SMC®

Operation Manual

PRODUCT NAME

Step Motor Controller (Servo/24 VDC)

Incremental / Battery-Less Absolute Encoder compatible

MODEL / Series / Product Number

JXC51/JXC61

SMC Corporation

Table of Contents

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JXC51/61 Controller
1. Safety Instructions

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

*1) ISO 4414: Pneumatic fluid power -- General rules relating to systems.
   ISO 4413: Hydraulic fluid power -- General rules relating to systems.
   IEC 60204-1: Safety of machinery -- Electrical equipment of machines. (Part 1: General requirements)
   ISO 10218: Manipulating industrial robots -Safety.
   etc.

⚠	**Caution**	**Caution** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
⚠	**Warning**	**Warning** indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
⚠	**Danger**	**Danger** indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

⚠Warning

1. **The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.**
   Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results.
   The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product.
   This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. **Only personnel with appropriate training should operate machinery and equipment.**
   The product specified here may become unsafe if handled incorrectly.
   The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. **Do not service or attempt to remove product and machinery/equipment until safety is confirmed.**
   1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
   2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
   3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. **Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.**
   1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
   2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.
   3. An application which could have negative effects on people, property, or animals requiring special safety analysis.
   4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

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JXC51/61 Controller
Safety Instructions

⚠Caution

1.The product is provided for use in manufacturing industries.
The product herein described is basically provided for peaceful use in manufacturing industries.
If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.
If anything is unclear, contact your nearest sales branch.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following "Limited warranty and Disclaimer" and "Compliance Requirements".
Read and accept them before using the product.

Limited warranty and Disclaimer

1. **The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first.∗2)**
   Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.
2. **For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.**
   This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.
3. **Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.**
   ∗2) Vacuum pads are excluded from this 1 year warranty.
   A vacuum pad is a consumable part, so it is warranted for a year after it is delivered. Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

1. **The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.**
2. **The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulation of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.**

⚠Caution

SMC products are not intended for use as instruments for legal metrology.
Products that SMC manufactures or sells are not measurement instruments that are qualified by pattern approval tests relating to the measurement laws of each country.
Therefore, SMC products cannot be used for business or certification ordained by the measurement laws of each country.

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2. Product Outline

2.1 Product features

The followings are the main functions of this controller:

● Electric Actuator Control

Positioning operation and Pushing operation, at a specific speed and force, of the electric actuator are possible by controlling the Step motor (24 VDC servo).

● Specified force operation

Control the pushing force (or the pressing force) of the electric actuator.

● Return to origin

Return the electric actuator to the home position by sending a single signal to a dedicated terminal.

● Alarm detection function

Automatically detect the abnormal conditions and output the appropriate alarm signal via the serial interface and parallel I/O. The alarm information (up to the last 8 alarms) will be recorded into the memory in the controller.

● 64 step data

Control the electric actuator according to the step data specified by the input of parallel I/O. It is possible to setup various parameters for each operation pattern.

● Area output

The area output terminal will be activated if the electric 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 parameter setup, status monitoring, trial run and alarm reset via the serial communication with a PC installed with the controller setting software or the teaching box.

● 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.

● Applicable for the Battery-Less Absolute Encoder

When using the actuator compatible with battery-less absolute encoder, detection of the absolute position enables the encoder to detect the actuator position when power is supplied, so operation is available with no return to origin operation.

⚠Caution

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

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2.2 Product configuration

The product configuration of this controller is as follows.

●Electric actuator [*1)]

●I/O cable
Part No: LEC-CN5-#

Prepared by user

PLC
[*3)]
Parallel I/O
Signal power supply
24 VDC

●Controller

[*1) *5)]
●Actuator cable
Battery-less absolute
compatible
 product number:
 LE-CE-#-#

Incremental compatible
product number:
 LE-CP-#-#-#

to ENC

to MOT

to PWR

to SI

●Conversion cable
Part No:P5062-5

[*5)]
Option

●Controller
communication cable

Part No:JXC-W2A-C

[*2) *4)]

PC

●USB cable
(A-miniB type)

Part No:LEC-W2-U

[*3)]
Controller power supply
24 VDC

●Power supply plug
(accessory)
Part No:JXC-CPW

Applicable cable size

AWG20 (0.5mm^2)

or

●Teaching box
(with 3m cable)

Part No: LEC-T1-3#G#

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

*2) Please download the controller configuration software from the SMC website.

https://www.smcworld.com/

*3) 24 VDC power supply for controller input and 24 VDC power supply for parallel I/O signal should be separated.

*5) PC is prepared by the user.

*6) Optional.

⚠ Warning

Refer to section **"4. External Connection for wiring"**.

Refer to **"13. Wiring of cables/Common precautions"** when handling the wiring and cables.

Do not connect the teaching box, LAN equipment, or LAN cable directly to a PC.
Otherwise, the controller, PC or equipment may be damaged.

