No.JXC※-OMU0008-D

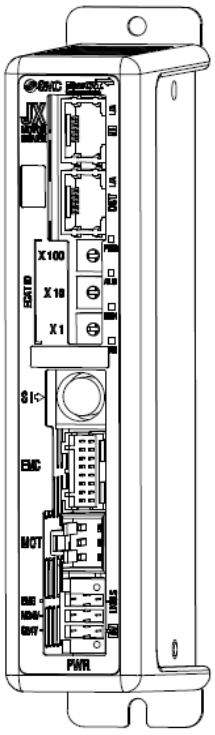
Operation Manual

PRODUCT NAME

EtherCAT Direct input type Step Motor Controller (Servo 24VDC)

Model / Series / Product Number

JXCE1



SMC Corporation

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JXCE1/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)
IEC 10218: Manipulating industrial robots －－ Safety

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, could 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.
Please perform periodic inspection to confirm proper operation.



JXCE1/Controller
1. Safety Instructions

⚠ Caution

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 within 1.5 years after the product is delivered. *3)
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.

*3) 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. Outlines of Product

2.1 Features

Features of the controller.

●EtherCAT compatible
This device can be directly connected to a EtherCAT fieldbus network. It will then be possible to establish communication with a EtherCAT Master (PLC).

●Actuator control
Positioning operation and operation at a specific speed and force for the actuator are possible by controlling the Step motor (servo 24VDC).

●Specified force operation
Control the pushing force or the pressing force of the actuator.

●Separated power supply
Power supply input is separated into the motor power supply and control power supply. Even if the power supply for the motor is turned OFF, the information from the encoder position is retained whilst the control power supply is ON, and EtherCAT communication and serial communication is available.

●Return to origin
Returning to origin is possible by a signal from EtherCAT.

●Alarm detection function
Abnormal conditions are automatically detected. Alarms are output via EtherCAT communication.
The alarm history can be stored in the controller memory.

●Positioning / pushing operation is available with step data and numerical operation mode
It is possible to operate the actuator by using the saved step data and by numeric data operation instruction by using EtherCAT communication.
In the step data operation mode, the operation is instructed by manipulating the memory which is relevant to input/output port such as DRIVE signal and INP signal. The actuator operates in accordance with the step data operating pattern of the specified step data.
In the numerical operation mode, the operation is executed by specifying the releveant numeric data.

●”AREA” signal
The controller has an “AREA” signal that turns ON if the actuator position is within the range specified by "Area 1" and "Area 2" in the step data.

●Data input method
It is possible to perform status monitoring, reset alarms and set Step data via EtherCAT communication, ACT controller software or teaching box. In addition the ACT controller software or teaching box can be used for parameter setup and trial run.

●Easy mode and Normal mode
There are two available modes for the controller setting software and the teaching box. In Easy mode, you can start the operation by only setting the speed, position, etc. In Normal mode, further detailed setup can be performed.

⚠Caution

When the device is set up or failure occurs, please refer the operation manual of the actuator and the teaching box as well as this operation manual.
Keep this operation manual accessible for reference when necessary.

2.2 How to Order

How to order is shown below.

JX C E 1 □ - □

Electric equipment

Controller

Controller type

E	EtherCAT

Number of shaft/
Type of power supply

1	1 axis, Power supply (24VDC)

Mounting

7	Direct mounting
8	DIN rail

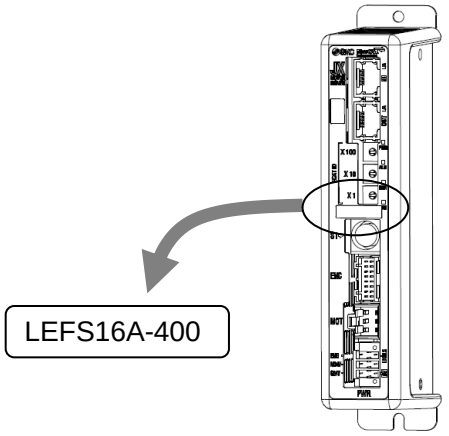
Actuator Model

(Enter from the actuator model to "stroke")
E.g.) LEFS16B-100B-S1CE17,
input “LEFS16B-100”.

⚠ Caution

Single controllers are also shipped after setting the actuator specification parameters.
Confirm the combination of the controller and the actuator is correct.

<Check the following before use.>
- Check the actuator label for the actuator model number. Check that the actuator model matches the label on the controller.

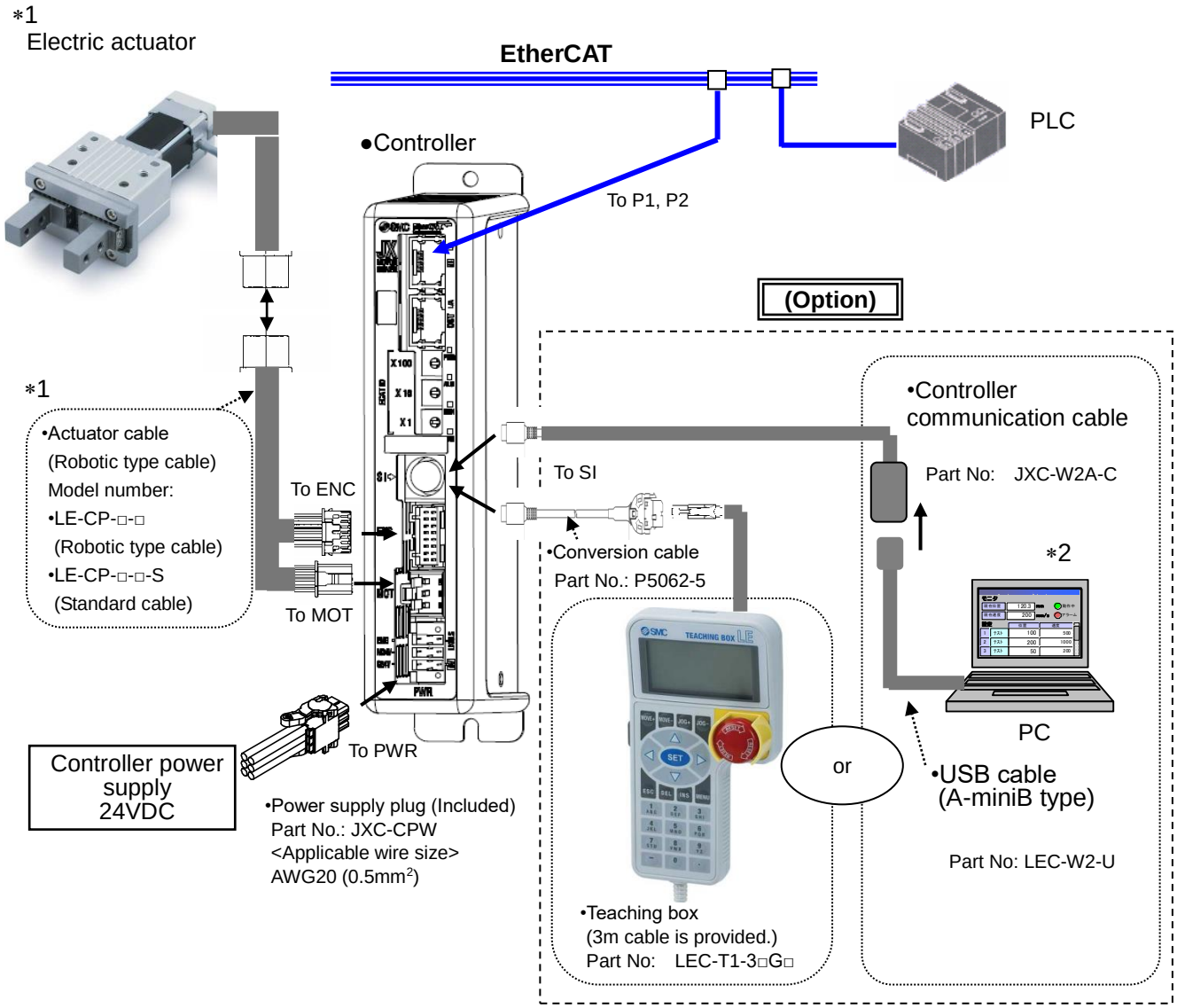


⚠ Caution

Refer to the chart of LECPMJ for checking the chart of <Speed - Work load> of actuator.
A high peak current is required to be supplied by the controller when the actuator motor is turned ON.
Please use a power supply with a current capacity of at least 1.5 times the peak power that is required by the actuator motor

2.3 Product configuration

An example of the controller structure is shown below.



∗1. These items are included when ordered using the part number for an actuator set.

∗2. Latest version of the controller setting software must be used.

Software can be downloaded from SMC website. http://www.smcworld.com/

⚠ Warning

Refer to **5. External Connections (P.19)** for wiring.
Refer to **16. Precautions for wiring and cable (P.64)** when handling the wiring and cables.

The Communication cable must be connected to a PC using a USB cable through a conversion unit.
Do not connect the teaching box to a PC, as this may cause damage to the personal computer.

2.4 Start up procedure

Install, wire, set and operate the controller referring to the procedure below when the product is used for the first time.

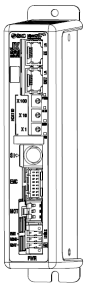
(1) Checking the contents of the package

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

Product name	Quantity
Controller (JXCE1□-□)	1 pc.
Power supply plug (JXC-CPW)	1 pc.
Actuator *1	1 pc.

*1. These items are included when ordered using the part number for an actuator set.

Controller



Power supply plug (JXC-CPW)



Option

Controller communication cable



USB cable



Teaching box (Conversion cable is needed)



[Options]

- Controller communication cable(Part No: JXC-W2A-C)
- USB cable (Part No: LEC-W2-U)
- Teaching box (Part No: LEC-T1-3∗G∗)

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

(2) Mounting the controller

Refer to section **3.4 Mounting (P.16)** for instructions on how to mount the controller.

(3) Controller Setting

It is necessary to set the address by the rotary switch of the controller.
Refer to **4.1 Setting of switch (IP address) (P.18)**

(4) PLC set up

Set the PLC parameter as a master station.

(5) Wiring and Connection

Connect the cables to the controller.
Refer to **5. External Connections (P.19)** for the wiring of the connectors.

(6) Supply of power

Supply power 24VDC.

If the condition is normal, LED on the front of the controller turns ON as shown on the table below

Items	LED condition	Status
PWR	Green LED is ON	Supply power
ALM	OFF	No alarm

Refer to **7. LED display (P.26)** for the explanation of LED lamps.

If the red [ALM] LED on the front of the controller (JXC) is ON, an alarm has been triggered.

⚠ Caution

When an alarm is generated

Refer to a corresponding memory of EtherCAT or connect a PC or teaching box to the SI serial I/O connector and check the details of the alarm. Then, remove the cause of the error referring to the **15. Alarm for Motor Control (P.58).**

∗ Please refer to the manuals of the controller setting software or the teaching box for details of the alarms.

(7) Configuration

Using the PLC setting software, the following steps are required to use the JXCE1 on a EtherCAT network.

- Install the ESI file.

When the setting of the PLC and JXCE1 controller is completed and the EtherCAT communication is established, the LED's on the front of the controller will be set as shown in the table below.

Items	LED condition	Status
PWR	Green LED is ON	Supply power
ALM	OFF	No alarm
RUN	Green LED is ON	EtherCAT connection is established.
ERR	OFF	No error in EtherCAT

Refer to **7 LED display (P.26)** for the explanation of the LED's.

Communication between PLC and controller is not established when the BF red LED is on or is flashing red.

⚠ Caution

Communication between PLC and controller is not established.

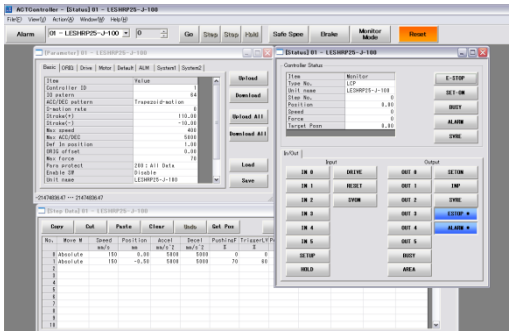
Refer to **19. Troubleshooting (P.74)**

Check if the communication speed of the PLC and controller and the information of the host computer are correctly set.

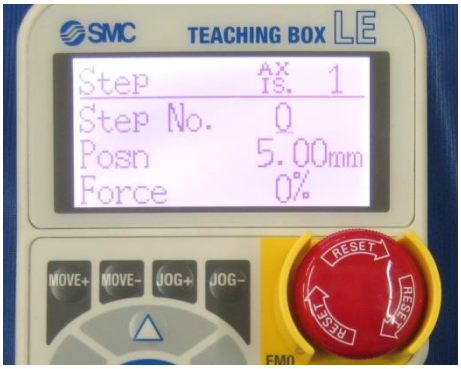
(8) Setup of the operation parameters

Set up the operation pattern (step data, basic parameters and return to origin parameters) to specify the target position, speed, etc. by using a PC (with the controller setting software) or the teaching box.

■PC (Normal mode)



■Teaching box



Please refer to the manuals of the controller setting software or the teaching box for how to set up the operation pattern.

(9) Test run

Refer to **9. Memory map (P.28)** for the assignment of the memory.

Input signals from PLC for checking the operation. Refer to **13. Operation Instructions (P.48)** for the operation.

3. Specifications

3.1 Specifications

Basic specifications of the product.

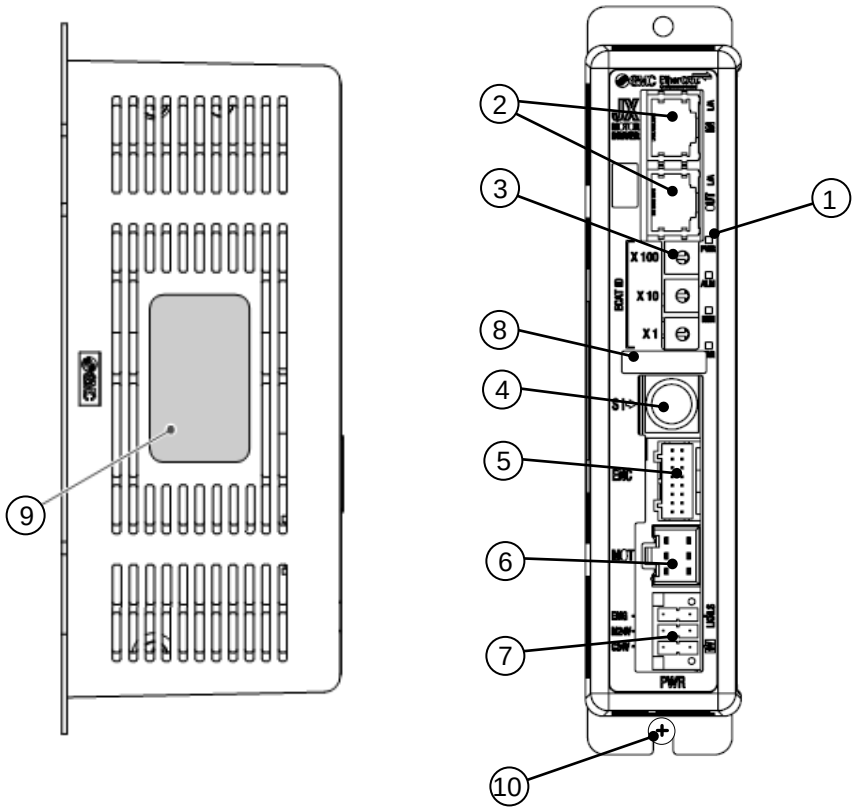
Item	Specifications	
Compatible motor	Step motor (servo 24 VDC)	
Power supply	Power supply voltage: 24 VDC±10%	
Current consumption	200 mA or less (Controller) Refer to the specification of actuator to be connected for total power consumption.	
Compatible encoder	Incremental A/B phase (800 pulse/rotation)	
Memory	EEPROM	
LED display	LED	Details
	L/A1	Link/Activity1
	L/A2	Link/Activity2
	PWR	Power supply
	ALM	Alarm status
	RUN	EtherCAT communication status.
	ERR	EtherCAT communication error status.
Locked	With unlocking terminal	
Cable length	Actuator cable: 20 m or less	
Cooling method	Air-cooling type	
Operating temperature range	0°C to 40°C (version S1.*/S2.*/V1.*/V2.*) 0°C to 55°C (Version S3.*/V3.* or later) No freezing	
Operating humidity range	90% RH or less (No condensation)	
Insulation resistance	Between the external terminals and case 50 MΩ (500 VDC)	
Weight	220 g (Direct mounting type) 240 g (DIN rail mounting type)	

[EtherCAT communication]

Items	Specification
Protocol	EtherCAT (Conformance Test Record V1.2.6)
Communication speed	100 Mbps
Communication method	Full duplex/ Half duplex (automatic negotiation)
Communication cable	Standard Ethernet cable (STP, CAT5 or higher, 100BASE-TX)
Setup file	ESI file (download from SMC web site).
Occupied area	Input 20 byte / Output 36 byte
Connectable nodes	Max. 65,535 nodes
Vendor ID	0114h (276)
Network topology	Refer to the EtherCAT topology

3.2 Parts Description

Details of the parts of the controller.

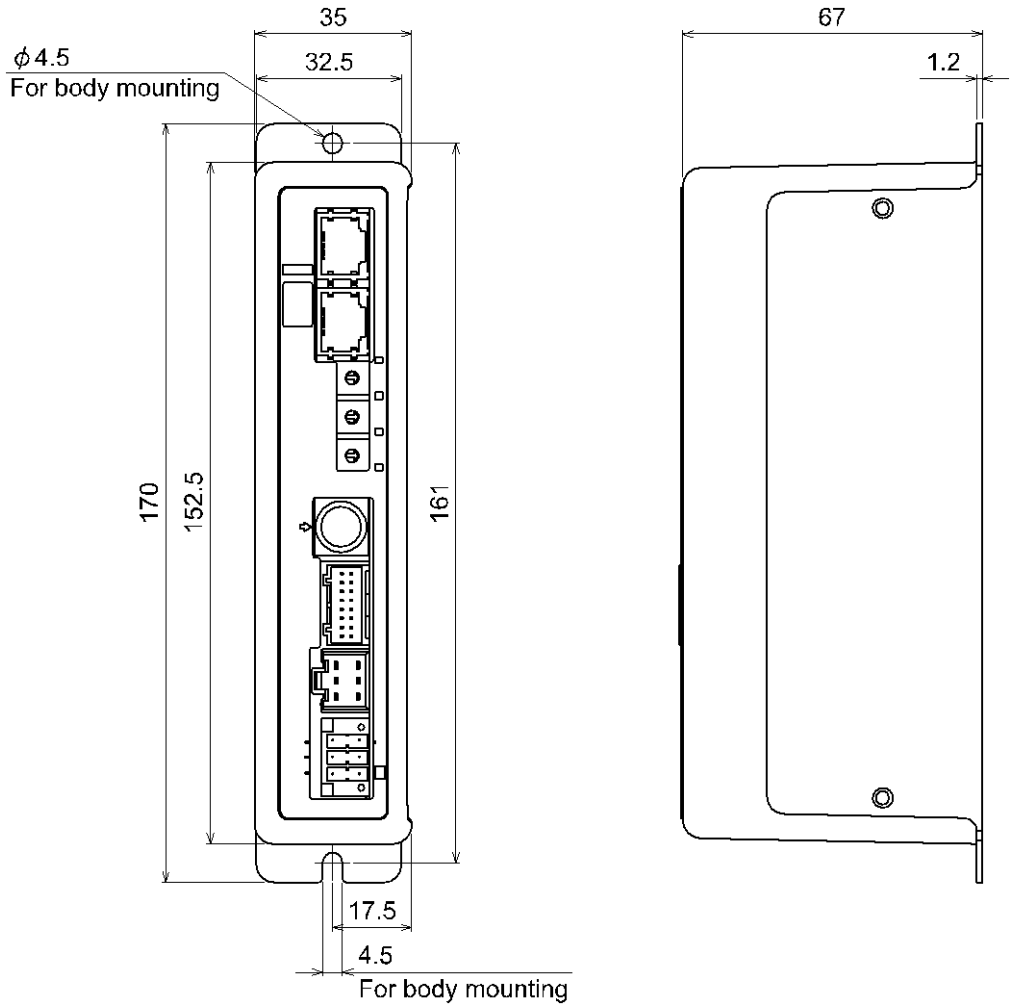


No.	Display	Name	Details
1	-	Display	LED's to indicate the controller status.
2	IN, OUT	EtherCAT communication connectors	Connect to the EtherCAT network.
3	ECAT ID	EtherCAT ID	Switches to set the slave EtherCAT communication ID (0 to 255) by X1, X10 and X100.
4	SI	Serial I/O connector (8 poles)	Connector for the teaching box (LEC-T1) or the controller communication cable (JXC-W2A-C).
5	ENC	Encoder connector (16 poles)	Connect to the actuator cable.
6	MOT	Motor driving connector (6 poles)	
7	PWR	Power supply connector (5 poles)	Connect to the controller power supply (24VDC) using the power supply plug. Control power (+), Stop signal (+), Motor power (+), Lock release (+), Common power (-)
8	-	Applicable actuator part number label	Label indicating the actuator part number which can be connected to the controller.
9	-	Controller part number label	Label indicating the controller part number.
10	-	FE	Functional Ground When the controller is mounted, tighten screws and connect the grounding cable.

