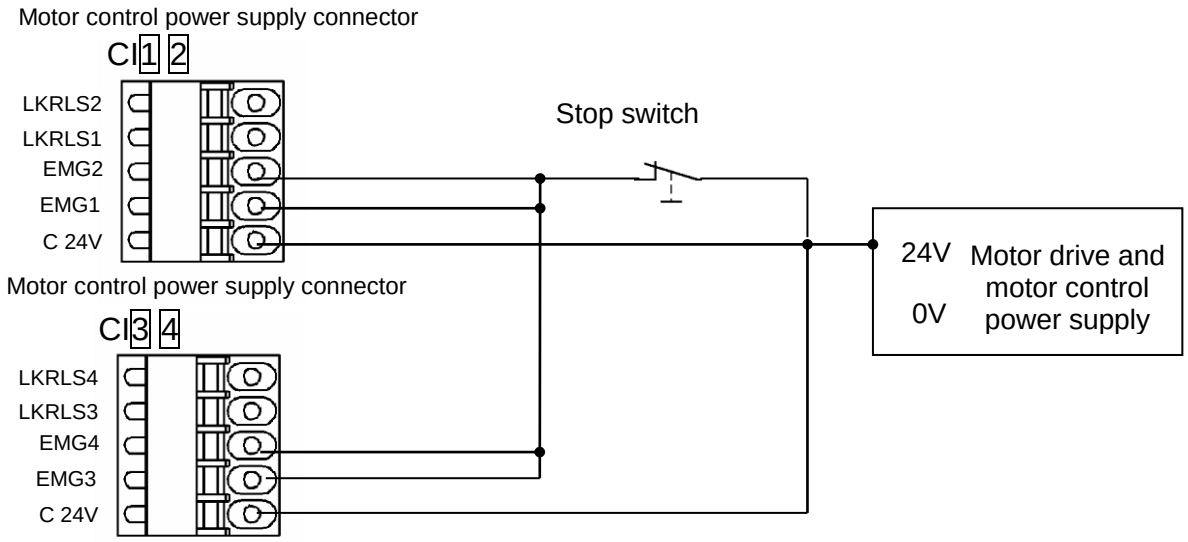
(3)The motor power and motor control power supply should be powered at the same time or prior to the main control power supply.
If the sequence of these power supplies is different then a "ModbusError" alarm will be generated.

(2) Wiring of the stop switch

A Stop switch must be installed by the user to stop the actuator in abnormal situations. The actuator stops its operation when the external shutdown switch is activated.

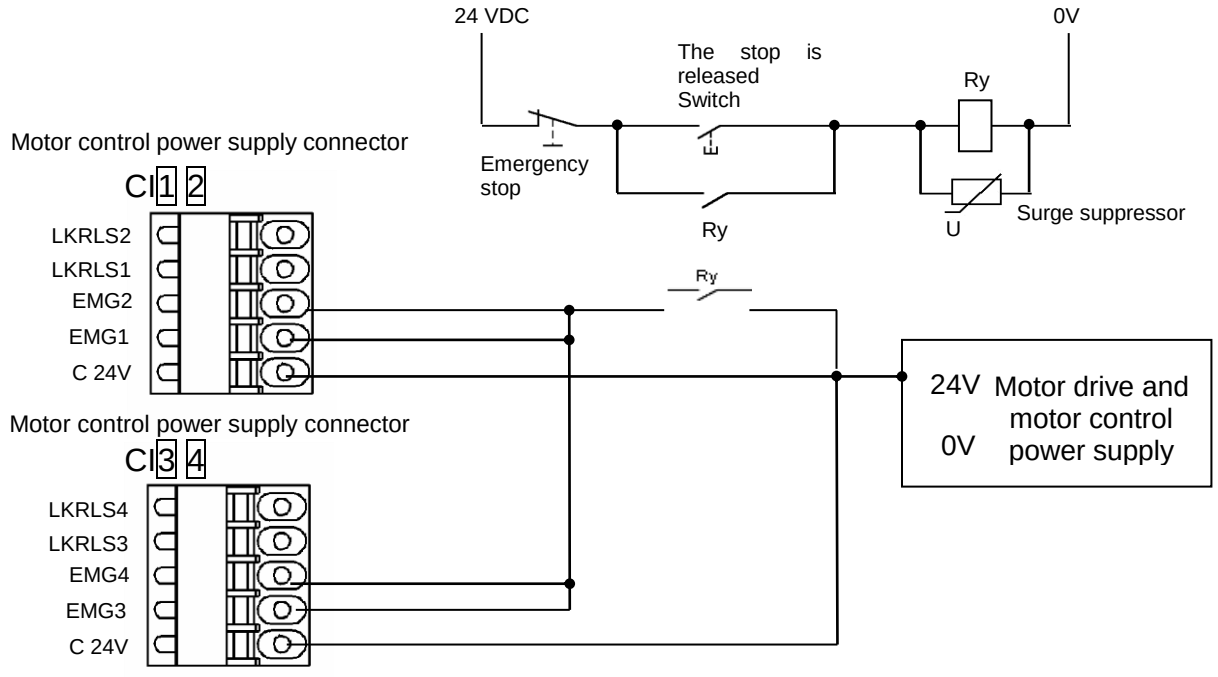
- Stop (Stop switch)

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



- 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 motor drive and motor control power supply and the EMG terminal of the motor control power supply connector. (Circuit example: The Figure below shows the stop status).

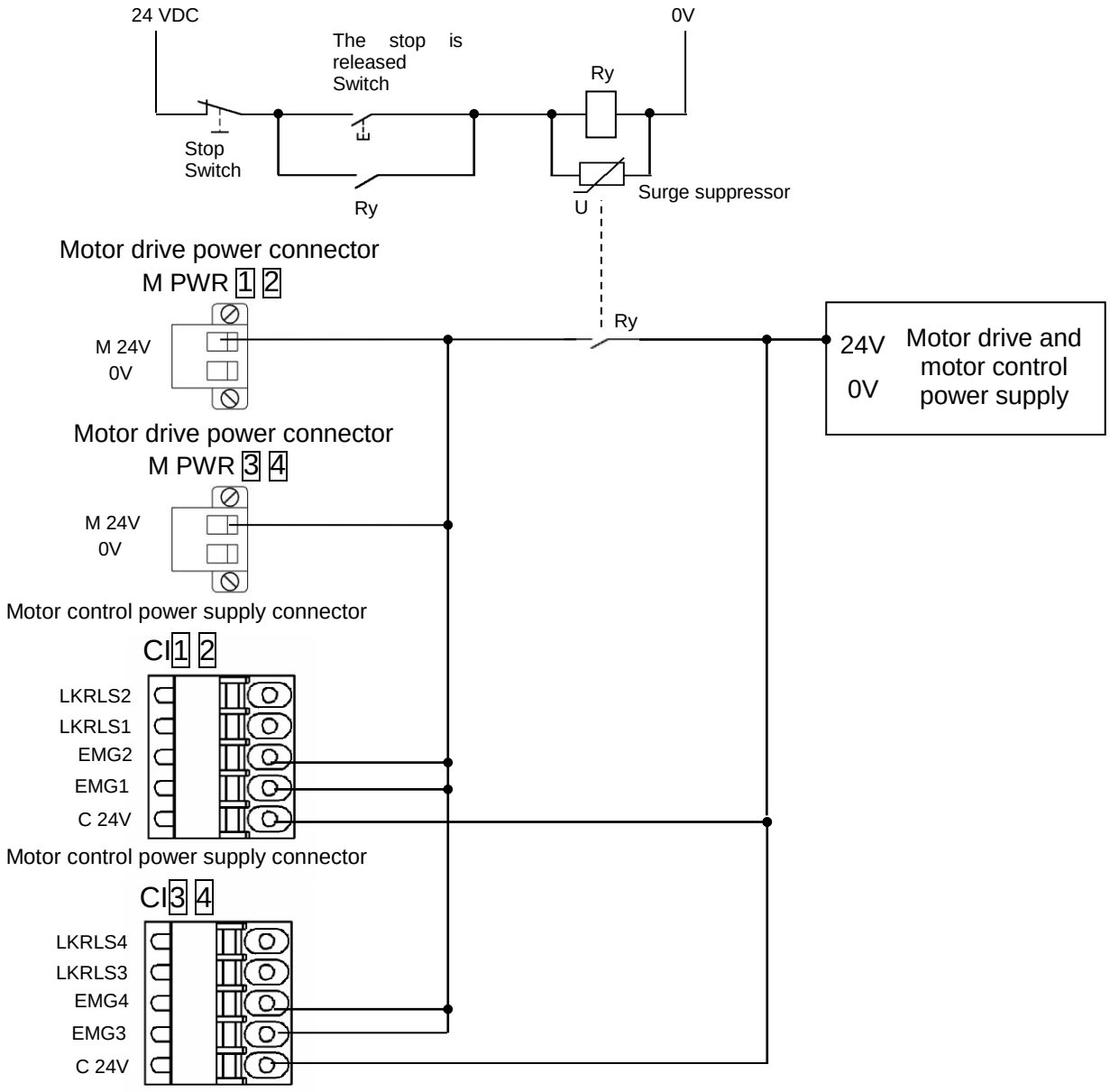


⚠ Caution

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

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 motor drive and motor control power supply and the M24V of the motor control power supply connector and the EMG terminal of the motor control power supply connector. (Circuit example: The Figure below shows the stop status)



⚠ Warning

(1) If it is necessary to have a circuit to shutdown the motor power supply, relay contacts should be placed between the motor drive and motor control power supply and the M24V terminal of the motor drive power connector and the EMG terminal of the motor control power supply connector. The actuator may make unexpected movement.

(2) Do not perform a return to origin operation (SETUP input ON) when the motor drive power (M24V) is disconnected.

The controller cannot recognize the correct origin point if a return to origin instruction is made with the motor drive power (M24V) disconnected.

(3) When wiring the stop switch, connect the switch such that EMG1 to EMG4 are shut down together.

6. Details of parallel I/O connector

This controller is available with NPN type (JXC73∗) or PNP type (JXC83∗) parallel I/O.

6.1 Parallel I/O specifications

■Input specifications

(NPN)

No.	Item	Specifications
1	Input circuit	Internal circuit and Optically isolated
2	Number of inputs	16
3	Voltage	24VDC+/-10%
4	Input current at ON state	5.1mA+/-20% (at 24 VDC)

(PNP)

No.	Item	Specifications
1	Input circuit	Internal circuit and Optically isolated
2	Number of inputs	16
3	Voltage	24VDC+/-10%
4	Input current at ON state	5.1mA+/-20% (at 24 VDC)

■Output specifications

(NPN)

No.	Item	Specifications
1	Output circuit	Internal circuit and Optically isolated
2	Number of outputs	32
3	Max. voltage between terminals	30 VDC
4	Max. output current	100mA
5	Saturation voltage	-COM+1.8V (Max.)

(PNP)

No.	Item	Specifications
1	Output circuit	Internal circuit and Optically isolated
2	Number of outputs	32
3	Max. voltage between terminals	30 VDC
4	Max. output current	100mA
5	Saturation voltage	+COM-1.8V (Max.)

6.2 Parallel I/O circuit (NPN, PNP)

(1)Parallel I/O input circuit

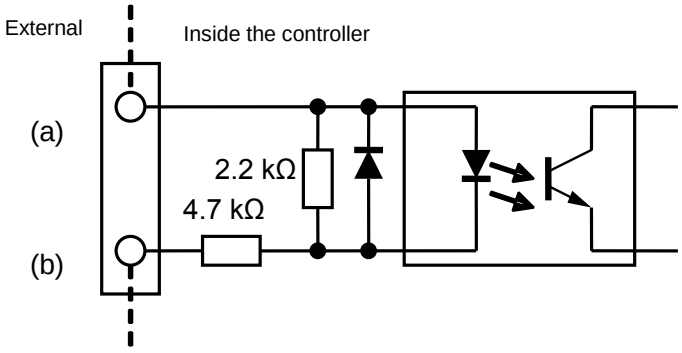
■ NPN type

I/O 1

(a)	+COM1, +COM2
(b)	IN0 to IN10, SETUP, HOLD, DRIVE, RESET, SVON

I/O 2

Unused



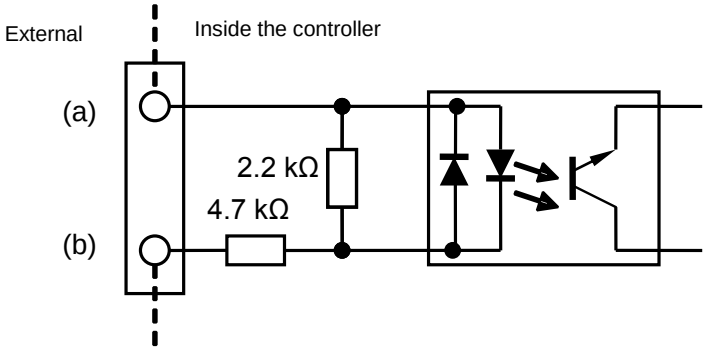
■ PNP type

I/O 1

(a)	-COM1, -COM2
(b)	IN0 to IN10, SETUP, HOLD, DRIVE, RESET, SVON

I/O 2

Unused



(2)Parallel I/O output circuit

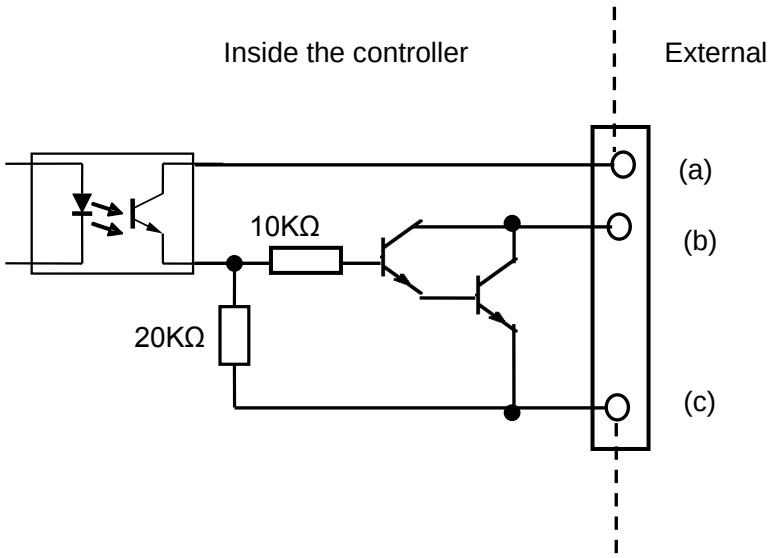
-NPN type

I/O 1

(a)	+COM1, +COM2
(b)	OUT0 to OUT8, BUSY, AREA, SETON, INP, SVRE, ∗ESTOP, ∗ALARM
(c)	-COM1, -COM2

I/O 2

(a)	+COM3, +COM4
(b)	BUSY1 to BUSY4, AREA1 to AREA4, INP1 to INP4, ∗ ALARM1 to ∗ALARM4
(c)	-COM3, -COM4



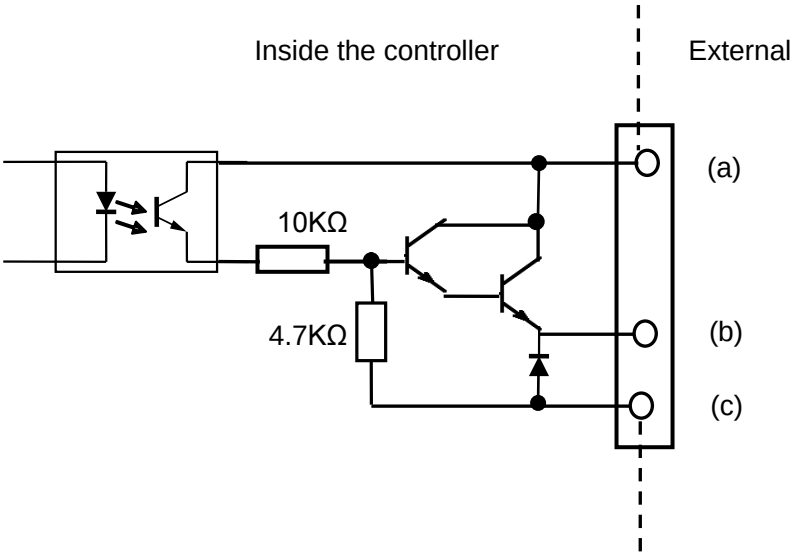
-PNP type

I/O 1

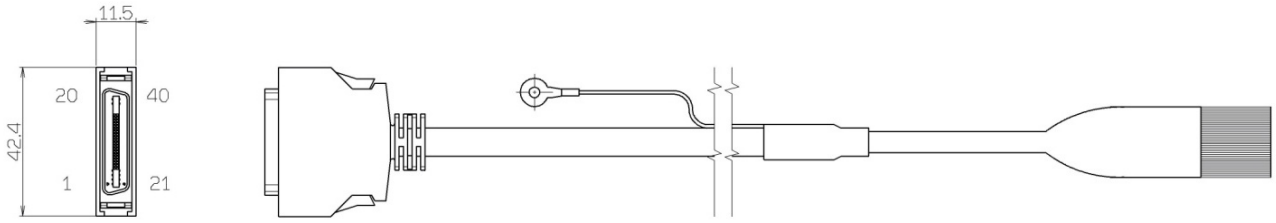
(a)	+COM1, +COM2
(b)	OUT0 to OUT8, BUSY, AREA, SETON, INP, SVRE, ∗ESTOP, ∗ALARM
(c)	-COM1, -COM2

I/O 2

(a)	+COM3, +COM4
(b)	BUSY1 to BUSY4, AREA1 to AREA4, INP1 to INP4, ∗ ALARM1 to ∗ALARM4
(c)	-COM3, -COM4



6.3 Parallel I/O signals



Pin No.	Insulator colour	Dot mark	Dot colour	Pin No.	Insulator colour	Dot mark	Dot colour
1	Orange	■	Black	11	Orange	■■■	Black
21	Orange	■	Red	31	Orange	■■■	Red
2	Grey	■	Black	12	Grey	■■■	Black
22	Grey	■	Red	32	Grey	■■■	Red
3	White	■	Black	13	White	■■■	Black
23	White	■	Red	33	White	■■■	Red
4	Yellow	■	Black	14	Yellow	■■■	Black
24	Yellow	■	Red	34	Yellow	■■■	Red
5	Pink	■	Black	15	Pink	■■■	Black
25	Pink	■	Red	35	Pink	■■■	Red
6	Orange	■■	Black	16	Orange	■■■■	Black
26	Orange	■■	Red	36	Orange	■■■■	Red
7	Grey	■■	Black	17	Grey	■■■■	Black
27	Grey	■■	Red	37	Grey	■■■■	Red
8	White	■■	Black	18	White	■■■■	Black
28	White	■■	Red	38	White	■■■■	Red
9	Yellow	■■	Black	19	Yellow	■■■■	Black
29	Yellow	■■	Red	39	Yellow	■■■■	Red
10	Pink	■■	Black	20	Pink	■■■■	Black
30	Pink	■■	Red	40	Pink	■■■■	Red

Signals are different for I/O1 and I/O2. Refer to the table below for details.