2.3 How to Order

The part number construction for this product is as follows:

$$J \quad X \quad C \; \square \; 1 \; \square \; \square \; - \; \square$$

- Electric equipment
- Controller
- Controller type

5	Parallel I/O input type (64-point, NPN)
6	Parallel I/O input type (64-point PNP)

Number of shaft type of power supply

1	1 axis, power supply 24 VDC

Mounting

7	Screw mounting
8	DIN rail mounting

I/O cable length

Nil	None
1	1.5m
3	3m
5	5m

● Electric actuator model

Battery-Less Absolute compaible

Stroke example: For LEFS25EB-100B-R3CM1T, specify LEFS25EB-100.
Rotating angle: For LER50EK-2L-R3CM1T, specify LER50EK-2.
(Enter from the electric actuator part number "LE" to "stroke/ rotating angle")

BC-E	Blank controller [*1]

● Electric actuator model

Incremental encoder compatible

Stroke example: For LEFS25B-100B-R3C517 specify LEFS25B-100.
Rotating angle: For LER50K-2L-R3C517 specify LER50K-2.
(Enter from the electric actuator part number "LE" to "stroke/ rotating angle")

BC	Blank controller [*1]

Note 1) Specified software (JXC-BCW) is required.

⚠ Caution

The controller and the electric actuator are factory set Confirm the combination of the controller and the electric actuator is correct.

<Check the following before use.>
(1) Check the electric actuator label for the model number. Check that this matches the controller.
(2) Check Parallel I/O configuration matches (NPN or PNP)
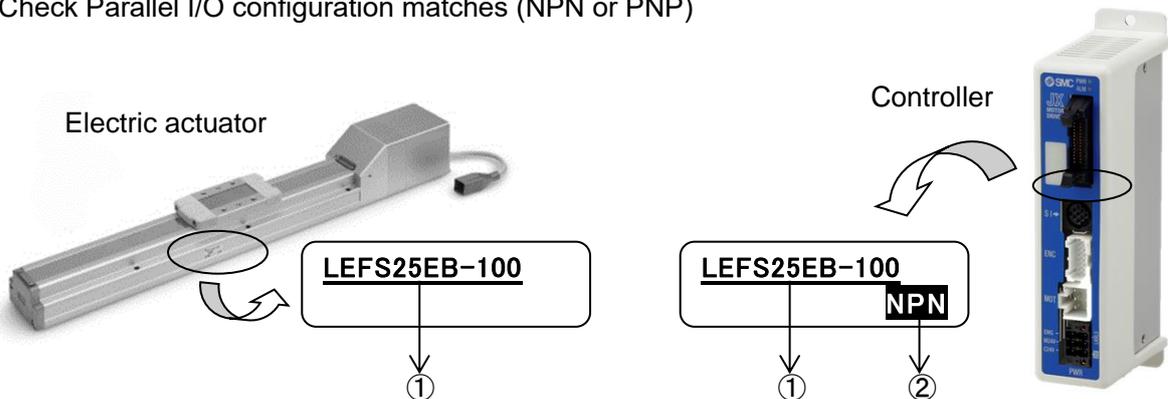
Electric actuator

Controller

LEFS25EB-100
①

LEFS25EB-100
NPN
① ②

(1) Battery-Less Absolute Encoder compatible

[1] Actuator cable

LE－CE－□

Cable length (L)

1	1.5m
3	3m
5	5m
8	8m*
A	10m*
B	15m*
C	20m*

* Produced upon receipt of order

(a)

Signal name	Terminal No.		Cable colour	Terminal No.	(c)
A	B-1		Brown	2	
A̅	A-1		Red	1	
B	B-2		Orange	6	
B̅	A-2		Yellow	5	
COM-A/COM	B-3		Green	3	
COM-B/ -	A-3		Blue	4	

(b)

Signal name	Terminal No.	Shield	Cable colour	Terminal No.	(d)
Vcc	B-1		Brown	12	
GND	A-1		Black	13	
A̅	B-2		Red	7	
A	A-2		Black	6	
B̅	B-3		Orange	9	
B	A-3		Black	8	
SD+(RX)	B-4		Yellow	11	
SD-(TX)	A-4		Black	10	
			Black	3	

Actuator side

Controller side

SMC
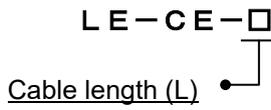
[2] Actuator cable for actuator with lock (for sensor and lock)

L E－C E－□－B

Cable length (L)

1	1.5m
3	3m
5	5m
8	8m*
A	10m*
B	15m*
C	20m*

* Produced upon receipt of order

(a)

Signal name	Terminal No.
A	B-1
Ā	A-1
B	B-2
B̄	A-2
COM-A/COM	B-3
COM-B/ -	A-3

(d)

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

(b)

Signal name	Terminal No.
Vcc	B-1
GND	A-1
Ā	B-2
A	A-2
B̄	B-3
B	A-3
SD+(RX)	B-4
SD-(TX)	A-4

Shield

(e)

Cable colour	Terminal No.
Brown	12
Black	13
Red	7
Black	6
Orange	9
Black	8
Yellow	11
Black	10
Black	3

(c)

Signal name	Terminal No.
Lock (+)	B-1
Lock (-)	A-1
Sensor (+)	B-3
Sensor (-)	A-3

Cable colour	Terminal No.
Red	4
Black	5
Brown	1
Blue	2

Actuator side

Controller side

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(2) Incremental Encoder compatible

[1] Actuator cable [5m or less]

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 No.
A	B-1
Ā	A-1
B	B-2
B̄	A-2
COM-A/COM	B-3
COM-B/ -	A-3

Vcc	B-4
GND	A-4
Ā	B-5
A	A-5
B̄	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

Actuator side ← → Controller side

[2] Actuator cable [8 - 20m]

LE-CP-☐

Cable length (L)

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

* produced upon recipt of order

* Only Robotic type cable can be selected.