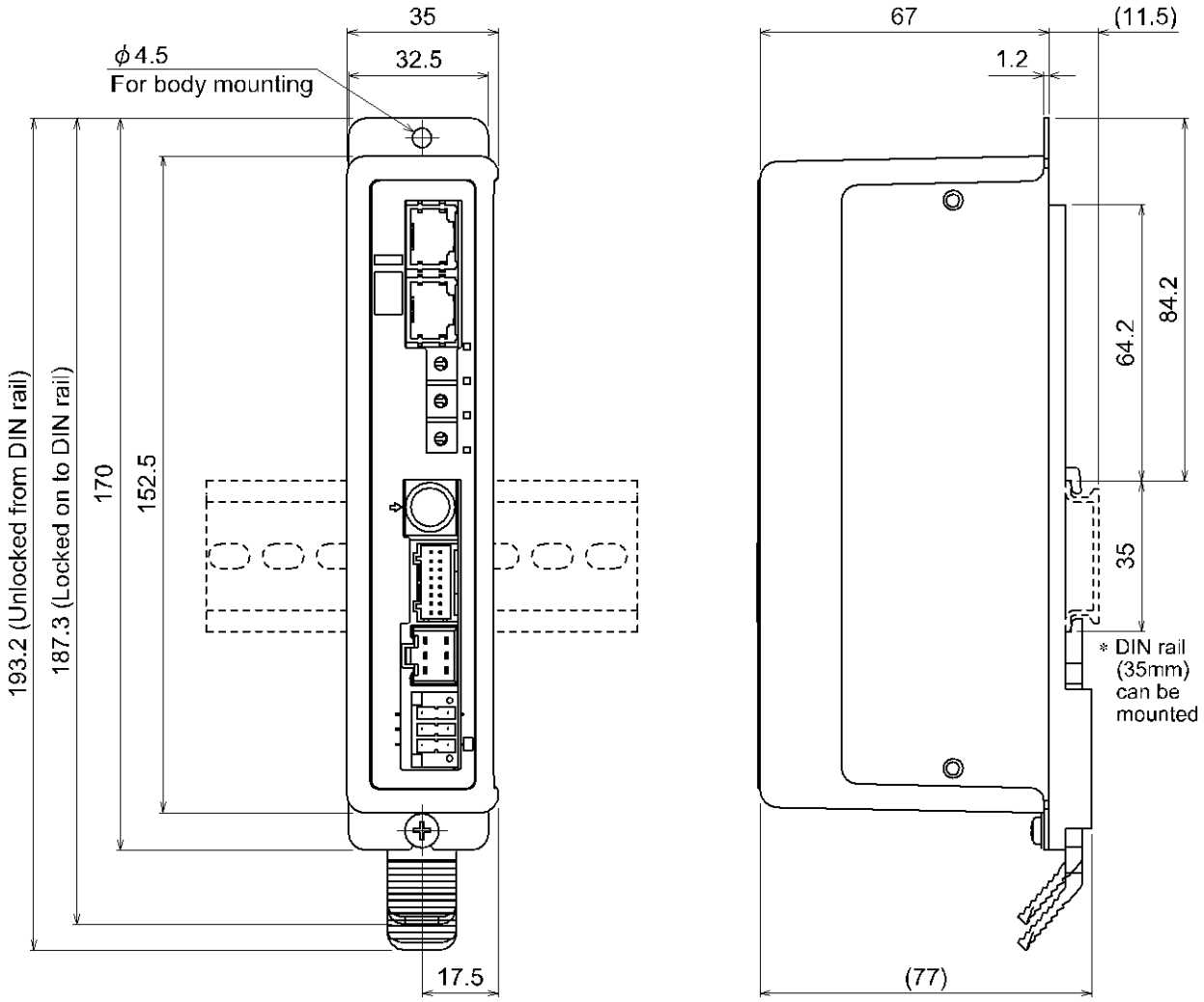
3.3 External Dimensions

The appearance of this product is as shown in the diagram below:

(1) Screw mounting (JXCE17-□)



(2) DIN rail mounting (JXCE18-□)



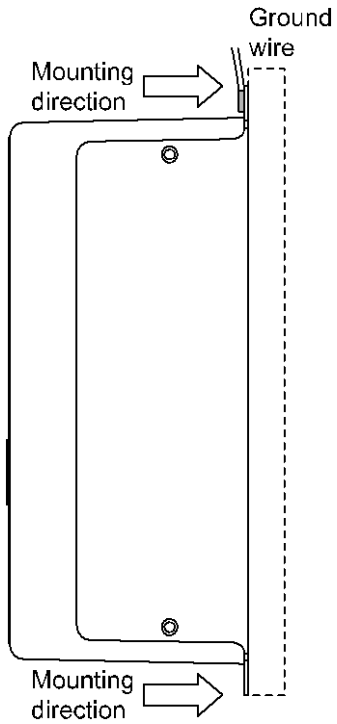
3.4 Mounting

(1) Mounting

The controller can be direct mounted using screws or mounted on a DIN rail.
Details of the controller mounting options are shown below.

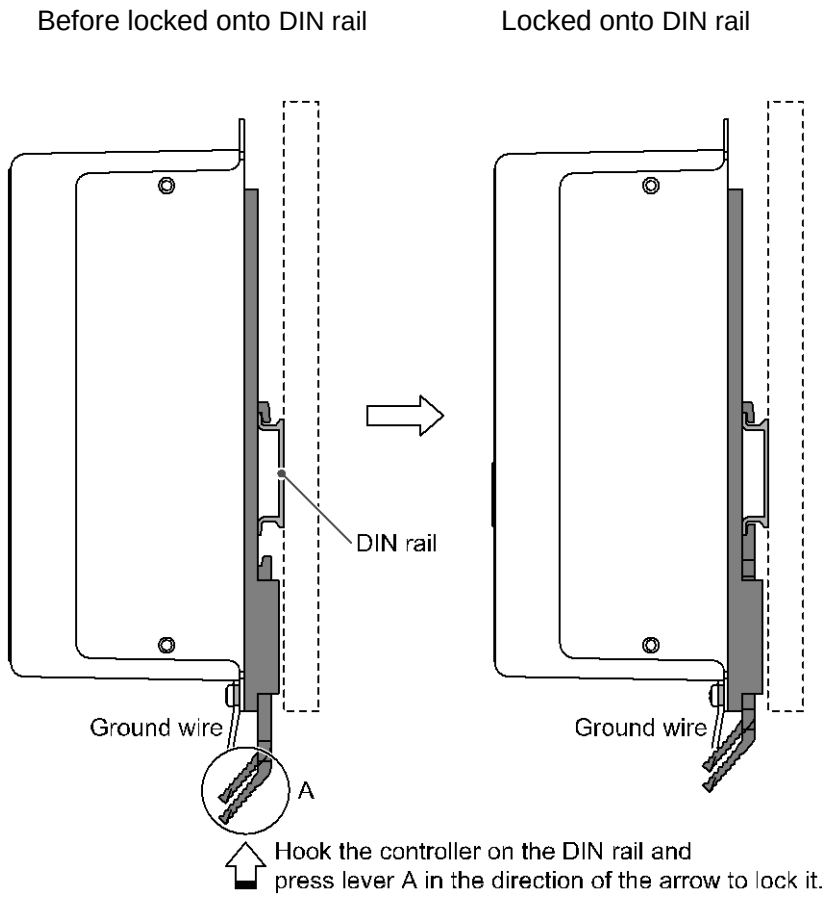
[1]Thread mounting (JXCE17-□)

(Mounting with two M4 screws)



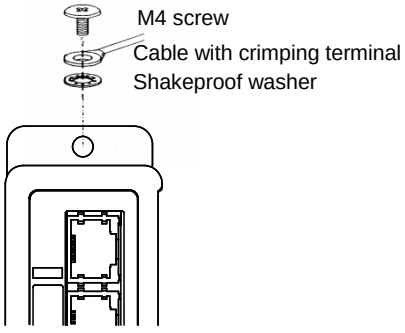
[2]DIN rail mounting (JXCE18-□)

(Mounting with DIN rail)



(2) Grounding

Place the grounding cable with crimped terminal between the M4 screw and shakeproof washer as shown below and tighten the screw.



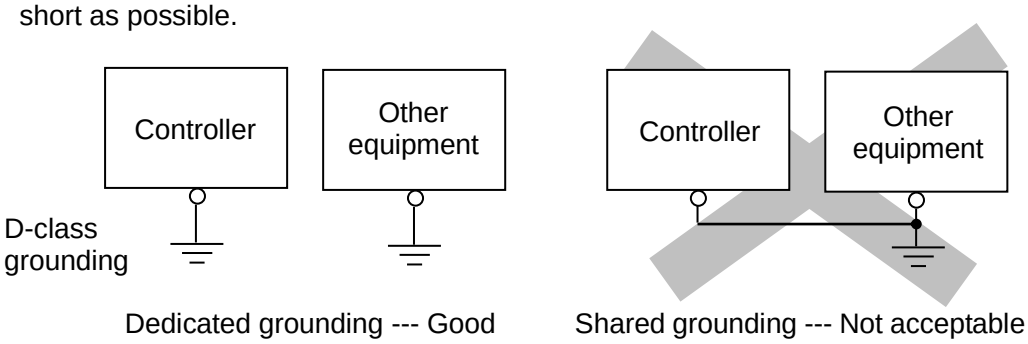
Controller

⚠Caution

The M4 screw, cable with crimped terminal and shakeproof washer must be prepared by the user.
The controller must be connected to Ground to reduce noise.

⚠ Caution

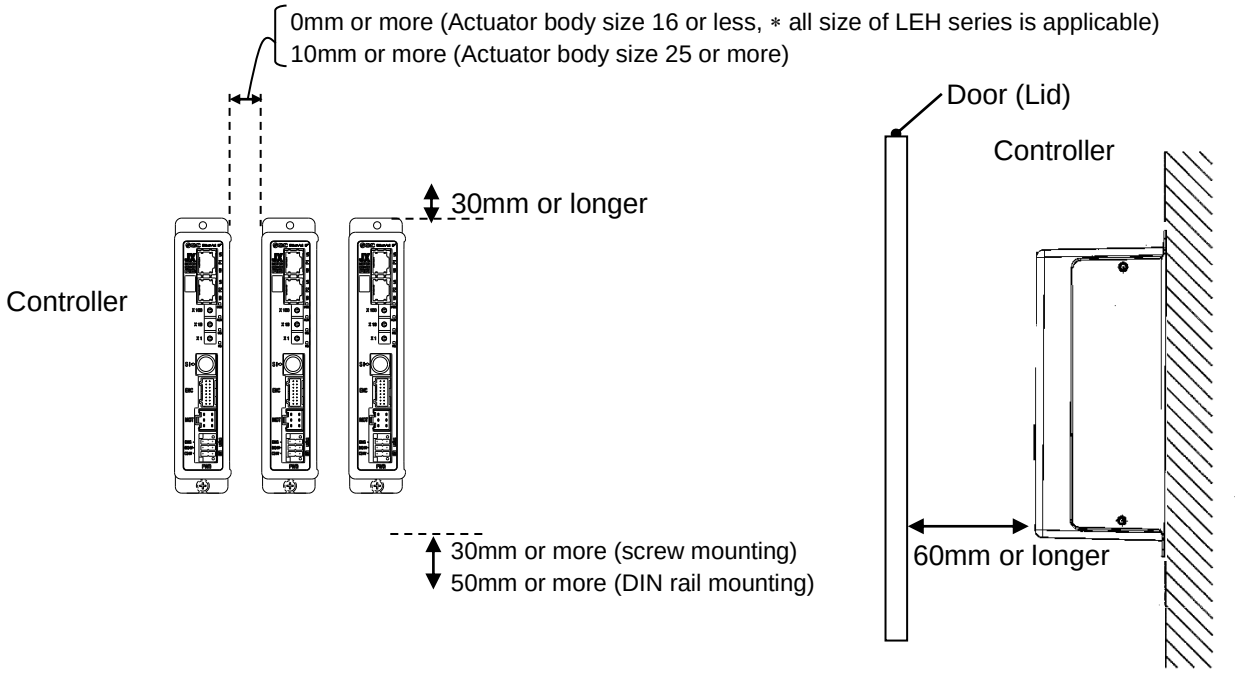
(1) A dedicated Ground connection must be used. Grounding should be to a D-class ground (ground resistance of 100Ω or less).
(2) The cross sectional area of the grounding cable shall be 2mm^2 minimum.
The Grounding point should be as near as possible to the controller. Keep the grounding cable as short as possible.



Dedicated grounding --- Good Shared grounding --- Not acceptable

(3) Mounting location

Design the size of the control panel and the installation type so that the temperature surrounding the controller is within the operating temperature range.
Mount the controller vertically on the wall with 30mm or 50 more of space on the top and bottom of the controller as shown below.
Allow 60mm or more of space between the front of the controller and the cover of the control cabinet to allow access to the connectors.
Leave enough space between the controllers so that the operating temperatures of the controllers stay within the specification range.
Avoid mounting the controller near a vibration source, such as a large electromagnetic contactor or circuit fuse breaker on the same panel, or keep it away from the controller.



⚠ Caution

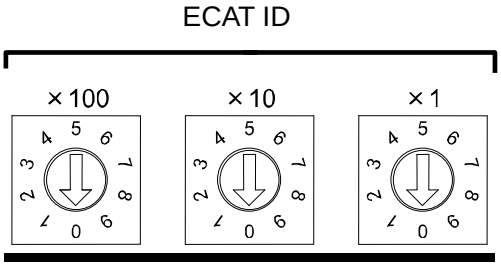
If the mounting surface for the controller is not flat or is uneven, excessive stress can be applied to the case, which can cause failure. Mount on a flat surface.

4. Initial Setting

4.1 Switch setting (EtherCAT ID)

Set the EtherCAT ID to “000 - 999” using the combination of rotary switches.

The EtherCAT ID of the controller is set using the rotary switches.
When the switches are set to “000”, the EtherCAT ID of the controller can be set by the EtherCAT master device.
To set the EtherCAT ID through the EtherCAT master device, refer to the manual of the EtherCAT master device.
(An initial value of the EtherCAT ID is “0", when “000” is set by the rotary switches.)



EtherCAT ID: 0～999 (Factory default “001”)

Setting			EtherCAT ID
x100	x10	x1	
0	0	0	Value that allows setting by EtherCAT master device (Initial value: “0”)
0	0	1	1 (Factory default)
0	0	2	2
0	:	:	:
0	6	4	64
:	:	:	:
9	9	9	999

⚠ Caution

Turn OFF the power supply while setting the switch.
The rotary switch should be set with a small watchmaker’s screwdriver.

4.2 Hardware Configuration

■ESI file (XML file)

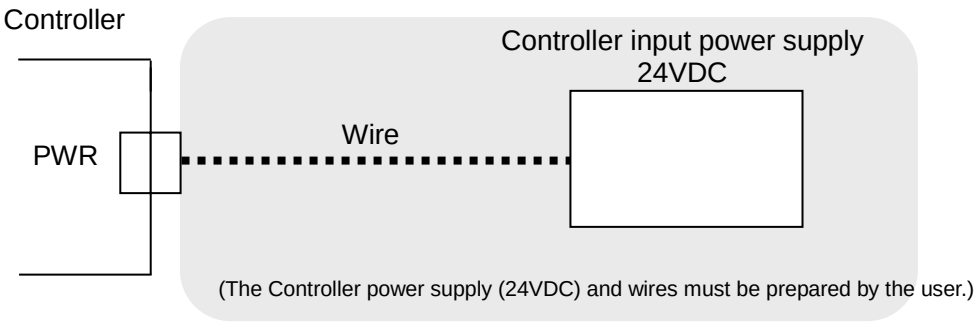
ESI file (XML file) is required to configure the controller.
ESI file (XML file) can be downloaded from the URL given below.

- URL:http://www.smcworld.com
  Informative documents → Operation manual -->SMC JXCE1_V10.zip
- Contents of SMC JXCE1_V10.zip
  ESI file: SMC JXCE1_V10.xml

5. External Connections

An example of standard wiring of the controller is shown for each connector.

5.1 PWR: Power supply connector



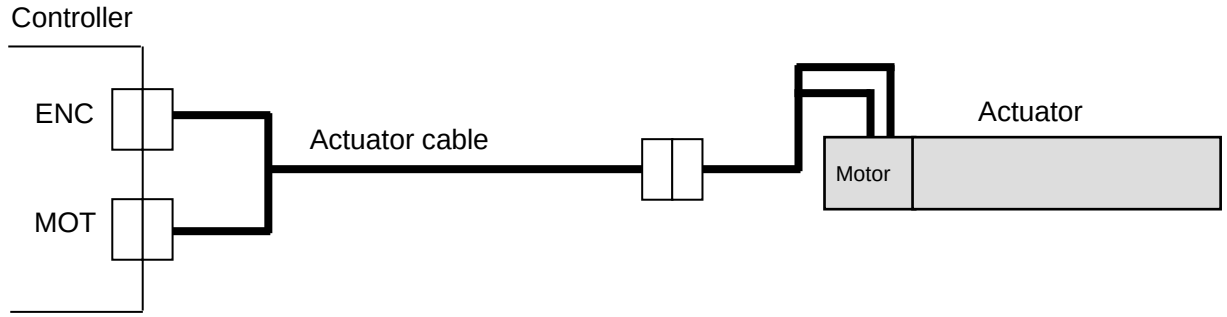
∗ Refer to **6. CN1: Power supply plug (P.21)** for wiring.

⚠ Caution

Do not use an inrush current limited type of power supply for the controller.

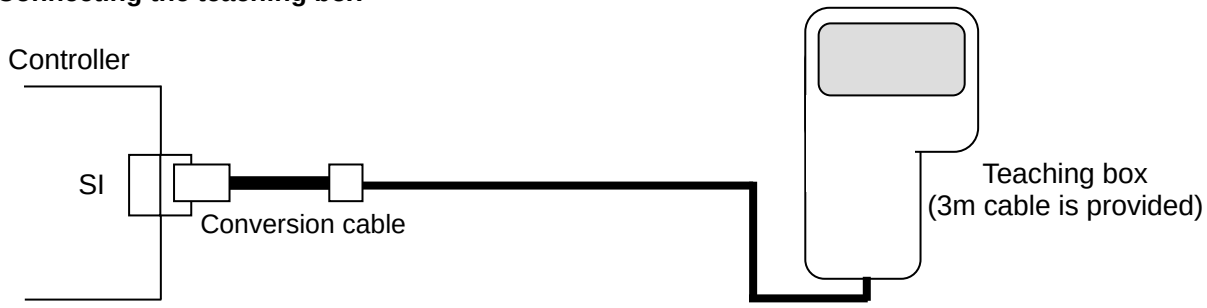
5.2 MOT: Motor connector, ENC: Encoder connector

Connect the controller and the actuator with the actuator cable (LE-CP-□)

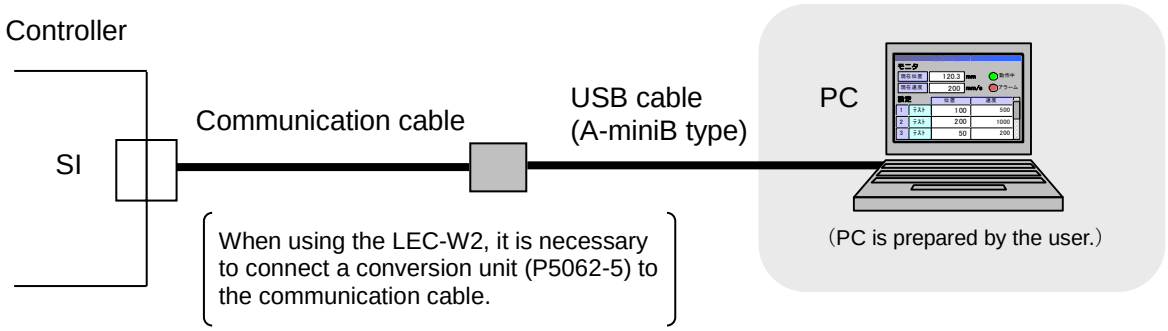


5.3 SI: Serial I/O Connector

(1) Connecting the teaching box

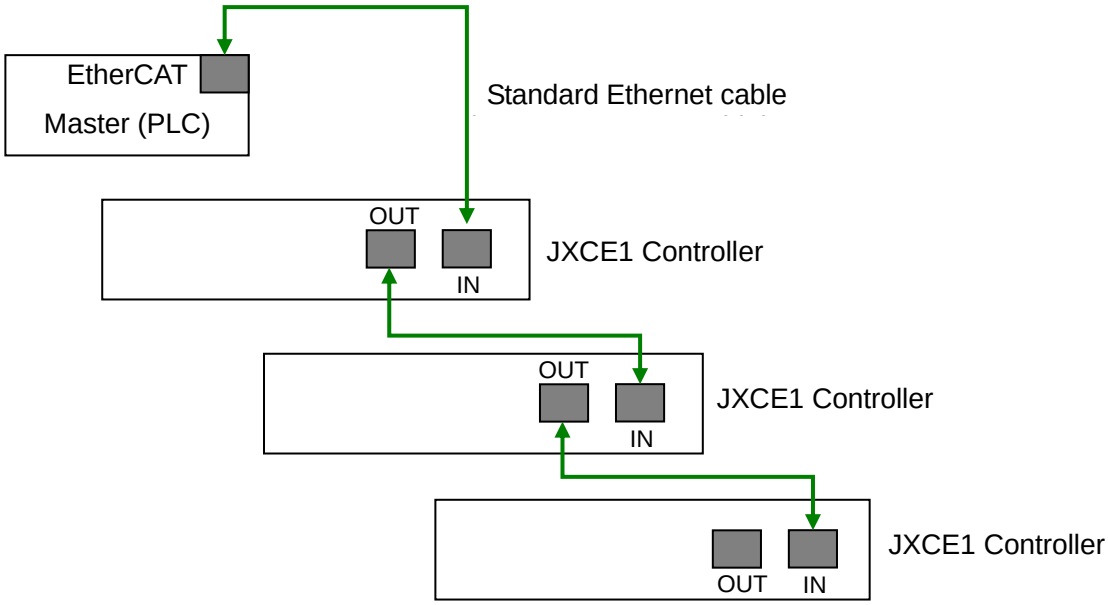


(2) Connection with a PC



5.4 IN, OUT: EtherCAT communication connector

E.g.) Example for a connection of the daisy chain



The standard Ethernet cable with CAT5 or higher and 100BASE-TX and PLC need to be prepared by the user.

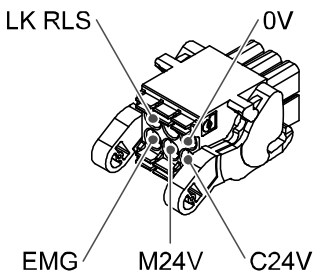
Connect the “IN” connector to the upper side device (PC, PLC, etc.), and connect the “OUT” connector to the lower side device.
Follow the topology of EtherCAT communication for details.

6. Details of Power Supply Plug

6.1 PWR: Power supply plug specifications

The specifications of the power supply plug supplied with the controller are shown below.

Power supply plug

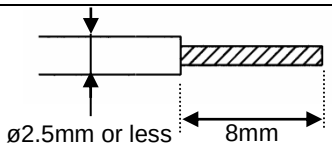


Pin No.	Terminal	Function	Functional explanation
1	C24V	Power supply (+)	The positive control power.
2	M24V	Motor power (+)	The positive power for the actuator motor to be supplied via the controller.
3	EMG	Stop (+)	The positive power for Stop signal
4	0V	Common power (-)	The negative common power for M24V, C24V, EMG and LK RLS.
5	-	NC	N/A
6	LK RLS	Unlocking (+)	The positive power for lock release.

∗ Equivalent to Phoenix Contact: DFMC1, 5/3-ST-LR

6.2 Electrical Wiring Specifications

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

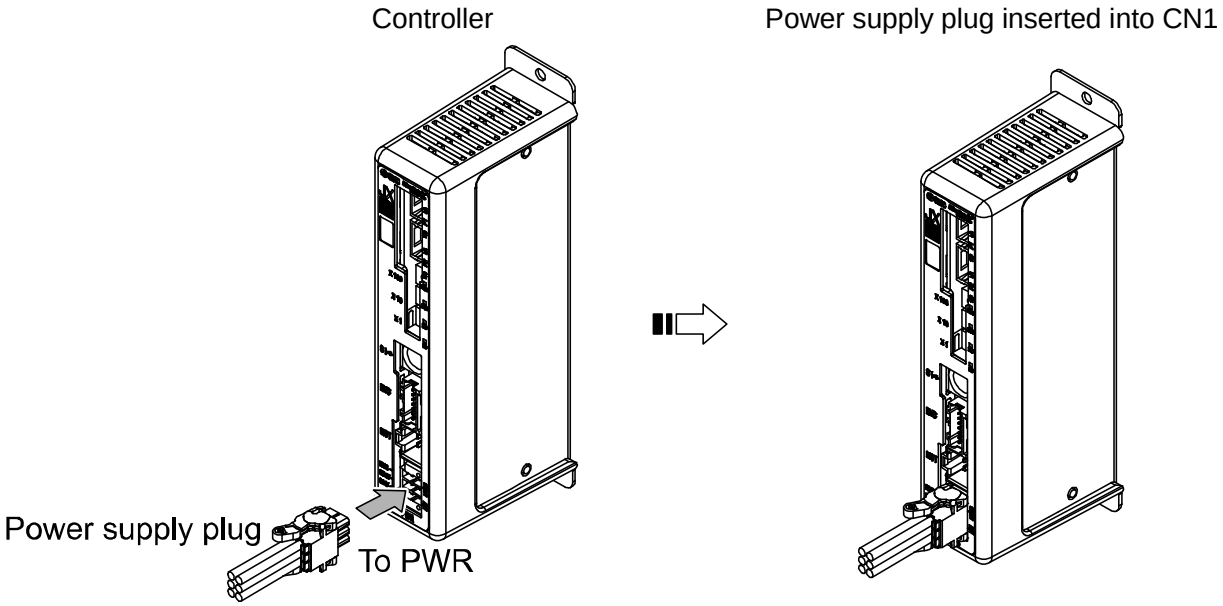
Item	Specifications
Applicable wire size	Single, stranded wire → AWG20 (0.5mm^2) ∗ The rated temperature of the insulation coating should be 60°C or more. The O.D. should be ø2.5mm or less.
Stripped wire length	

⚠ Caution

Do not connect multiple wires to one terminal.