(1) I/O1

-Input side

<table>
<tr><th>Pin No.</th><th>Signal name</th><th>Description</th></tr>
<tr><td>1</td><td>+COM1</td><td rowspan="2">Connect the 24 VDC power supply to the input/ output signals
For IN0 to IN10, SETUP, HOLD, DRIVE, RESET, SVON
For OUT0 to OUT8, BUSY, AREA, SETON, INP, SVRE, ∗ESTOP, ∗ALARM</td></tr>
<tr><td>21</td><td>+COM2</td></tr>
<tr><td>2</td><td>IN0</td><td rowspan="9">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)
<table>
<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>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr>
<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>
</table>
← Binary code</td></tr>
<tr><td>22</td><td>IN1</td></tr>
<tr><td>3</td><td>IN2</td></tr>
<tr><td>23</td><td>IN3</td></tr>
<tr><td>4</td><td>IN4</td></tr>
<tr><td>24</td><td>IN5</td></tr>
<tr><td>5</td><td>IN6</td></tr>
<tr><td>25</td><td>IN7</td></tr>
<tr><td>6</td><td>IN8</td></tr>
<tr><td>26</td><td>IN9</td><td rowspan="2">Step data instruction extended mode bit No (Extended: 2048 is used)</td></tr>
<tr><td>7</td><td>IN10</td></tr>
<tr><td>27</td><td>SETUP</td><td>Command to Return to Origin
Actuators return to origin based on the order of setting for return to origin.
When SVRE output is ON, the SETUP operation (return to origin) will be performed. During the SETUP operation, BUSY will be turned ON and after completion of the SETUP operation, SETON and INP will be turned ON.</td></tr>
<tr><td>8</td><td>HOLD</td><td>Pause of operation
All axes in operation are paused.
If HOLD input 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 is ON and when HOLD is turned OFF, the actuator restarts to travel the remaining stroke.
⚠Caution
(1) Do not command SETUP or DRIVE while the HOLD input is ON.
The actuator may make unexpected movements.
(2) While HOLD input is ON, do not move the actuator position.
Changing the residual travel distance may cause inconsistency with the target position.
(3) HOLD input is invalid during return to origin operation.</td></tr>
<tr><td>28</td><td>DRIVE</td><td>Operation instruction
Read the step data from IN0 to IN8 while the DRIVE signal is ON and start operation.
The number of ongoing steps is output to the OUT terminal when the DRIVE signal is ON.</td></tr>
</table>

<table>
<tr><th>Pin No.</th><th>Signal name</th><th>Description</th></tr>
<tr><td>9</td><td>RESET</td><td>Alarm reset and interruption of operation
When RESET is turned ON during operation, the speed decreases at maximum deceleration of the basic parameter until the actuator stops.
INP and OUT0 to OUT10 are OFF. (However, if the actuator is stopped within the in-position range, the INP 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).
⚠Caution
(1) Do not command SETUP or DRIVE while the RESET input is ON.
The actuator may make unexpected movements.
(2) If the RESET input is ON during a return to origin operation, return to origin may not be available when the RESET input is turned OFF.
In this case, turn on the servo, and then turn on the SETUP input.</td></tr>
<tr><td>29</td><td>SVON</td><td>Servo ON instruction
When SVON is ON, the servo motor for all axes will be turned ON.Note1)
When SVON is OFF, the servo motor will be turned OFF.</td></tr>
</table>

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

-Output side

<table>
<tr><th>Pin No.</th><th>Signal name</th><th>Description</th></tr>
<tr><td>10</td><td>OUT0</td><td rowspan="8">Output the number of ongoing step data.
When the operation is started and the DRIVE input is turned ON, a Bit No. corresponding to the number of the active step data will be output from these terminals. These output signals will be updated when the DRIVE input is turned ON.
⚠Caution
(1) When RESET is turned ON, these terminals are turned OFF.
(2) During an alarm, these terminals output the alarm group.</td></tr>
<tr><td>30</td><td>OUT1</td></tr>
<tr><td>11</td><td>OUT2</td></tr>
<tr><td>31</td><td>OUT3</td></tr>
<tr><td>12</td><td>OUT4</td></tr>
<tr><td>32</td><td>OUT5</td></tr>
<tr><td>13</td><td>OUT6</td></tr>
<tr><td>33</td><td>OUT7</td></tr>
<tr><td>14</td><td>OUT8</td></tr>
<tr><td>34</td><td>BUSY (OUT9)</td><td>The Busy signal turns on until the completion of operation time (theoretically value) of all actuators, and also during the movement of one or more actuators. (OR of BUSY1 to BUSY4.)However, when the positioning operation of pushing operation is inhibited and the movement stops, the Busy signal keeps turning ON exceptionally until operation is released. (Not OR of BUSY1 to BUSY4.)
The Bit No is output during step data in extended mode.Note3)</td></tr>
<tr><td>15</td><td>AREA (OUT10)</td><td>The Area signal turns on when all actuators are within the area output range. (AND of AREA1 to AREA4)
The Bit No is output during step data in extended mode.Note3)</td></tr>
<tr><td>35</td><td>SETON</td><td>Return to origin completion signal.
SETON turns on when all axes have completed the return to origin operation.</td></tr>
<tr><td>16</td><td>INP</td><td>Positioning complete signal
INP turns on according to the conditions below.(AND of INP1 to INP4)
<table>
<tr><th>Movement mode</th><th>Details</th></tr>
<tr><td>Positioning operation</td><td>When the actuator moves to within this range from the target position after the positioning completion time (theoretical value), the INP output will turn ON.</td></tr>
<tr><td>Pushing operation</td><td>When the Pushing force becomes more than the set "Trigger level" value in the profile parameter and the actuator stopped within the pushing area, the INP output will turn ON.</td></tr>
</table></td></tr>
<tr><td>36</td><td>SVRE</td><td>The Servo ON signal turns on when the servo motor is ON.Note1)</td></tr>
<tr><td>17</td><td>∗ESTOP</td><td>∗ESTOP turns OFF when EMG signal stops Note2).</td></tr>
<tr><td>37</td><td>∗ALARM</td><td>∗ALARM turns OFF when an alarm is generated to one or more actuator. (Reverse of OR of ∗ALARM1 to ∗ALARM4) Note2)</td></tr>
<tr><td>18</td><td>-COM1</td><td rowspan="3">Connects the power supply 0V to the input/output signals
For OUT0 to OUT7</td></tr>
<tr><td>19</td><td>-COM1</td></tr>
<tr><td>38</td><td>-COM1</td></tr>
<tr><td>20</td><td>-COM2</td><td rowspan="3">Connects the power supply 0V to the input/output signals
For OUT8, BUSY, AREA, SETON, INP, SVRE, ∗ESTOP, and ∗ALARM</td></tr>
<tr><td>39</td><td>-COM2</td></tr>
<tr><td>40</td><td>-COM2</td></tr>
</table>

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

Note 2) Negative logic signal.

Note 3) For BUSY and AREA signals, use BUSY1 to BUSY4 and AREA1 to AREA4 for I/O2 (optional).

(2) I/O2

-Input side

Pin No.	Signal name	Description
1	+COM3	Connects the power supply 24 V to the input/output signals For BUSY1 to BUSY4, AREA1 to AREA4, INP1 to INP4, and ∗ALARM1 to ∗ALARM4.
21	+COM4	
2	N.C.	Unused
22		
3		
23		
4		
24		
5		
25		
6		
26		
7		
27		
8		
28		
9		
29		

-Output side

Pin No.	Signal name	Description
10	BUSY1	Busy signal for Axis x When the actuator starts to operate, the BUSY signal will be turned ON until the completion of operation time (theoretically value). After the completion of operation time if the actuator has stopped, the BUSY signal will be turned off.
30	BUSY2	
11	BUSY3	
31	BUSY4	
12	AREA1	Area signal for Axis 1
32	AREA2	Area signal for Axis 2
13	AREA3	Area signal for Axis 3
33	AREA4	Area signal for Axis 4
14	INP1	Positioning complete signal for Axis 1
34	INP2	Positioning complete signal for Axis 2
15	INP3	Positioning complete signal for Axis 3
35	INP4	Positioning complete signal for Axis 4
16	ALARM1	Alarm signal for Axis 1Note1)
36	ALARM2	Alarm signal for Axis 2Note1)
17	ALARM3	Alarm signal for Axis 3Note1)
37	ALARM4	Alarm signal for Axis 4Note1)
18	-COM3	Connect the power supply 0V to the input/output signals For BUSY1 to BUSY4, AREA1 to AREA4.
19	-COM3	
38	-COM3	
20	-COM4	Connect the power supply 0V to the input/output signals For INP1 to INP4, ∗ALARM1 to ∗ALARM4.
39	-COM4	
40	-COM4	

Note 1) Negative logic signal.

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

Status \ Output	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	ON[Note3)]

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) of the DRIVE input signal.
Note 3) Retain the previous state.
Note 4) The output turns on when the actuator is "In position" according to the step data.

6.4 Parallel I/O Wiring Example

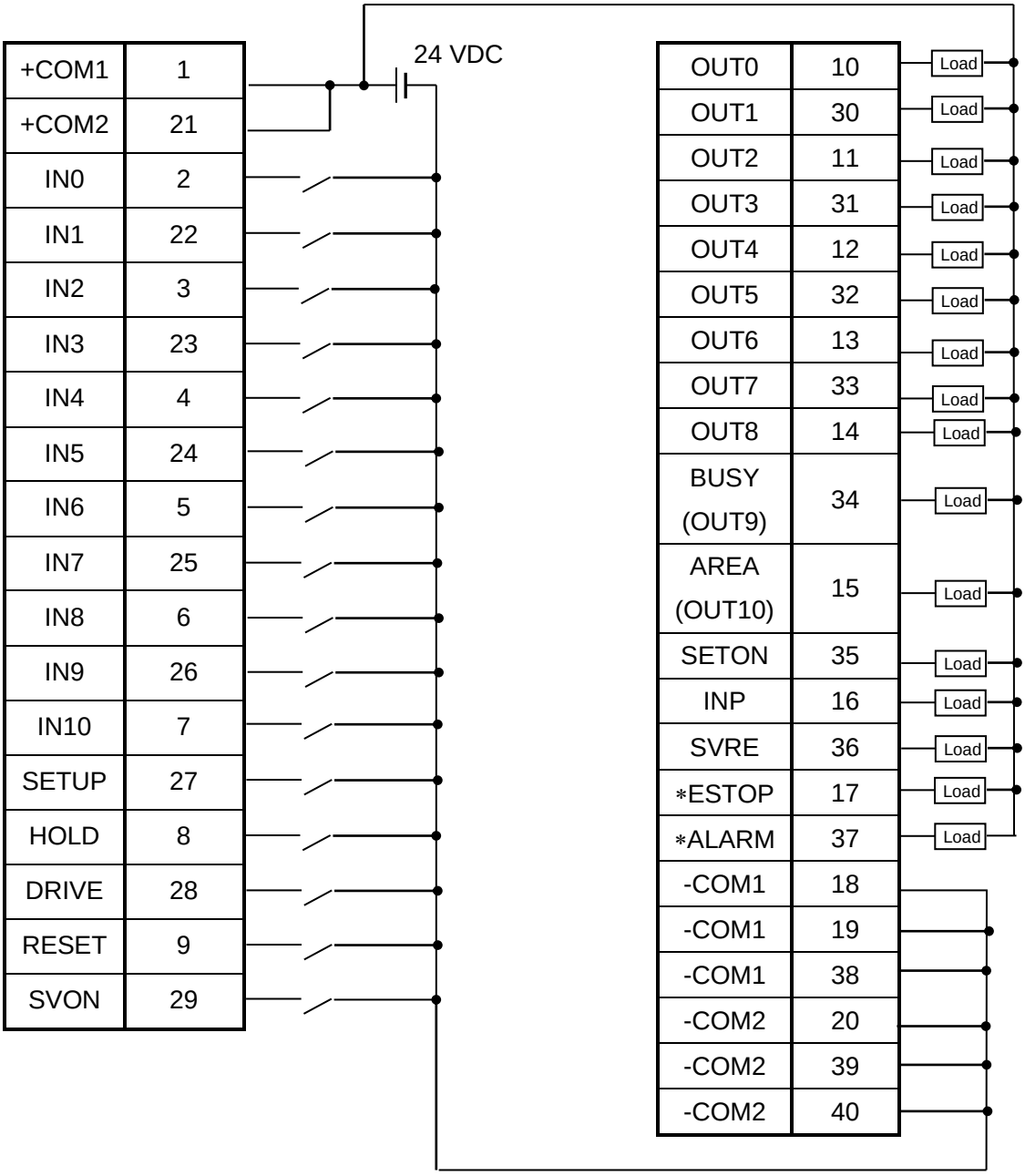
The Wiring depends on the parallel input/output type of the controller (NPN or PNP).

⚠Caution

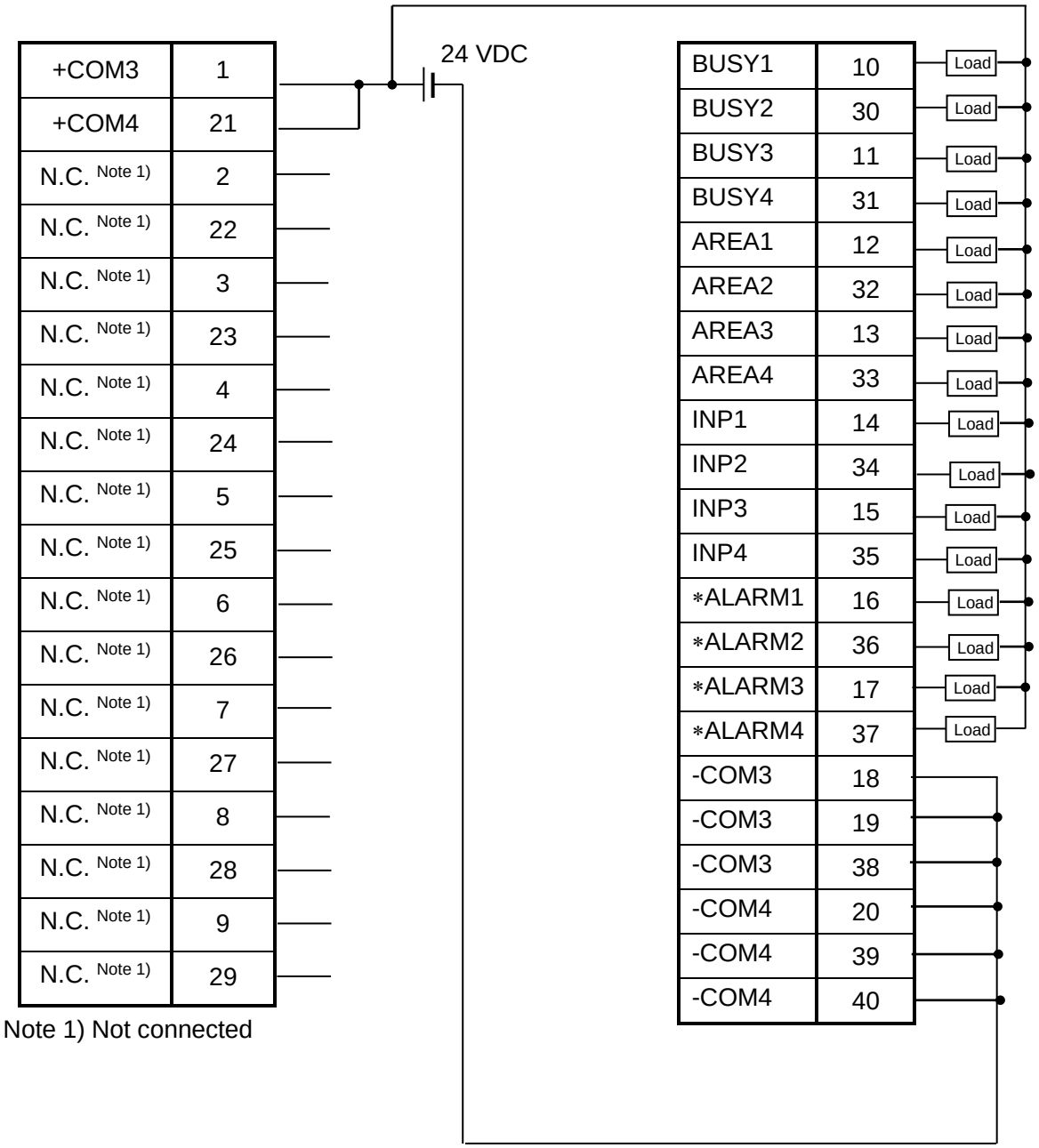
Prepare a separate power supply for the main control, motor drive and motor control and input/ output signal.

(1) NPN type

I/O 1



I/O 2



Note 1) Not connected

⚠Caution

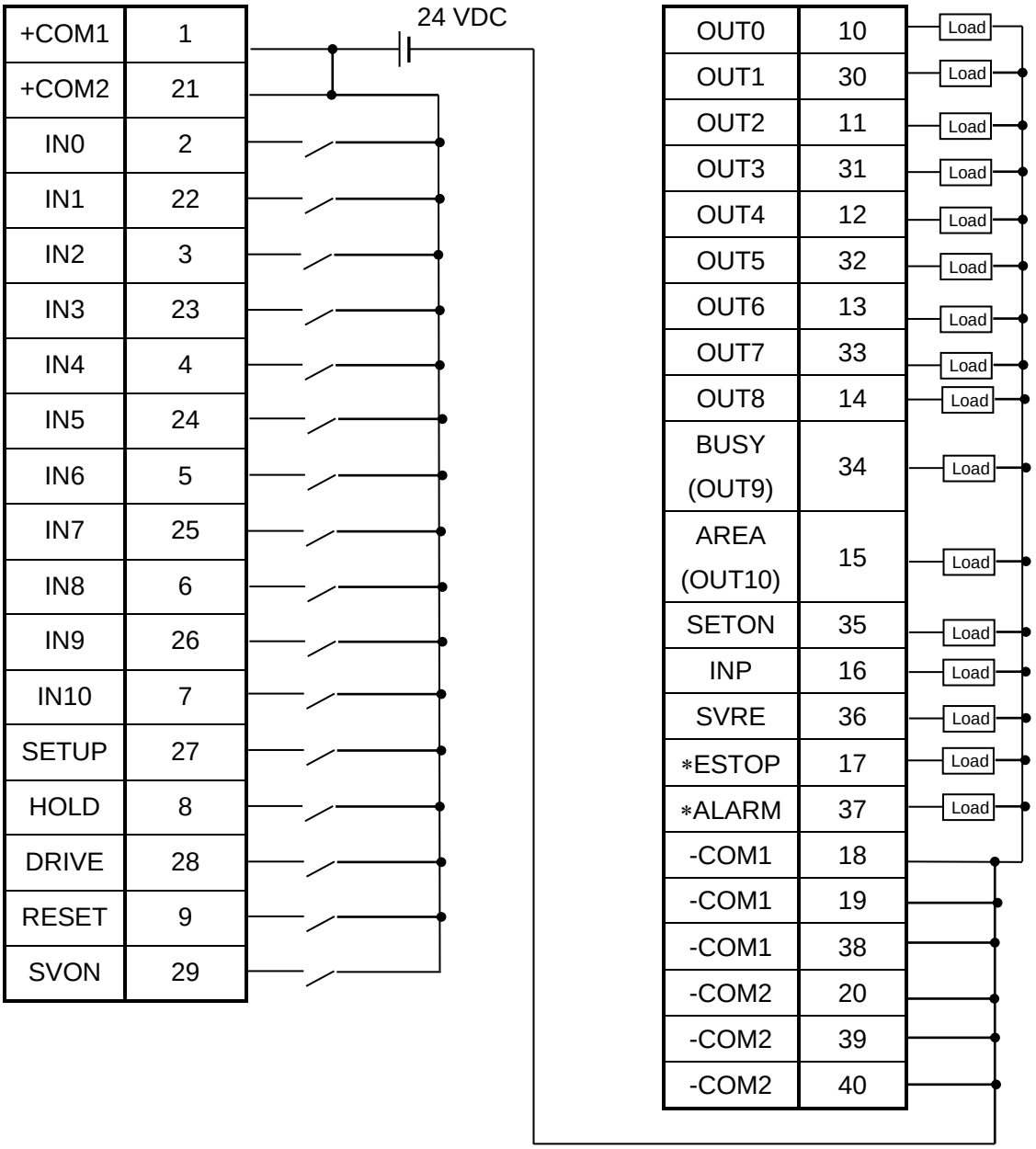
+COM1, +COM2 and +COM3, +COM4 are not connected inside the controller. When I/O2 is used, connect +COM1, +COM2 and +COM3, +COM4 to the 24V side of the common input/ output signal 24 VDC power supply.