(1)

Signal name	Terminal No.
A	B-1
Ā	A-1
B	B-2
B̄	A-2
COM-A/COM	B-3
COM-B/ -	A-3

Vcc	B-4
GND	A-4
Ā	B-5
A	A-5
B̄	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

Actuator side ← → Controller side

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[3] Actuator cable for actuator with lock (for sensor and 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
Ā	A-1
B	B-2
B̄	A-2
COM-A/COM	B-3
COM-B/ -	A-3

(2)

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

Shield (3)

Signal name	Terminal No.		Cable color	Terminal No.
Vcc	B-4		Brown	12
GND	A-4		Black	13
Ā	B-5		Red	7
A	A-5		Black	6
B̄	B-6		Orange	9
B	A-6		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

← Actuator side   Controller side →

A1 (1) B1
A6   B6
A1   B1
A3   B3
(4)

(17.7) (10.2) (Φ8) (Φ5.7)
(30.7) L (11)
(14.2) (14) (18)
1 (2) 2
5   6
1   2
15 (3) 16

[4] Actuator cable for actuator with lock (for sensor and lock) [8 - 20m]

LE - CP - □ - B

Cable length (L)

8	8m∗
A	10m∗
B	15m∗
C	20m∗

∗ produced upon recipt of order

∗ Only Robotic type cable can be selected.

(1)

Signal name	Terminal No.
A	B-1
Ā	A-1
B	B-2
B̄	A-2
COM-A/COM	B-3
COM-B/ -	A-3

(2)

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

Shield (3)

Signal name	Terminal No.		Cable color	Terminal No.
Vcc	B-4		Brown	12
GND	A-4		Black	13
Ā	B-5		Red	7
A	A-5		Black	6
B̄	B-6		Orange	9
B	A-6		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

← Actuator side   Controller side →

A1 (1) B1
A6   B6
A1   B1
A3   B3
(4)

(17.7) (10.2) (Φ5.5) (Φ6.3) (Φ5.7)
(30.7) L (11)
(14.2) (14) (18)
1 2
5 (2) 6
1 (3) 2
15   16

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(3) I/O Cable

L E C－C N 5－□

Cable length (L)

1	1.5m
3	3m
5	5m

Pin No.	# of wire	Color of insulation	Dot mark	Dot color	Pin No.	# of wire	Color of insulation	Dot mark	Dot color
A1	1	Light brown	■	Black	B1	7	Yellow	■■	Red
A2		Light brown	■	Red	B2	8	Light green	■■	Black
A3	2	Yellow	■	Black	B3		Light green	■■	Red
A4		Yellow	■	Red	B4	9	Grey	■■	Black
A5	3	Light green	■	Black	B5		Grey	■■	Red
A6		Light green	■	Red	B6	10	White	■■	Black
A7	4	Grey	■	Black	B7		White	■■	Red
A8		Grey	■	Red	B8	11	Light brown	■■■	Black
A9	5	White	■	Black	B9		Light brown	■■■	Red
A10		White	■	Red	B10	12	Yellow	■■■	Black
A11	6	Light brown	■■	Black	B11		Yellow	■■■	Red
A12		Light brown	■■	Red	B12	13	Light green	■■■	Black
A13	7	Yellow	■■	Black	B13		Light green	■■■	Red
					-		Shield		

Controller side

PLC side

（φ8.9）

(22.4)

(14.4)

L
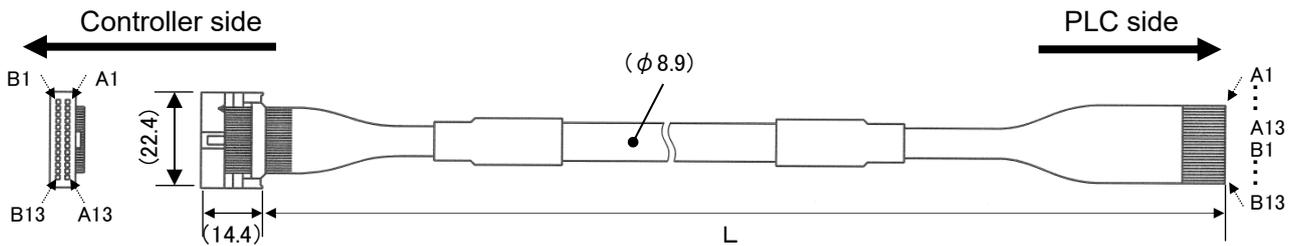
Number of Ways	26
AWG	AWG28

The separate lines of the terminal on the PLC side are twisted together with an adhesive tape with a pitch of 2.54 mm.