After wiring the power supply plug, connect it to PWR power connector of the controller.

∗ Refer to **6.3 Power Supply Plug Wiring (P.22)** for wiring.

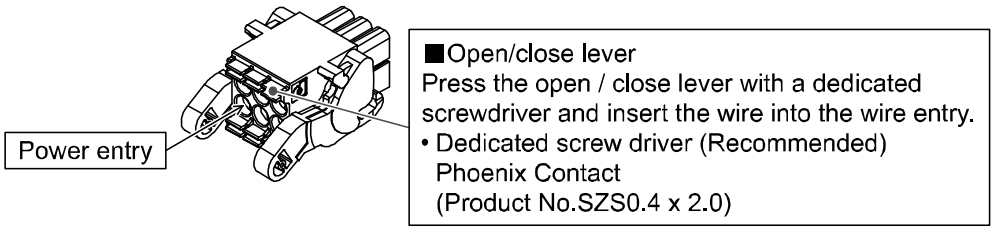


6.3 Power Supply Plug Wiring

Connect the power supply plug to the 24VDC controller power supply according to instructions (1) (2) and (3) and then insert it into the PWR connector of the controller.

(1) Wiring of power supply (C24V, M24V, 0V)

Connect the positive of the 24VDC controller power supply to the C24V and M24V and connect the negative of that power supply to the 0V terminal.

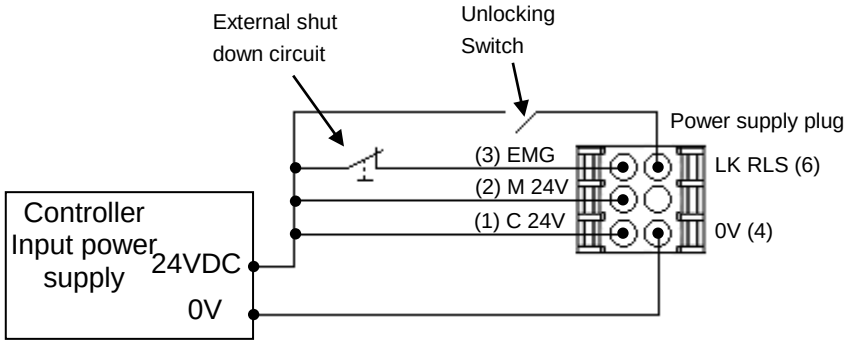


(2) Wiring of the stop switch (EMG)

Stop switch must be installed by the user to stop the actuator in abnormal situations.
Refer to **6.4 Wiring of stop circuit (P.23) for wiring.**

(3) Wiring of the lock release (LK RLS)

Install an unlocking switch for adjustment or recovery during an emergency of the locking actuator.
∗ Switch (24V DC, contact capacity 0.5A or more) is provided by customer.
One terminal of the lock release switch should be connected to the 24VDC power supply and the other should be connected to the LK RLS terminal. When this is switched on, the lock will be released.



⚠Caution

(1) Do not use a power supply with "inrush-current control" for the controller power supply.
(2) It is unnecessary to connect LK RLS terminal when the actuator does not have locking mechanism.
(3) The LK RLS terminal is only used for adjustment and emergency return. It must not be energized during normal operation.

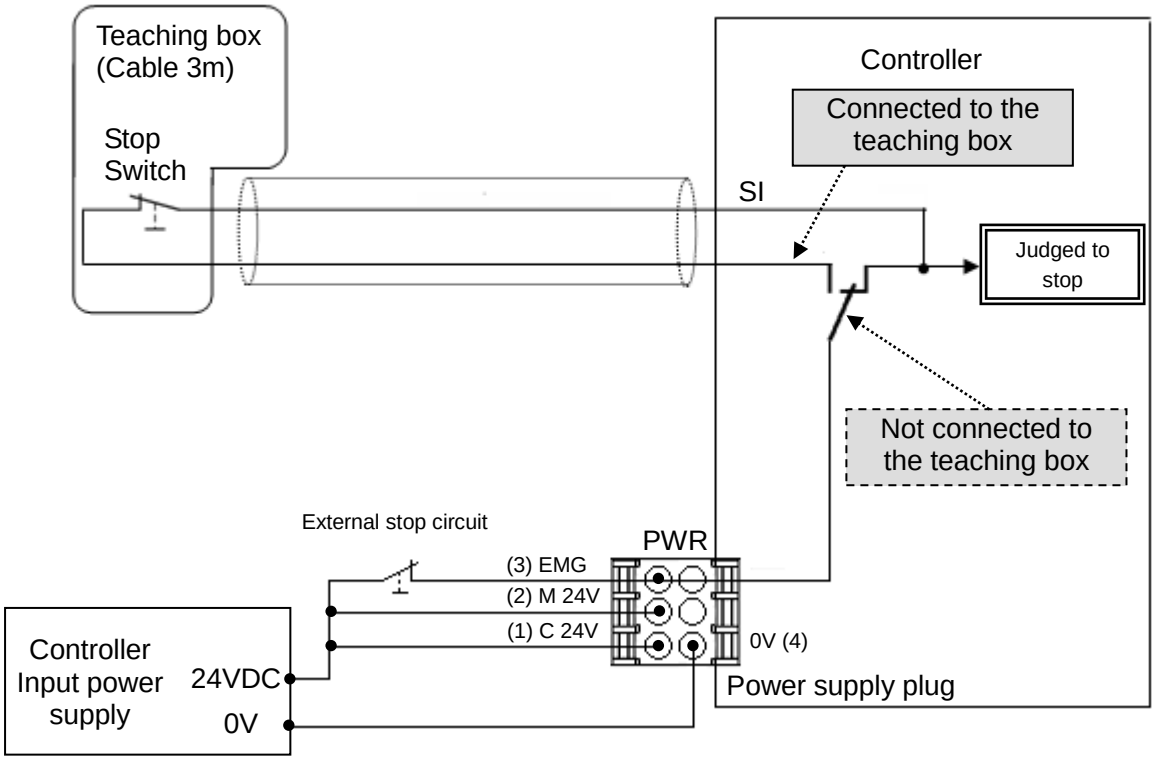
6.4 Wiring of stop circuit

The actuator stops its operation when the external stop switch or the stop switch of the teaching box is activated.

(1)Stop (example of recommended circuit)

When the controller recognizes the connection of the teaching box, the stop of the teaching box is activated.

(Circuit example)



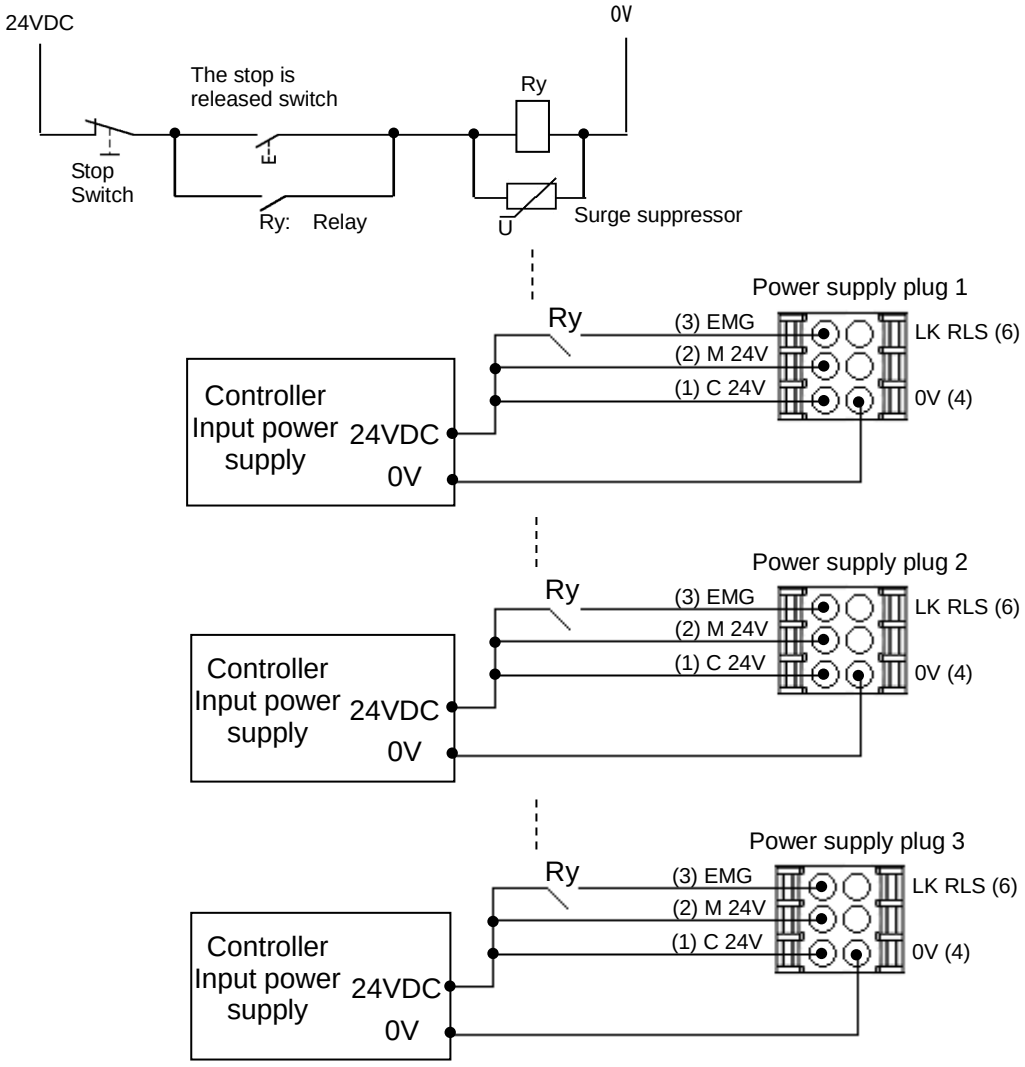
⚠Warning

The teaching box's stop switch is effective only for the controller that is connected to it.

(2) Stop (relay contact (1))

If the system where this controller is installed has a stop circuit for the whole system, or if the system has multiple controllers with individual power supply, relay contacts should be made between the 24VDC controller power supply and the EMG terminal of the power supply plug.

(Circuit example)



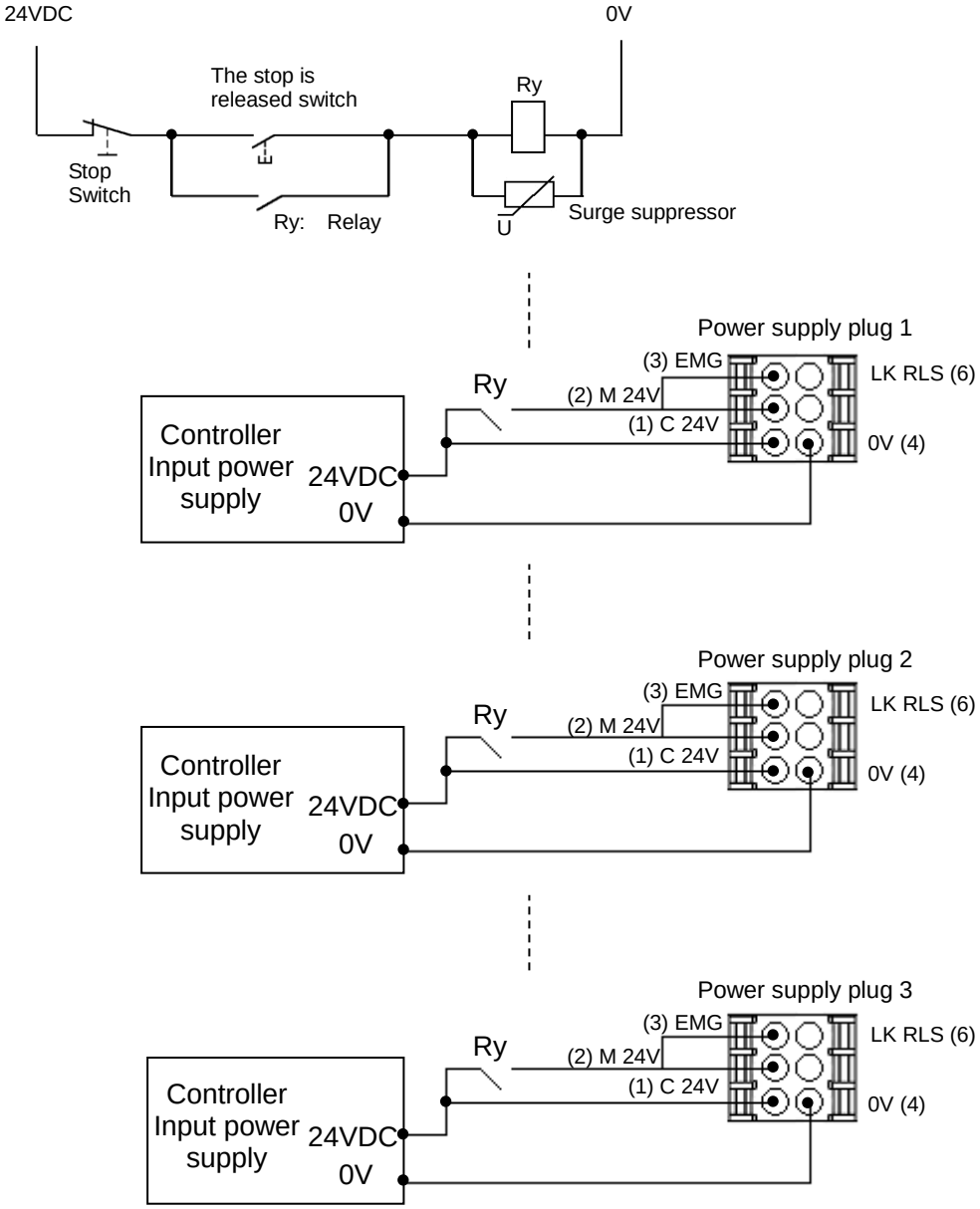
⚠ Caution

When shutdown is input, the controller stops with maximum deceleration, then the motor is turned OFF.

(3) Motor power shutdown (relay contact (2))

If it is necessary to have a circuit to shutdown the motor power externally, relay contacts should be made between the 24VDC controller power supply and the M24V and EMG terminal of the power supply plug.

(Circuit example)



⚠ Warning

(1) Relay contacts should be made between the 24VDC controller power supply and the M24V and EMG terminal of the power supply plug. The actuator may make unexpected movement.
(2) Do not perform return to origin (SETUP) when 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) Do not energize the LK RLS terminal while the motor drive power (M24V) is disconnected.

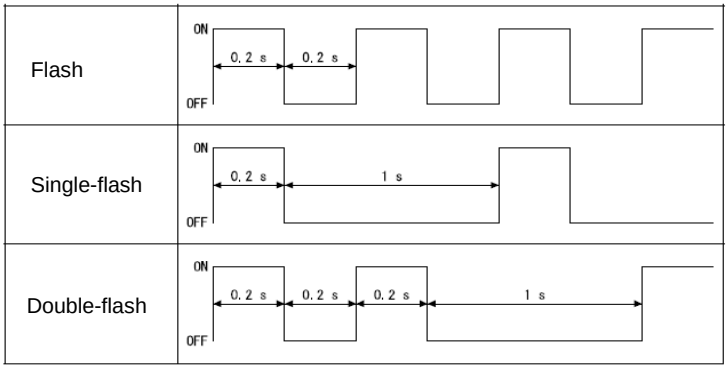
7. LED display

7.1 LED display

Refer to the table below for details of the LED status.

LED	Details		
PWR	Power supply status.	OFF	Power is not supplied
		Green LED is ON	Power is supplied
ALM	Controller alarm status.	OFF	Normal operation
		Red LED is ON	Alarm generated
RUN	EtherCAT communication status.	OFF	INIT state
		Green LED is flashing ∗1	Pre-Operational state
		Green LED is single flashing ∗1	Safe-Operational state
		Green LED is ON	Operational state
ERR	EtherCAT communication error status	OFF	No error in EtherCAT communication
		Red LED is flashing ∗1	Error in the setting of EtherCAT communication
		Red LED is double flashing ∗1	Error in the setting of EtherCAT communication(application watch dog timeout)
L/A1	Link/Activity1	OFF	“IN” port: No Link, No Activity
		Green LED is ON	“IN” port: Link, No Activity
		Green LED is flashing	“IN” port: Link, Activity
L/A2	Link/Activity2	OFF	“OUT” port: No Link, No Activity
		Green LED is ON	“OUT” port: Link, No Activity
		Green LED is flashing	“OUT” port: Link, Activity

∗1 Refer to the following for the cycle when LED is flashing (Flush, Single-flush, Double-flush).



7.2 LED and Controller Status

Refer to the table below for the LED and the controller status.

Controller status		LED description			
		PWR	ALM	RUN	ERR
When power is supplied		Green LED is ON	LED is OFF	-	-
When EtherCAT communication is normal		-	-	Green LED is ON	LED is OFF
Motor controller	Controller alarm generated	LED is OFF	Red LED is ON	-	-
	Controller system error generated	Green LED is ON	Red LED is ON	-	-
	Writing to controller EEPROM	Green LED is flashing	-	-	-

-: LED display is unstable

⚠ Caution

Do not turn OFF the power supply for the controller or disconnect and connect the cable while data is being written to EEPROM (PWR LED (green) is flashing).
∗ This is to avoid the possibility of incorrect / corrupt data (step data, parameter)

8. Operation methods

8.1 Outline

Two types of operation method are available for this product on the EtherCAT network. The first method is “Operation by Step No.”. When using this method, step data stored in the product can be driven by sending specific commands over the network. The second method is “Operation by numerical instruction”. When using this method the numerical data (e.g. Position, speed etc.) is changed based on the already set step data.

8.2 Operation by Step No.

Instructions and monitoring of the movement of the actuator are possible by reading/writing the memory bits corresponding to the input/output port signals (e.g. DRIVE, INP) using a master (PLC).
When an operation is based on the preset step data, select the step data No. then activate the DRIVE signal.
Refer to **13.2 Operation procedure for Operation by Step No. (P.48)**.

8.3 Position/speed monitor

Reads the current position and current speed for monitoring.
Refer to **9. Memory map (P.28)** for the current position and speed.

8.4 Operation by numerical instruction

When numerical data relating to the actuator speed, position etc. is sent, the actuator will execute this data provided it is within the allowable range of values.
For the JXCE1 controller, it is possible to instruct all step data items (operation method, speed, position, acceleration, deceleration, pushing force, switch point, pushing speed, positioning thrust, area 1, area 2, positioning width) by numeric values.
Preparatory operations such as turning the servo on and performing a return to origin are required before the actuator may execute numerical data.
Refer to **13.3 Operation procedure for operation by numerical instruction (P.53)**.

9. Memory map

9.1 Memory allocation

(1) Input Data Area TxPDO Mapping

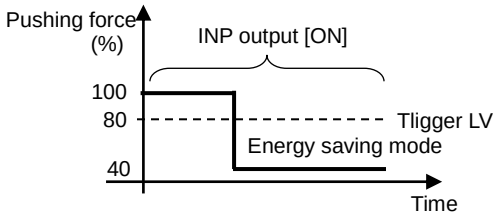
●Input data area TxPDO mapping list (data sent from JXCE1 controller to EtherCAT master)

INDEX (SUB)	Size	Name
6010h	2 bytes	Signal allocated to the input port
6011h	2 bytes	Controller information flag
6020h	4 bytes	Current position [0.01mm]
6021h	2 bytes	Current speed [mm/s]
6022h	2 bytes	Current pushing force [%]
6023h	4 bytes	Target position [0.01mm]
6030h (1)	1 byte	Alarm1
6030h (2)	1 byte	Alarm2
6030h (3)	1 byte	Alarm3
6030h (4)	1 byte	Alarm4

(2) Input data area TxPDO details

●Index 6010h: Input port equivalent signal details

<table>
<tr><th>Index</th><th>Bit</th><th>Signal name</th><th>Description</th></tr>
<tr><td rowspan="12">6010h</td><td>0</td><td>OUT0</td><td rowspan="6">When the operation is started and “DRIVE” is turned OFF, the step No. executed by “DRIVE” will be refreshed/updated by the combination of “OUT0” to “OUT5” (binary digit).
(E.g.) Step data No.3 is output
<table><tr><td>OUT5</td><td>OUT 4</td><td>OUT 3</td><td>OUT 2</td><td>OUT 1</td><td>OUT 0</td></tr><tr><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr></table>⚠Caution
(1) When “RESET” is turned ON, these signals turn OFF.
(2) During the alarm, these signals output the alarm group.
(3) During the pushing operation, if the actuator runs over the defined pushing width, these signals turn OFF.</td></tr>
<tr><td>1</td><td>OUT1</td></tr>
<tr><td>2</td><td>OUT2</td></tr>
<tr><td>3</td><td>OUT3</td></tr>
<tr><td>4</td><td>OUT4</td></tr>
<tr><td>5</td><td>OUT5</td></tr>
<tr><td>6</td><td>—</td><td>—</td></tr>
<tr><td>7</td><td>—</td><td>—</td></tr>
<tr><td>8</td><td>BUSY</td><td>This terminal is ON during the movement of the actuator (during the positioning operation, etc.).
⚠Caution
During the pushing operation without movement (no movement but the actuator generating the pushing force), “BUSY” is OFF.</td></tr>
<tr><td>9</td><td>SVRE</td><td>When the servo motor is OFF, “SVRE” is OFF. When the servo motor is ON, “SVRE” is ON.</td></tr>
<tr><td>10</td><td>SETON</td><td>When the actuator is in the SETON status (the position information is established), this signal turns ON.
When the position status is not established, this signal is OFF.</td></tr>
</table>

<table>
<tr><th>Index</th><th>Bit</th><th>Signal name</th><th>Description</th></tr>
<tr><td rowspan="5">6010h</td><td>11</td><td>INP</td><td>The condition when “INP” turns ON depends on the actuator action.
- Return to origin
Turns ON at the origin when within the ±"default in position" in the Basic parameters.
- During positioning operation
Turns ON when the current position is within "Step data position +/- positioning range".
- During pushing operation-
Turns ON when the pushing force exceeds the value set in the step data “Trigger LV”.
⚠Caution
After the pushing operation is completed, even if it switches automatically to energy saving mode, “INP” remains ON. When movement starts again from the pushing stopped state, pushing operation is repeated with the normal pushing force.
(E.g.) Step data “force” is 100%
Step data “Trigger LV” is 80%
The energy saving setting of the actuator is 40%
(The actuator model determines the energy saving settings. Please refer to the manual of the actuator for more details.)