⚠Caution

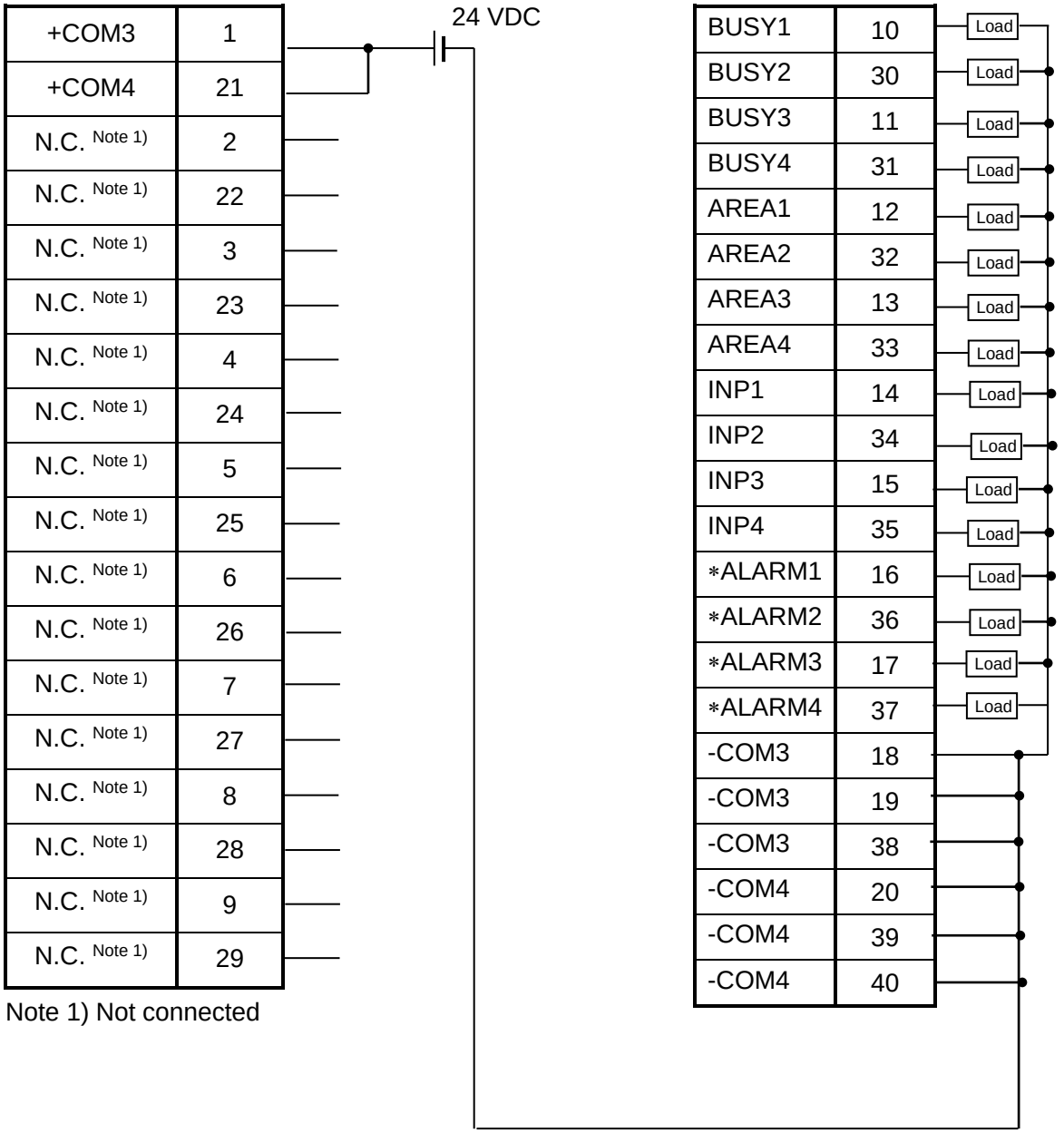
-COM1, -COM2, -COM3, -COM4 are not connected inside the controller. Connect the corresponding common -COM of the 0V side of the input/ output signal 24 VDC power supply.

(2) PNP type

I/O 1



I/O 2



Note 1) Not connected

⚠Caution

+COM1, +COM2 and +COM3, +COM4 are not connected inside the controller. When I/O2 is used, connect +COM1, +COM2 and +COM3, +COM4 to the 24V side of the common input/ output signal 24 VDC power supply.

⚠Caution

-COM1, -COM2, -COM3, -COM4 are not connected inside the controller. Connect the corresponding common -COM of the 0V side of the input/ output signal 24 VDC power supply.

7. 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.

7.1 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)

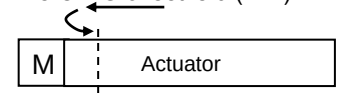
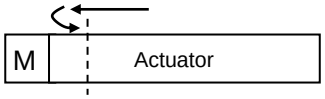
Description	Input range	Explanation	Write
Max step data Num	512 or 2048	Set the maximum step data number	X
Activated axis	0 or 1	Validity of axes to be set in the controller. "Disabled" axis is ignored regardless of the connection with the actuator. 0: Disabled 1: Enabled	X
Pushing force	Note1)	The force for the pushing operation. Pushing is performed with this pushing force when the pushing operation is selected by the step data. (Setting per step data is not possible.)	X
Trigger level	Note1)	A condition where the INP output signal is ON during the pushing operation. When the actuator generates a force above the trigger level value during the pushing operation, INP will be turned ON. (Setting per step data is not possible.)	X
Pushing speed	Note1)	The movement speed for the pushing operation. (Setting per step data is not possible.)	X
Moving force	Note1)	The setting to define the maximum force during the positioning operation. (Setting per step data is not possible.)	X
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: 2, Axis 3: 2, Axis 4:3 The order of returning starts from Axis 1, then Axis 2 and 3, and then Axis 4. (2) Axis 1: 1, Axis 2: 1, Axis 3: 1, Axis 4:1 Four axes return simultaneously. **⚠Caution** Simultaneous return to origin of 4 axes is not synchronous.	X
Adapter file version	Fixed value	This is a 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.

7.2 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" input signals.	-
Def In position	Note1)	Set the INP output range to Origin Position after a Return to Origin. [Unit: mm]	XX
ORIG offset	Note1)	Define the position of the actuator after the Return to origin operation. [Unit: mm] ■ The ORIG offset is 0 (mm)  Controller recognizes position after return to home position (0mm) ■The ORIG offset is 100 (mm).  Controller recognizes Position after return to home position (100mm) In the examples on the left, the actuator positions are not different but the reference point that the controller recognizes will be changed after the Return to origin operation. **⚠Caution** If the value for the “ORIG offset” is changed, the “Stroke (+)” and “Stroke (-)” in the basic parameters should be checked.	XX
Max force	Note1)	Set the maximum possible force for "Pushing Force" in the profile parameters.	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.

<table>
<tr><th>Description</th><th>Input range</th><th>Explanation</th><th>Write</th></tr>
<tr><td>Undefined No.11</td><td>1 to 4096</td><td rowspan="2">Define the electronic Gear.
- Undefined No.11: "Electronic Gear (numerator)"
- Undefined No.12: "Electronic Gear (denominator)"
This product controls the LE series motor (800 pulse per rotation).
Please refer to <u>Supplement 1. Actuator Specifications</u> for the travel distance of the motor per rotation.
[Setting example]
(1) "Electronic Gear (numerator): 1", "Electronic Gear (denominator): 1"
→ The motor makes one turn when 800 pulses are input.
(2) "Electronic Gear (numerator): 1", "Electronic Gear (denominator): 2"
→ The motor makes one turn when 1600 pulses are input.
(3) "Electronic Gear (numerator): 2", "Electronic Gear (denominator): 1"
→ The motor makes one turn when 400 pulses are input.
"Electronic Gear (numerator): 1", "Electronic Gear (denominator): 1" is recommended. If other values are entered, vibration or noise of the actuator could result.
When "0" is set, it is recognized as "1".When a value greater than "4097" is set, it is recognized as "4096".
⚠Caution
When interpolation is performed for the actuators of different leads, the travel distance per pulse must be the same.
Set the electronic Gear for Axis 2, 3 or 4 so that the travel distance are the same as Axis 1.
[Setting example]
<table><tr><th>Axis</th><th>Actuator</th><th>Lead</th><th>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>25/ 50</td></tr><tr><td>Axis 3</td><td>LEY16A-300</td><td>10mm</td><td>25/ 100</td></tr></table>Set Axis 2 and 3 so that their travel distance becomes 2.5mm per 800 pulse.
Electronic Gear ratio
= Lead of Axis 1/ Lead of Axis 2(or Axis 3)
=2.5mm/5mm (or 2.5mm/10mm)
=25/50 (or 25/100)</td><td>X</td></tr>
<tr><td>Undefined No.12</td><td>1 to 4096</td><td>X</td></tr>
</table>

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

7.3 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 or 2	Set the mode of the Return to origin operation. 1: ORIG Press 2. Return to origin with sensor	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 2	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 polarity is contact "a" 2: The origin sensor polarity is contact "b"	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.

7.4 Step data

A “step data” is the data set to define the movement of the actuator. Total of 512 step data (9 attributes per step) are possible to be handled by this controller. (When "2048" is set for "Max step data Num" in the Profile parameter, up to 2048 steps are possible to be used).

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	Area 1 (mm)	Area 2 (mm)	In-position (mm)
0	Axis 1	ABS	100	200.00	1000	1000	0	6.0	12.0	0.5
	Axis 2	ABS	50	100.00	1000	1000	0	6.0	12.0	0.5
	Axis 3	ABS	50	100.00	1000	1000	0	6.0	12.0	0.5
	Axis 4	ABS	50	100.00	1000	1000	0	6.0	12.0	0.5
1	Axis 1	INC	500	800.00	1000	1000	1	0	0	10
	Axis 2	INC	500	900.00	1000	1000	1	0	0	10
	Axis 3	INC	500	900.00	1000	1000	1	0	0	10
	Axis 4	INC	500	900.00	1000	1000	1	0	0	10
⋮		⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮

Step Data details

<table>
<tr><th>Description</th><th>Input range</th><th>Explanation</th></tr>
<tr><td>Step No.</td><td>0 to 2047</td><td>Number of step data. 4 lines of data for one step.</td></tr>
<tr><td>Axis</td><td>Axis 1 to Axis 4</td><td>Set the axis to be used (ENC 1 MOT to ENC 4 MOT).</td></tr>
<tr><td>Movement mode</td><td>7 types
(Refer to the table on the right)</td><td>Set the mode of movement to the target position.
<table>
<tr><th>Movement mode</th><th>Pushing operation</th><th>Details</th></tr>
<tr><td>Blank</td><td>×</td><td>Data invalid (No process)
Set blank for the axis which does not travel.</td></tr>
<tr><td>ABS</td><td>○</td><td>Move the actuator to the absolute position.</td></tr>
<tr><td>INC</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 coordinate and central coordinate from the current position using relative coordinate.</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 coordinate and central coordinate from the current position using relative coordinate.</td></tr>
<tr><td>SYN- I</td><td>×</td><td>Move the actuator to a relative position with speed tuning control.</td></tr>
</table></td></tr>
<tr><td>Speed</td><td>From minimum value to "Max speed" of basic parameter^{Note1)}</td><td>The speed to move to the target position. (Unit: mm/s)
Refer to (1) to (5) on page 54 for the speed setting for movement mode.</td></tr>
</table>

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

<table>
<tr><th>Description</th><th>Input range</th><th>Explanation</th></tr>
<tr><td>Position</td><td>“Stroke (-)” to “Stroke (+)” in the basic parameters</td><td>Set the target position (unit: mm)
Refer to (1) to (5) on page 54 for position setting for movement mode.</td></tr>
<tr><td>Acceleration</td><td>1 to “Max ACC/DEC” in the basic parameters</td><td>Set the acceleration to reach to travel speed. (Unit:mm/s^2)
Refer to (1) to (5) on page 54 for acceleration speed setting for movement mode.</td></tr>
<tr><td>Deceleration</td><td>1 to “Max ACC/DEC” in the basic parameters</td><td>Set the deceleration from travel speed to stop. (Unit:mm/s^2)
Refer to (1) to (5) on page 54 for deceleration speed setting for movement mode.</td></tr>
<tr><td>Pushing Selection</td><td>0 or 1</td><td>Define a Pushing operation or Positioning operation.
When a Pushing operation is selected, it is performed at a force greater than the pushing force set in the profile parameters.
<table>
<tr><th>Value</th><th>Movement mode</th><th>Details</th></tr>
<tr><td>0</td><td>Positioning operation</td><td>The actuator moves to the position specified by the “Position".</td></tr>
<tr><td>1</td><td>Pushing operation</td><td>The actuator moves to the position specified by the “Position”, and then performs a pushing action with a force not greater than the set force.</td></tr>
</table></td></tr>
<tr><td>Area 1</td><td>Step data "Area 2" from "Stroke (-)" in the basic parameters</td><td rowspan="2">The setting to define the conditions where the AREA output will be turned ON [Unit: mm]
If the current position is within the range between the Area1 and Area2, the AREA output will be turned ON.
If Area1= Area2= 0, the AREA output will be turned OFF.</td></tr>
<tr><td>Area 2</td><td>Step data "Area 1" to "Stroke(+)" in the basic parameters</td></tr>
<tr><td>In-position</td><td>Note1)</td><td>The In-position functionis different for the pushing operation and the positioning operation.
●Positioning operation: Positioning range (Unit: mm)
●Pushing operation Pushing range (Unit: mm)
<table>
<tr><th>Movement mode</th><th>Details</th></tr>
<tr><td>Positioning operation</td><td>This setting defines the In-position, where the INP output will be turned ON.
When the actuator moves to within a distance from the target position, the INP output 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.
The INP output will be turned ON when the pushing force exceeds the "Trigger level" set in the profile parameters.</td></tr>
</table></td></tr>
</table>

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	Area 1 (mm)	Area 2 (mm)	In-position (mm)
0	Axis 1	ABS	100	200.00	1000	1000	0	6.0	12.0	0.5
	Axis 2	ABS	50	100.00	1000	1000	0	6.0	12.0	0.5
	Axis 3	ABS	100	100.00	1000	1000	1	0.0	0.0	5.0
	Axis 4	ABS	50	50.0	1000	1000	1	0.0	0.0	10.0

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

0: Positioning operation
1: 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	Area 1 (mm)	Area 2 (mm)	In-position (mm)
0	Axis 1	INC	100	200.00	1000	1000	0	6.0	12.0	0.5
	Axis 2	INC	50	100.00	1000	1000	0	6.0	12.0	0.5
	Axis 3	INC	100	100.00	1000	1000	1	0.0	0.0	5.0
	Axis 4	INC	50	50.0	1000	1000	1	0.0	0.0	10.0

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

0: Positioning operation
1: 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	Area 1 (mm)	Area 2 (mm)	In-position (mm)
0	Axis 1	LIN-A	100	200.00	1000	1000	-	0.0	0.0	0.5
	Axis 2	LIN-A	-	100.00	-	-	-	0.0	0.0	0.5
	Axis 3	LIN-A	-	100.00	-	-	-	0.0	0.0	0.5
	Axis 4	- Note2)	-		-	-	-	-	-	-

Composite speed

Target position (Absolute position)Note 1

Composite acceleration and deceleration speed

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

Note 2) For LIN-A and LIN-I, Axis 1 to Axis 3 are based on interpolation. Do not perform a setting for Axis 4.

(4) CIR-R / CIR-L

Step No.	Axis	Movement mode	Speed (mm/s)	Position (mm)	Acceleration (mm/s²)	Deceleration (mm/s²)	Pushing Selection	Area 1 (mm)	Area 2 (mm)	In-position (mm)
0	Axis 1	CIR-R	100	100.00	1000	1000	-	0.0	0.0	0.5
	Axis 2	CIR-R	-	100.00	-	-	-	0.0	0.0	0.5
	Axis 3	- Note1)	-	50.00	-	-	-	-	-	-
	Axis 4	- Note1)	-	50.00	-	-	-	-	-	-

Composite speed

Target position (Relative position)

Rotation centre (Relative position)

Composite acceleration and deceleration speed

Note 1) For CIR-R and CIR-L, Axis 1 and 2 are based on interpolation. Do not perform a setting for Axis 3 and 4.

(5) SYN-I

Step No.	Axis	Movement mode	Speed (mm/s)	Position (mm)	Acceleration (mm/s²)	Deceleration (mm/s²)	Pushing Selection	Area 1 (mm)	Area 2 (mm)	In-position (mm)
0	Axis 1	SYN-I	100	100.00	1000	1000	-	0.0	0.0	0.5
	Axis 2	SYN-I	-	-	-	-	-	0.0	0.0	0.5
	Axis 3	SYN-I	-	-	-	-	-	0.0	0.0	0.5
	Axis 4	SYN-I	-	-	-	-	-	0.0	0.0	0.5

Target position for all Speed tuning control axes(Relative position)

⚠Caution

It is not possible to set more than one movement method in one step data.

8. Description of operation

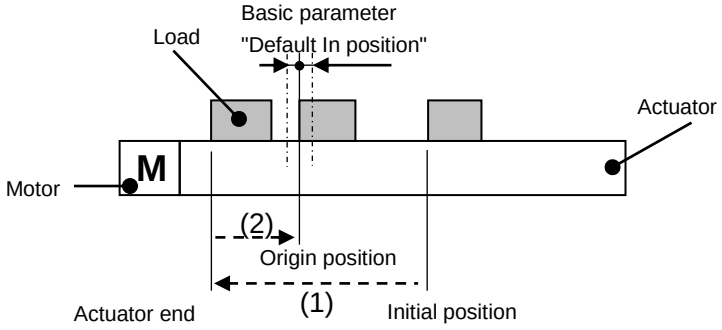
8.1 Return to origin

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 the end of travel limit it pauses for a short time. The controller recognizes the position as the end of travel limit of the actuator. Then, the actuator moves at a low speed in the direction opposite to the Return to origin direction. The position after the travel ("(2)" of the figure below) becomes the origin.