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(4) Communication cable for controller setting

To controller

PC

JXC－W2A－C

Communication cable

Communication cable

USB cable

LEC－W2－U

USB cable

• Controller Configuration Software
• USB driver

Please download from SMC website.
https://www.smcworld.com
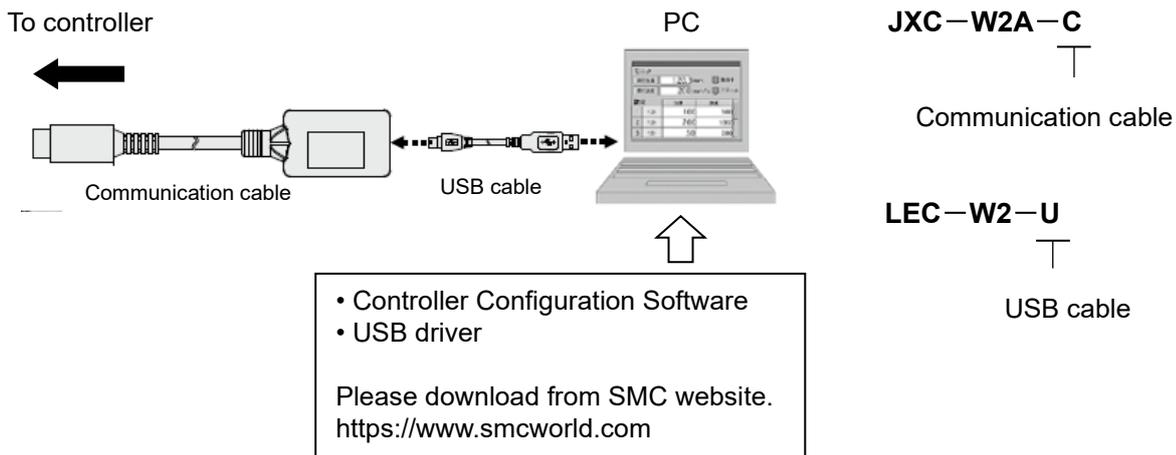
Operating environment

OS	Windows®7,Windows®8.1,Windows®10,Windows®11
Communication interface	USB1.1 or USB2.0 port
Display	1024×768 or more

Windows®7, Windows®8.1, Windows®10, and Windows®11 are registered trademarks of United States Microsoft

Corporation.

⚠Caution

The latest version of the controller setting software must be used.

Please download from SMC website. https://www.smcworld.com/

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(5) Power supply plug

JXC-CPW
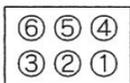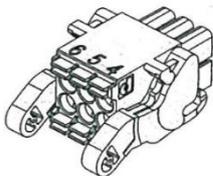
① C24V   ④ 0V
② M24V   ⑤ N.C.
③ EMG   ⑥ LK RLS

Power Supply Plug

No.	Terminal	Function	Details
1	C24V	Control power supply (+)	Positive control power to be supplied to the controller.
2	M24V	Motor power (+)	Positive control power to be supplied to the motor.
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 (+)	Positive power for unlocking.