</td></tr>
<tr><td>12</td><td>AREA</td><td>When the actuator is within the output range between Area1 and Area2 in the step data, this terminal will turned ON.
The area output setting range changes depending on the active step data.</td></tr>
<tr><td>13</td><td>WAREA</td><td>When the actuator is within the output range between "W area 1 and W area 2" of basic parameter, this terminal will turn ON.</td></tr>
<tr><td>14</td><td>ESTOP</td><td>During activation of the Teaching Box stop switch, this signal is ON. During the normal operation, it is OFF.
This is synchronized to the input for the EMG signal on the controller PWR connector.</td></tr>
<tr><td>15</td><td>ALARM</td><td>Alarm generated when abnormal conditions occur to the actuator or its controlling status. OFF when there are no alarms. ON in alarm condition.</td></tr>
</table>

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

Status \ Output signal	BUSY	INP	SVRE	Lock	SETON	OUT0to5
During stopping when “SVON” is OFF after turning ON the power supply to the controller	OFF	OFF	OFF	Lock	OFF	OFF
During stopping when “SVON” is ON after turning ON the power supply to the controller	OFF	OFF	ON	Unlock	OFF	OFF
During returning to origin	ON	OFF	ON	Unlock	OFF	OFF
The actuator is at the origin. On completion of “SETUP”	OFF	ON(∗1)	ON	Unlock	ON	OFF
During movement by positioning/pushing operation	ON	OFF	ON	Unlock	ON	ON(∗2)
The actuator is paused by “HOLD”	OFF	OFF	ON	Unlock	ON	ON(∗2)
On completion of the positioning operation	OFF	ON(∗4)	ON	Unlock	ON	ON(∗2)
Stopped due to pushing a workload in pushing operation	OFF	ON	ON	Unlock	ON	ON(∗2)
Stopped due to no detection of workload during a pushing operation	OFF	OFF	ON	Unlock	ON	OFF
During stopping when “SVON” is OFF after returning to the home position	OFF	OFF(∗4)	OFF	Lock	ON	ON(∗3)
EMG signal stop from the PWR connector when the actuator is at the origin	OFF	OFF(∗4)	OFF	Lock	ON	OFF

∗1 The signal turns ON when the actuator is within the range defined in the basic parameter setup.

∗2 The signal is updated on the transition of (ON → OFF) of the DRIVE signal.

∗3 Retains the previous state.

∗4 The signal turns ON when the actuator is "In position" according to the step data.

●Index 6011h: Controller information flag

Index	Bit	Signal name	Description
6011h	0-3	(Unused)	-
	4	READY	READY turns ON when Servo is ON and no alarm is generated. The READY flag turns ON.
	5	(Unused)	-
	6-15	(Unused)	-

●Index 6020h: Current speed

Index	Bit	Signal name	Description
6020h	0-31	Current position	Current position of the actuator is shown in multiples of 0.01mm when numerical data can be read. (∗5) E.g.) 800.00[mm](80000d=13880h) is output. 6020h: Current position = 00013880h

●Index 6021h: Current speed

Index	Bit	Signal name	Description
6021h	0-15	Current speed	Current speed of the actuator is shown in multiples of 1mm/s when numerical data can be read. E.g.) 300[mm/s](300d=012Ch) is output. 6021h：Current speed = 012Ch

●Index 6022h: Current pushing force

Index	Bit	Signal name	Description
6022h	0-15	Current pushing force	Current pushing force of the actuator is shown in multiples of 1% when numerical data can be read.

∗5 Please refer to **20. Handling of sent/received data (P.79)** for handling of the data

●Index 6023h: Target position

Index	Bit	Signal name	Description
6023h	0-31	Target position	Target position of the actuator is shown in multiples of 0.01mm when numerical data can be read. E.g.) When 800.00[mm](80000d=13880h) is input. (∗5) 6023h: Target position = 00013880h

●Index 6030h: Alarm

<table>
<tr><th>Index</th><th>Bit</th><th>Signal name</th><th>Description</th></tr>
<tr><td>6030h
(1)</td><td>0-7</td><td>Alarm 1</td><td rowspan="4">Alarm code shown as a 3 digit decimal number when read numerical data is valid and alarm is generated. 5

Latest alarm code generated will be output to alarm 1.
Alarm is updated by another alarm. The code of the alarm generated in the past will be shifted as alarm 1 → 2 → 3 → 4.
When the number of alarm generated exceeds the maximum alarm output of each tool (PC Setting Software or Teaching box), the oldest alarm code is deleted from the record

E.g.) Alarm was generated in order of (1) -> (5)
<table>
<tr><td>Alarm 1 (Latest)</td><td>(1)</td><td rowspan="4">→</td><td>(2)</td><td rowspan="4">→</td><td>(3)</td><td rowspan="4">→</td><td>(4)</td><td rowspan="4">→</td><td>(5)</td></tr>
<tr><td>Alarm 2</td><td>0</td><td>(1)</td><td>(2)</td><td>(3)</td><td>(4)</td></tr>
<tr><td>Alarm 3</td><td>0</td><td>0</td><td>(1)</td><td>(2)</td><td>(3)</td></tr>
<tr><td>Alarm 4</td><td>0</td><td>0</td><td>0</td><td>(1)</td><td>(2)</td></tr>
</table>
(1) to (5) in the table indicate the alarm codes which are generated.

Refer to “<u>15.3. Alarms and countermeasures (P.59)</u>” for detailed alarm information.</td></tr>
<tr><td>6030h
(2)</td><td>0-7</td><td>Alarm 2</td></tr>
<tr><td>6030h
(3)</td><td>0-7</td><td>Alarm 3</td></tr>
<tr><td>6030h
(4)</td><td>0-7</td><td>Alarm 1</td></tr>
</table>

∗5 Please refer to **20. Handling of sent/received data (P.79)** for handling of the data.

(3) Output data area RxPDO mapping

●Output data area RxPDO mapping list (data sent from PROFINET master to JXCP1 controller)

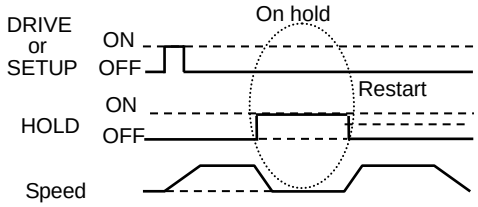
Index (SUB)	Size	Name
7010h	2 bytes	Output port to which signals are allocated
7011h	2 bytes	Numerical data flag
7012h	1 byte	Start flag
7020h	1 byte	Movement mode
7021h	2 bytes	Speed
7022h	4 bytes	Target position
7023h	2 bytes	Acceleration
7024h	2 bytes	Deceleration
7025h	2 bytes	Pushing force
7026h	2 bytes	Trigger LV
7027h	2 bytes	Pushing speed
7028h	2 bytes	Moving force
7029h	4 bytes	Area1
702Ah	4 bytes	Area2
702Bh	4 bytes	In Position

(4) Output data area RxPDO details

●Index 7010h: Output port to which signal is allocated

<table>
<tr><th>Index</th><th>Bit</th><th>Signal name</th><th>Description</th></tr>
<tr><td rowspan="8">7010h</td><td>0</td><td>IN0</td><td rowspan="6">The step data No. instruction the drive will be specified by the combination of “IN0” to “IN5” (binary digit).

E.g.) Step data No.3 has been assigned
<table><tr><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>ON</td><td>ON</td></tr></table>⚠Caution
Be sure to decide the step data No. via the “IN*” signal before turning “DRIVE” ON.
Otherwise, the actuator might operate with unexpected step data.</td></tr>
<tr><td>1</td><td>IN1</td></tr>
<tr><td>2</td><td>IN2</td></tr>
<tr><td>3</td><td>IN3</td></tr>
<tr><td>4</td><td>IN4</td></tr>
<tr><td>5</td><td>IN5</td></tr>
<tr><td>6</td><td>—</td><td>SET always OFF(0)</td></tr>
<tr><td>7</td><td>—</td><td>SET always OFF(0)</td></tr>
</table>

Index	Bit	Signal name	Description
7010h	8	HOLD	If “HOLD” is turned ON during operation, the speed decreases at maximum deceleration set in the basic parameters 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 and travels for the remaining stroke. - When “DRIVE” or “SETUP” is ON  **⚠Caution** (1) Do not turn on “SETUP”, “DRIVE”, “JOG+/JOG-“ or Start flag when “HOLD” is ON. The actuator may make unexpected movement. (2) The signals are rendered invalid whilst “HOLD” is in operation.
	9	SVON	“SVON” signal turns the servo motor ON. When “SVON” is ON, the servo motor will be turned ON. When it is OFF, the servo motor will be turned OFF. **⚠Caution** (1) When “SVON” is ON for the first time after supplying power to the controller, the actuator moves several mm to improve the control accuracy. (2) When “SVON” is OFF, turn OFF “DRIVE” and “SETUP”.
	10	DRIVE	When “DRIVE” is turned ON, the system scans “IN0” to “IN5” and starts the operation of the actuator. (∗6) Then, when “DRIVE” is turned OFF, the number of the active step data will be output via the “OUT0” to “OUT5” signals.
	11	RESET	“RESET” is a signal to reset the alarm and the operation. After “RESET”, the speed decreases at maximum deceleration of the basic parameter until the actuator stops. “INP” and “OUT0” to “OUT5” will be turned OFF (however, if the actuator is stopped within the in-position range, “INP” will turn ON).
	12	SETUP	When “SVRE” is ON, the “SETUP” operation (return to origin operation) will be performed. During the “SETUP” operation, “BUSY” will turn ON. After completion of the “SETUP” operation, “SETON” and “INP” will turn ON.
	13	JOG(-)	Jogging in the (-) direction. The actuator moves when the signal is ON and stops when the signal is OFF. When the “FLGTH” (signal for switching Jogging and Inching) is ON, movement towards the (-) side is made according to the "JOG(-)" signal. “INP” and “OUT0” to “OUT5” are OFF during Jogging/Inching. When Jogging/Inching is completed, “INP” will turn ON, but “OUT0” to “OUT5” will remain OFF.
	14	JOG(+)	Jogging in the (+) direction. Operation is the same as “JOG(-)”. with "-" changed to "+"
	15	FLGTH	FLGTH switches the function (Jogging and Inching) of Jogging signal "JOG(-)" and "JOG(+)". Inching starts when this signal is ON and when the Jogging signal turns ON. The Inching amount is set in the operation parameters.

∗6 Turn ON “DRIVE” while stopping. If ”DRIVE” is turned ON while operating, it might lead to unexpected operation.

●Index 7011h: Controlling of the controller/numerical data flag

Index	Bit	Signal name		Description
7011h	0	Flags for controller	(Unused)	SET always OFF(0)
	1		Speed restriction	Speed is restricted for all operations. Value for speed limit varies depending on actuator type.
	2		(Unused)	SET always OFF(0)
	3		(Unused)	SET always OFF(0)
	4	Numerical data input flag	Movement mode	When the operation is commanded numerically, values can be changed while the set values are ON. (∗7)
	5		Speed	
	6		Position	
	7		Acceleration	
	8		Deceleration	
	9		Pushing force	
	10		Trigger LV	
	11		Pushing speed	
	12		Moving force	
	13		AREA 1	
	14		AREA 2	
	15		In-Position	

●Index 7012h: Start flag

Index	Bit	Signal name	Description
7012h	0	Start flag	Data transmission flag during numerically instructed operation. Turn OFF during waiting for transmitting. Turn ON when transmitting numerical data to the controller. (∗7, ∗8, ∗9)
	1-7	(Unused)	SET always OFF(0)

●Index 7020h: Movement mode

Index	Bit	Signal name	Description
7020h	0-1	Movement mode	1: ABS (Absolute) 2: INC (Relative) (∗7, ∗10)
	2-7	(Unused)	SET always OFF(0)

●Index 7021h: Speed

Index	Bit	Signal name	Description	
			Input range	Min. unit
7021h	0-15	Speed	1 to Basic parameters "Maximum speed" (∗7, ∗11)	1mm/s

●Index 7022h: Target position

Index	Bit	Signal name	Description	
			Input range	Min. unit
7022h	0-31	Target position	Basic parameter "Stroke(-)" - "Stroke (+)" (∗5, ∗7, ∗11)	0.01 mm

●Index 7023h: Acceleration

Index	Bit	Signal name	Description	
			Input range	Min. unit
7023h	0-15	Acceleration	1 ~ Basic parameters "Maximum acceleration speed" (∗7, ∗11)	1 mm/s^2

∗5 Please refer to **20. Handling of sent/received data (P.79)** for handling of the data.
∗7 Change the numerical data input flag and the numerical data only when the start flag is OFF. If the numerical data input flag or the numerical data are changed when the start flag is ON, it may lead to unexpected operation.
∗8 Turn ON the start flag from OFF only when stopped. If the numerical data input flag or the numerical data is changed while operating, it may lead to unexpected operation.
∗9 To avoid unintentionally changing the numerical data, it is recommended to turn OFF the start flag after starting an operation.
∗10 Do not input numbers other than [1(ABS)] and [2(INC)].
∗11 The actuator model determines the limit for the input values. Please refer to the manual of the actuator for more details.

●Index 7024h: Deceleration

Index	Bit	Signal name	Description	
			Input range	Min. unit
7024h	0-15	Deceleration	1 ~ Basic parameters "Maximum deceleration speed" (∗7, ∗11)	1 mm/s^2

●Index 7025h: Pushing force

Index	Bit	Signal name	Description	
			Input range	Min. unit
7025h	0-15	Pushing force	(∗7, ∗11)	1%

●Index 7026h: Trigger LV

Index	Bit	Signal name	Description	
			Input range	Min. unit
7026h	0-15	Trigger LV	(∗7, ∗11)	1%

●Index 7027h: Pushing speed

Index	Bit	Signal name	Description	
			Input range	Min. unit
7027h	0-15	Pushing speed	(∗7, ∗11)	1 mm/s

●Index 7028h: Moving force

Index	Bit	Signal name	Description	
			Input range	Min. unit
7028h	0-15	Moving force	(∗7, ∗11)	1%

●Index 7029h: AREA 1

Index	Bit	Signal name	Description	
			Input range	Min. unit
7029h	0-31	AREA1	Basic parameter "Stroke (-)" - "Stroke (+)" (∗5, ∗7, ∗11)	0.01 mm

●Index 702Ah: AREA 2

Index	Bit	Signal name	Description	
			Input range	Min. unit
702Ah	0-31	AREA2	Basic parameter "Stroke (-)" - "Stroke (+)" (∗5, ∗7, ∗11)	0.01 mm

●Index 702Bh: In-Position

Index	Bit	Signal name	Description	
			Input range	Min. unit
702Bh	0-31	In-Position	(∗7, ∗11)	0.01 mm

∗5 Please refer to **21. Handling of sent/received data (P.79)** for handling of the data.
∗7 Change the numerical data input flag and the numerical data only when the start flag is OFF. If the numerical data input flag or the numerical data are changed when the start flag is ON, it may lead to unexpected operation.
∗11 The actuator model determines the limit for the input values. Please refer to the manual of the actuator for more details.

(5) Vendor specific area mapping

●**Vendor specific area mapping list (Jogging/Inching speed, Step data)**
Jogging / Inching speed and Step data are set.
Refer to **10.1 Step data (P.37)** for details of Jogging.
Refer to **9.1(4) Output area RxPDO details (P.28)** for details of the each item in the step data.

Index (SUB)	Size	Name		Description
2260h (1)	2 bytes	Jogging / Inching Speed		The speed [mm/s] of Jogging / Inching is set by this setting. Jogging: JOG(+/-) Inching: JOG(+/-) + FLGTH
3000h (1)	2 bytes	Step data No.0	Movement mode	Refer to **10.1 Step data (P.37)**
3000h (2)	2 bytes		Speed	
3000h (3)	4 bytes		Target position	
3000h (4)	2 bytes		Acceleration	
3000h (5)	2 bytes		Deceleration	
3000h (6)	2 bytes		Pushing force	
3000h (7)	2 bytes		Trigger LV	
3000h (8)	2 bytes		Pushing speed	
3000h (9)	2 bytes		Moving force	
3000h (10)	4 bytes		Area1	
3000h (11)	4 bytes		Area2	
3000h (12)	4 bytes		In-position	
3001h	Step data No.1			
⋮	⋮			
303Fh	Step data No.63			

10. Settings and Data Entry

In order to move the actuator to a specific position, it is necessary to setup the patterns of operations with a PC (with the controller setting software) or the teaching box or record data. This setup data input by the software or teaching box will be recorded in the memory of the controller.

Step data is possible to be set in Vendor specific area.

Refer to **9.1 (5) Vendor specific area mapping(P.36)** for details

For the controller setting software and the teaching box, there are two available modes (the Easy mode and the Normal mode).
You can select the appropriate one depending on the operation.

•Easy mode
In Easy mode, the actuator can be started by entering only a limited number of settings with the controller setting software and the teaching box.
∗ The combination of settings you need to set up will change depending on the type of actuator. (A combination of data can be selected).

•Normal mode
In Normal mode, a more detailed setup can be made (conditions for actuator and controller, etc.) than in Easy mode.
Three kinds of setting data can be changed in this mode; "Step data", "Basic parameter" and "Return to origin parameter".

10.1 Step Data

A "step data" is the setting data mainly describing the movement of the actuator. Total 64 step data (12 attributes per step) can be handled with this controller. Each step data will become effective as soon as it is recorded into the controller.

E.g.) Step data on the PC (controller setting software) screen [Normal mode]

No.	Movement mode	Speed mm/s	Position (mm)	Acceleration mm/s²	Deceleration mm/s²	Pushing force %	Trigger LV %	Pushing speed mm/s	Moving force %	Area 1 (mm)	Area 2 (mm)	In pos (mm)
0	Absolute	100	20.00	1000	1000	0	0	0	100	18.00	22.50	0.5
1	Absolute	50	10.00	1000	1000	70	60	5	100	6.0	12.0	1.5
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
63	Absolute	20	5.00	500	500	0	0	0	100	3.0	8.0	1.2

Details of Step Data

<table>
<tr><th colspan="2">Description</th><th rowspan="2">Range</th><th rowspan="2">Explanation</th></tr>
<tr><th>Controller setting software</th><th>Teaching box (TB)</th></tr>
<tr><td>No.</td><td>Step No.</td><td>0 to 63</td><td>Number of the step data.</td></tr>
<tr><td>Movement mode</td><td>Movement mode</td><td>3 types
(Refer to the table on the right)</td><td>Specifies the co-ordinate system for the target position.
<table>
<tr><th>Software</th><th>TB</th><th>PLC</th><th>Details</th></tr>
<tr><td>Blank</td><td>Disable</td><td>0</td><td>The step data is ineffective.</td></tr>
<tr><td>Absolute</td><td>Absolute</td><td>1</td><td>The target position will be defined in relation to the absolute origin point.</td></tr>
<tr><td>Relative</td><td>Relative</td><td>2</td><td>The target position will be defined relative to the current position.</td></tr>
</table></td></tr>
<tr><td>Speed</td><td>Speed</td><td>(∗1)</td><td>The speed to move to the target position. (Unit: mm/s)</td></tr>
<tr><td>Position</td><td>Position</td><td>Basic parameter "Stroke (-)" - "Stroke (+)"</td><td>The target position (unit: mm)</td></tr>
<tr><td>Acceleration</td><td>Acceleration</td><td>1 ~ Basic parameters "Maximum acceleration/ deceleration speed"</td><td>Sets the acceleration to reach to travel speed. (Unit: mm/s^2)</td></tr>
<tr><td>Deceleration</td><td>Deceleration</td><td>1 ~ Basic parameters "Maximum acceleration/ deceleration speed"</td><td>Sets the deceleration from travel speed to stop. (Unit: mm/s^2)</td></tr>
<tr><td>Pushing force</td><td>Pushing force</td><td>(∗1)</td><td>The setting to define the pushing operation or the positioning operation.
For the positioning operation, the value specifies the force as a percentage of the maximum force (Unit: %).
∗ The maximum force depends on the actuator. Please refer to the manual and the rated force of the actuator.
<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 in the "Position".</td></tr>
<tr><td>1 to 100</td><td>Pushing operation</td><td>The actuator moves to the position specified in the "Position" and then, performs a pushing action with a force not more than the set force.</td></tr>
</table></td></tr>
<tr><td>Trigger LV</td><td>Trigger LV</td><td>(∗1)</td><td>■Effective only for the pushing operation
(the value for the "Pushing force" is between 1 to 100).
“Trigger LV” is the setting to define the conditions where “INP” will turn ON. When the actuator generates a force greater than this value, “INP” will turn ON.
This parameter is set according to the value of the pushing force or lower. (Unit: %)
For the positioning operation, this value is ignored.</td></tr>
</table>

<table>
<tr><td>Pushing speed</td><td>Pushing speed</td><td>(∗1)</td><td>■Effective only for the pushing operation
(when the value for the "Pushing force" is from 1 to 100).
This defines the movement speed during the pushing operation. If this Speed is too high, it may cause damage to the actuator or work piece due to impacts. Therefore, enter a value within the range appropriate for the actuator. (Unit: mm/s)
Please refer to the actuator manual for the appropriate range of the speed.
For the positioning operation, this value is ignored.</td></tr>
<tr><td>Moving force</td><td>Moving force</td><td>(∗1)</td><td>The setting to define the maximum torque during the positioning operation. (Unit: %)
Enter a value within the range appropriate for the actuator. (Unit: mm/s)
Please refer to the actuator manual for the appropriate range of the speed.</td></tr>
<tr><td>Area 1</td><td>AREA 1</td><td>Basic parameter "Stroke (-)" - "Stroke (+)"</td><td rowspan="2">The setting to define the conditions where “AREA” will turn ON. (Unit: mm)
If the current position is within the range between Area1 and Area2, the “AREA” signal will turn ON.
∗ If Area1 > Area2, the alarm "Step Data ALM1" will be activated. (However, no alarm is generated if "Area1" = "Area2" = 0, the “AREA” signal will be OFF).</td></tr>
<tr><td>Area 2</td><td>AREA 2</td><td>Basic parameter "Stroke (-)" - "Stroke (+)"</td></tr>
<tr><td>In position</td><td>In position</td><td>(∗1)</td><td>The functions of this will be different between the pushing operation and the positioning operation.
∗ Positioning operation: Positioning range (Unit: mm)
∗ Pushing operation: Pushing distance (Unit: mm)
<table>
<tr><th>Movement mode</th><th>Details</th></tr>
<tr><td>Positioning operation</td><td>This is the setting to define the conditions where “INP” will turn ON.
When the actuator enters within this range from the target position, “INP” will turn ON.
(It is not necessary to change this from the initial value).
If it is required to receive a signal before the actuator completes the positioning operation, this value should be larger.
∗ “INP” will turn ON.
Target position - in position ≤ actuator position ≤ target position + in position</td></tr>
<tr><td>Pushing operation</td><td>This is the setting to define the distance pushed by the actuator during the pushing operation. When the actuator has exceeded this distance, the pushing operation will end. In this case, “INP” will not turn ON.</td></tr>
</table></td></tr>
</table>

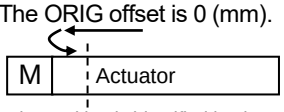
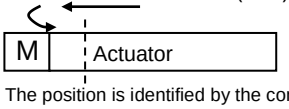
∗1 The range varies depending on the actuator. Please refer to the manual of the actuator for more details.