Return to Origin position command → Travel in the set Origin position direction → Stop travelling → Reverse travel → Set the Origin position

Return to Origin position reference example



⚠Caution

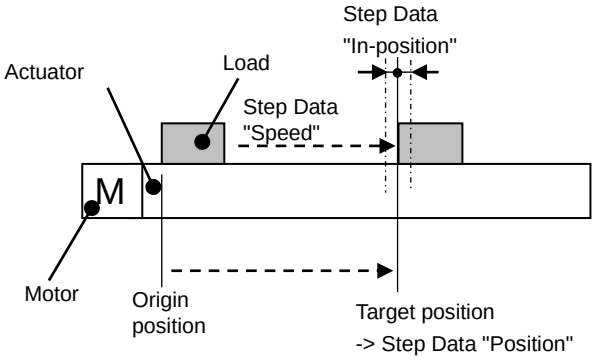
The Return to origin direction is dependent upon the actuator.

8.2 Positioning Operation

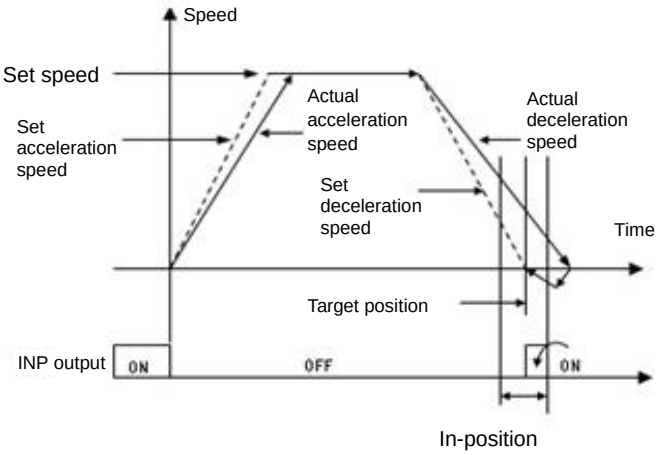
When the "Pushing selection" step data is "0" for a Positioning operation.

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

● **Positioning Operation (Example)**



● **Positioning operation [Speed/Position] (Example)**

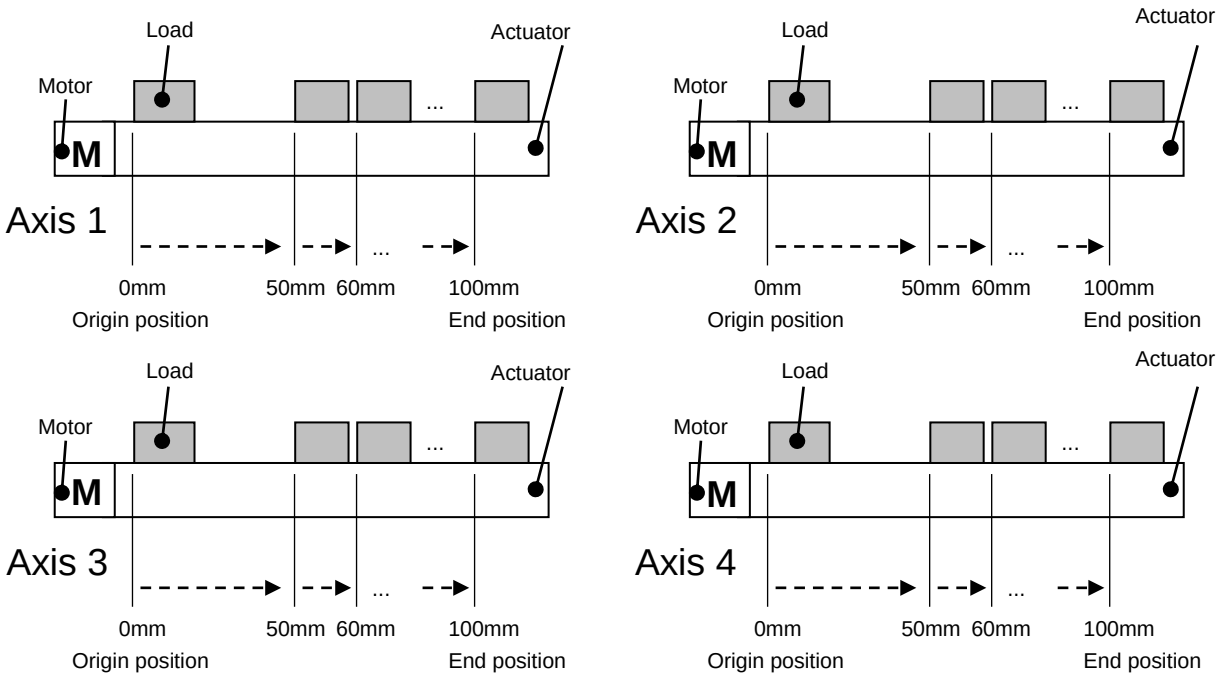


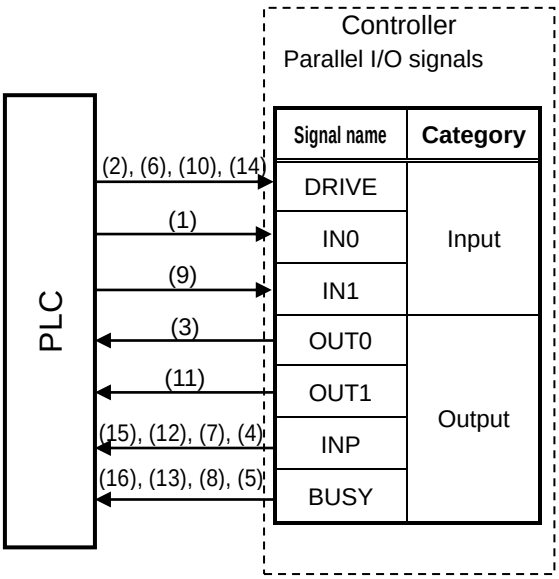
Example) After a Return to origin, move the 4 axes from the origin to a 50mm position at 100mm/s (Step No.1). Next, move the actuator to a 100mm position by moving it 5 times consecutively, 10mm at a time, at a speed of 50 mm/s (Step No. 2).

Step Data Setting Example

Step No.	Axis	Movement mode	Speed (mm/s)	Position (mm)	Acceleration (mm/s^2)	Deceleration (mm/s^2)	Pushing Selection	Area 1 (mm)	Area 2 (mm)	In-position (mm)
1	Axis 1	ABS	100	50.00	1000	1000	0	0	0	0.5
	Axis 2	ABS	100	50.00	1000	1000	0	0	0	0.5
	Axis 3	ABS	100	50.00	1000	1000	0	0	0	0.5
	Axis 4	ABS	100	50.00	1000	1000	0	0	0	0.5
2	Axis 1	INC	50	10.00	1000	1000	0	0	0	0.5
	Axis 2	INC	50	10.00	1000	1000	0	0	0	0.5
	Axis 3	INC	50	10.00	1000	1000	0	0	0	0.5
	Axis 4	INC	50	10.00	1000	1000	0	0	0	0.5

Operation (Example)





Flow chart (Reference)

(1) Select input Step No.1. (Turn IN0 ON.)

↓

(2) Turn the "DRIVE" input ON.

↓

The Motor starts to move to the position set in Step No.1.

↓

(3) Step No.1 output turns on.
(OUT0 output is turned ON)

↓

(4) INP output turns OFF.

↓

(5) The "BUSY" output turns ON.

↓

(6)Turn the DRIVE input OFF.

↓

(7) “INP” output is turned ON.

↓

(8) “BUSY” output is turned OFF.

↓

The move to the position set in Step Data No.1 is completed.

↓

(9) Select input Step No.2. (Turn the IN0 input OFF, and the IN1 input ON.)

↓

(10) Turn ON "DRIVE" input.

↓

Start moving to 10mm from the current position.

↓

(11) Step No.2 output is turned ON.
(OUT1 output is turned ON)

↓

(12) “INP” output is turned OFF.

↓

(13) “BUSY” output is turned ON.

↓

5 times

(14) “DRIVE” input is turned OFF.

↓

(15) “INP” output is turned ON.

↓

(16) “BUSY” output is turned OFF.

↓

The move to 10mm away is completed.

8.3 Pushing Operation

When the "Pushing selection" step data is "1", for a pushing operation.

First a positioning operation is performed to the "Target" position andaccording 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 force” in the profile parameters.

(1) Successful pushing operation

During the pushing operation, if the pushing force is greater than the value specified by the “Trigger level” set in the profile parameters for a specificed time, the INP output will be turned ON. The pushing force applied is set in the profile parameters and continues even after the INP output is ON.

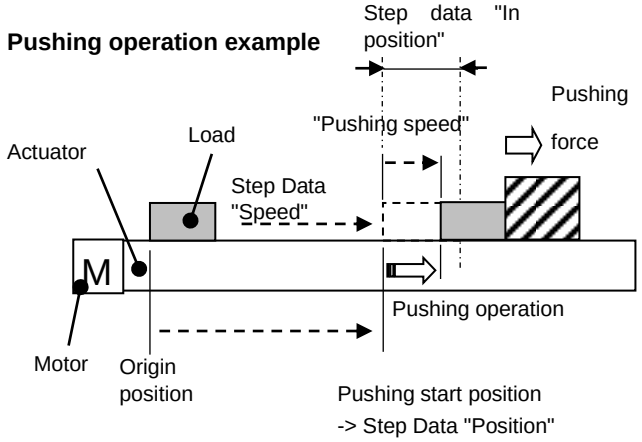
It is regarded that the pushing operation is completed successfully when two of the conditions below are satisfied.

Condition 1) The BUSY output is OFF

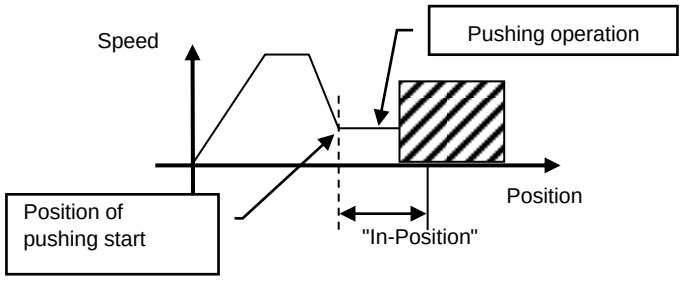
and

Condition 2) The INP output is ON

● **Pushing operation example**



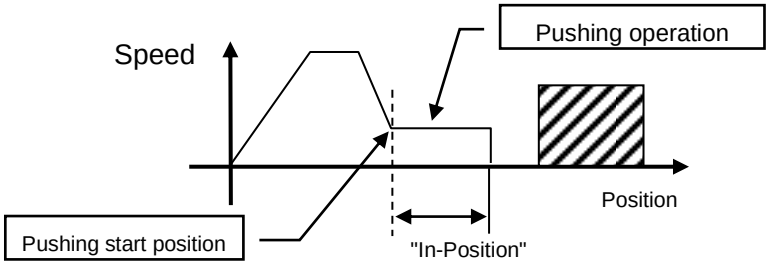
● **Pushing operation (Speed/Position)**



(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 output and BUSY output will be turned OFF.



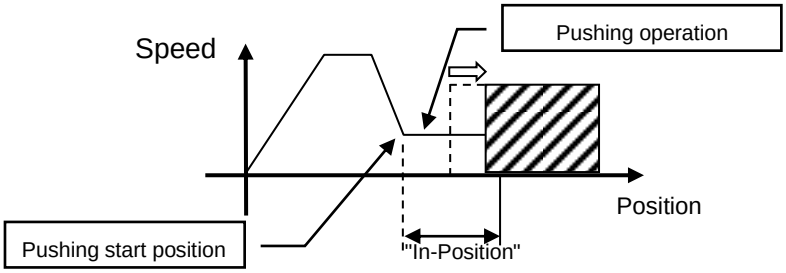
(3) Movement of the workpiece after completingthe pushing operation

(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 “Trigger level” of the profile parameter.

In this case, the INP output 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 “Trigger level” in the profile parameter for a specified time, the INP output will be turned ON again.

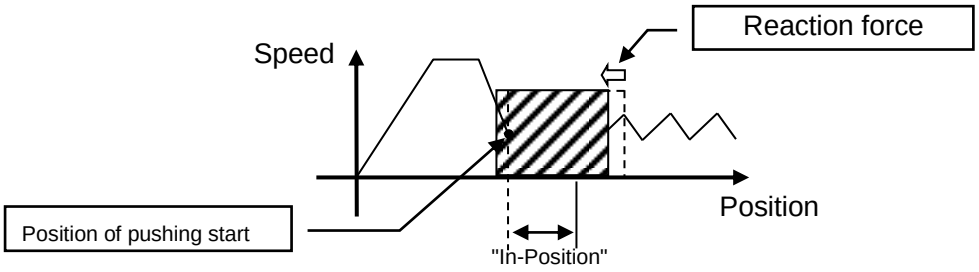


(b) Movement of the workpiece in the direction opposite to the pushing direction

(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 output 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 target position).

The INP output is OFF after passing the pushing start position.



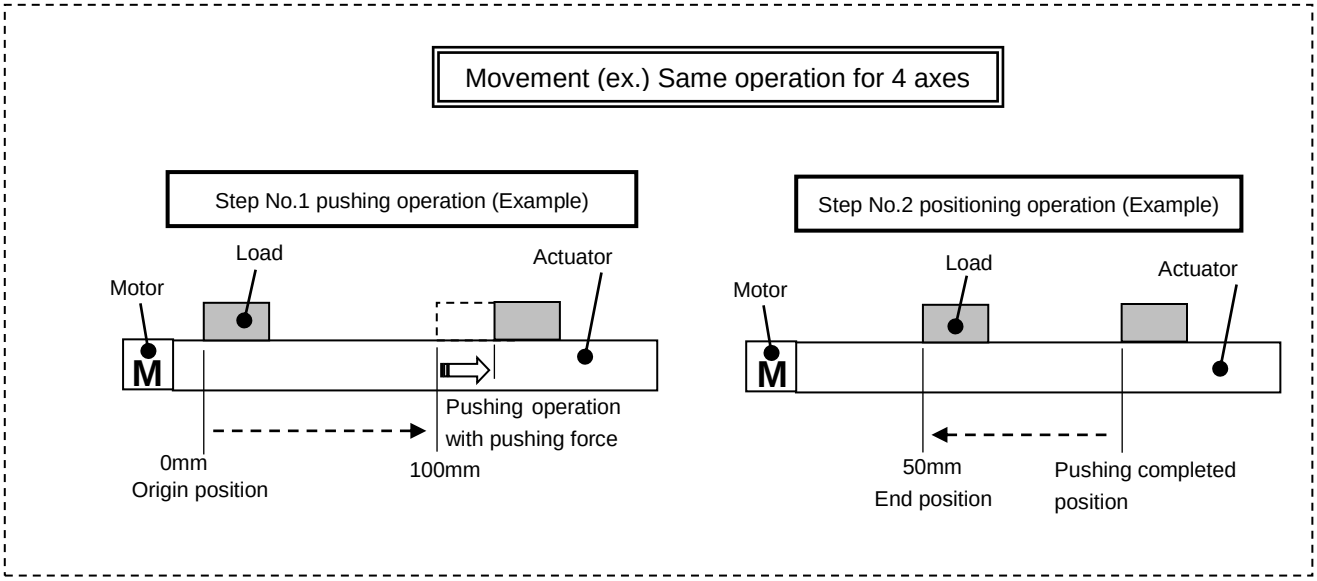
Example) After a Return to origin, move 4 axes from the origin to 100mm position at 100mm/s.

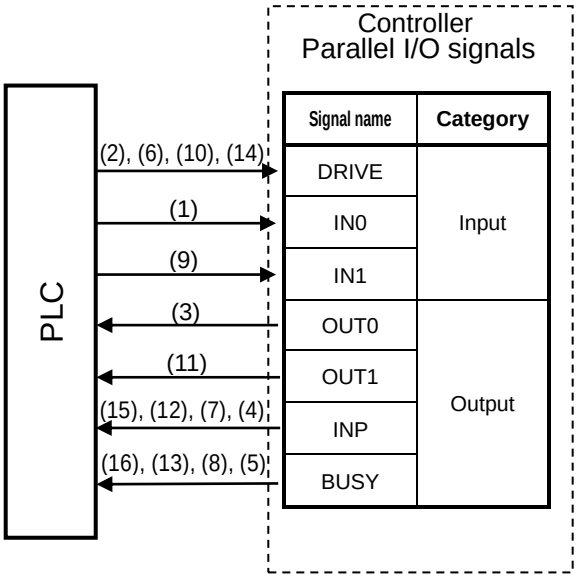
From the 100mm position, pushing for a maximum of 5mm at a speed of 10mm/s(profileparameter: Pushing speed) at 50% or lower of thrust(profile parameter: Pushing force) (Step No.1).

Then, move 4 axes to 50 mm position from the origin at 50mm/s from the Pushing completed position (position where "INP" output 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	Area 1 (mm)	Area 2 (mm)	In-position (mm)
1	Axis 1	ABS	100	100.00	1000	1000	1	0	0	5.0
	Axis 2	ABS	100	100.00	1000	1000	1	0	0	5.0
	Axis 3	ABS	100	100.00	1000	1000	1	0	0	5.0
	Axis 4	ABS	100	100.00	1000	1000	1	0	0	5.0
2	Axis 1	ABS	50	50.00	1000	1000	0	0	0	0.5
	Axis 2	ABS	50	50.00	1000	1000	0	0	0	0.5
	Axis 3	ABS	50	50.00	1000	1000	0	0	0	0.5
	Axis 4	ABS	50	50.00	1000	1000	0	0	0	0.5





Flow chart （Reference）

(1)Select input Step No.1. (Turn IN0 ON.)

↓

(2)Turn the "DRIVE" input ON.

↓

The Motor starts to move to the position set in Step No.1.

↓

(3) Step No.1 output is turned ON.
(OUT0 output is turned ON)

↓

(4) “INP” output is turned OFF.

↓

(5) “BUSY” output is turned ON.

↓

(6) “DRIVE" input is turned OFF.

↓

Move at low speed after passing the “Position” in Step No.1

↓

Push the workpiece with the specified pushing force.

↓

(7) “INP” output is turned ON.

↓

(8) “BUSY” output is turned OFF.

↓

The move to the position set in Step No.1 is completed.

↓

(9) Select input Step No.2. (Turn the IN0 input OFF, and the IN1 input ON.)

↓

(10)Turn the "DRIVE" input ON.

↓

Start moving to the position of Step No.2

↓

(11)Step No.2 output is turned ON.
(OUT1 output is turned ON)

↓

(12) “INP” output is turned OFF.

↓

(13) “BUSY” output is turned ON.

↓

(14) “DRIVE” input is turned OFF.