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(6) Teaching box

```
LEC - T1 - 3 □ G □
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Teaching box

Cable length

3	3m

Original language

J	Japanes
E	English

Stop switch

G	With Stop

Enable switch

Nil	No enable switch
S	Equipped with

Conversion cable for connecting the teaching box
P5062-5 (Cable length: 0.3 m)
* Required for connecting the teaching box and JXC controller

300

Dimensions

34.5
102
185
25 22.5

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

2.5 Startup Procedures

Be sure to check the procedure below before use.

(1) Confirmation of the package content

After unpacking everything, check the description on the label to identify the controller and the number of accessories. If any parts are missing or damaged, please contact your distributor.

Item	Quantity
Controller （JXC51##-#、 JXC61##-#）	1 unit
Power supply plug （JXC-CPW）	1 piece
I/O cable (LEC-CN5-#)[*1]	1 piece

*1) Included in the package only when the I/O cable length is specified.
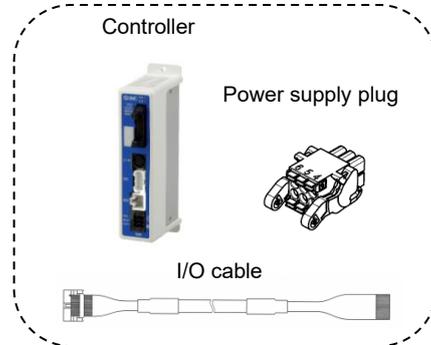
【Option】
- ●Teaching box
- ●Comunicatio cable for controller setting
- ●USB Cable
- ●Actuator cable

Teaching box

Communication cable for controller setting

USB cable
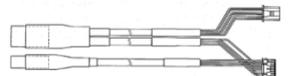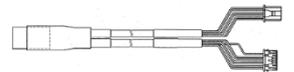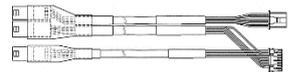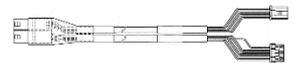
Actuator cable

(2) Installation

Please refer to the **"3.4 How to install"**.

(3) Wiring and connection

Prepare the electric actuator and the cable.

Connect the cable to the controller.

Please refer to the **"4 External Wiring Diagram"** for the wiring of the connectors.

Connector

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(4) Power ON alarm (error)

Ensure the stop is not activated and then supply 24 VDC power.
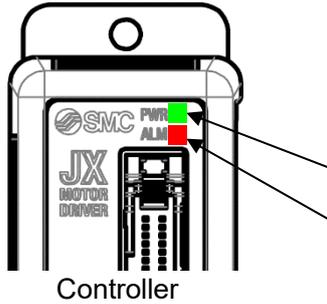
Controller

Function	LED status	Status
PWR	Green LED is ON.	Normal
ALM	OFF	No alarm is generated.

If the LED [PWR] lights in green, the controller is in the normal condition.

However, if the LED [ALM] lights in red, the controller is in the alarm (error) condition.

⚠️Caution

When an alarm is generated, connect the controller configuration software or teaching box to the SI: serial I/O connector. Then, remove the cause of the error referring to the **12. Alarm Detection.**

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

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(5) Operation pattern setting

Set up the step data and parameters using the controller set up software or the teaching box.

● Controller set up software