10.2 Basic parameters

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

Details of basic parameters

Activation: "■" = Effective as soon as it is recorded into the controller
"○" = Become effective after restarting the controller
"-" = The parameter cannot be changed (fixed value)

Description		Range	Explanation	Write
Controller setting software	Teaching box			
Controller ID	Controller ID	1 to 32	Identification number (axis) parameter of serial communication that this controller communicates with the PC or the teaching box is set.	○
IO pattern	IO pattern	Fixed value	This is the fixed value for this controller. (∗ Do not change the setting) The value for this should be 64 (Standard).	-
Acceleration/ deceleration pattern	Acceleration/ deceleration pattern	Fixed value	This is the fixed value for this controller. (∗ Do not change the setting) This defines the trapezoidal acceleration/deceleration parameter.	-
S-motion rate	S-motion rate	Fixed value	This is the fixed value for this controller. (∗ Do not change the setting)	-
Stroke (+)	Stroke (+)	(∗1)	This defines the positive (+) side limit of the position. (Unit: mm) Any value greater than the [stroke(+)] value cannot be entered in the "Position" field data of step parameter setup.	■
Stroke (-)	Stroke (-)	(∗1)	This defines the positive (+) side limit of the position. (Unit: mm) Any value less than the [stroke(-)] value cannot be entered in the "Position" field data of step parameter setup.	■
Maximum velocity	Maximum velocity	(∗1)	This defines the maximum limit of the speed. (Unit: mm/s) Any value greater than the [Max speed] value cannot be entered in the "Speed" field data of step parameter setup.	■
Maximum Acceleration/ Deceleration speed	Maximum Acceleration/ Deceleration speed	(∗1)	This defines the maximum limit of the ACC/DEC. (Unit: mm/s^2) Any value greater than the [Max ACC/DEC] value cannot be entered in the "Accel" field data of step parameter setup.	■
Default In position	Default In positioning	(∗1)	This defines the range to activate the INP output when the actuator is within it after the return to origin operation. (Unit: mm)	■
ORIG offset	ORIG offset	(□1)	This defines the position of the actuator after the return to origin operation. (Unit: mm) ■The ORIG offset is 0 (mm).  The position is identified by the controller after the return to the origin operation (0mm). ■The ORIG offset is 100 (mm).  The position is identified by the controller after the return to the origin operation (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 (-)" of the basic parameters should be checked.	■
Maximum pushing force	Maximum pushing force	(∗1)	The maximum force for the pushing operation. (Unit %)	■

Para protect	Para protect	1 to 2	Sets the range in which parameter and step data can be changed. 1. Basic parameter + Step data (Basic parameter + Return to origin parameter + Step data) 2. Basic parameter (Basic parameter + Return to origin parameter)	■
Enable SW	Enable SW	1 to 2	This defines the status of the Enable switch of the teaching box. 1. Enabled 2. Disabled	■
Unit name	Unit name	Fixed value	Indication of actuator type compatible with the controller. (Do not change the setting)	-
W-AREA1	W-AREA1	Basic parameter "Stroke (-)" - "Stroke (+)"	This is the setting to define the conditions where the "W-AREA" signal will turn ON. [Unit: mm] If the current position is within the range between the W-AREA1 and W-AREA2, "WAREA" will turn ON. ∗ If W-AREA1 >W-AREA2, the "Parameter ALM" alarm will be activated. However if W-AREA1= W-AREA2 = 0, "WAREA" will be OFF and no alarm will be generated.	■
W-AREA2	W-AREA2	Basic parameter "Stroke (-)" - "Stroke (+)"		■
ORG Correct	Link Offset	Fixed value	This is the fixed value for this controller. (∗ Do not change the setting)	-
Sensor type	Sensor type	Fixed value	This is the fixed value for this controller. (∗ Do not change the setting)	-
Option 1	Option 1	Fixed value	This is the fixed value for this controller. (∗ Do not change the setting)	○
Undefine No. 11	Undefine No. 11	Fixed value	This is the fixed value for this controller. (∗ Do not change the setting)	○
Undefine No. 12	Undefine No. 12	Fixed value	This is the fixed value for this controller. (∗ Do not change the setting)	-

∗1 The range varies depending on the actuator. Please refer to the manual of the actuator for more details.

10.3 Return to origin parameter

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

Details of Return to origin parameter

Activation: "■" = Effective as soon as it is recorded into the controller
"O" = Become effective after restarting the controller
"-" = The parameter cannot be changed (fixed value)

Description		Range	Explanation	Write
Controller configuration software	Teaching box			
ORIG direction	ORIG direction	1 to 2	Sets the direction of return to origin operation. 1. CW 2. CCW	○
ORIG mode	Return to origin mode	1 to 2	The setting for the return to origin operation. 1. Pushing origin operation [Stop] 2. Limit switch origin [Sensor]	■
ORIG limit	ORIG limit	(∗1)	A pushing force level at which to set the origin.	■
ORIG time	ORIG time	Fixed value	This is the fixed value for this controller. (∗ Do not change the setting)	-
ORIG speed	ORIG speed	(∗1)	The allowable speed to move to origin.	■
ORIG ACC/DEC	ORIG ACC	(∗1)	The acceleration and deceleration during finding origin.	■
Creep speed	Creep speed	Fixed value	This is the fixed value for this controller. (∗ Do not change the setting)	-
ORIG sensor	ORIG sensor	0 to 2	The setting for ORIG sensor. 0. The origin sensor is not effective. [Disable] 1. The origin sensor is N.O type. [N.O]. 2. The origin sensor is N.C type. [N.C.]	■
Did not detect sensor when returning to ORIG.	Origin switch direction	Fixed value	This is the fixed value for this controller. (∗ Do not change the setting)	-
Undefine No. 21	Undefine No. 21	Fixed value	This is the fixed value for this controller. (∗ Do not change the setting)	-

∗1 The range varies depending on the actuator. Please refer to the manual of the actuator for more details.

11. Operations

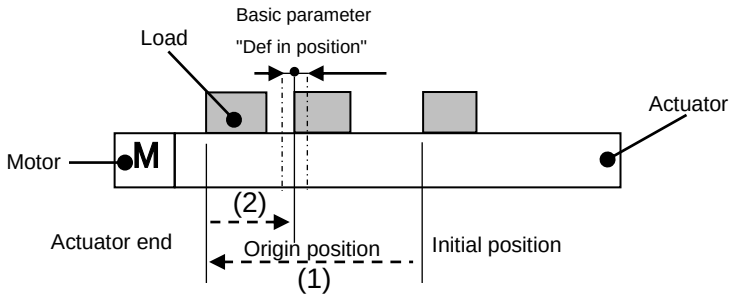
11.1 Return to Origin

After entering the setting data, it is necessary to perform a return to origin operation (to establish the origin point) before starting the positioning or pushing operation. (To ensure the position of origin)

■Return to origin
The actuator moves in the return to origin direction (∗ this direction is 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: Refer to (2) in the figure below.
The position after the travel becomes the origin.

Return to Origin position command → Travels in the set Origin position direction → Stops traveling → Reverse travel → Sets the Origin position

E.g.) Return to Origin position reference example



⚠Caution

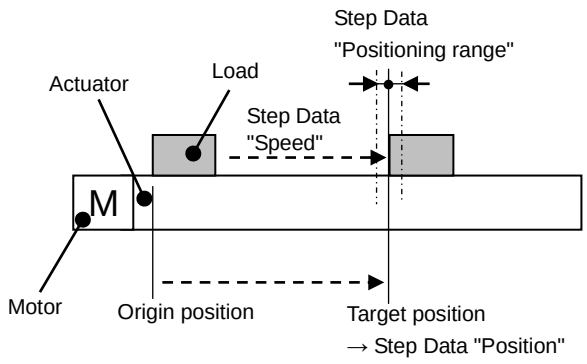
This direction is dependent on the actuator.

11.2 Positioning Operation

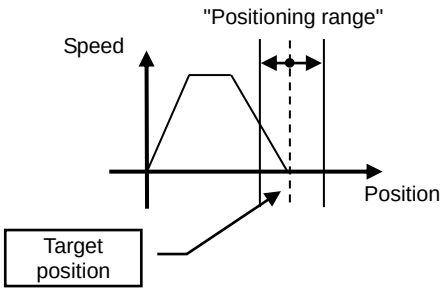
Step data "Pushing force" is set to 0.

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

•(E.g.) Positioning Operation



•(E.g.) Positioning operation [Speed/Position]



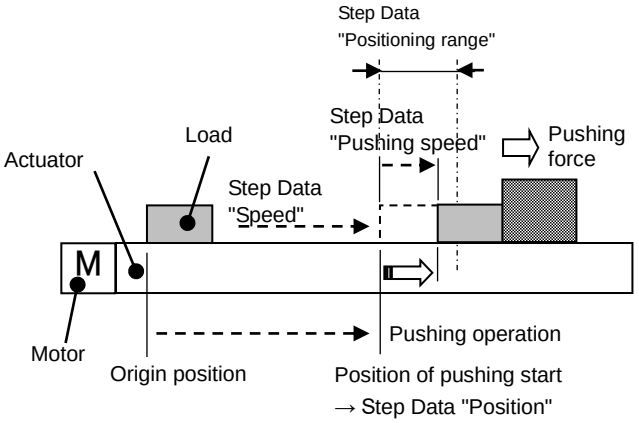
11.3 Pushing Operation

The pushing operation is active when the value of the "Pushing F%" in the Step data is set to "1" or more. Similar to the positioning operation, the actuator moves according to the settings of "Position" and "Speed" in the step data and then, when it reaches the target position, it starts the pushing process. The actuator pushes the load with a force no more than the maximum force set in the "Pushing force" of the step data.

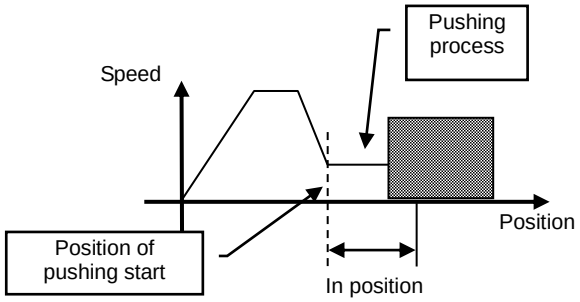
(1) Pushing operation is successfully performed.

During the pushing operation, if the pushing force is kept higher than the value specified by "Trigger LV" of the step data for a certain time, “INP” will turn ON. Even after the completion of the pushing operation, the actuator will keep generating the force set in the step data.

•(eg.) Pushing operation

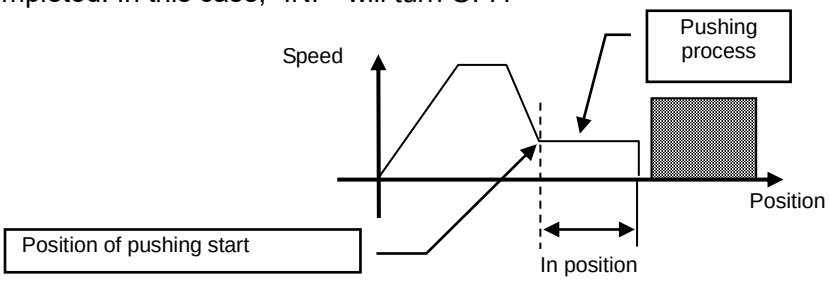


•(eg.) Pushing operation [Speed/Position]



(2) Pushing operation fails (empty pushing).

If the pushing process is not completed even after the actuator runs over the range specified in the step data from the target position (the starting point of the pushing process), the operation will be completed. In this case, “INP” will turn OFF.



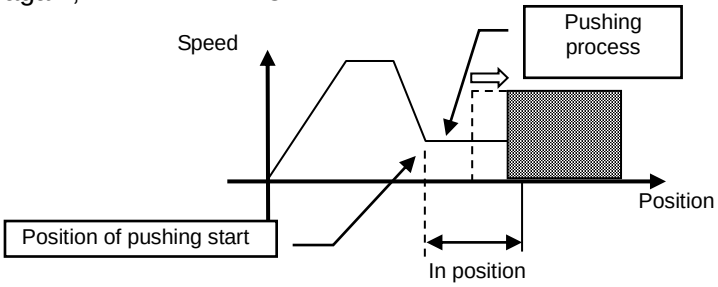
(3) Movement of the workpiece after the completion of the pushing process

[1] The workpiece moves in the pushing direction.

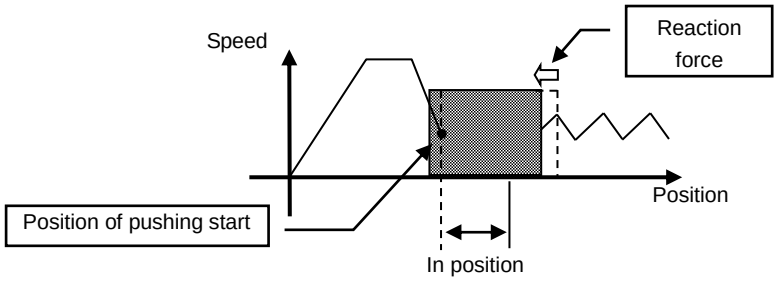
After completion of the pushing operation, if the reaction force from the workpiece becomes smaller, the actuator may move with a force smaller than that specified in the "Trigger LV" of the step data.

In this case, “INP” will turn OFF and the actuator moves within the positioning range according to the balance of the force.

If the pushing force is kept higher than the value specified by "Trigger LV" of the step data for a certain time again, “INP” will turn ON.



[2] 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 completion of the pushing operation, if the reaction force from the workpiece becomes larger, the actuator may be pushed back. In this case, while “INP” remains 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).
If the actuator is pushed back over the target position, the alarm (ORIG ALM) will be activated.



11.4 Controller signal response time

The controller signal response delay include the following factors.

(1) Controller signal scan delay

(2) Delay due to signal analysis

(3) Delay of command analysis

Set the time more than twice the communication cycle time for the interval between the signals, when the signals are continuously input, as PLC processing delays and controller scanning delays can occur.

11.5 Methods of interrupting operation

There are 3 methods of interrupting operation and stopping the actuator during positioning operation and pushing operation, as shown below. The state after the interruption is different, therefore use the method appropriate to the application.

•Stopping by “EMG” signal

If the “EMG” signal is turned OFF during operation, after the actuator decelerates and stops, the servo will turn OFF, and the stopped position is not held.
(For an actuator with lock, it will be held by the lock function).

•Stopping by “RESET” signal

If the “RESET” signal is turned ON during operation, after the actuator decelerates and stops, the stopped position is held.
(The servo does not turn OFF).

•Stopped by “HOLD” signal

The actuator decelerates to stop when the “HOLD” signal is ON during operation.
(The servo does not turn OFF).

⚠ Caution
If instructed to stop by the “EMG” or “RESET” signal, all “OUT” signals will turn OFF.

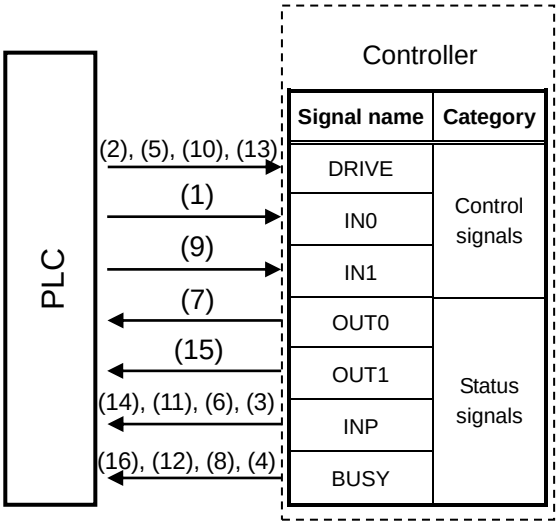
12. Operation Examples

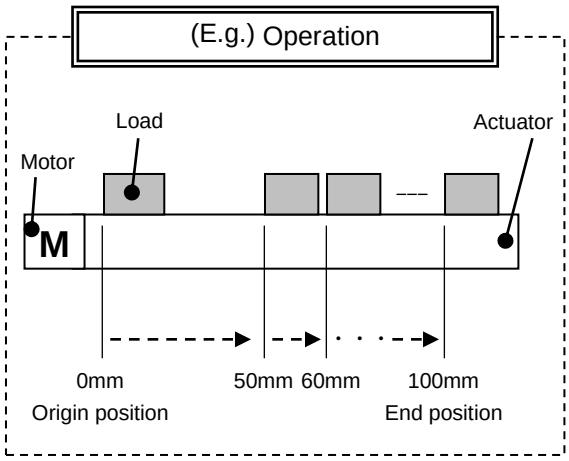
12.1 Positioning Operation

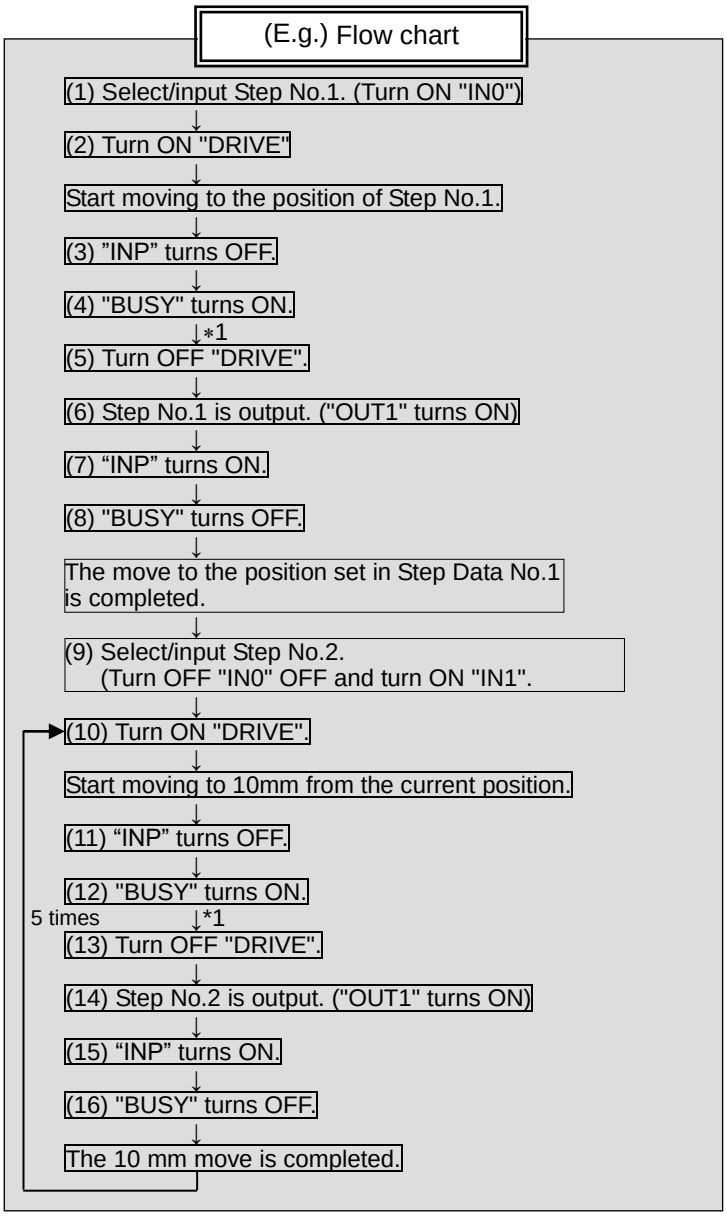
E.g.) Move an actuator from the origin to 100mm point at 50mm/s. (Step No.1 instruction)
Next, move the actuator from the 50mm point to 100mm point by moving it 5 times continuously, 10mm at a time, at a speed of 50mm/s. (Step No. 2)

■[Normal mode] Step data (e.g.)

No.	Movement mode	Speed mm/s	Position (mm)	Acceleration mm/s²	Deceleration mm/s²	Pushing force %	Threshold Force Value %	Pushing speed Speed mm/s	Moving force %	Area 1 (mm)	Area 2 (mm)	In pos (mm)
0	-	-	-	-	-	-	-	-	-	-	-	-
1	Absolute	100	50.00	1000	1000	0	0	0	100	0	0	0, 1
2	Relative	50	10.00	1000	1000	0	0	0	100	0	0	0, 1







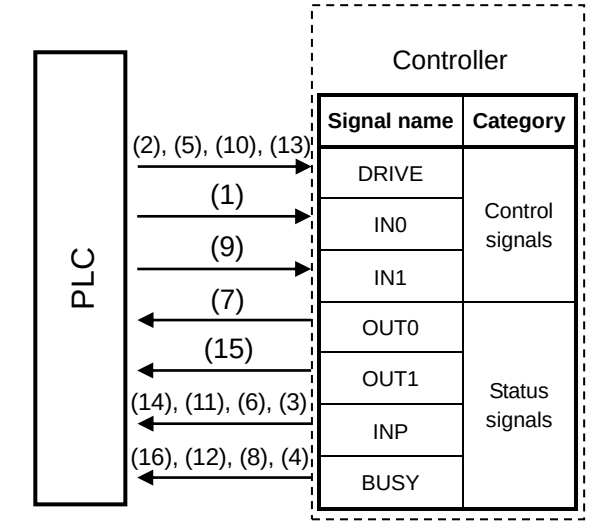
*1 "SVRE" and "SETON" must be ON.

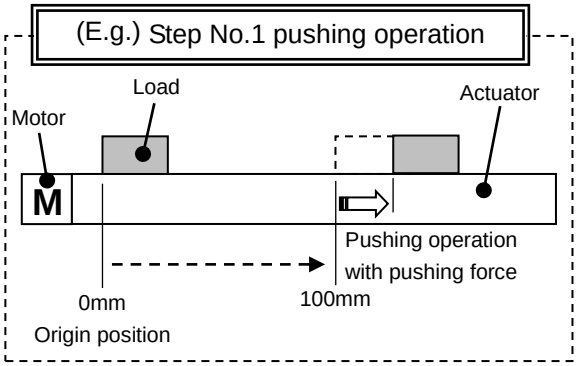
12.2 Pushing Operation

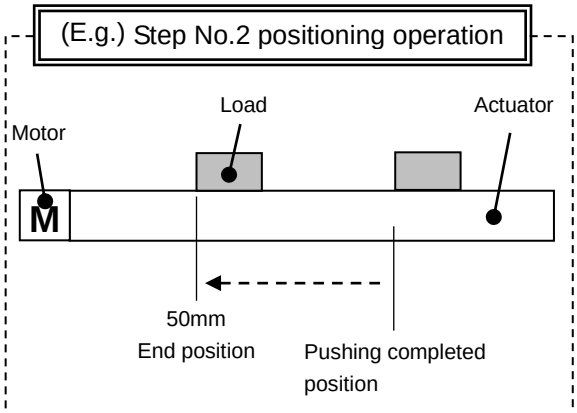
Eg.) Move the actuator from the origin to a point 100 mm away at 100 mm/s. (Step Data No.1 is used for this operation).
From the 100 mm point, the actuator must start a pushing operation of 10 mm/s speed and 50% or less force.
(the pushing distance is up to 5 mm).
Then, the actuator should move from the position where the pushing operation was completed (where "INP" turned ON) to a point 50 mm away at 50 mm/s.
(Step Data No.2 is used for this operation).

■[Normal mode] Step data example

No.	Movement mode	Speed mm/s	Position (mm)	Acceleration mm/s²	Deceleration mm/s²	Pushing force %	Threshold Force Value %	Pushing speed mm/s	Moving force %	Area 1 (mm)	Area 2 (mm)	In pos (mm)
0	-	-	-	-	-	-	-	-	-	-	-	-
1	Absolute	100	100.00	1000	1000	50	40	10	100	0	0	5
2	Absolute	50	50.00	1000	1000	0	0	0	100	0	0	0, 1







(E.g.) Flow chart

(1) Select Step No.1. (Turn ON "IN0")
↓
(2) Turn ON "DRIVE".
↓
Start moving to the position of Step No.1.
↓
(3) "INP" turns OFF.
↓
(4) "BUSY" turns ON.
↓
(5) Turn OFF "DRIVE".
↓
(6) Step No.1 is output. ("OUT1" turns ON)
↓
Move at low speed after passing the "Position" of the Step No.1.
↓
Push the workpiece with the specified pushing force.
↓
(7) "INP" turns ON.
↓
(8) "BUSY" turns OFF.
↓
The move to the position set in Step No.1 is completed.
↓
(9) Select Step No.2.
(Turn OFF "IN0" and turn ON "IN1".)
↓
(10) Turn ON "DRIVE".
↓
Start moving to the position of Step No.2.
↓
(11) "INP" turns OFF.
↓
(12) "BUSY" turns ON.
↓*1
(13) Turn OFF "DRIVE".
↓
(14) Step No.1 is output. ("OUT1" turns ON)
↓
(15) "INP" turns ON.
↓
(16) "BUSY" turns OFF.
↓
The move to the position set in Step No. 2 is completed.