↓

(15) “INP” output is turned ON.

↓

(16) “BUSY” output is turned OFF.

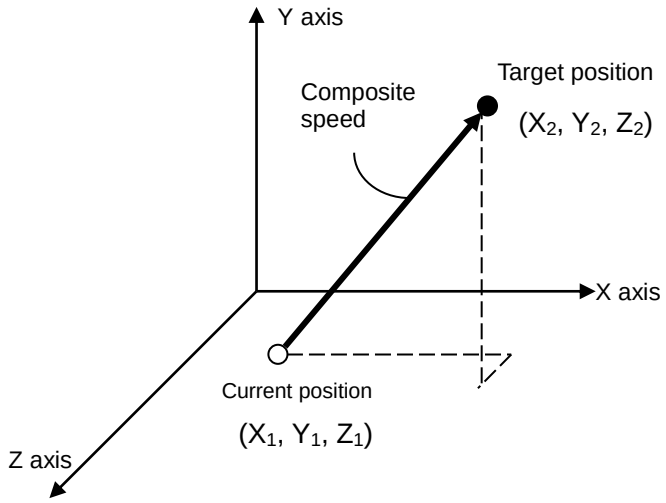
↓

The move to the position set in Step No. 2 is completed.

8.4 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 and linear interpolation of Axis 4 cannot be used.



[Axis speed calculation]

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

Xaxis speed = $((X_2-X_1)/$ Composite travel distance$) \times$ Composite speed

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

Z axis speed = $((Z_2-Z_1)/$ Composite travel distance$) \times$ 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** for the calculation of the electronic Gear.

⚠Caution

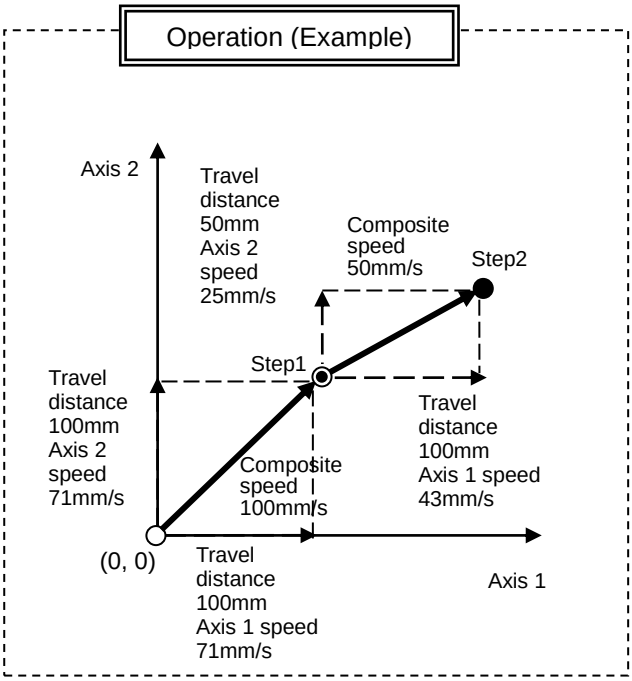
The speed of the actuator may be outside of the specification range depending on the step data. Calculate the speed of each axis before operation, and confirm that the speed is within the minimum and maximum speed specified.

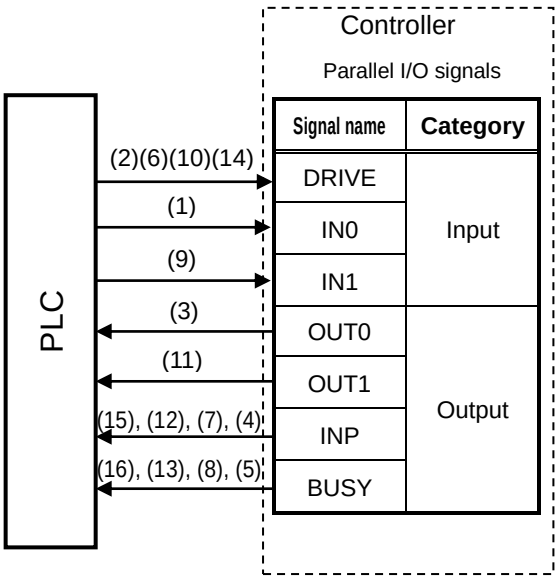
Example) After a Return to origin, move from the origin position at 100mm/s of composite speed to a point at100mm on Axis 1 and 100mm on Axis 2 (Step No.1).

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	Area 1 (mm)	Area 2 (mm)	In-position (mm)
1	Axis 1	LIN -A	100	100.00	1000	1000	-	0	0	0.5
	Axis 2	LIN -A	-	100.00	-	-	-	0	0	0.5
	Axis 3	-	-	-	-	-	-	-	-	-
	Axis 4	-	-	-	-	-	-	-	-	-
2	Axis 1	LIN -I	50	100.00	1000	1000	-	0	0	0.5
	Axis 2	LIN -I	-	50.00	-	-	-	0	0	0.5
	Axis 3	-	-	-	-	-	-	-	-	-
	Axis 4	-	-	-	-	-	-	-	-	-





Flow chart (Reference)

(1) Select input Step No.1. (Turn IN0 ON.)

↓

(2) Turn the DRIVE input ON.

↓

The Motor starts to move to the position set in Step No.1.

↓

(3)Step No.1 output is turned ON.
(OUT0 output is turned ON)

↓

(4)INP output is turned OFF.

↓

(5)BUSY output is turned ON.

↓

(6)Turn the DRIVE input OFF.

↓

(7)INP output is turned ON.

↓

(8)BUSY output is turned OFF.

↓

The move to the position set in Step Data No.1 is completed.

↓

(9)Select input Step No.2. (Turn the IN0 input OFF, and the IN1 input ON.)

↓

(10)Turn the "DRIVE" input ON.

↓

Start moving to a point at 100mm on Axis 1 and 50mm on Axis 2.

↓

(11)Step No.2 output is turned ON.
(OUT1 output is turned ON)

↓

(12) INP output is turned OFF.

↓

(13) BUSY output is turned ON.

↓

(14) DRIVE input is turned OFF.

↓

(15) INP output is turned ON.

↓

(16) BUSY output is turned OFF.

↓

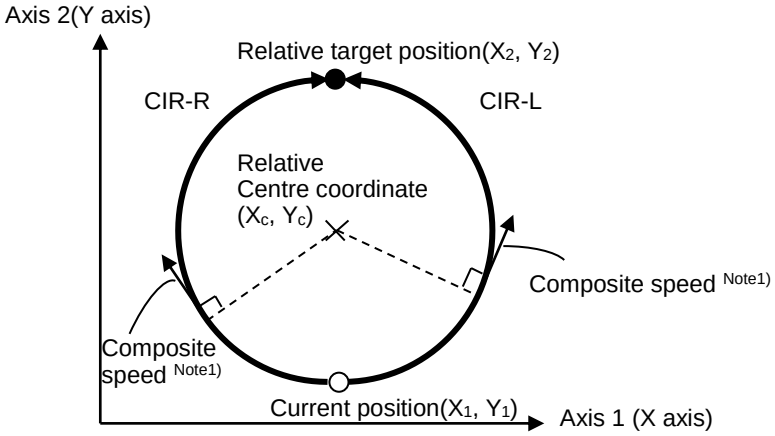
Move to a point at 100mm on Axis 1 and 50mm on Axis 2.

8.5 Circular interpolation

Circular interpolation by specifying the target coordinate (relative) and centre coordinate (relative) referring to Axis 1 as the X axis and Axis 2 as the Y axis. Clockwise circular interpolation is in CIR-R mode and counterclockwise is in CIR-L mode. 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.

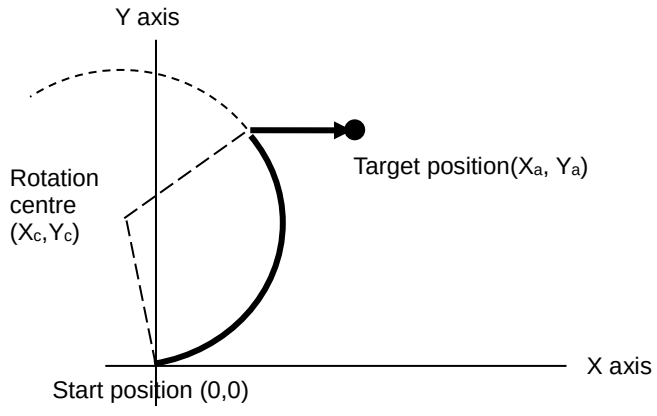
The pushing operation and circular interpolation of Axis 3 and 4 cannot be used.



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 centre coordinate.

When the target position does not exist on the arc composed by the current position and centre coordinate, the target position is reached using linear movement on the X or Y axes at the end of the operation (Refer to the 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** for the calculation of the electronic Gear.

⚠ Caution

When mode CIR-R/L 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 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 centre coordinate.

3) Do not set the rotation centre position to (0, 0).

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).

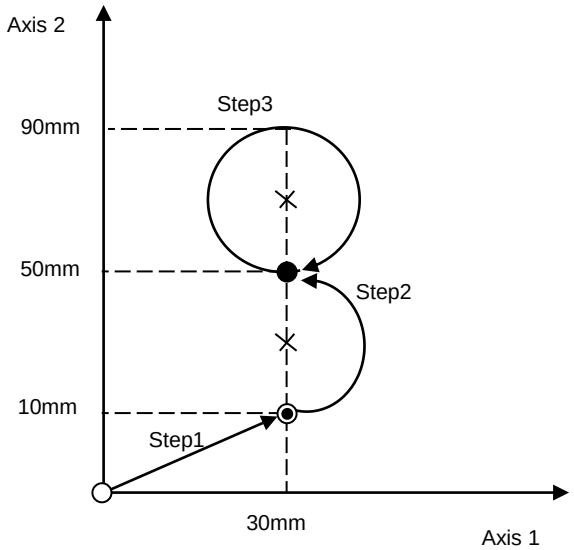
Move from the current position using counterclockwise circular interpolation movement at 100 mm/s composite speed to a point 0mm on Axis 1 and 40mm on Axis 2 (Step No.2: Centre position 0mm on Axis 1, 20mm on Axis 2).

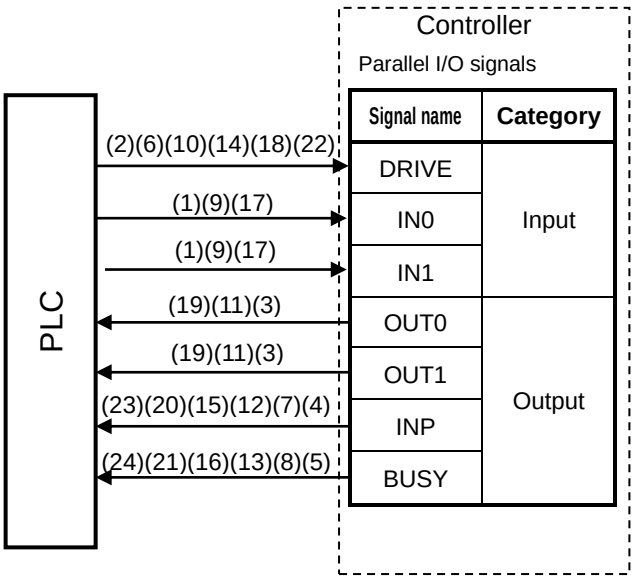
Make one clockwise rotation movementat 100 mm/s of composite speed (Step No.3: Centre position 0mm on Axis 1, 0mm on Axis 2).

Step Data Setting Example

Step No.	Axis	Movement mode	Speed (mm/s)	Position (mm)	Acceleration (mm/s^2)	Deceleration (mm/s^2)	Pushing Selection	Area 1 (mm)	Area 2 (mm)	In-position (mm)
1	Axis 1	ABS	100	30.00	1000	1000	0	0	0	0.5
	Axis 2	ABS	100	10.00	1000	1000	0	0	0	0.5
	Axis 3	-	-	-	-	-	-	-	-	-
	Axis 4	-	-	-	-	-	-	-	-	-
2	Axis 1	CIR-L	100	0.00	1000	1000	-	0	0	0.5
	Axis 2	CIR-L	-	40.00	-	-	-	0	0	0.5
	Axis 3	-	-	0.00	-	-	-	-	-	-
	Axis 4	-	-	20.00	-	-	-	-	-	-
3	Axis 1	CIR-R	100	0.00	1000	1000	-	0	0	0.5
	Axis 2	CIR-R	-	0.00	-	-	-	0	0	0.5
	Axis 3	-	-	0.00	-	-	-	-	-	-
	Axis 4	-	-	20.00	-	-	-	-	-	-

Operation （Example）





Flow chart （Reference）

(1)Select input Step No.1. (Turn IN0 ON.)

↓

(2)Turn the DRIVE input ON.

↓

The Motor starts to move to the position set in Step No.1.

↓

(3) Step No.1 output is turned ON.
(OUT0 output is turned ON)

↓

(4)INP output is turned OFF.

↓

(5)BUSY output is turned ON.

↓

(6)Turn the DRIVE input OFF.

↓

(7)INP output is turned ON.

↓

(8)BUSY output is turned OFF.

↓

The move to the position set in Step Data No.1 is completed.

↓

(9)Select input Step No.2. (Turn the IN0 input OFF, and the IN1 input ON.)

↓

(10)Turn the "DRIVE" input ON.

↓

Move to the position set in Step No.2.

↓

(11) Step No.2 output is turned ON.
(OUT0 output is turned OFF, OUT1 output is turned ON.)

↓

(12) INP output is turned OFF.

↓

(13) BUSY output is turned ON.

↓

(14) DRIVE input is turned OFF.

↓

(15) INP output is turned ON.

↓

(16) BUSY output is turned OFF.

↓

The move to the position set in Step No. 3 is completed.

↓

(17)Select input Step No.3. (Turn IN0 and IN1 ON)

↓

(18)Turn the "DRIVE" input ON.

↓

Start to move to the position set in Step No.3.

↓

(19)Step No.3 output is turned ON.
(OUT1 and OUT0 output are turned ON)

↓

(20) INP output is turned OFF.

↓

(21)BUSY output is turned ON.

↓

(22) The DRIVE input is turned OFF.

↓

(23) INP output is turned ON.

↓

(24) “BUSY” output is turned OFF.

↓

The move to the position set in Step No. 3 is completed.

8.6 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** 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, etc.

Speed tuning control works when the actual speed becomes slower than the set speed. So, it does not work 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.

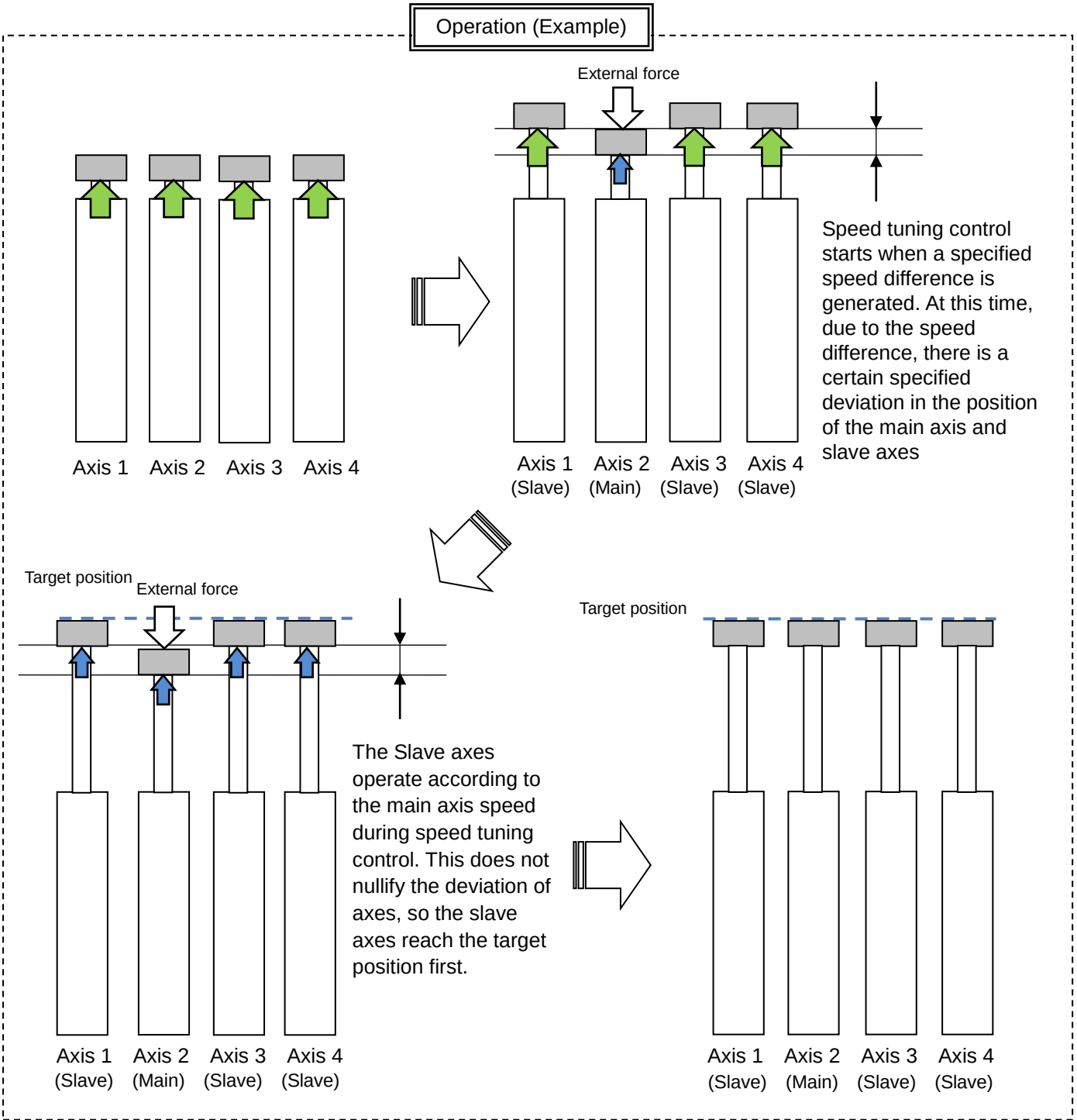
Please design and construct the system taking these cautions into consideration.

Example) After a Return to origin, move all axes synchronously from the origin to 200mm position at 100mm/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/s²)	Deceleration (mm/s²)	Pushing Selection (%)	Area 1 (mm)	Area 2 (mm)	In-position (mm)
0	Axis 1	SYN-I	100	200.00	1000	1000	-	0	0	0.5
	Axis 2	SYN-I	-	-	-	-	-	0	0	0.5
	Axis 3	SYN-I	-	-	-	-	-	0	0	0.5
	Axis 4	SYN-I	-	-	-	-	-	0	0	0.5

Operation (Example)



8.7 Controller input signal response time

The controller input signal response time includes the following factors.

1) Controller input signal scan time

2) Delay due to input signal analysis

3) Delay due to command analysis

Leave an interval of 15ms or more (recommendation is 30 ms) between input signals and maintain the state of the signal for 15ms or more (recommendation is 30 ms), because PLC processing delays and controller scanning delays could occur.

8.8 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.