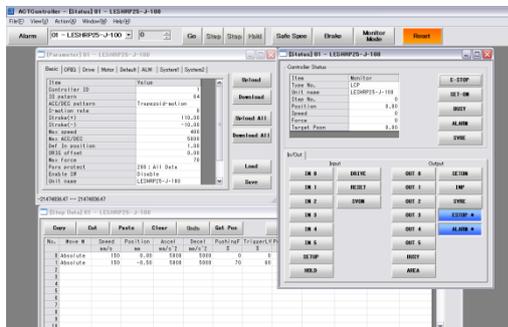
● Teaching box

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

(6) Trial run

Please refer to the manuals of the controller setting software or the teaching box manual for how to perform a trial run.

3. Product Specifications

3.1 Basic specifications

The basic specifications of this controller are as follows:

Item	Specifications
Compatible motor	Step Motor (Servo / 24 VDC)
Power supply [1]	Power voltage: 24 VDC +/-10% Max. current consumption: 3A (Peak 5A) [2] (for both of motor drive power control power, stop, lock brake release)
Parallel input	11 inputs (photo-coupler isolation)
Parallel output	13 outputs (photo-coupler isolation)
Compatible encoder	Battery-less absolute encoder (resolution: 4096 pulses/rotation) Incremental A/B phase (800 pulse / rotaion)
Serial communication	RS485
Memory	EEPROM
LED indicator	2 of LED's (green and red)
Lock control	Forced-lock release terminal (Applicable to non -magnetizing lock.)
Cable length	I/O cable: 5m or less Actuator cable: 20m or less
Cooling system	Natural air cooling
Operating temperature range	0 to 55°C [3] (No freezing)
Operating humidity range	90%RH or less (No condensation)
Storage temperature range	-10 to 60°C (No freezing)
Storage humidity range	90%RH or less (No condensation)
Insulation resistance	Between external terminals and case 50MΩ (500VDC)
Mass	150g (screw mount type) 170g (DIN rail mount type)

*1) The controller power supply do not use the power supply of "inrush current restraining type".

*2) The power consumption changes depending on the electric actuator model.
   Please refer to the specifications of the electric actuator for more details.

*3) For the LEY40 and LEYG40 series compatible with battery-less absolute encoder, if the vertical
   transfer load is greater than the weight listed below, the controller must be used at an ambient
   temperature of 40°C or less.
   LEY40#EA: 9 kg, LEY40#EB: 19 kg, LEY40#EC: 38 kg
   LEYG40#EA: 7 kg, LEYG40#EB: 17 kg, LEYG40#EC: 36 kg

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3.2 Parts description

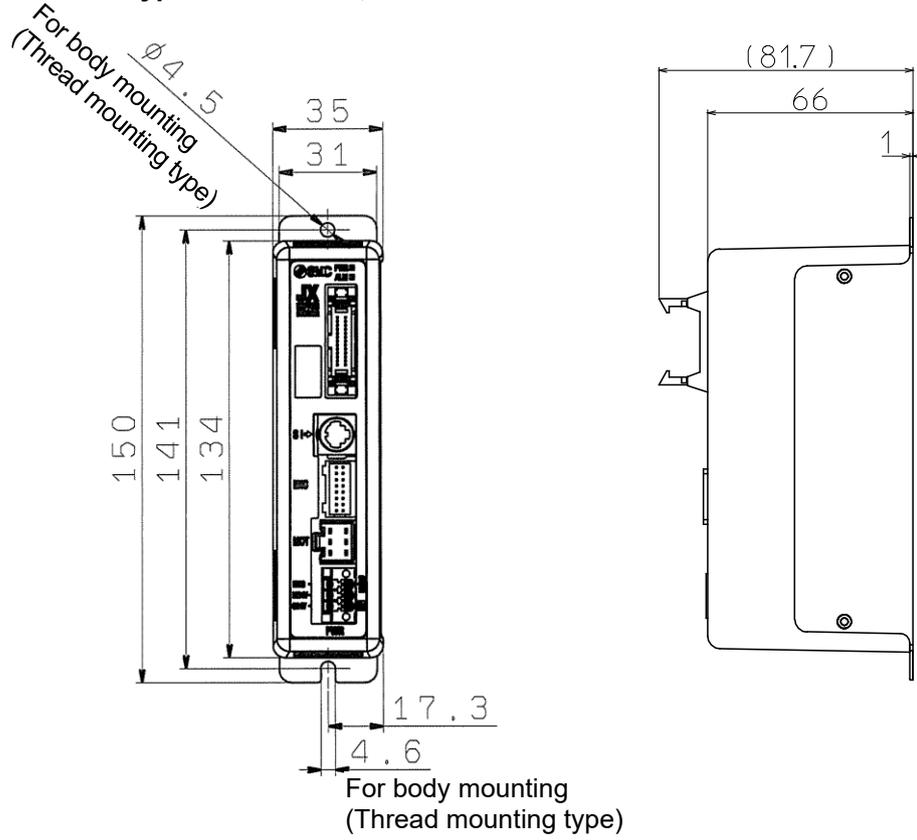The detailed descriptions of each part are as follows:

A side view (controller version)

Label of controller version

A side
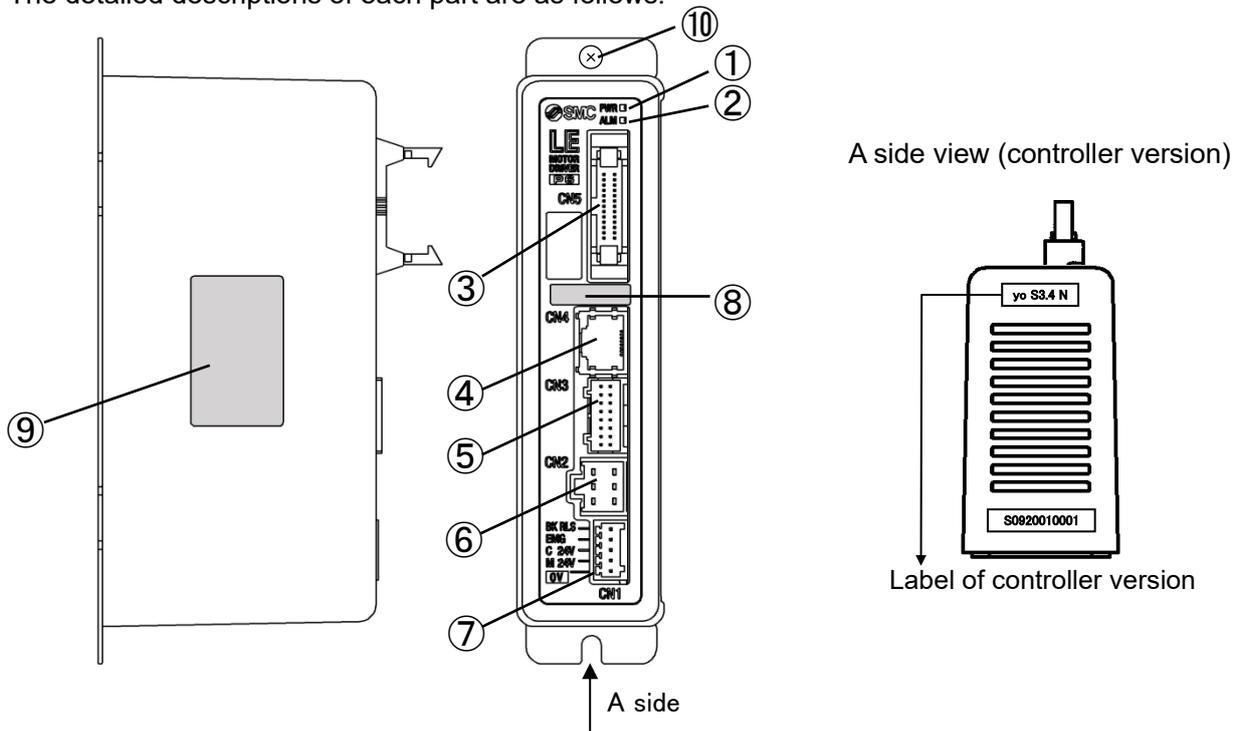
No.	Label	Name	Description
①	PWR	Power LED (green)	Power ON/No alarm: Green light Data (step data, parameter) writing /green light flashing ⚠ **Caution** Do not turn off the input power supply for the controller while the data is being written (power supply LED (green) flashes). Data (step data, parameter) may not be written correctly.