*1 "SVRE" and "SETON" must be ON.

13. Operation Instructions

13.1 Overview of the Operation Instructions

Shows operation instruction method of each function shown in **8. Operation methods (P.27)**.

13.2 Operation procedure for Operation by Step No.

Refer to the following "Procedures" and "Timing charts" for details of the Return to Origin, operation mode procedures and the signal timing. Refer to **9.1 Memory allocation (P.28)** for the memory allocation of signals.

[1] Power on and Return to Origin position

- Procedure -

(1) Turn the power supply ON.

(2) Turn ON “SVON”.

(3) "SVRE" turns ON.
- ∗ The time when “SVRE” turns ON depends on the type of actuator and the customers application.
- ∗ The actuator with lock is unlocked.

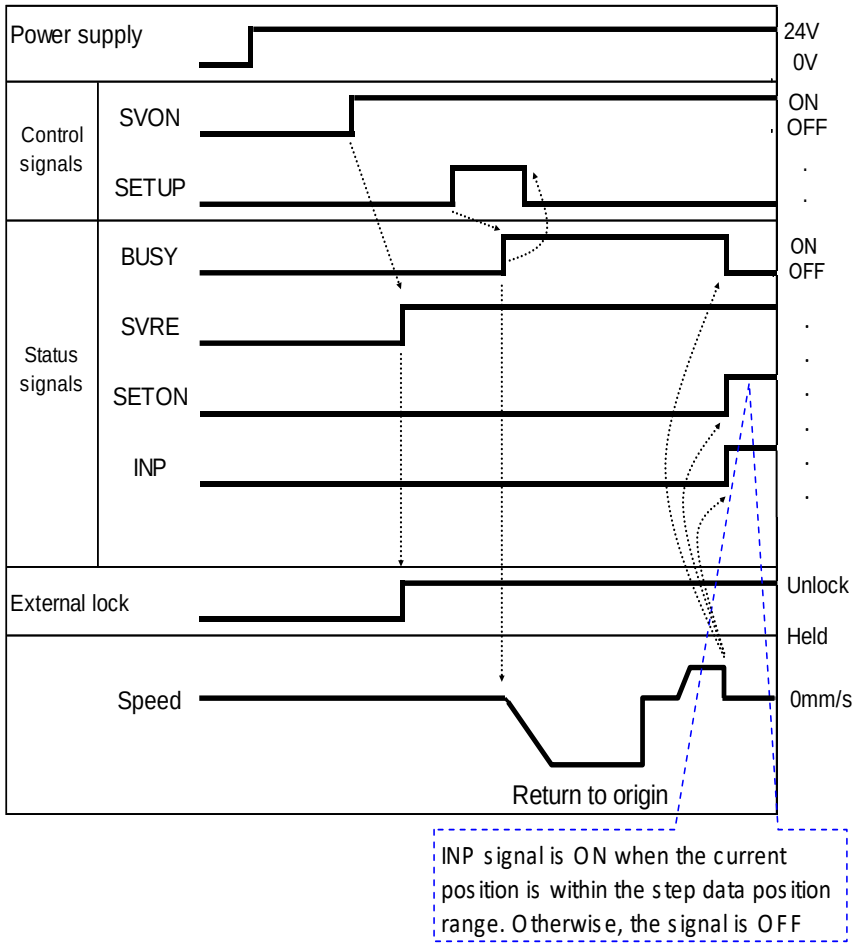
(4) Turn ON "SETUP".

(5) "BUSY" turns ON.
(The actuator starts the operation.)
After "BUSY" turns ON, "SETUP" will turn OFF.

(6) "SETON" and "INP" will turn ON.
Return to origin is completed when "INP" turns ON.

- Timing chart -

Timing chart/Return to origin



[2] Positioning operation

- Procedure -

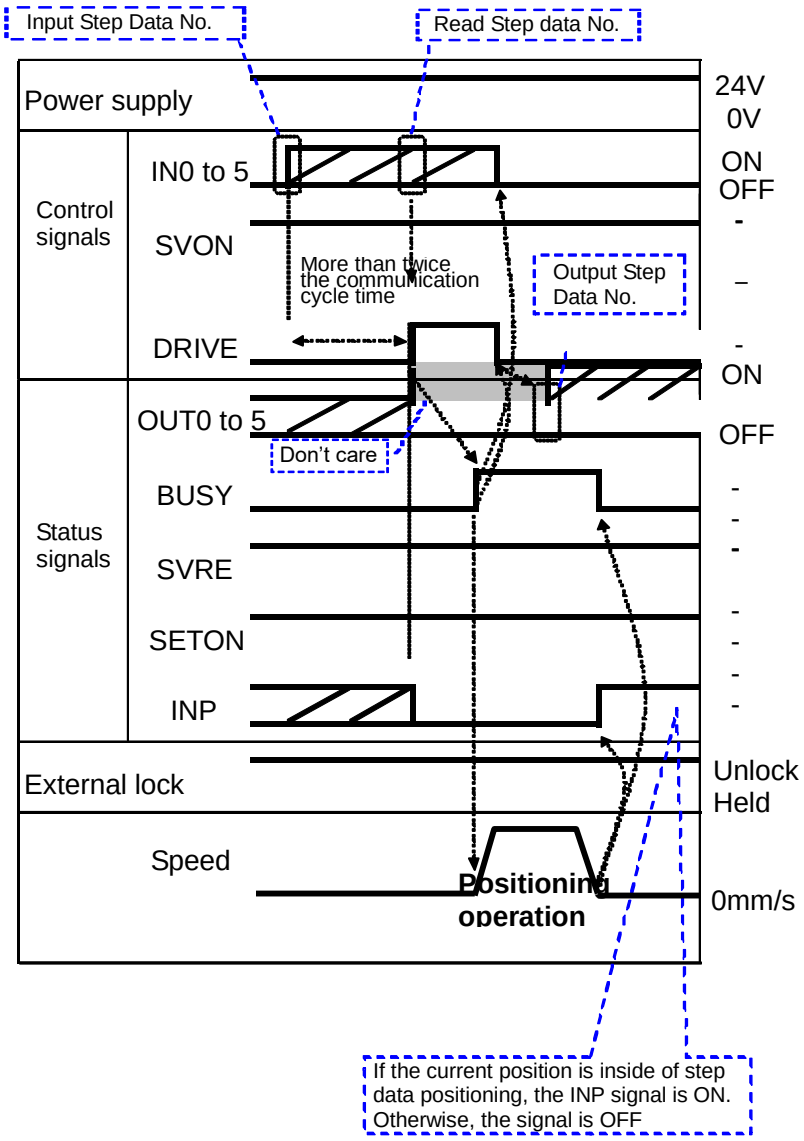
(1) Input step data No. (“IN0” to “IN5”)

(2) Turn ON the "DRIVE".
(“INP” turns OFF.)
Scan the specified step data number (from "IN0" to "IN5").

(3) "BUSY" turns ON.
(and the positioning movement starts.)
∗ After "BUSY" turns ON, if "DRIVE" is turned OFF, the step data number will be output (from "OUT0" to "OUT5").

(4) When "INP" turns ON and "BUSY" turns OFF, the positioning operation will be completed.

- Timing chart -



[3] Pushing Operation

- Procedure -

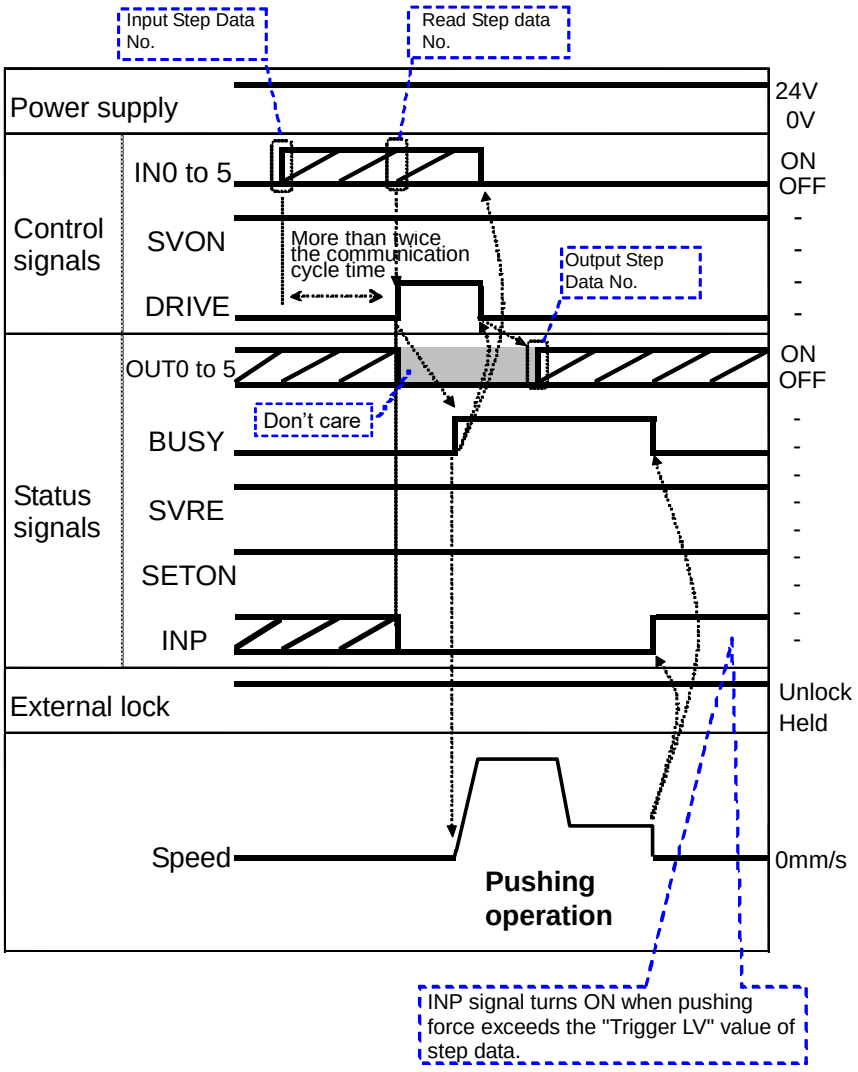
(1) Input step data No.
(“IN0” to “IN5”)

(2) Turn ON the "DRIVE".
(“INP” turns OFF.)
→Scan the step data number (from “IN0” to “IN5”).

(3) "BUSY" is ON when pushing starts.
∗ After "BUSY" turns ON, if "DRIVE" is turned OFF, the step data number will be output (from "OUT0" to "OUT5").

4) When "INP" turns ON and "BUSY" turns OFF, the pushing operation will be completed (the actuator generates the force larger than that specified in "Trigger LV" of the step data).

- Timing chart -



[4] HOLD

- Procedure -

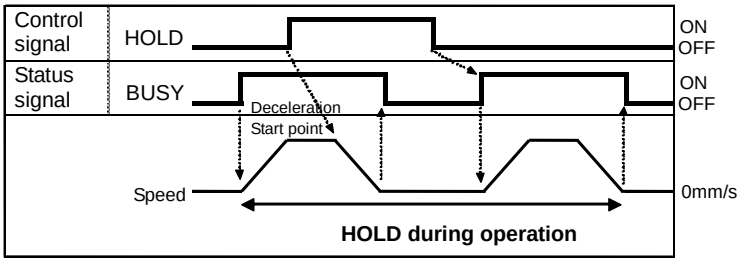
(1) During operation ("BUSY" is ON), turn ON "HOLD".

(2) "BUSY" turns OFF.
(The actuator stops.)

(3) Turn OFF "HOLD".

(4) "BUSY" turns ON.
(The actuator restarts.)

- Timing chart -



[5] Reset

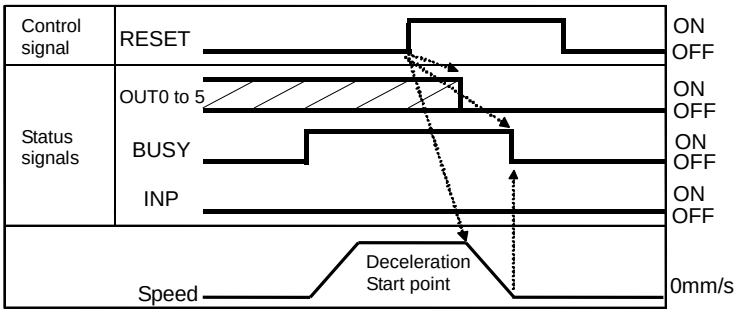
-Procedure- [Driving reset]

(1) During operation ("BUSY" is ON), "RESET" is turned ON.

(2) “BUSY” and “OUT0” to “OUT5” are OFF.

(3) The actuator decelerates to stop (controlled).

- Timing chart - Reset



∗ INP is ON when stop position is within the positioning range.

-Procedure- [Alarm Reset]

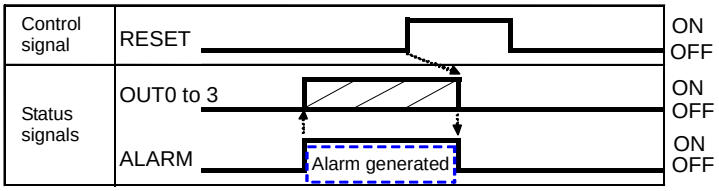
(1) Alarm generated
“ALARM” turns ON.
Alarm group is output to “OUT0” to “OUT3”.

For memory to be checked and detailed, Please refer to **9. Memory map (P.28)**
15.1 Alarm group signals (P.58)
15.3 Alarms and countermeasures (P.59)

(2) Turn ON "RESET".

(3) "ALARM" turns OFF, “OUT0” to “OUT3” turn OFF. (The alarm is deactivated.)

- Timing chart - Alarm Reset



[6] Stop

- Procedure -

(1) During operation ("BUSY" is ON), turn OFF "EMG". (Stop command)

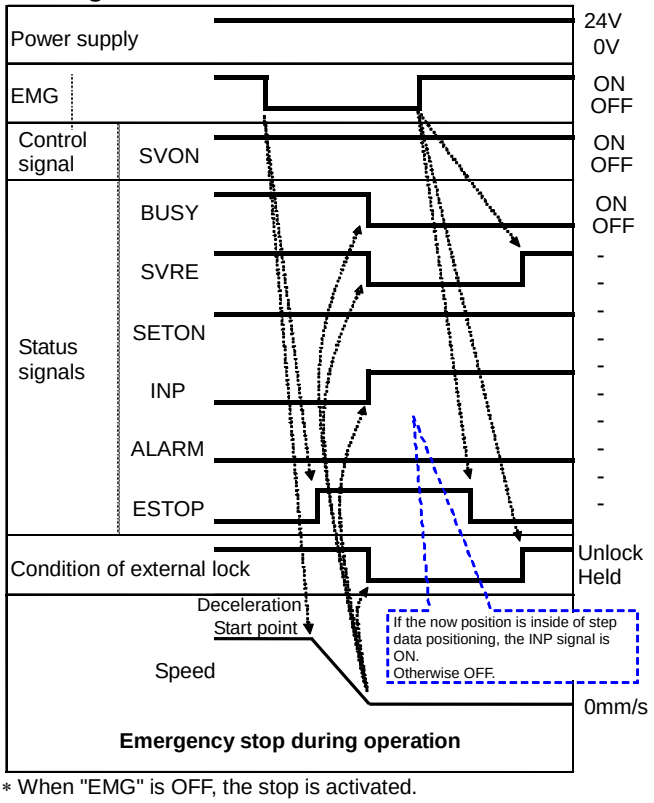
(2) "ESTOP" turns ON.

(3) "BUSY" turns OFF. (The actuator stops.)
“SVRE” turns OFF.
∗ The actuator with lock is locked.

(4) Turn ON "EMG".(The stop release command)

(5) "ESTOP" turns OFF.
"SVRE" turns ON.
∗ The actuator with lock is unlocked.

- Timing chart -



∗ When "EMG" is OFF, the stop is activated.

[7] Area output

- Procedure -

●Step data No.1 operation

(1) Input step data No.
(“IN0” to “IN5”)

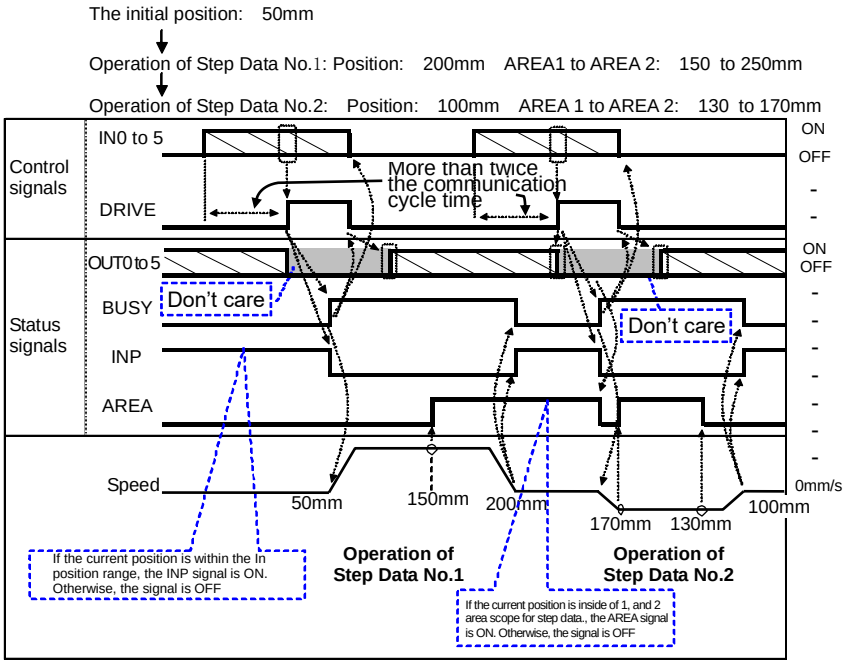
(2) Turn "DRIVE" ON.
→ Receive the step data no.1 (from “IN0” to “IN5”).

(3) "BUSY" turns ON.
(The actuator starts the operation.)
"INP" turns OFF.
∗ After "BUSY" turns OFF, if the "DRIVE" is turned OFF, the step data No.1 ("OUT0" to "OUT5") will be output.

(4) "AREA" of step data No.1 turns ON. (at 150mm from the origin point)

(5) "BUSY" turns OFF.
(The actuator stops.)
"INP" turns ON.

Timing chart



●Step data No.2 operation

(6) Input step data No. ("IN0" to "IN5")

(7) Turn ON "DRIVE".
→ Read step data No. 2 ("IN0" to "IN5")

(8) "AREA" turns OFF.
"BUSY" turns ON. (The actuator starts the operation.)
"INP" turns OFF.
∗ After "BUSY" turns OFF, if "DRIVE" turns OFF, the step data No.2 ("OUT0" to "OUT5") will be output.

(9) "AREA" of step data No.2 turns ON. (at 170mm from the origin point)

(10) "AREA" of step data No.2 turns OFF. (at 130mm from the origin point)

(11) "BUSY" turns OFF. (The actuator stops.)
"INP" turns ON.

13.3 Operation procedure for Operation by numerical instruction

E.g.) Input 50.00 [mm] to the position parameter of the specified step data and start the actuator.
For parameters other than position which are numerically specified (speed, acceleration/deceleration), the values set for the specified step data are used.
Before starting the operation by numerical instruction, make sure that the servo is on and returning to origin has completed.

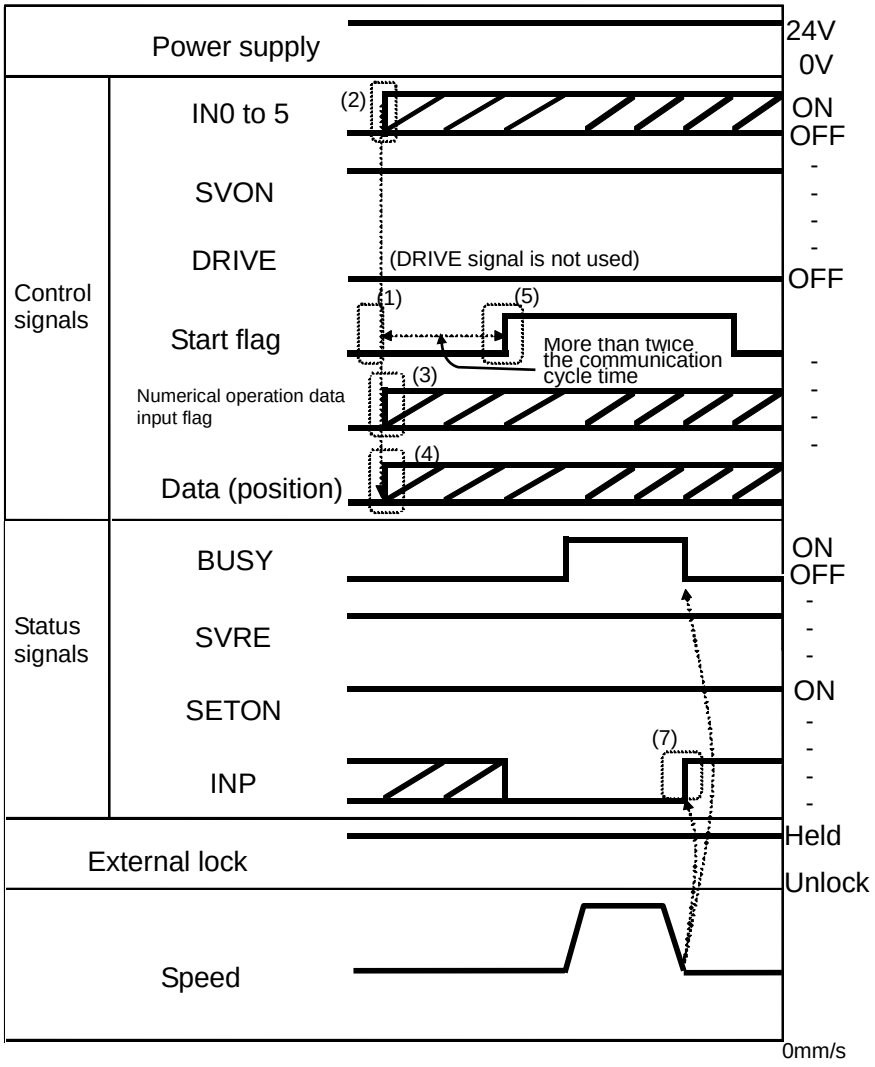
(1) Confirm that Word2, bit0: Start flag=OFF.
Input Word2, bit0: Start flag =OFF when it is ON.

(2) Input the step data No. to be specified by Word0, bit0-5:IN0-5
E.g.) Specify step data No.1
→7010h, bit0: IN0=ON,
7010h, bit1-5: IN1-5=OFF
This is the Base step No that will be used.