9. Operation Instructions

9.1 Outline of the Operation instruction

The actuator is operated by selecting step data which is preset in the controller, using parallel I/O signals. Refer to the following section for details of the parallel I/O signal timing and control procedures.

9.2 Operation procedure of parallel I/O signals

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 output turns ON.
∗ESTOP output is turned ON.

↓

(c) SVON input is turned ON.

↓

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

[The time taken for SVRE output and INP output 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 input ON.

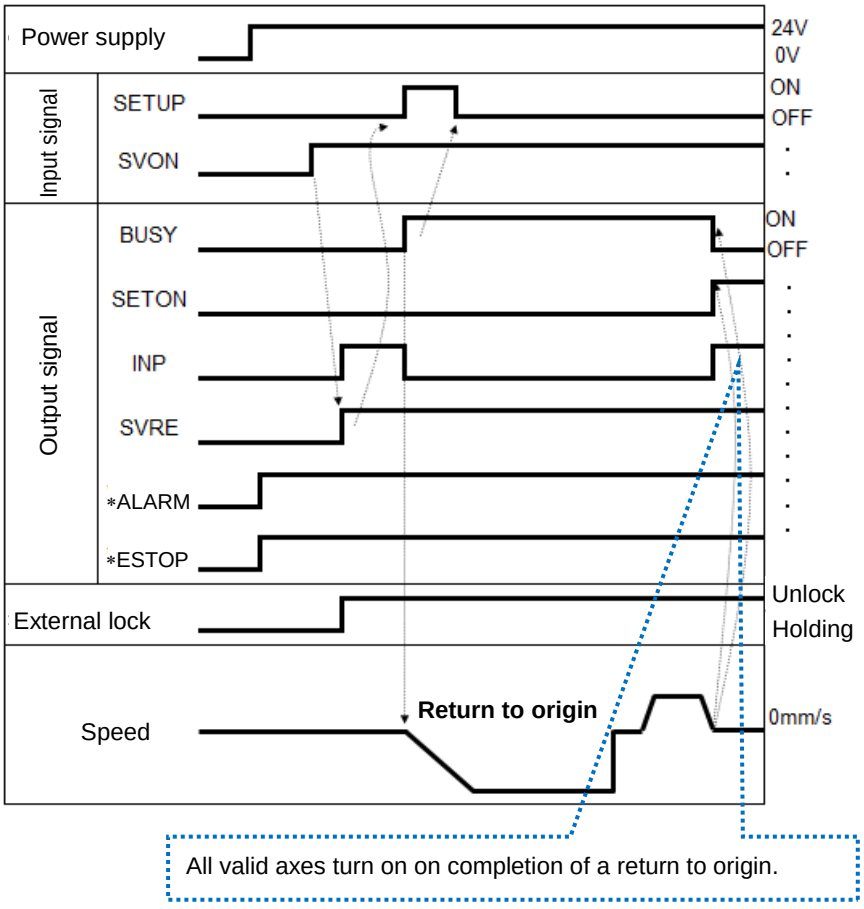
↓

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

↓

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

- Timing chart -



The “∗ALARM” and “∗ESTOP” are expressed

(2) Positioning operation

- Procedure -

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

↓

(b)Turn the DRIVE input ON.
The step data No. (OUT x output) will be output.

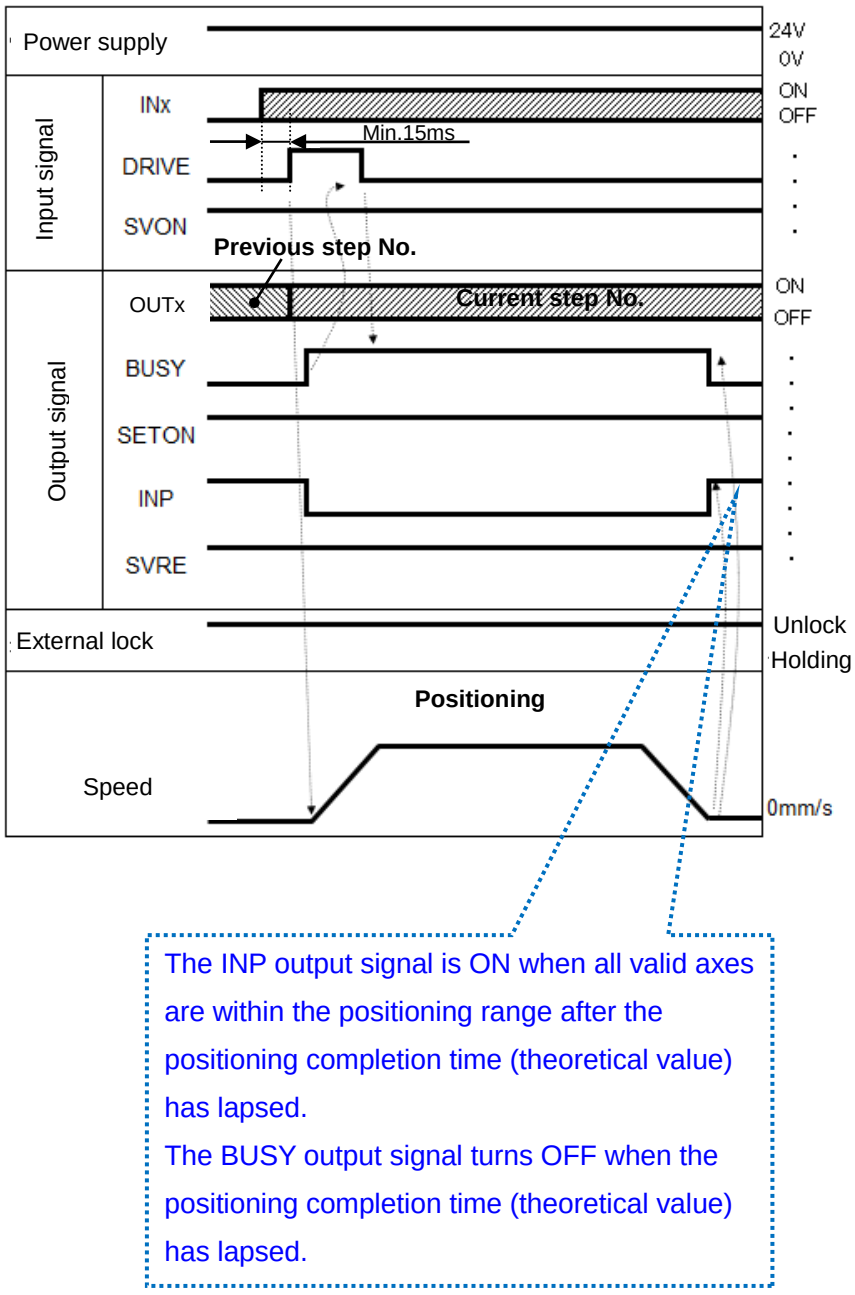
↓

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

↓

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

- Timing chart -



⚠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 output: ON, BUSY output: 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) Pushing operation

- Procedure -

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

↓

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

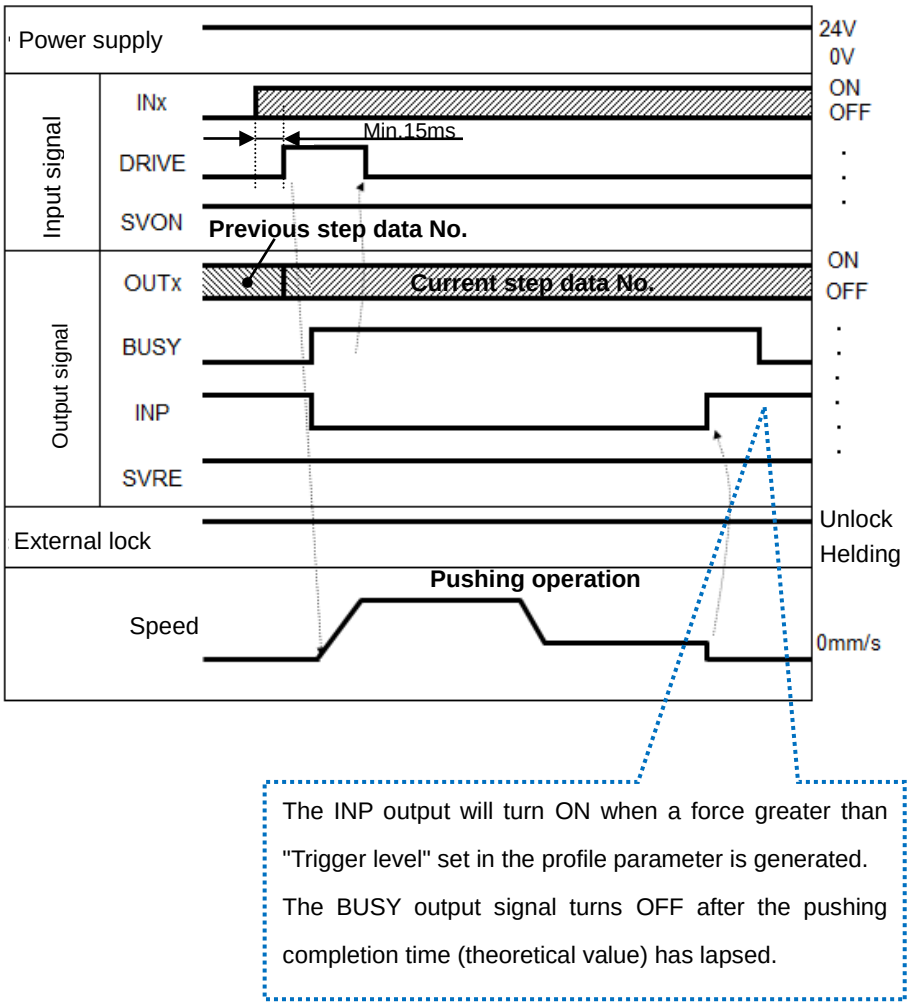
↓

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

↓

(d) The pushing operation is complete when INP is ON and BUSY output is OFF. (The force set as the "Pushing Force" in the profile parameter will be generated).

- Timing chart -



⚠Caution

1) If the movement is interrupted during positioning of the pushing operation, an alarm “(0-149) Failed to achieve set position in set time limit” 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.

(4) HOLD

- Procedure -

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

↓

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

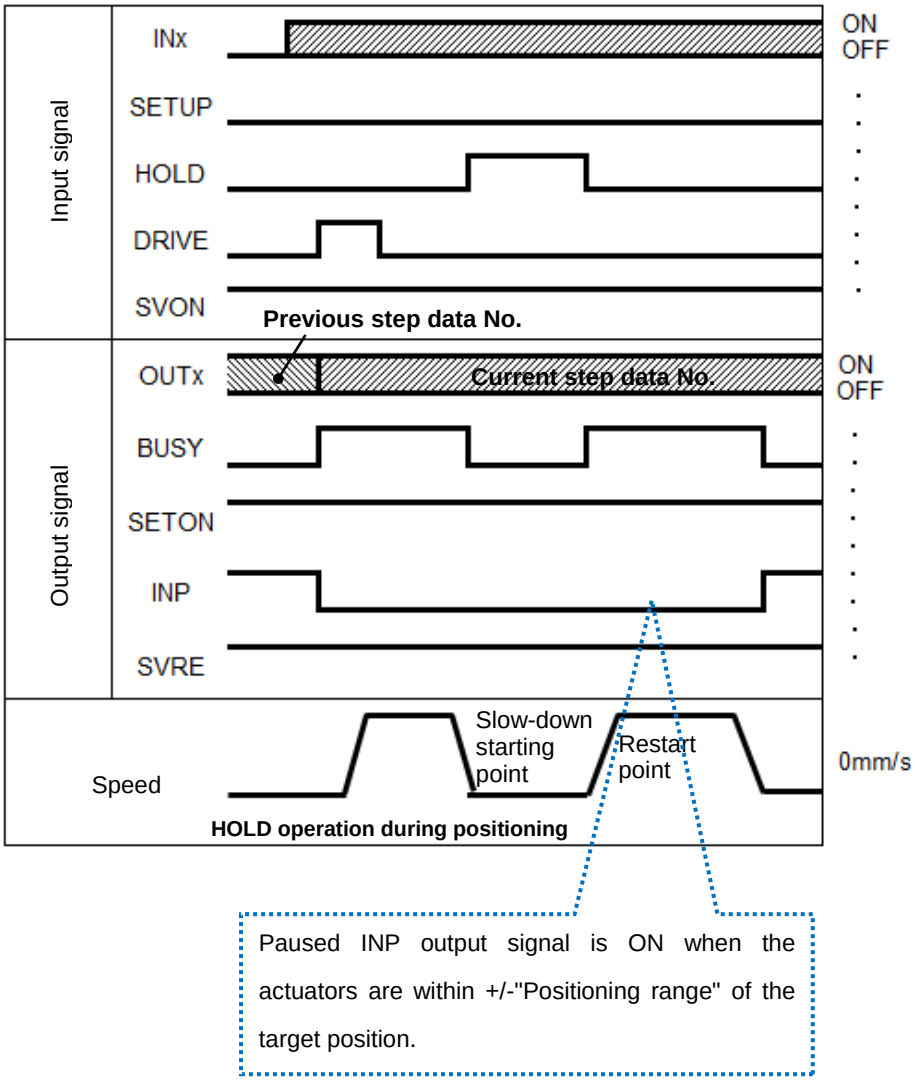
↓

(c) The HOLD output turn OFF.

↓

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

- Timing chart -



(5) RESET

[Alarm reset]

- Procedure -

(a) Generation of an alarm (When the ∗ALARM output is OFF, OUTx output corresponding to the alarm group will turn ON).

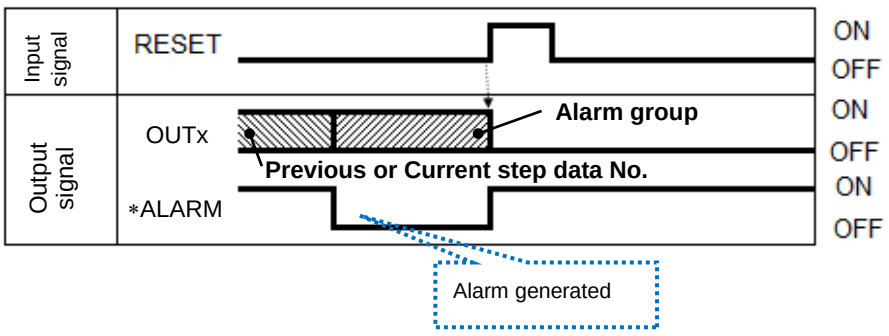
↓

(b) The RESET input is turned ON.

↓

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

- Timing chart -



∗ALARM is displayed in negative logic.

(In case of alarm group E, the power supply for the main control and motor control needs to be re-applied to reset the alarm.)

[Reset of operation]

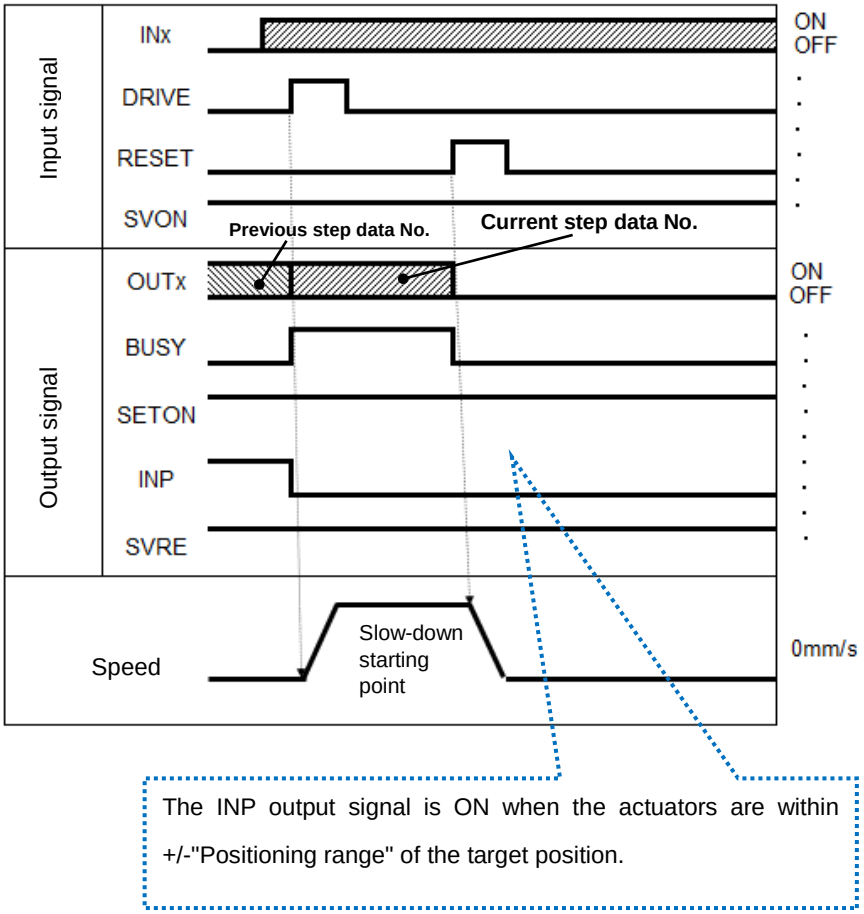
- Procedure -

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

↓

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

- Timing chart -



(6) STOP

- Procedure

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

↓

(b) The ∗ESTOP output will turn OFF.

↓

(c) The BUSY output will turn OFF.
(The actuator will stop).
The SVRE output will turn OFF.
(The actuator (with lock) will be locked.)

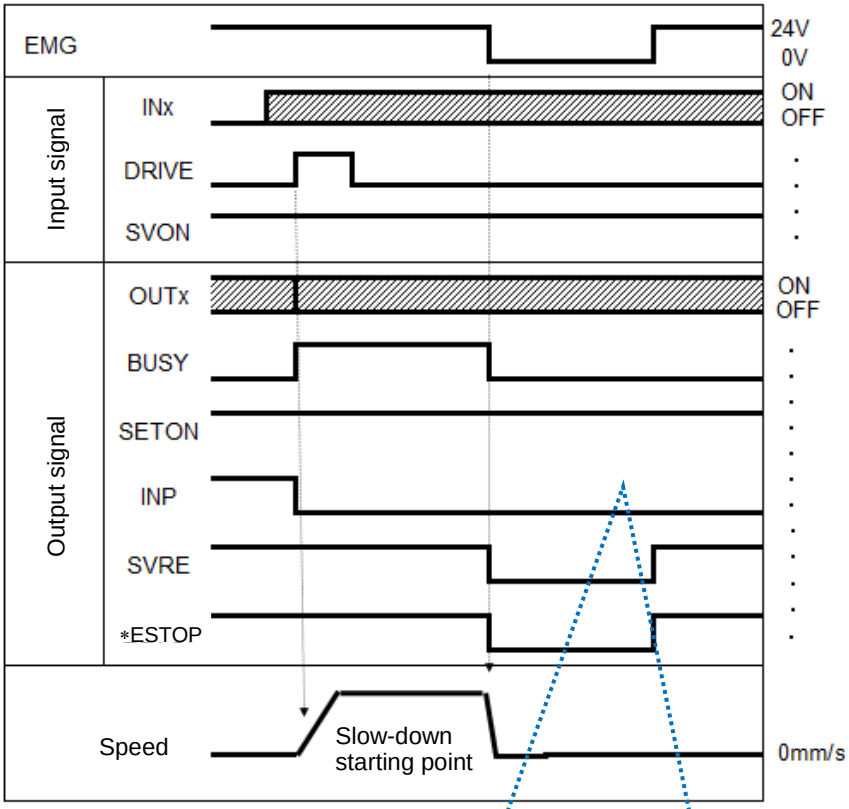
↓

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

↓

(e) The ∗ESTOP output will turn ON.
SVRE is turned ON.
(The actuator (with lock) will be unlocked.)