②	ALM	Power LED (red)	Power ON/Alarm: Red light
③	-	Parallel I/O Connector (26 pins)	Used to connect PLC, etc. with the I/O cable. (11 inputs and COM, 13 outputs and COM)
④	SI	Serial I/O Connector (8 pins)	Used to connect the teaching box, PC, etc.
⑤	ENC	Encoder connector (16 pins)	Used to connect the actuator cable.
⑥	MOT	Motor power connector (6 pins)	
⑦	PWR	Power connector (6 pins)	Used to connect the controller power supply (24 VDC) with the power supply plug. Common power (-) ,Motor power (+) ,Control power (+) ,Stop signal (+) ,Lock release (+)
⑧	-	Applicable electric actuator model number label	The label indicating the applicable electric actuator model. It also indicates the type of the parallel I/O (PNP/NPN).
⑨	-	Controller label	The label indicating the part number of the controller.
⑩	-	FG	Functional ground (When the controller is mounted, tighten screws and connect the grounding cable)

SMC

3.3 Outside dimension diagram

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

(1) Screw mount type（JXC517#-#, JXC617#-#）

For body mounting
(Thread mounting type)

For body mounting
(Thread mounting type)

**(2) DIN rail mount type （JXC518#-#, JXC618#-#）**

DIN rail (35mm)
can be mounted

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3.4 How to install

(1) How to install

The controller can be direct mounted using screws or mounted on a DIN rail.

The followings are the descriptions on how to install each type:

1) Screw mount type（JXC517#-#、JXC617#-#）　2) DIN rail mount type（JXC518#-#、JXC618#-#）

(Installation with two M4 screws)　　　　　　　　(Installation with the DIN rail)
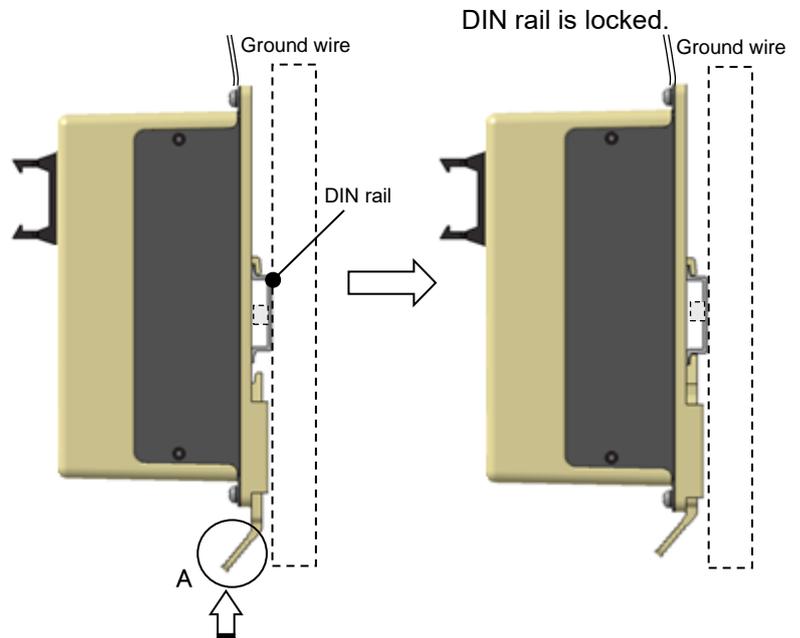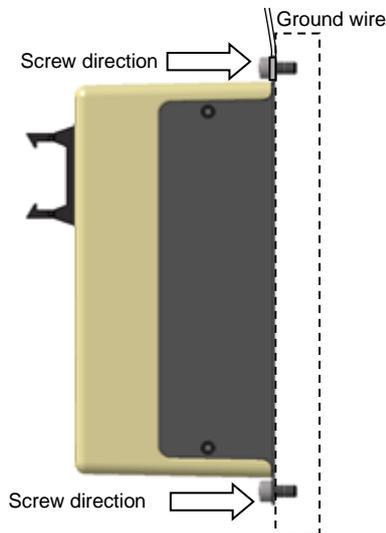
Hook the controller on the DIN rail and press the lever of section A in the arrow direction to lock it.

(2) Ground wire connection

Place the grounding cable with crimping terminal and toothed washer as shown below and tighten the screw.

M4 screw
Cable with crimping terminal
Toothed washer
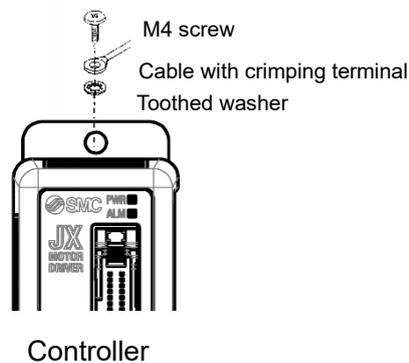
Controller

⚠Caution

The M4 screw, cable with crimping terminal, and toothed washer should be obtained separately.

Ground the controller to shield it from electric noise.

If higher noise resistance is required, ground the 0V (signal ground).

When grounding the 0V, avoid flowing noise from the ground to the 0V.

⚠️Caution

The earthling should be the dedicated grounding point. It should be a functional ground with less than 100 Ω resistance.

The cross section of the grounding wire should be greater than 2mm^2.
The ground point should be near this controller to make the wire length shorter.