(3) Specify the numerical operation input flags which control the numerical operation data to be entered, by 7011h, bit4-7.
Turn ON the relevant flag which must be numerically input into the specified step data and turn OFF the relevant flag which is not required.
E.g.) Only [position] of the numerical data input flag must be specified.
→7011h, bit6=ON,
7011h, bit4-5=OFF,
7011h, bit7-15=OFF

(4) Input 7020h, bit0-1:Movement mode and
7021h-702Bh:numerical operation data.
E.g.) Input [Position] 50.00 [mm].
5000[0.01mm]=(00001388)h
→7022h: Position=(00001388)h

Timing chart/numerically instructed operation



(5) Input the numerical operation data input flag bit and numerical operation data, and then, input 7012h, bit0: Start flag=ON.
The numerical operation data will be transmitted when the start flag is ON.

(6) When the actuator starts operating, 6010h, bit8: BUSY=ON will be output.
Then, input 7012h, bit0: Start flag=OFF.

(7) When the actuator reached the target position, 6010h, bit11: INP=ON is output.
(Refer to **"INP" section (P.29)** for signal ON conditions)
When the actuator stops, 6010h, bit8: BUSY=OFF will be output.
The completion of the actuator operation is validated when both 6010h, bit11: INP=ON and 6010h, bit8: BUSY=OFF are established.

14. Options

14.1 Actuator cable [5m or shorter]

LE-CP- □ - □

Cable length (L)

1	1.5m
3	3m
5	5m

Actuator cable type

Nil	Robotic type cable
S	Standard cable

(1)

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

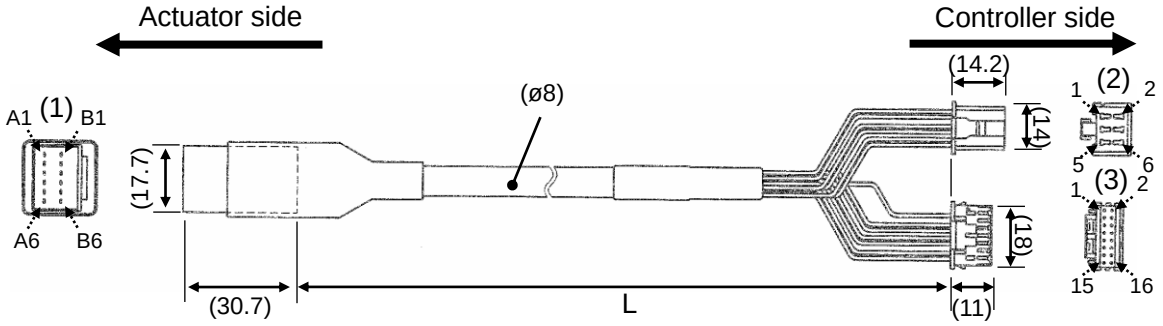
(2)

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

(3)

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

Shield



14.2 Actuator cable [8 to 20m]

LE-CP- □

Cable length (L)

8	8m ∗
A	10m ∗
B	15m ∗
C	20m ∗

Produced upon receipt of order

∗ Only "Robotic type cable" can be selected.

(1)

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

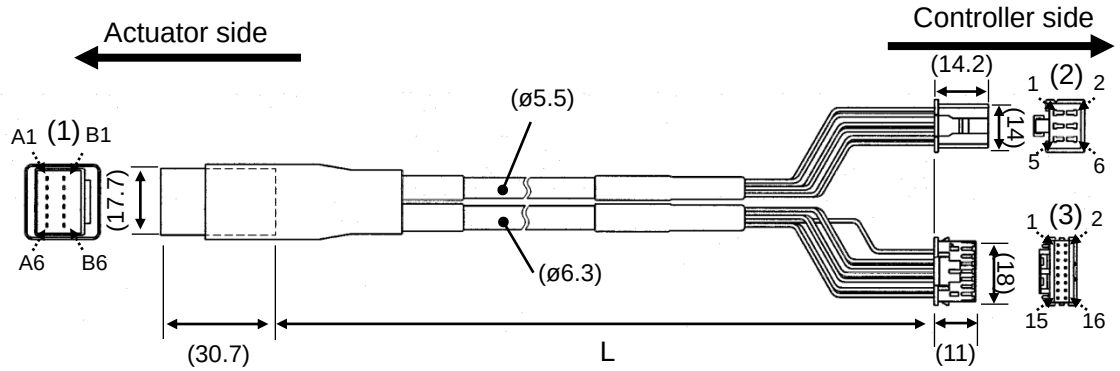
(2)

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

(3)

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

Shield



SMC

No.JXC※-OMU0008-D

14.3 Actuator cable for with lock [5m or less]

LE-CP- □ - B- □

Cable length (L)

1	1.5m
3	3m
5	5m

Actuator cable type

Nil	Robotic type cable
S	Standard cable

(1)

Signal name	Terminal No.
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

(2)

Cable color	Terminal No.
Brown	2
Red	1
Orange	6
Yellow	5
Green	3
Blue	4

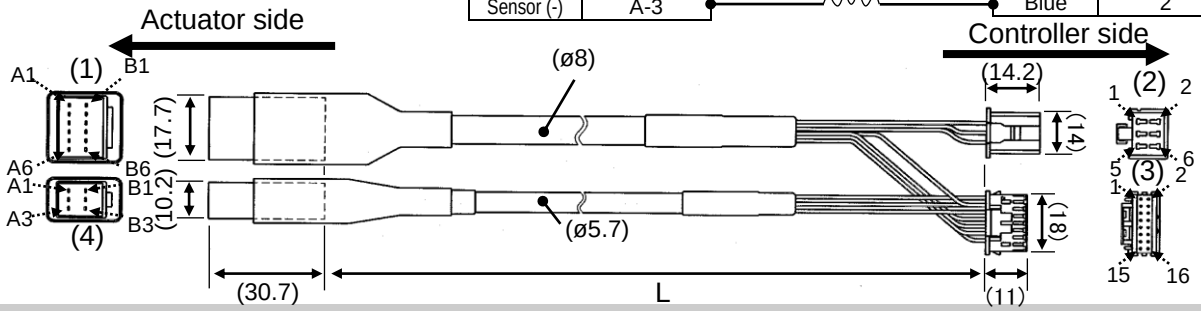
Shield

(3)

Cable color	Terminal No.
Brown	12
Black	13
Red	7
Black	6*
Orange	9
Black	8
-	3

(4)

Signal name	Terminal No.	Cable color	Terminal No.
Lock (+)	B-1	Red	4
Lock (-)	A-1	Black	5
Sensor (+)	B-3	Brown	1
Sensor (-)	A-3	Blue	2



14.4 Actuator cable for with lock [8 to 20m]

LE-CP- □ - B

Cable length (L)

8	8m *
A	10m *
B	15m *
C	20m *

* Produced upon receipt of order

*Only "Robotic type cable" can be selected.

(1)

Signal name	Terminal No.
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

(2)

Cable color	Terminal No.
Brown	2
Red	1
Orange	6
Yellow	5
Green	3
Blue	4

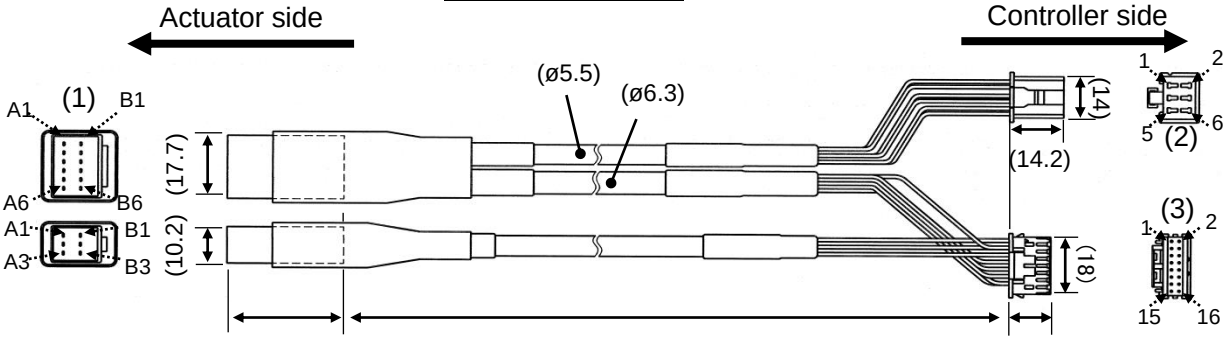
Shield

(3)

Cable color	Terminal No.
Brown	12
Black	13
Red	7
Black	6
Orange	9
Black	8
-	3

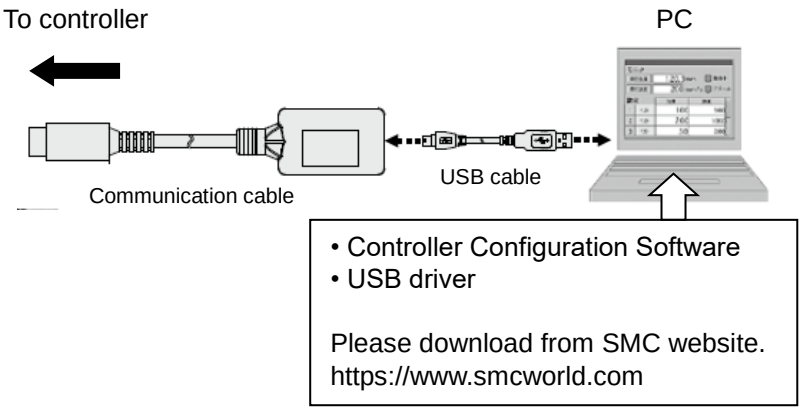
(4)

Signal name	Terminal No.	Cable color	Terminal No.
Lock (+)	B-1	Red	4
Lock (-)	A-1	Black	5
Sensor (+)	B-3	Brown	1
Sensor (-)	A-3	Blue	2



SMC

14.5 Controller Communication Cable



JXC－W2A－C

Communication cable

LEC－W2－U

USB cable

Operating environment

OS	Window®7,Windows®8.1,Windows®10
Communication interface	USB1.1 or USB2.0 port
Display	1024×768 or more

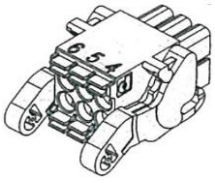
Windows®7, Windows®8.1, and Windows®10 are registered trademarks of United States Microsoft Corporation.

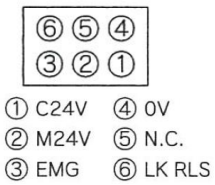
⚠Caution

The latest version of the controller setting software must be used.
Upgrade software can be downloaded from SMC website. http://www.smcworld.com/

14.6 Power supply plug

JXC-CPW





Detail of Power supply plug

No.	Terminal	Function	Functional explanation
1	C24V	Power supply (+)	The positive control power.
2	M24V	Motor power (+)	The positive power for the actuator motor to be supplied via the controller.
3	EMG	Stop (+)	The positive power for Stop signal
4	0V	Common power (-)	The negative common power for M24V, C24V, EMG and LK RLS.
5	-	NC	
6	LK RLS	Unlocking (+)	The positive power for lock release.

14.7 Teaching box



LEC- T1 - 3 □ G □

Teaching box

Cable length

3	3m

Original language

E	English
J	Japanese

Enable switch

Nil	No enable switch
S	Equipped with enable switch

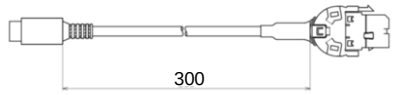
Stop switch

G	With Stop switch

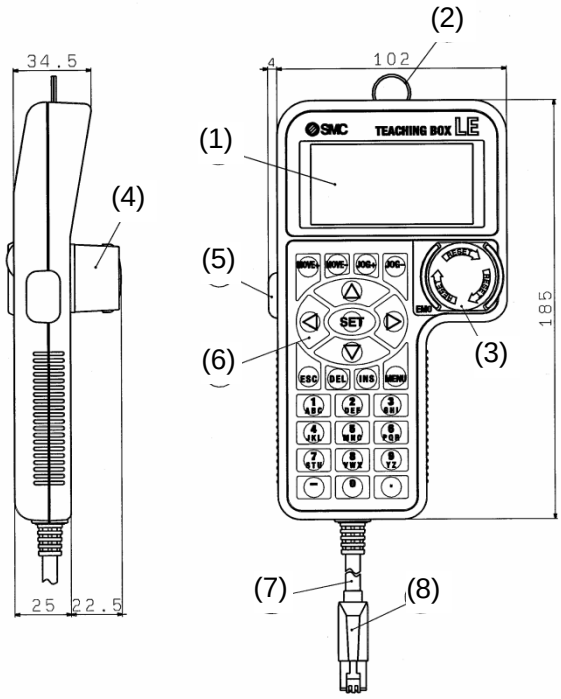
Conversion Cable

P5062-5 (Cable length: 0.3m)

∗This cable is necessary only when connecting the teaching box to the JXC controller



Dimensions



No	Indication	Function
(1)	LCD	Liquid crystal display (with backlight)
(2)	Ring	The ring to hang the teaching box.
(3)	Stop switch	When the switch is pressed, the switch locks and it stops. Turn clockwise to release the lock.
(4)	Stop guard	Protector for the stop switch
(5)	Enable switch (Option)	Switch to prevent unintentional operation of Jog test function. ∗ Does not apply to other functions e.g. data change
(6)	Key switch	Entry switches
(7)	Cable	3m length
(8)	Connector	The connector to be connected to the CN4 of the controller

15. Alarm for Motor Control

The details of the alarm for motor control can be checked using a PC (the controller setting software) or the teaching box.

∗ Please refer to the manuals of the controller setting software or the teaching box for details of the alarms.

When an alarm is generated, deactivate the alarm after troubleshooting and correcting the error with reference to chapter **"15.3 Alarms and countermeasures" (P.59)**.

Alarms are divided into two types. One is an alarm group B to D which can be cleared by turning ON “RESET”. The other is group E which cannot be cleared unless the power supply control (24 VDC) is turned OFF once.

15.1 Alarm group signals

This product outputs a signal to establish which type of alarm has been generated.

Alarms are classified into 5 groups. When an alarm is generated, it is output using “OUT0” to “OUT3”.

The table below shows the combination of alarm groups and remote IO signal output (“OUT0” to “OUT3”).

Alarm group	Signal				
	ALARM	OUT0	OUT1	OUT2	OUT3
Alarm group B	ON	OFF	ON	OFF	OFF
Alarm group C	ON	OFF	OFF	ON	OFF
Alarm group D	ON	OFF	OFF	OFF	ON
Alarm group E	ON	OFF	OFF	OFF	OFF

After generation of the alarm, SVRE or SETON are output according to the contents of the alarm as shown below.

Alarm group	Signal		How to restart
	SVRE	SETON	
Alarm group B	No change	No change	Turn ON “RESET”
Alarm group C	No change	No change	Turn ON “RESET”
Alarm group D	OFF	No change	Turn ON “RESET”, then turn ON “SVON”.
Alarm group E	OFF	OFF	Power supply for control is turned OFF → Supply power again

- Procedure to restart operation when alarm group D is generated -

Procedure 1: Alarm group D is generated → "SVRE" changes to OFF (Servo is OFF)

Procedure 2: Turn ON RESET → (The alarm is cancelled)

→ After turning ON “SVON”, “SVRE” turns ON (Servo is ON).

15.2 Alarms and countermeasures

Controller setting software (code) ∗1	Teaching box	Group	How to deactivate	Alarm contents/Countermeasure
Drive data value is wrong (01-048)	Step data ALM1	B	RESET	<Condition>The step data is incorrect for the following conditions (Settable range) (1) Area1 <Area2 (If both Area1 and Area2 is 0, the alarm will not be activated.) (2) Trigger LV ≤ Pushing force (3) Minimum speed of actuator ≤ Pushing speed ≤ Speed (4) Pushing speed ≤ Maximum pushing speed of actuator (5) Pushing force ≤ Minimum pushing force of actuator (6) Basic parameter "Maximum pushing force" ≥Minimum pushing force of the actuator (7) Basic parameters "Max pushing force" ≥ Threshold <Countermeasure> Modify the step data and basic parameters setting **⚠Caution** Please refer to the manual or the catalogue of the actuator for the max/min pushing force/speed for the actuator.
Parameter value is wrong (01-049)	Parame ter ALM	B	RESET	<Contents> The basic parameter is not correct for the following condition: (Settable range) (1) Stroke(-) < Stroke (+) (2) W-Area 1 < W-Area 2 (∗ If both W-Area1 and W-Area2 is 0, the alarm will not be activated.) (3) Maximum pushing force < Maximum pushing force of actuator <Countermeasure> Modify the basic parameter setting. **⚠Caution** Please refer to the manual or the catalogue of the actuator for the maximum pushing force for the actuator.
Set step data is not registered on list. (01-051)	Step data ALM2	B	RESET	<Contents> For an operation for a specific step data no., the requested number of the step data is not registered. (When operation is commanded through PLC, this alarm will be generated depending on the signal interval and the holding time of signals) < Countermeasure > (1) Make sure that the “Movement MOD” in the step data is not "Blank (Disabled)" and that numbers [1(ABS)] and [2(INC)] or input in the numerical instruction operation. (2) Set the interval time between signals to more than twice the communication cycle time, when signals are to be continuously input, because PLC processing delays and controller scanning delays can occur. Refer to **13.2[2] Positioning operation (P.49)**
Set stroke is outside the stroke limit. (01-052)	Stroke limit	B	RESET	<Contents> The actuator goes outside the stroke limit specified by the basic parameters, "Stroke (+)" and "Stroke (-)" if it performs the requested operation. (Including JOG operation after return to origin) <Countermeasure> Make sure that the basic parameters, "Stroke (+)" and "Stroke (-)" are consistent with the distance of actuator movement specified in the step data. **⚠Caution** If the operation method of step data is "relative coordinated movement", note the location where the operation starts and the distance traveled. If the location is out of the stroke range when the power is supplied, this alarm is generated. Move the table within stroke range, and supply power.

<table>
<tr><td>Alarm
_Comment
_058
(01-058)</td><td>3A</td><td>B</td><td>RESET</td><td><Content> This alarm occurs when the following parameter is outside of the settable range during the numerical instruction operation. (Settable range)
(1) Area1 < Area2
(If both Area1 and Area2 is 0, the alarm will not be activated.)
(2) Trigger LV ≤ Pushing force
(3) Minimum speed of actuator ≤ Pushing speed ≤ Speed
(4) Pushing speed ≤ Maximum pushing speed of actuator
(5) Pushing force ≤ Minimum pushing force of actuator
(6) Basic parameter "Maximum pushing force" ≥Minimum pushing force of the actuator
(7) Basic parameters "Max pushing force" ≥ Switch point

<Countermeasure>Modify the basic parameter setting.
⚠Caution
Please refer to the operation manual or catalog of the actuator for the maximum pushing speed, minimum pushing force, and minimum speed for the actuator.</td></tr>
<tr><td>Alarm
_Comment
_061
(01-061)</td><td>3D</td><td>B</td><td>RESET</td><td><Content> This alarm occurs when specifying step data based on the unregistered No. of the step data or when the numbers of the Movement MOD specify outside of range during numerical instruction operation. (When operation is commanded through PLC, this alarm will be generated depending on the signal interval and the holding time of signals)

<Countermeasures>
(1) Make sure that the “Movement MOD” in the step data is not "Blank (Disabled)" and that numbers [1(ABS)] or [2(INC)] are input in the numerical instruction operation.
(2) Set the interval time between signals to more than twice the communication cycle time, when signals are to be continuously input, because PLC processing delays and controller scanning delays can occur.
<u>Refer to 13.2[2] Positioning (P.49)</u></td></tr>
<tr><td>Alarm
_Comment
_062
(01-062)</td><td>3E</td><td>B</td><td>RESET</td><td><Content> The actuator goes outside the stroke limit specified by the basic parameters, "Stroke (+)" and "Stroke (-)" if it performs the requested operation during numerical instruction operation.

<Countermeasure> Make sure the basic parameters, "Stroke (+)" and "Stroke (-)" are consistent with the distance of actuator movement specified in the step data.
⚠Caution
If the operation method of step data is “relative coordinated movement”, note the location where the operation starts and the distance traveled.
If the location is out of the stroke range when the power is supplied, this alarm is generated. Move the table within stroke range, and supply power.</td></tr>
<tr><td>Reacting force is outside limit when pushing. Position is unstable.
(01-096)</td><td>Pushing ALM</td><td>C</td><td>RESET</td><td><Contents> In the pushing operation, the actuator is pushed back from the pushing operation origin position.

<Countermeasure> Increase the distance from the pushing operation origin position to the object being pushed. Or, increase the pushing force.</td></tr>
</table>

<table>
<tr><td>Return to ORIG did not complete in the set time.
(01-097)</td><td>ORIG ALM</td><td>C</td><td>RESET</td><td><Contents> Return to origin is not completed within the set time.
<Countermeasure> Make sure there are no obstructions that interfere with the actuator movement.</td></tr>
<tr><td>Drive is ON when SVRE is OFF
(01-098)</td><td>Servo OFF ALM</td><td>C</td><td>RESET</td><td><Contents> While the servo motor is OFF, the return to origin operation, positioning operation, pushing operation or JOG operation is requested.
<Countermeasure> Modify the setting so that those operations will be requested while the servo motor is ON (“SVRE” is ON).</td></tr>
<tr><td>Drive is ON when SETON is OFF
(01-099)</td><td>Drive ALM</td><td>C</td><td>RESET</td><td><Contents> A positioning operation or pushing operation is requested before the return to origin position is completed.
<Countermeasure> Modify the setting so that these operations will be requested after the return to origin position is completed.</td></tr>
<tr><td>Did not detect sensor when returning to ORIG.
(01-103)</td><td>ORIG Sens ALM</td><td>C</td><td>RESET</td><td><Contents> Alarm is generated when return parameter has the conditions 1, 2 shown below.
<table>
<tr><th></th><th colspan="2">Return to origin parameter setting</th></tr>
<tr><th></th><th>Return to origin mode</th><th>ORIG sensor</th></tr>
<tr><td>1</td><td>Pushing origin operation [Stop]</td><td>•Sensor N.O type [N.O]</td></tr>
<tr><td>2</td><td>Limit switch origin [Sensor]</td><td>•The origin sensor is not effective. [Disabled]
or
•Sensor N.O type [N.O]</td></tr>
</table>
∗ Alarm is generated with the conditions above when the sensor is not mounted to the actuator.
<Countermeasure> Check the sensor installation and settings of the return to origin parameter.</td></tr>
<tr><td>Speed exceeded set value
(01-144)</td><td>Over speed</td><td>D</td><td>RESET
SVON</td><td><Contents> The motor speed exceeds a specific level due to an external force, etc.
<Countermeasure> Make improvements so that the motor speed will not exceed the maximum speed of the actuator.
<table>
<tr><th>⚠ Caution</th></tr>
<tr><td>Please refer to the manual or the catalogue of the actuator for the maximum speed of the actuator.</td></tr>
</table></td></tr>
<tr><td>Motor power supply voltage is outside set range.
(01-145)</td><td>Over motorVol</td><td>D</td><td>RESET
SVON</td><td><Contents> The motor power supply voltage is out of range during [SVON].
<Countermeasure> Make sure that the voltage supplied to the motor power (M24V) of the controller is within specification.
<table>
<tr><th>⚠ Caution</th></tr>
<tr><td>If the power supply is "inrush-current control type", a voltage drop may cause an alarm during acceleration/deceleration.</td></tr>
</table>
<Contents> The alarm may be caused by regenerative power depending on the method of operation of the actuator.
<Countermeasure> Make sure that the operating conditions are within the specifications.
<table>
<tr><th>⚠ Caution</th></tr>
<tr><td>Please refer to the manual or the catalogue of the actuator for the method of operation of the actuator.</td></tr>
</table></td></tr>
</table>

Controller temperature exceeded set range. (01-146)	Over Temp	D	RESET SVON	<Details> The temperature around the power element of the controller is too high. <Countermeasures> Make improvements so that the temperature around the controller is kept appropriate.
Controller supply voltage is outside set range. (01-147)	Over CrtlVol	D	RESET SVON	<Contents> The control power supply voltage within the controller is outside the set range. <Countermeasure> Make sure that the voltage supplied to the control power (C24V) of the controller is appropriate. **⚠ Caution** If a single power supply is used for both the control power and the motor power, or the power supply is "inrush-current control type", a power voltage drop may be caused due to a voltage drop during acceleration/deceleration.
Current limit is exceeded (01-148)	Over load	D	RESET SVON	<Contents> The output current accumulated value exceeds the specified value. <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 actuator.
The target position was not reached within the set time limit (01-149)	Posn failed ALM	D	RESET SVON	<Content> Failed to reach the set position within the set time limit. <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 actuator.
Communication error. (01-150)	Ctrl Comm ALM	D	RESET SVON	<Contents> The connection with the higher-level devices (such as the PC and teaching box) is disconnected. <Contents> The connection with the higher-level devices (such as the PC and teaching box) is disconnected. In case of the communication failure of PC or teaching box, resetting of alarm by PC or teaching box is possible after connecting again.
Encoder error (01-192)	Encoder ALM	E	Turn OFF and ON the power supply for the controller	<Contents> Abnormality in communication with the encoder. <Countermeasure> Check the connection of the actuator cable.
Unable to find motor phase in set time. (01-193)	Polarity not found	E	Turn OFF and ON the power supply for the controller	<Contents> Unable to find the motor phase within the set time. (When the servo motor is turned ON (“SVON” turns ON) for the first time after the power is applied, the actuator needs to move a little to find the motor phase. However, if this actuator movement is prevented, this alarm will be activated.) <Countermeasure> Make sure there are no obstructions that interfere with the actuator movement and then turn ON the servo motor (“SVON” turns ON).