- Timing charge -



The INP output signal is OFF when the EMG input is OFF.
The EMG turns ON (Stop release), and the INP output 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.

(7) Area output

-Procedures-

(a) Input the Step data No. (INx).

(b) Turn the "DRIVE" input ON. Step data No. 1 (OUTx output) will be output.

(c) The BUSY output will turn ON and INP output will turn OFF (the positioning operation will starts).

(d) The AREA output of step data No.1 turns ON (at 150mm from the origin point).

(e) The BUSY output will turn OFF and INP output will turn ON. (Positioning operation of step data No.1 is completed).

(f) Input the step data No. 2 (INx).

(g) Turn the "DRIVE" input ON. Step data No. 2 (OUTx output) will be output.

(h) The AREA output will turn OFF. The BUSY output will turn ON and INP output will turn OFF. (The positioning operation will start).

(i) The AREA output for step data No.2 will turnON (at 170mm from the origin point).

(j) The AREA output for step data No.2 will turnOFF (at 130mm from the origin point).

(k) The BUSY output will turn OFF and INP output will turn ON. (Positioning operation of step data No.2 is completed).

- Timing chart -

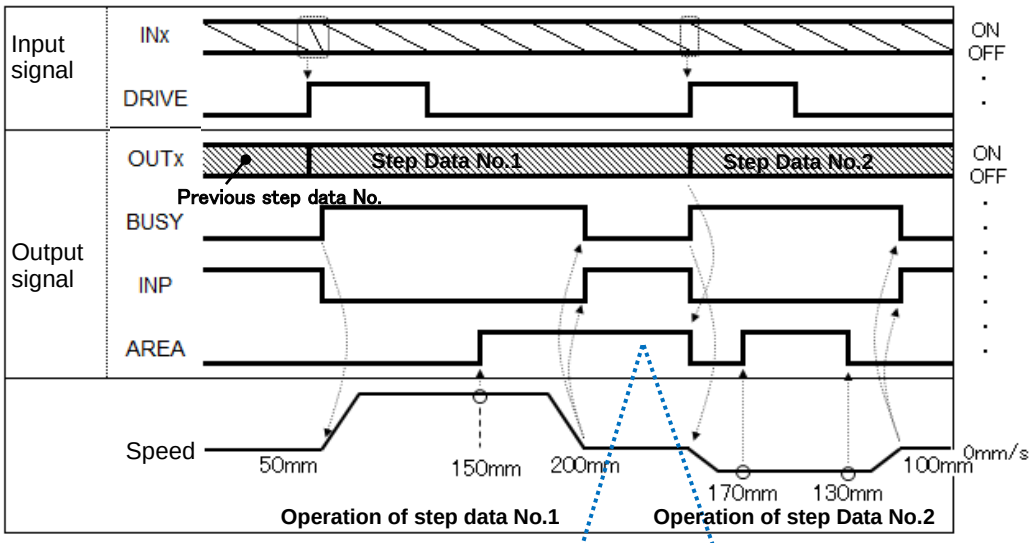
Initial position: 50mm

↓

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)

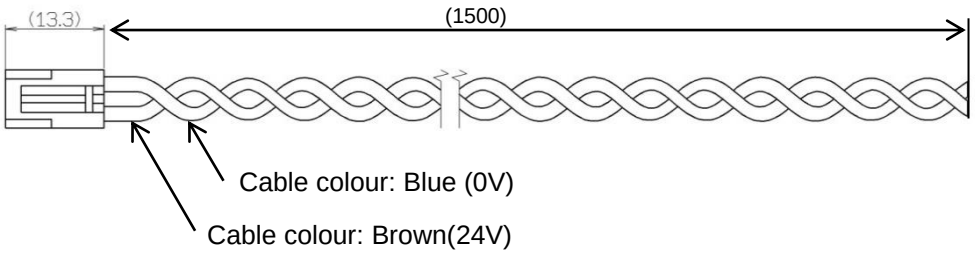


If the current position is within Area 1 and 2 of step data, the AREA signal will turn ON. Otherwise, the signal is OFF

10. Accessories

10.1 Power cable for main control

JXC-C1

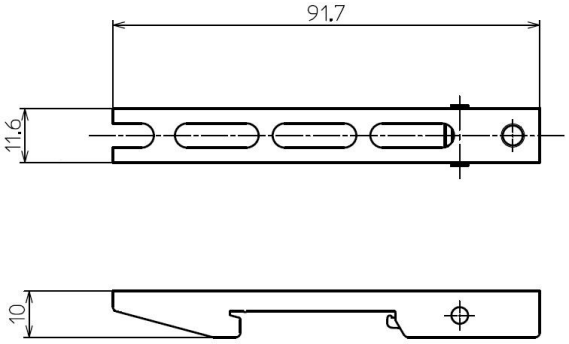


Cable specification

Item	Specifications
Cable length	1.5m
Electric wire size	Stranded wire --> AWG20 (0.5mm^2) O.D. of sheath →ϕ1.76 mm
Wire sheath colour	+24V: Brown 24-0V: Blue

10.2 DIN rail mounting bracket

JXC-Z1



Included with the controller

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

10.3 Actuator cable (5m or less)

L E - C P - ∗ - ∗

Cable length [L]

1	1.5m
3	3m
5	5m

Cable type

Nil	Robotic type cable
S	Standard cable

(a)

Signal name	Terminal number
A	B-1
$\overline{A}$	A-1
B	B-2
$\overline{B}$	A-2
COM-A/COM	B-3
COM-B/ -	A-3
Vcc	B-4
GND	A-4
$\overline{A}$	B-5
A	A-5
$\overline{B}$	B-6
B	A-6

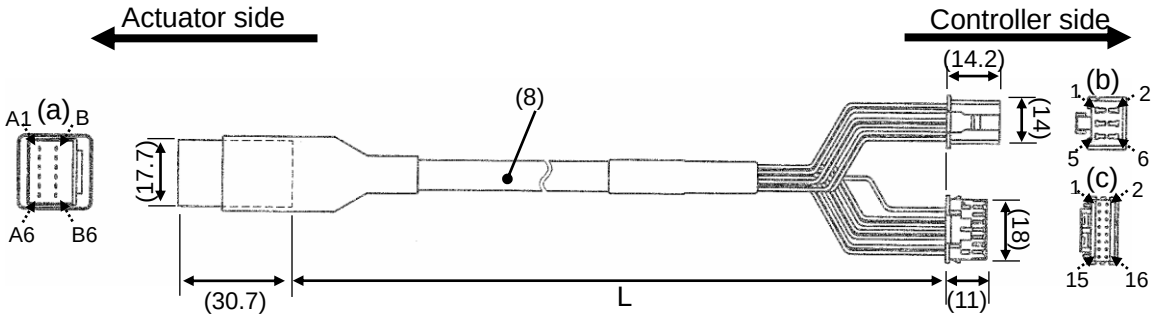
(b)

Cable colour	Terminal number
Brown	2
Red	1
Orange	6
Yellow	5
Green	3
Blue	4

Shield

(c)

Cable colour	Terminal number
Brown	12
Black	13
Red	7
Black	6
Orange	9
Black	8
-	3



10.4 Actuator cable (8-20m)

L E - C P - ∗

Cable length [L]

8	8m Note)
A	10m Note)
B	15m Note)
C	20m Note)

Note)Produced upon receipt of order
(Only "Robotic type cable" is available)

(a)

Signal name	Terminal number
A	B-1
$\overline{A}$	A-1
B	B-2
$\overline{B}$	A-2
COM-A/COM	B-3
COM-B/ -	A-3
Vcc	B-4
GND	A-4
$\overline{A}$	B-5
A	A-5
$\overline{B}$	B-6
B	A-6

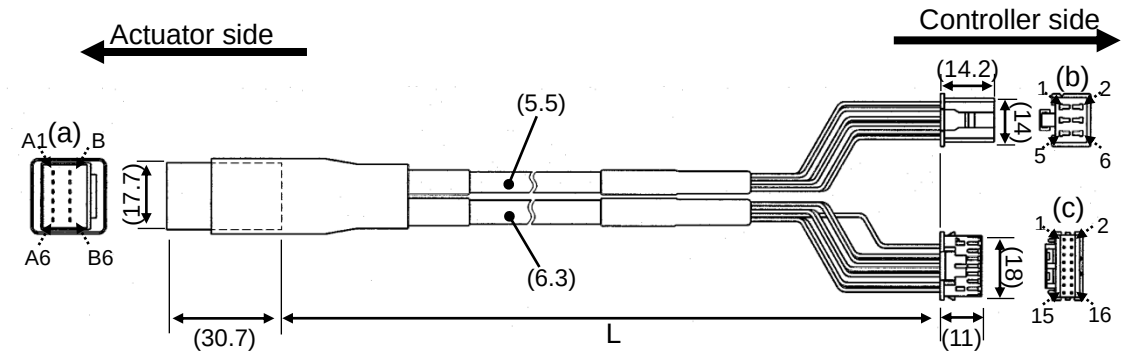
(b)

Cable colour	Terminal number
Brown	2
Red	1
Orange	6
Yellow	5
Green	3
Blue	4

Shield

(c)

Cable colour	Terminal number
Brown	12
Black	13
Red	7
Black	6
Orange	9
Black	8
-	3



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

LE-CP-∗-B-∗

Cable length [L]

1	1.5m
3	3m
5	5m

Cable type

Nil	Robotic type cable
S	Standard cable

(a)

Signal name	Terminal number
A	B-1
$\overline{A}$	A-1
B	B-2
$\overline{B}$	A-2
COM-A/COM	B-3
COM-B/ -	A-3
Vcc	B-4
GND	A-4
$\overline{A}$	B-5
A	A-5
$\overline{B}$	B-6
B	A-6

(b)

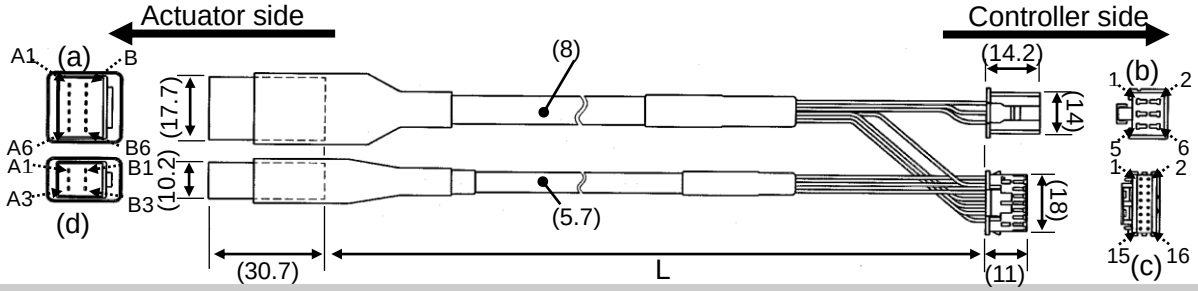
Cable color	Terminal number
Brown	2
Red	1
Orange	6
Yellow	5
Green	3
Blue	4

(c) Shield

Cable color	Terminal number
Brown	12
Black	13
Red	7
Black	6
Orange	9
Black	8
-	3

(d)

Signal name	Terminal number	Cable color	Terminal number
Lock (+)	B-1	Red	4
Lock (-)	A-1	Black	5
Sensor (+)	B-3	Brown	1
Sensor (-)	A-3	Blue	2



10.6 Actuator cable [For sensor/ with lock (8m to 20m)]

LE-CP-∗-B (a)

Cable length [L]

8	8m Note)
A	10m Note)
B	15m Note)
C	20m Note)

Note) Produced upon receipt of order

(Only "Robotic type cable" is available)

(a)

Signal name	Terminal number
A	B-1
$\overline{A}$	A-1
B	B-2
$\overline{B}$	A-2
COM-A/COM	B-3
COM-B/ -	A-3
Vcc	B-4
GND	A-4
$\overline{A}$	B-5
A	A-5
$\overline{B}$	B-6
B	A-6

(b)

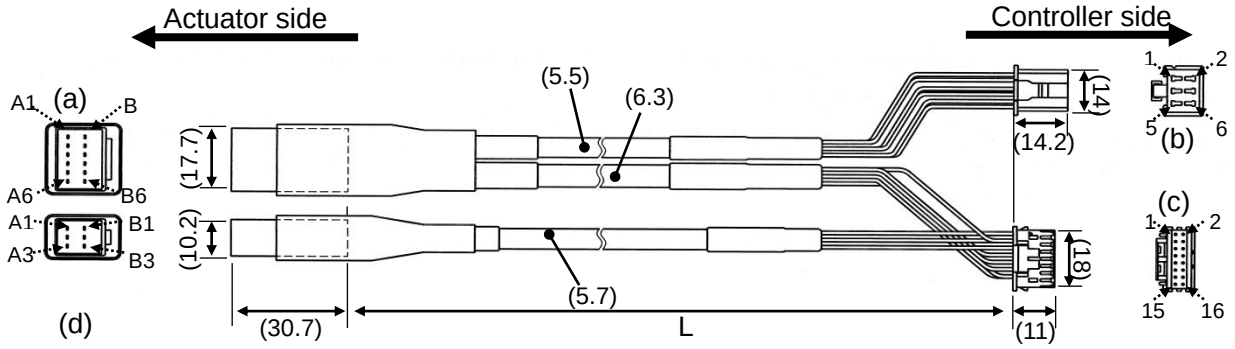
Cable colour	Terminal number
Brown	2
Red	1
Orange	6
Yellow	5
Green	3
Blue	4

(c) Shield

Cable colour	Terminal number
Brown	12
Black	13
Red	7
Black	6
Orange	9
Black	8
-	3

(d)

Signal name	Terminal number	Cable colour	Terminal number
Lock (+)	B-1	Red	4
Lock (-)	A-1	Black	5
Sensor (+)	B-3	Brown	1
Sensor (-)	A-3	Blue	2



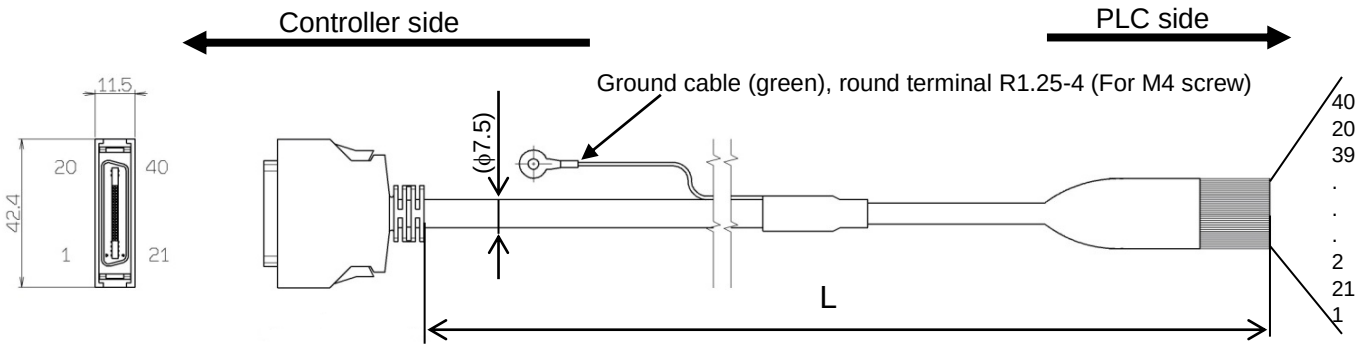
10.7 Parallell/O cable

J X C - C 2 - ∗

Cable length [L]

1	1.5m
3	3m
5	5m

Core number	40
AWG size	AWG28



The separate lines of the terminal on the PLC side are fusion together with an adhesive tape with a pitch of 1.27mm.

Pin No.	Insulator colour	Dot mark	Dot colour	Pin No.	Insulator colour	Dot mark	Dot colour
1	Orange	■	Black	11	Orange	■■■	Black
21	Orange	■	Red	31	Orange	■■■	Red
2	Grey	■	Black	12	Grey	■■■	Black
22	Grey	■	Red	32	Grey	■■■	Red
3	White	■	Black	13	White	■■■	Black
23	White	■	Red	33	White	■■■	Red
4	Yellow	■	Black	14	Yellow	■■■	Black
24	Yellow	■	Red	34	Yellow	■■■	Red
5	Pink	■	Black	5	Pink	■■■	Black
25	Pink	■	Red	35	Pink	■■■	Red
6	Orange	■■	Black	16	Orange	■■■■	Black
26	Orange	■■	Red	36	Orange	■■■■	Red
7	Grey	■■	Black	17	Grey	■■■■	Black
27	Grey	■■	Red	37	Grey	■■■■	Red
8	White	■■	Black	18	White	■■■■	Black
28	White	■■	Red	38	White	■■■■	Red
9	Yellow	■■	Black	19	Yellow	■■■■	Black
29	Yellow	■■	Red	39	Yellow	■■■■	Red
10	Pink	■■	Black	20	Pink	■■■■	Black
30	Pink	■■	Red	40	Pink	■■■■	Red

10.8 Controller Set up kit

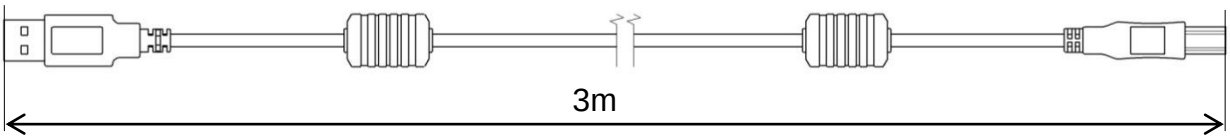
JXC-W1

Contents

(1) Controller set up software (CD-ROM)　Product No.: JXC-W1-1

(2) USBcable (A-B type)　Product number JXC-W1-2

PC　　Controller



Operating environment

Compatible OS Note1)	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)

Note1) Windows®is the registered trademark of United States Microsoft Corporation.

11. Alarm detection

The details of an alarm generated are possible to check using a PC (with controller setting software). Please refer to the controller setting software manual (No. SFOD-OMT0012) to check the details of the alarms.

When an alarm is generated, deactivate the alarm after troubleshooting and correcting the error with reference to section **11.2 Alarms and countermeasures**. Alarms are divided into two types. One alarm type is possible to be cleared by inputting the RESET signal. The other type cannot be cleared unless the main control and motor control power supplies are turned off and on again.

11.1 Parallel output Alarm group

The controller outputs a signal to distinguish the type of alarm when an alarm is generated.
Alarms are classified into 4 groups. When an alarm is generated, it is output in OUT0 to 3 outputs.
Refer to the table below for the combination of the alarm group and the output terminals.