Output current limit is exceeded set value (01-194)	Over current	E	Turn OFF and ON the power supply for the controller	<Contents> The output current of the power circuit is abnormally high. <Countermeasure> Make sure that there are no short circuits of actuator cables, connectors, etc. In addition, make sure that the actuator is compatible with the controller.
I sens ALM (1-195)	I sens ALM	E	Turn OFF and ON the power supply for the controller	<Contents> An abnormality is detected by the current sensor that is checked when the controller is reset. <Countermeasure> Make sure that the electric actuator conforms to the controller. When a command to turn on servo is given, check if LK RLS is energized by installing the electric actuator vertically in order to check if the motor is driven by an external force.Even after this measure, if the alarm regenerates when the power is reapplied, please contact SMC.
Error counter overflowed (01-196)	Err overflow	E	Turn OFF and ON the power supply for the controller	<Contents> An overflow of the position error counter inside of the controller has occurred. <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 actuator.
Memory Abnormality has occurred (01-197)	Memory ALM	E	Turn OFF and ON the power supply for the controller	<Contents> An error of the EEPROM has occurred. <Countermeasure> Please contact SMC. (The write limit of the EEPROM is roughly 100,000 times)
CPU error (01-198)	CPU failure	E	Turn OFF and ON the power supply for the controller	<Contents> The CPU is not operating normally. (It is possible that the CPU or surrounding circuits has failed, or the CPU is malfunctioning due to electrical noise). <Countermeasure> If the alarm cannot be deactivated even after the power is reapplied, please contact SMC.

∗1 When alarm is generated, 3-digit numbers after [-] in this table [(code)] are stored to [Alarm code] of 6030h (1-4) in the input area of the memory map. The numbers of the alarm code indicated in this table are expressed as decimal numbers.

16. Precautions for wiring and cable

⚠Warning

(1) Adjusting, mounting or wiring change should never be done before shutting OFF 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.

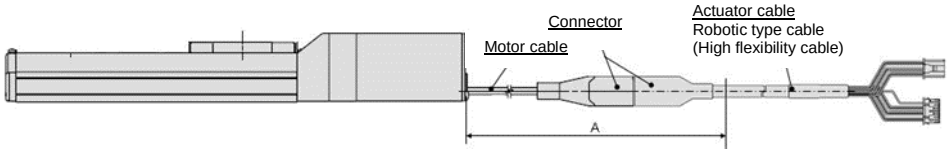
(4) Do not route wires or cables together with power or high voltage cables.
The product may malfunction due to interference and surge voltages. Route the wires of the product separately from power or high voltage cables.

(5) Take care that actuator movement does not damage cables.

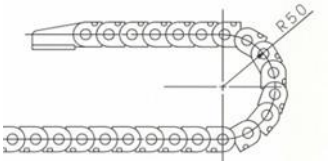
(6) Operate with cables secured. Avoid bending cables at sharp angles where they enter the product.

(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 proper 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 be reduced 10% per 5 m maximum. (If cable length is 15m, 20% reduction maximum.)

Transport

⚠Caution

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

17. Electric Actuators/Common Precautions

17.1 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) Disassembly and modification is prohibited.
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 stop signal, "EMG" of the controller and stop switch on the teaching box as the emergency stop for the system.
The stop signal, "EMG" of the controller and the stop switch on the teaching box are for decelerating and stopping the actuator. Design the system with an emergency stop circuit which is applied to the relevant safety standard separately.

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

(4) Return to origin cannot be carried out during operating.
This function cannot be carried out during positioning operation or pushing operation.

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

17.2 Mounting

⚠Warning

(1) Install and operate the product only after reading the Operation Manual carefully and understanding its contents.
Keep the manual in a safe place for future reference.

(2) Tighten threads with the proper tightening torque.
Tighten the 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 over 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.
Allow sufficient space for maintenance and inspection.

17.3. Handling Precautions

⚠Warning

(1) Do not touch the motor while in operation.
The surface temperature of the motor can increase to approx. 90ºC to 100ºC 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 with a servo motor (24VDC), the "motor phase detection step" is done by turning ON "SVON" 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) Keep the controller and actuator combination as delivered for use.
The product parameters are set before shipment. If the controller is combined with a different actuator, failure can result.

(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 are 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.

17.4 Operating environment

⚠Warning

(1) Avoid use in the following environments.

1. Locations where a large amount of dust and cutting chips are airborne.
2. Locations where the ambient temperature is outside the range of the temperature specification (refer to specifications).
3. Locations where the ambient humidity is outside the range of the humidity specification (refer to specifications).
4. Locations where corrosive gas, flammable gas, seawater, water and steam are present.
5. Locations where strong magnetic or electric fields are generated.
6. Locations where direct vibration or impact is applied to the product.
7. Areas that are dusty, or are exposed to splashes of water and oil drops.
8. Areas exposed to direct sunlight (ultraviolet rays).
9. Environment at an altitude of 1000 meters or higher Heat dissipation and withstand voltage will decrease.
   Contact your SMC representative 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) Shade the sunlight in the place where the product is applied with direct sunshine.

(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. Protect it with a cover, etc.

(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 (-10ºC to 60ºC and up to 85%. No condensation or freezing.)

(3) Do not apply vibration and impact to the product during storage.

17.5 Maintenance 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) Maintenance should be performed according to the procedure indicated in the Operating Manual.
Incorrect handling can cause 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.

[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.

17.6 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) For vertical mounting, use the product with a lock.
If the product is not equipped with a lock, the product will move and drop the work piece when the power is removed. If the actuator with lock is not used, preventive measures should be taken in the design of the equipment.

(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 drops 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” signal is OFF), supply 24VDC to the [LK RLS] 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 power supply constantly to the [LK RLS].
Only supply 24VDC power supply to the [LK RLS (Lock release)] terminal during normal operation. If power is supplied to the [LK RLS] 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).

18. Controller and Peripheral Devices/Specific Product Precautions

18.1 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) In order to prevent danger and damage due to the breakdown and the malfunction of this product, which may occur at a certain probability, a backup system should be established in advance by giving a multiple-layered structure or a fail-safe design to the equipment, etc.

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

(6) The upper limit of writing cycle to EEPROM of the JXCE1 controller is 100,000 cycles.
If the upper limit of writing cycle is exceeded, the writing will not be performed correctly.

18.2 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) Use only the specified combination of controller and electric actuator.
It may cause damage to the controller or the actuator.

(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.

18.3 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 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.

18.4 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.

18.5 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 of the "in-rush current limiting type", a voltage drop may occur 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.

18.6 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.

18.7 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.

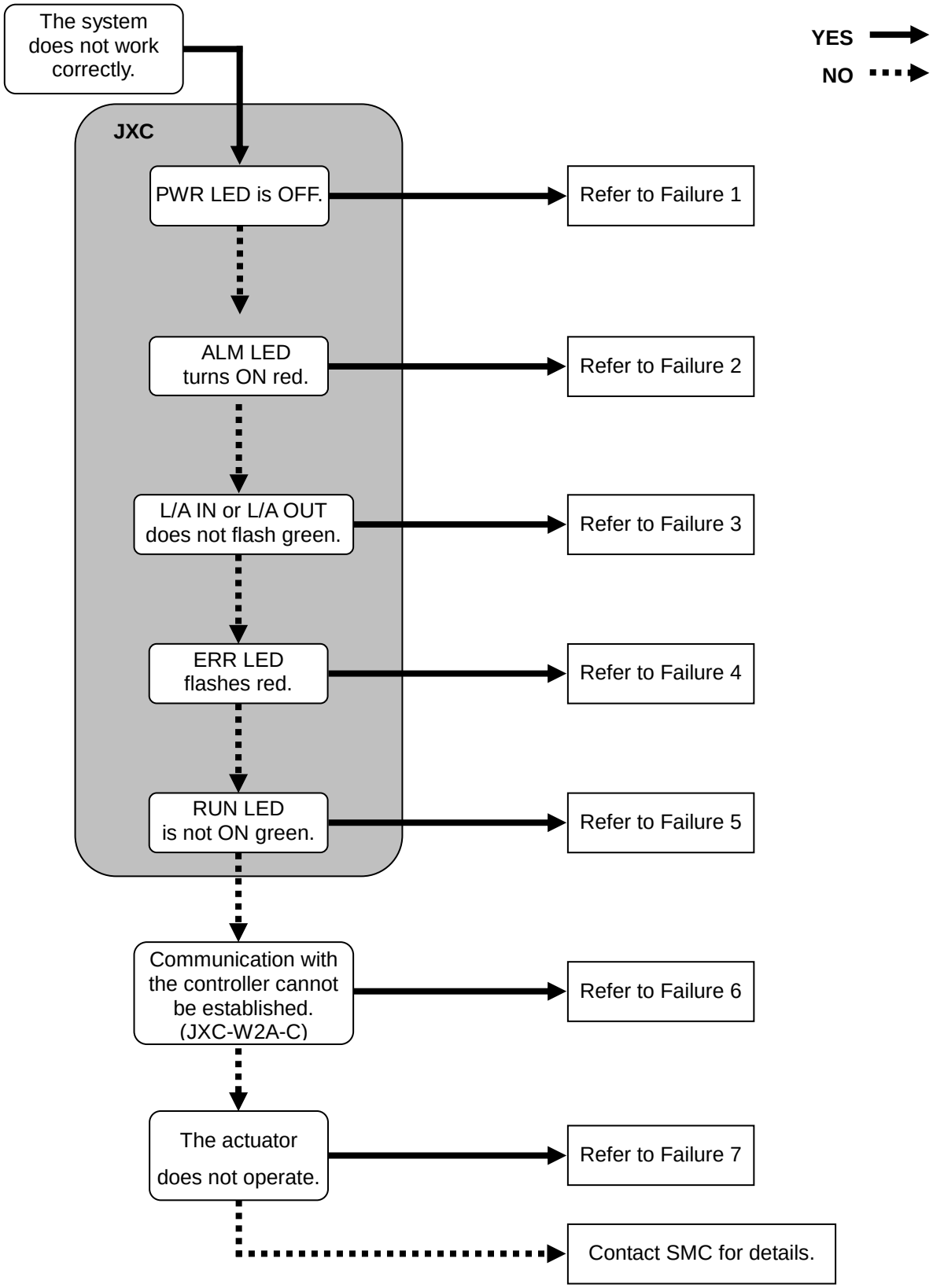
(4) Do not put anything conductive or flammable inside of the controller.
Fire or explosion can result.

(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.

19. Troubleshooting

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



Problem No.	Problem	Possible causes	Investigation method and location of possible causes	Countermeasures
1	LED is OFF.	Power fault	Check that PWR (green) of the controller turns OFF at either of when power is supplied, SVON ON is instructed or the actuator is operating.	Use an appropriate voltage and power supply capacity in reference to the operation manual of the actuator and controller connected. → **3. Specifications (P.12)** → **5. External Connections (P.19)**
		Incorrect wiring	Check the incorrect wiring, broken wire and short circuit of the power supply plug.	Please correct the wiring in reference to Controller Operation Manual. → **5. External Connections (P.19)** → **6. CN1: Power Supply Plug (P.21)**
2	ALM is on	Alarm generated	If it is, check the type of alarm referring to this manual.	Refer to the controller operation manual and take appropriate measures. → **15. Alarm for Motor Control (P.58)**
3	L/A IN and L/A OUT are OFF.	EtherCAT communication is not established.	Check the conditions of the EtherCAT device in one upper class side.	Supply power to the upper side EtherCAT device that L/A IN LED is OFF.
			Check fitting state of connectors and check disconnection of wiring.	Connect the connectors of communication cable correctly. Exchange the communication cable if disconnection has been found.
			Check whether there are noise sources near the communication line.	Keep wiring away from noise sources.
	L/A IN and L/A OUT turn ON green.	EtherCAT communication is established, but data is not received.	Check the conditions of the EtherCAT master device.	Make EtherCAT master device “RUN” state.
			Check whether theupper side EtherCAT devices L/A LED are OFF	Supply the power supplies to the upper side EtherCAT devices.
				Connect the connectors of communication cable correctly. Exchange the communication cable if disconnection has been found.
			Check whether there are noise sources near the communication line.	Keep wiring away from noise sources .
4	ERR LED is flashing in Double-flash (∗1)	Error in EtherCAT communication (Application watch dog timeout)	Check the conditions of the EtherCAT master device.	Make EtherCAT master device in “RUN” state.
			Check whether power is supplied to EtherCAT devices.	Supply power to EtherCAT devices.
			Check fitting state of connectors of communication cable and check disconnection of communication cable.	Connect the connectors of communication cable correctly. Exchange the communication cable if disconnection has been found.
	ERR LED is flashing in Single-flash(∗1)	Error in EtherCAT communication setting	Check the configuration of EtherCAT master device.	Match the configuration of the EtherCAT master device with real constitution correctly.
5	RUN LED is OFF	Initialized state	Check the conditions of the EtherCAT master device.	Make EtherCAT master device in “RUN” state.
				Configure with the ESI file (XML file) that is downloaded from SMC web site.
	RUN LED is flashing in Flash(∗1)	Pre-operational state	Check the conditions of the EtherCAT master device.	Make EtherCAT master device in “RUN” state.
	RUN LED is flashing in Single-flash(∗1)	Safe-operational state	Check the conditions of the EtherCAT master device.	Make EtherCAT master device in “RUN” state.

∗1 Refer to **7.LED display(P.26)** for the cycle when LED is flashing (Flush, Single-flush, Double-flush).

6	Communication fault (JXC－W2A-C)	The USB driver is not installed	Check that the USB driver for the conversion unit is installed.	Please install the USB driver of the communication unit. The USB driver's installation starts when the communication unit is connected with PC. Details of the installation procedure are shown in "Installation procedure of the JXC-W2 setting software".
		Incorrect COM port setting	Please confirm if the correct COM port is set to the ACT Controller.	The COM port allocated to the controller is different for different PC's. Check and confirm the COM port number with the controller connected to the PC. The COM port number can be checked using the Device Manager of the PC. For details of the COM port checking and setting methods refer to the "JXC-W2 Controller Configuration Software Installation Manual".
		Connection failure	Please confirm the connection status.	Please confirm motor controller (JXC) = communications cable = communication unit = USB cable = PC is connected. For example, communication cannot be established if the connector has been damaged. Please confirm the power supply of motor controller (JXC) has been turned ON. Communication cannot be established if the power supply is OFF. If equipment other than the motor controller (JXC) (PLC and measurement equipment) is connected with PC, remove these before checking. (There is a possibility that the communication with other equipment interferes in PC.)
7	Does not operate at all.	Lock release error	When the unlock switch is turned ON or OFF there is an unlocking sound made.	If there is no sound of lock release, the lock brake may be broken. → If the problem persists, please contact SMC.
		External equipment failure	Check that the PLC connected to the controller operates correctly. Test operation of the controller on its own.	Refer to the controller operation manual and take appropriate measures. → **9.1 Memory allocation (P.28)**
		Unsuitable spec.	Check if the controller's specifications are appropriate, the power supply is suitable and the controller is compatible with the actuator.	Take appropriate measures according to this manual. → **3. Specifications (P.12)**

7	Operation stops intermittently	Incorrect wiring	Is the wiring connected correctly? Refer to the controller operation manual to confirm wiring, and check for broken wires and short-circuits.	Correct the wiring so that the input/output of each signal is performed appropriately. → **5. External Connections (P.19)** → **9.1 Memory allocation (P.28)**
		Electric noise	Connect to Ground correctly. Avoid bundling the cables.	Refer to the controller operation manual and take appropriate measures. → **3.4 Mounting (P.16)**
		Incorrect parameters	Check that the parameter values are correct. Also, check the cables are not bundled.	Take appropriate measures according to this manual. → **10. Settings and Data Entry (P.37)**
		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” signal from the PWR connector will turn OFF so the actuator will stop. However, this stop will be released when the voltage recovers.)	There is a possibility of a momentary voltage drop because the capacity of the power supply is insufficient, or if the power supply is "inrush-current control" type. If necessary, replace the power supply. → **3. Specifications (P.12)**
		Failure of pushing operation.	Check that “INP” turns ON during a pushing operation. (If completion of the pushing operation is detected by “INP”, the PLC cannot confirm completion)	Check “INP” signal before the energy saving mode is turned ON. → **9.1 Memory allocation (P.28)**
		Unsuitable spec.	Check if the controller’s specifications are appropriate, the power supply is suitable and the controller is compatible with the actuator.	Take appropriate measures according to this manual. → **3. Specifications (P.12)**
		Signal timing	Check the timing of the signal from the PLC to the controller.	Set the interval time between signals to more than twice the communication cycle time, when the signals are to be continuously input, because PLC processing delays and controller scanning delays can occur. → **11.4 Controller input signal response time (P.45)**
	The actuator does not move to the correct position.	Incorrect origin position	If it is a pushing operation, repeat return to origin operations several times to check if the actuator returns to the origin correctly. Perform the Return to Origin position operation several times to check the Origin position.	Take measures to make the actuator operate normally (remove foreign matter that interferes with the actuator movement, etc.)
		Incorrect parameters	Check that the parameter values are appropriate and the program is correct. Review the maximum speed, the maximum acceleration and the maximum deceleration of the actuator.	Modify the parameters and test the operation. → **10. Settings and Data Entry (P.37)**
		Unsuitable specification	Check if the controller’s specifications are appropriate, the power supply is suitable and the controller is compatible with the actuator.	Take appropriate measures according to this manual. → **3. Specifications (P.12)**

7	The actuator does not move correctly.	Incorrect wiring	Is the wiring connected correctly? Refer to the controller operation manual to confirm wiring, and check for broken wires and short-circuits.	Correct the wiring so that the input/output of each signal is performed appropriately. → **5. External Connections (P.19)** → **9.1 Memory allocation (P.28)**
		Unsuitable specification	Check if the controller's specifications are appropriate, the power supply is suitable and the controller is compatible with the actuator.	Take appropriate measures according to this manual. → **3. Specifications (P.12)**
		Signal timing	Check the timing of the signal from the PLC to the controller.	Set the interval time between signals to more than twice the communication cycle time, when the signals are to be continuously input, because PLC processing delays and controller scanning delays can occur. → **11.4 Controller input signal response time (P.45)**
		Data not stored correctly	Check whether data (step data, parameter) is written correctly. Do not turn OFF the controller input power or remove the cable while data is being written (green light flashing).	Input correct data (step data, parameter) again and confirm operation. → **3.2 Parts Description (P.13)** → **10. Settings and Data Entry (P.37)**
	Speed not achieved	Incorrect parameters	Check that the parameter values are correct. Review the maximum speed and the maximum acceleration of the actuator.	Modify the values of the parameters and test the operation. → **10. Settings and Data Entry (P.37)**
		Operation pattern is not suitable.	Check if a trapezoidal acceleration/deceleration is programmed for the actuator operation. In case of such operation, the actuator may start slowing down before it reaches the maximum speed.	Modify the setting to make the moving distance longer or the acceleration larger. → **10. Settings and Data Entry (P.37)**
		Unsuitable specification	Check if the controller's specifications are appropriate, the power supply is suitable and the controller is compatible with the actuator.	Take appropriate measures according to this manual. → **3. Specifications (P.12)**
		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 CN1 power connector will turn OFF so the actuator will stop. However, this stop will be released when the voltage recovers.)	There is a possibility of a momentary voltage drop because the capacity of the power supply is insufficient, or if the power supply is "inrush-current control" type. If necessary, replace the power supply. → **3. Specifications (P.12)**

20. Handling of sent/received data

There are three types of data, 1byte data, 2bytes data and 4bytes data.
Specifically, handling of 4bytes negative data is explained below.

● **Negative value data**

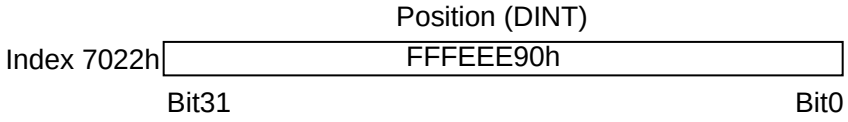
"Please note following example for negative value data.
In the example, 4bytes negative value data is explained.

E.g.) Output data "position": When inputting -700.00mm (negative value) to Index 7022h.
"Position" is based on the unit by 0.01mm.

Negative values are expressed using two's complement notation

The value to express -700.00mm is -70000 in decimal number, and FFFEEE90h in hexadecimal.

Sending of **FFFEEE90 h** data is as shown below.



21. Definitions and terminology

The major terminology used in this Operation Manual is stated below.

	Terminology	Definition
C	Communication speed	Data transmission speed of a network such as a Fieldbus network. The speed is determined by upper devices (PLC etc.). The unit is bit per second (bps).
	Communication cycle time	This is a cycle of sending data from masters to slaves (JXCE1 controller).
E	ESI file	Allows a device to be configured for an EtherCAT network, using PLC setting software. The file describes data exchange, the slave information and supported EtherCAT features.
	EtherCAT ID	This is the ID number that is used to identify each slave on the EtherCAT network.
	Ethernet	The most commonly used LAN technology that was standardized by IEEE802.3
F	Fieldbus	An industrial communication system, which uses a defined protocol to transfer data between devices on a network. A typical automation system will use a fieldbus network to exchange data between a PLC master and the actuators/sensors.
P	PLC	Abbreviation of Programmable Logic Controller, a digital computer used for automation of electromechanical processes.
T	Topology	Connection configuration of the Fieldbus network Expresses how each terminal and control components are connected. The typical topology is star type, linear type and ring type.

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B: Contents revised in several places. [May 2017]
C: Contents revised in several places. [Nov 2019]
D: Contents revised in several places. [Nov 2020]

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