Alarm group	Parallel signal output.				
	∗ALARM	OUT0	OUT1	OUT2	OUT3
Alarm group B	OFF	OFF	ON	OFF	OFF
Alarm group C	OFF	OFF	OFF	ON	OFF
Alarm group D	OFF	OFF	OFF	OFF	ON
Alarm group E	OFF	OFF	OFF	OFF	OFF

"∗ALARM" is displayed in negative logic.

When an alarm is generated, the SVRE or SETON are output according to the contents of the alarm, as shown below.

Alarm group	Parallel signal output.		How to start test run.
	SVRE	SETON	
Alarm group B	No change	No change	Input RESET
Alarm group C	No change	No change	Input RESET
Alarm group D	OFF	No change	Input RESET
Alarm group E	OFF	OFF	Turn off the main control and motor control power supplies→Turn on again

- Procedure to restart -

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

11.2 Alarms and countermeasures

(1) Controller alarm

Name of the controller setting software (code)	Group	How to deactivate	Alarms and countermeasures
DRIVE is ON when SVRE is OFF (0-098)	C	Input RESET	**< Details >** An alarm is generated when the Drive operation [DRIVE] is ON when the servo [SVRE] is OFF after a Return to origin. **<Countermeasure>** Command operation while the servo motor is on (SVRE output is ON).
DRIVE is ON when SETON is OFF (0-099)	C	Input RESET	**< Details >** An alarm is generated when the drive operation is ON before a return to origin. **<Countermeasure>** Start operation after completion of a Return to origin.
Failed to achieve set position in set time limit. (0-149)	D	Input RESET SVON	**< Details >** The time to reach the target position is greater than the specified time. **<Countermeasure>** Check if the travel of the actuator was interrupted. Also, make sure that the load, speed, acceleration and deceleration are within the range of the actuator.
Parameter is not registered (0-901)	E	Turn off the main control and motor control power supplies.	**< Details >** An alarm is generated when the step data is executed without parameter settings. **<Countermeasure>** Download an appropriate parameter to the controller.
Step data is not regestered (0-902)	E	Turn off the main control and motor control power supplies.	**< Details >** An alarm is generated when the step data is executed without step data setting. **<Countermeasure>** Download the step data to the controller.
System Error (0-910)	E	Turn off the main control and motor control power supplies.	**< Details >** System error occurred. There is a possibility of damage to the controller or a malfunction due to noise. **<Countermeasure>** If the alarm is still generated when the power is reapplied, please contact SMC.
SDRAM Error (0-911)	E	Turn off the main control and motor control power supplies.	**< Details >** Abnormality concerning SDRAM is confirmed. **<Countermeasure>** Please contact SMC.

Name of the controller setting software (code)	Group	How to deactivate	Alarms and countermeasures
FROM Error (0-912)	E	Turn off the main control and motor control power supplies.	**< Details >** Abnormality concerning FROM is confirmed. **<Countermeasure>** Please contact SMC.
Modbus Error (0-913)	E	Turn off the main control and motor control power supplies.	**< Details >** An alarm is generated when an abnormality is found in the Modbus communication to the controller. There is a possibility that the motor control power supply (CI 1 2 and CI 3 4) is OFF or a malfunction occurred due to noise. **<Countermeasure>** If the alarm is still generated when the power is reapplied, please contact SMC.
Module Error (0-914)	E	Turn off the main control and motor control power supplies.	**< 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. **<Countermeasure>** If the alarm is still generated when the power is reapplied, please contact SMC.

(2) Driver alarm

Name of the controller setting software (code)	Group	How to deactivate	Alarms and countermeasures
Step data value is wrong (1-048)	B	Input RESET	**< Details >** The step data or parameter is incorrect for the following parameter assignable range. [Settable range] (1) Pushing force ≥ Trigger level (2) Pushing force > 0 (3) Speed ≥ Pushing speed ≥ Minimum speed of the actuator (4) Pushing speed≤Maximum pushing speed of the actuator (5) Pushing force≥Minimum pushing force of actuator (6) The Basic parameter "Max pushing force"≥minimum pushing force of the actuator (7) The Basic parameter "Max pushing force" ≥ "Trigger level". **<Countermeasure>** Modify the step data and basic parameter settings **⚠Caution** Please refer to the actuator manual or the catalogue for the max/min pushing force/speed for the actuator.
Parameter value is wrong (1-049)	B	Input RESET	**< 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 **<Countermeasure>** Modify the basic parameter settings. **⚠Caution** Please refer to the actuator manual or the catalogue for the max pushing force for the actuator.
Set stroke is outside stroke limit. (1-052)	B	Input RESET	**< Details >** An alarm is generated when an operation exceeds the basic parameter "Stroke (+)", "Stroke (-)". (Including JOG operation after a Return to origin) **<Countermeasure>** Make sure that the basic parameters "Stroke (+)" and "Stroke (-)" are consistent with the distance of the actuator movement specified in the step data. **⚠Caution** 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.

Name of the controller setting software (code)	Group	How to deactivate	Alarms and countermeasures
Return to ORIG did not complete in the set time. (1-097)	C	Input RESET	**< Details >** Return to origin was not completed within the set time. **<Countermeasure>** - If the ORIG mode is "0: Pushing Return to origin", 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 (1-098)	C	Input RESET	**< Details >** An alarm is generated when a Return to origin instruction is made when the servo is OFF. **<Countermeasure>** Start the operation when the servo motor is ON (SVRE output is ON).

<table>
<tr><th>Name of the controller setting software (code)</th><th>Group</th><th>How to deactivate</th><th>Alarms and countermeasures</th></tr>
<tr><td>ORIG switch direction (1-103)</td><td>C</td><td>Input RESET</td><td>
< 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.
<table>
<tr><th colspan="2">Return to origin parameter Value</th><th rowspan="2">Alarm conditions</th></tr>
<tr><th>ORIG mode</th><th>ORIG sensor</th></tr>
<tr><td rowspan="3">0: Return to origin by pushing force</td><td>0. No sensor</td><td>(No alarm will be generated).</td></tr>
<tr><td>1: Sensor A contact</td><td>The end position is detected when the sensor has been off since the Return to origin operation started.</td></tr>
<tr><td>2: Sensor B contact</td><td>The end position is detected when the sensor has been on since the Return to origin operation started.</td></tr>
<tr><td rowspan="3">2,3: Sensor Return to origin</td><td>0: No sensor</td><td>Immediately after inputting a command to Return to origin</td></tr>
<tr><td>1: Sensor A contact</td><td>The end position is detected when the sensor has been off since the Return to origin operation started, or the end position is detected after the sensor ON is detected and before the Return to origin operation is completed.</td></tr>
<tr><td>2: Sensor B contact</td><td>The end position is detected when the sensor has been on since the Return to origin operation started, or the end position is detected after the sensor OFF is detected and before the Return to origin operation is completed.</td></tr>
</table>
<Countermeasure>
-If the ORIG mode is "0: Return to origin by pushing force"
Set the return to origin sensor at 0.
- If the ORIG mode is "2 or 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.
</td></tr>
<tr><td>(Position error Alarm) Position error counter overflow (1-108)</td><td>C</td><td>Input RESET</td><td>
< Details >
Position deviation counter in the driver has overflowed during the operation by pulse signals.
<Countermeasure>
Make sure there are no obstructions that interfere with the actuator movement. Also, make sure that the load, speed, acceleration and deceleration are within the range of the actuators.
</td></tr>
</table>

Name of the controller setting software (code)	Group	How to deactivate	Alarms and countermeasures
Speed exceeded set value (1-144)	D	Input RESET SVON	**< Details >** The motor speed has exceeded the specified value, possibly due to an external force, etc. **<Countermeasure>** Make improvements to ensure that the motor speed will not exceed the maximum speed of the actuator. **⚠Caution** Please refer to the actuator manual or the catalogue for the maximum speed of the actuator.
Actuator power supply voltage is outside set range. (1-145)	D	Input RESET SVON	**< 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. **<Countermeasure>** Check the voltage supplied to the controller motor power supply (M24V). **⚠Caution** If the power supply is a type with “inrushcurrent protection”, a voltage drop may cause an alarm during acceleration/ deceleration. **< Details >** The alarm may be caused by regenerative power depending on the method of operation of the actuator. **<Countermeasure>** Check if the operating condition of the actuator is within the specification range. **⚠Caution** Please refer to the actuator manual or the catalogue for the method of operation of the actuator.
Controller temperature exceeded set range. (1-146)	D	Input RESET SVON	**< Details >** The temperature around the power element of the controller is too high. **<Countermeasure>** Make improvements so that the temperature around the controller is kept appropriate.

Name of the controller setting software (code)	Group	How to deactivate	Alarms and countermeasures
Controller supply voltage is outside set range. (1-147)	D	Input RESET SVON	**< Details >** The power supply voltage for motor control detected by the controller is outside of the specified range. **<Countermeasure>** Check the motor control power supply voltage connected to the controller. **⚠ Caution** If a single power supply is used for both the control power and the motor power, or the power supply is an “inrush current protection type”, a voltage drop may occur during acceleration/deceleration, which will generate an alarm. **< Details >** The alarm may be caused by regenerative power depending on the method of operation of the actuator. **<Countermeasure>** Check if the operating condition of the actuator is within the specification range. **⚠ Caution** Please refer to the actuator manual or the catalogue for the method of operation of the actuator.
Current limit is exceeded (1-148)	D	Input RESET SVON	**< Details >** The output current accumulated value has exceeded the specified value. **<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.

Name of the controller setting software (code)	Group	How to deactivate	Alarms and countermeasures
Encoder error (1-192)	E	Turn off the main control and motor control power supplies.	**< Details >** An abnormality occurred in communication with the encoder. **<Countermeasure>** Check the actuator cable connection.
Unable to find motor phase in set time. (1-193)	E	Turn off the main control and motor control power supplies.	**< Details >** Positioning of the polarity is not completed properly. (When the servo motor is turned on (SVON 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). **<Countermeasure>** Make sure there are no obstructions that interfere with the actuator movement and then turn on the servo motor (SVON is ON).
Output current limit exceeded set value (1-194)	E	Turn off the main control and motor control power supplies.	**< Details >** The Output current in the power supply circuit is abnormally high. **<Countermeasure>** Check if the actuator cable or connector is short-circuited. In addition, make sure that the actuator is compatible with the controller.
Current sensor abnormality has occurred. (1-195)	E	Turn off the main control and motor control power supplies.	**< Details >** An abnormality with the current sensors is detected, which is recognized when the controller is initialized. **<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.
Position error overflowed (1-196)	E	Turn off the main control and motor control power supplies.	**< Details >** The position deviation counter in the controller has overflowed. **<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.
Memory abnormality has occurred (1-197)	E	Turn off the main control and motor control power supplies.	**< Details >** Abnormality concerning EEPROM is confirmed. **<Countermeasure>** Please contact SMC. (The write limit of the EEPROM is approximately100,000 times)
CPU error (1-198)	E	Turn off the main control and motor control power supplies.	**< 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). **<Countermeasure>** If the alarm is still generated when the power is reapplied, please contact SMC.

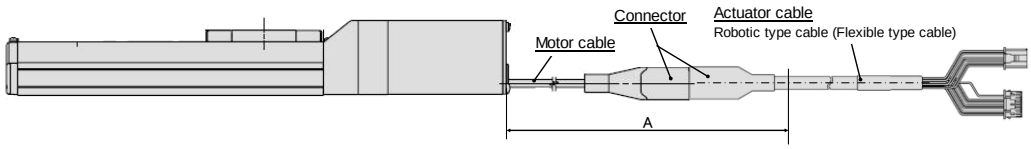
12. Common Precautions for wiring and cable

⚠Warning

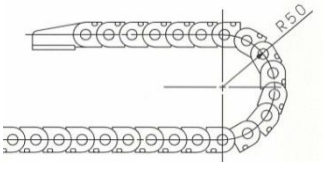
1. **Adjustment, mounting, inspection or wiring should never be carried out before disconnecting the power supply to the product. Electric shock, malfunction and damage can result.**
2. **Do not disassemble the cable. Use only specified cables.**
3. **Do not connect or disconnect the cable or connector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

13. Electric Actuators / Common Precautions

13.1 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.**

13.2 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 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.

13.3. 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.

13.4 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 ºC to 60 ºC and 35 to 85%. No condensation or freezing.)**
3. **Do not apply vibration or impact to the product during storage.**

13.5 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. Aninduced 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.

13.6 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 use the actuator except for horizontal mounting, must use the product with a lock.**
   It becomes the cause of damaging the inside part of controller. If the product is not equipped with a lock, the product 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).

14. Controller and Peripheral Devices / Specific Product Precautions

14.1 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.

14.2 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.

14.3 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.

14.4 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.

14.5 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.

14.6 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.

14.7 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.

15. Troubleshooting

Refer to the table below for troubleshooting. When none of the causes in the troubleshooting are possible to be confirmed, it is presumed that the product is faulty and normal operation could 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.

15.1 Operation Errors

Problems	Possible causes	Investigation method	Countermeasures
Does not operate at all.	Power fault	Check that the green LED (PWR) on the controller is ON?	Check the power, voltage and current supplied to the controller. -> 4. Product Specifications -> 5.1Connector specifications
	Stop command	Check that 24 VDC is supplied to the EMG terminal. If it is not energized, the servo will be OFF	Supply 24 VDC to the EMG terminal.
	External equipment failure	Check that the PLC connected to the controller is operating correctly. Check the operation of a single unit of the controller with a test run.	Refer to this Operation Manual and take appropriate measures. -> 6.3 Parallel I/O signals
	Incorrect wiring	Check that the wiring is 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. Prepare a separate power supply for the main control, motor drive and motor control, and input/ output signals. -> 2.3 Product configuration -> 5. Power supply connector -> 6.4 Parallel I/O Wiring Example
	Alarm generated	Check if the controller has generated an alarm? Check the type of alarm, referring to this Operation Manual.	Refer to thismanual and take appropriate measures. -> 11. Alarm detection
	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.
	Unsuitable specification	Check that the controller parameter settings for the product model and power supply specification are appropriate for the actuator connected.	Check that the actuator product number matches the controller parameters. Check that the power supply specification is correct, -> 4. Product Specifications

Problems	Possible causes	Investigation method	Countermeasures
Operation stops intermittently	Alarm generated	Check if the controller has generated an alarm? Check the type of alarm, referring to this manual.	Refer to thismanual and take appropriate measures. -> 11. Alarm detection
	Incorrect wiring	Check that the wiring is connected correctly? Refer to this 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. Prepare a separate power supply for the main control, motor drive and motor control, and input/ output signals. -> 2.3 Product configuration -> 5. Power supply connector -> 6.4 Parallel I/O Wiring Example
	Electrical noise	Connect to Ground correctly. Avoid bundling the cables.	Refer to this manual and take appropriate measures. -> 4.4 Mounting
	Incorrect parameters	Check that the parameter values are correct. Check that the appropriate parameters are used for the actuators connected.	Modify the values of the parameters and test the operation. -> 7. Settings Data Entry
	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 in the motor 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 an “inrush-current protection” type. -> 4. Product Specifications
	Failure of pushing operation.	Check that the INP output turns on during a pushing operation. (If completion of the pushing operation is detected by the INP output, the PLC cannot confirm the completion).	Check the INP output signal before the energy saving mode is turned on. -> 6.3 Parallel I/O signals
	Unsuitable specification	Check that the controller parameter settings for the product model and power supply specification are appropriate for the actuator connected.	Check that the controller parameters matches with the actuator product number. Check that the power supply specification is correct, -> 4. Product Specifications
	Signal timing	Check the timing of the signal from the PLC to the controller.	Leave an interval of 15ms or more (recommendation is 30 ms) between input signals and maintain the state of the signal for 15ms or more (recommendation is 30 ms), because PLC processing delays and controller scanning delays can occur. -> 8.7 Controller input signal response time
	SVON time	Check that the Operation was sent after SVON input is ON and SVRE output is ON.	When the power is supplied, it may take up to 20 seconds from servo ON to SVRE ON depending on the actuator position or conditions. Send an operation only when the SVRE output is ON.

Problem	Possible causes	Investigation method	Countermeasures
Communication fault (JXC-W1)	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 given in the controller setting software Installation Manual.
	Connection failure	Please confirm the connection status.	Confirm the correct connection of controller (JXC), USB cable and PC. For example, communication cannot be established if the connector has been damaged. Check that the power supply to the controller (JXC) has been turned on. Communication cannot be established if the power supply is off. If any external equipment (PLC and measurement hardware), other than the controller (JXC), are connected to the PC, disconnect them. (There is a possibility that the other equipment in the PC may interfere with the communication.)

15.2 Position / Speed problems

Problems	Possible causes	Investigation method	Countermeasures
The actuator does not move to the correct position.	Incorrect origin position	For a pushing operation, repeat the Return to origin operation several times to check that the actuator returns to the origin correctly.	Check the actuator operation (if foreign matter is caught in the product etc.).
	Incorrect parameters	Check that the controller parameters are appropriate and the program is correct. Review the maximum speed, the maximum acceleration and maximum deceleration of the actuator.	Modify the parameters and test the operation. -> 7. Settings Data Entry
	Unsuitable specification	Check that the controller parameter settings for the product model and power supply specification are appropriate for the actuator connected.	Check that the controller parameters for the product number matches with the actuators. Check that the power specification is correct. -> 4. Product Specifications
The actuator does not move correctly.	Incorrect wiring	Check that the wiring is connected correctly? Refer to this 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. Prepare a separate power supply for the main control, motor drive and motor control, and input/ output signals. -> 2.3 Product configuration -> 5. Power supply connector -> 6.4 Parallel I/O Wiring Example
	Unsuitable specification	Check thatthe controller parameter settings for the product modelandpower supply specification are appropriatefor the actuator connected.	Check that the controller parameters for the product number matches with the actuators. Check that the power specification is correct, -> 4. Product Specifications
	Signal timing	Check the timing of the signal from the PLC to the controller.	Leave an interval of 15ms or more (recommendation is 30 ms) between input signals and maintain the state of the signal for 15ms or more (recommendation is 30 ms), because PLC processing delays and controller scanning delays can occur. -> 8.7 Controller input signal response time
	Data not stored correctly	Check that the data (step data, parameters) is stored correctly. Do not turn off the controller power supply or remove the USB cable while data is being stored.	Input the correct data (step data, parameters) again and confirm operation. -> 4.2 Parts Description -> 7. Settings Data Entry

Problems	Possible causes	Investigation method	Countermeasures
Required speed is not achieved	Incorrect parameters	Check that the parameter values are correct. Review the maximum speed and the maximum acceleration and deceleration of the actuator.	Correct the parameter values and test the operation. -> 7. Settings Data Entry
	Operation pattern is not suitable.	Check if a triangular 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 movement distance longer or the acceleration higher. -> 7. Settings Data Entry
	Unsuitable specification	Check that the controller parameter settings for the product model and power supply specification are appropriate for the actuator connected.	Check that the controller parameters for the product number of the actuator matches the actuator connected. Check that the power supply specification is correct. -> 4. Product Specifications
	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 motor 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 an “inrush-current protection” type. -> 4. Product Specifications

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	1000	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

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