Recommended Functional grounding   Not Recommended grounding
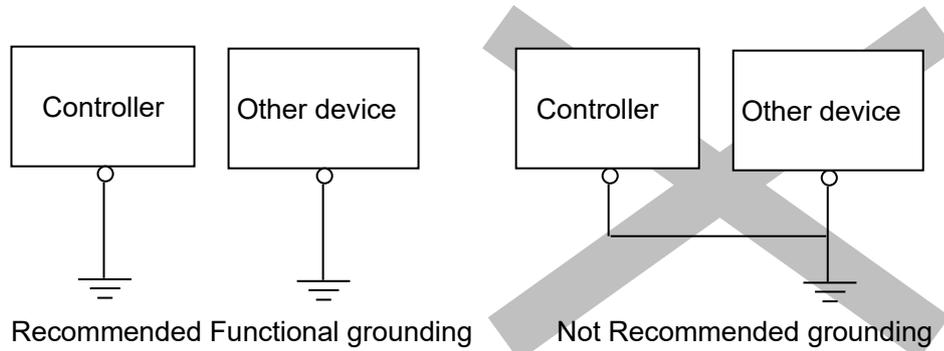
(3) Mounting location

Design the size of the control panel and the installation so that the temperature surrounding the controller is 55°C or less (Note 1). Mount the controller vertically on the wall with 30 mm minimum space on the top and bottom of the controller as shown below.

Allow 60 mm minimum space between the front of the controller and the door (lid) so that the connectors can be connected and disconnected.

Leave enough space between the controllers so that the operating temperatures of the controllers remain within the specification range.

Avoid mounting the controller near a vibration source, such as a large electromagnetic contactor or circuit breaker on the same panel.

Note 1) For the LEY40 and LEYG40 series, if the vertical transfer load is greater than the weight listed below, the controller must be used at an ambient temperature of 40°C or less.
LEY40#EA: 9 kg, LEY40#EB:19 kg, LEY40#EC:38 kg
LEYG40#EA:7 kg, LEYG40#EB:17 kg, LEYG40#EC:36 kg
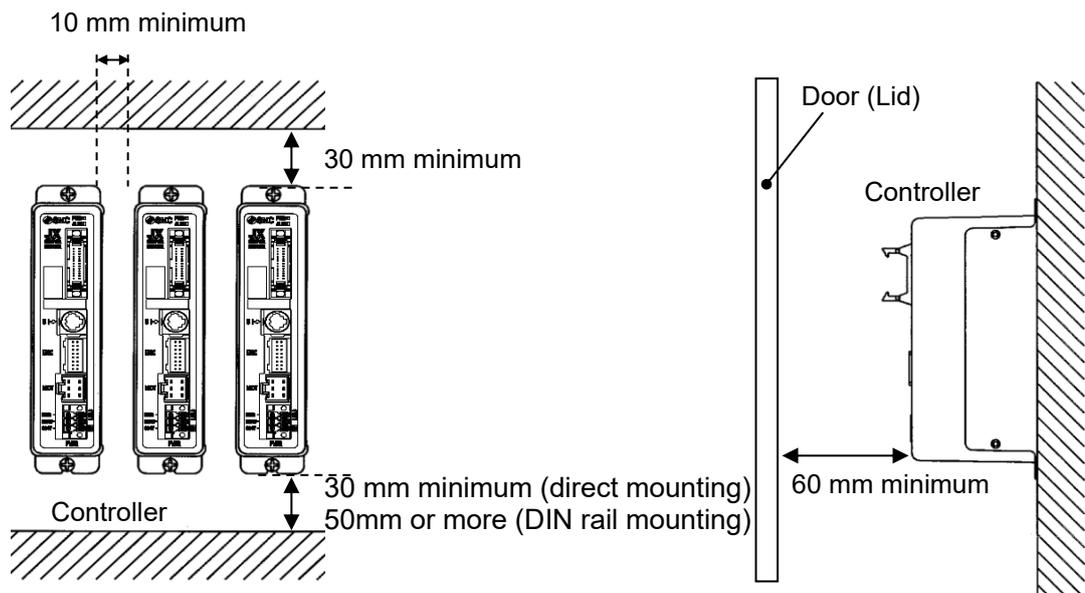
⚠️Caution

If the mounting surface for the controller is not flat or is uneven, excessive stress may be applied to the enclosure, which can cause failure. Be sure to mount on a flat surface.

(4) Precautions for electric actuator compatible with battery-less absolute encoder installation

⚠ Warning

Do not use in an environment where strong magnetic field are present.
A magnetic sensor is used in the encoder. Therefore, if the actuator motor is used in a strong magnetic field environment, malfunction or failure may occur.
Do not expose the actuator motor to a magnetic field with a magnetic flux density of 1 mT or more.
(1) When installing an air cylinder with an auto switch (ex. CDQ2 series) by side,
     maintain 40 mm minimum space around the motor.
     Refer to the construction drawing of the actuator motor.
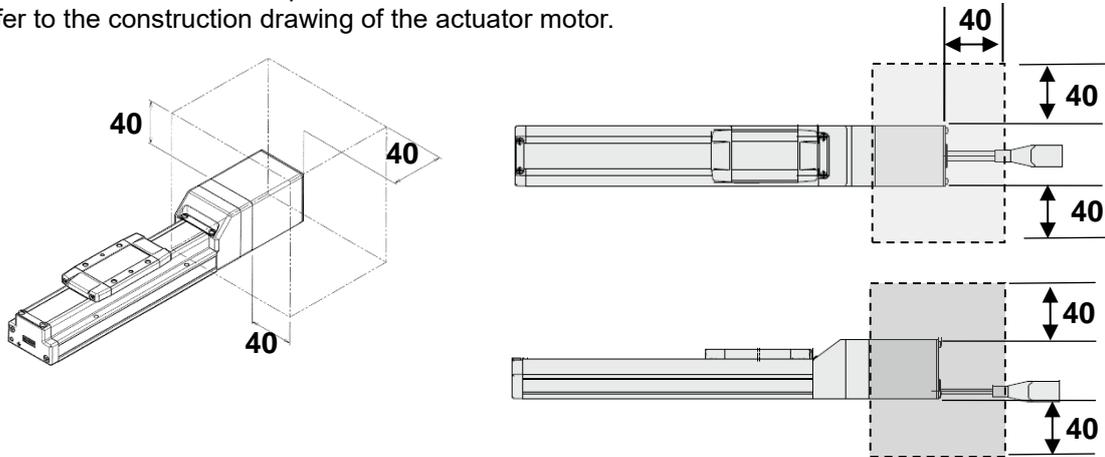
Air cylinder installation with an auto switch is forbidden in the shaded area.

(2) When installing electric actuator LEY(G) or LEF series with an auto switch by side,

     leave a gap of 40 mm or more with respect to the position where the magnet passes.

     Keep away from the magnet passing position and leave a space of 40 mm or more.


Magnet passing position

Magnet mouting position
LEY(G) / Piston part

Magnet passing position

Magnet mouting position
LEFS / Table center

The motors of the electric actuator can be installed close to each other.

Motors can be installed close to each other

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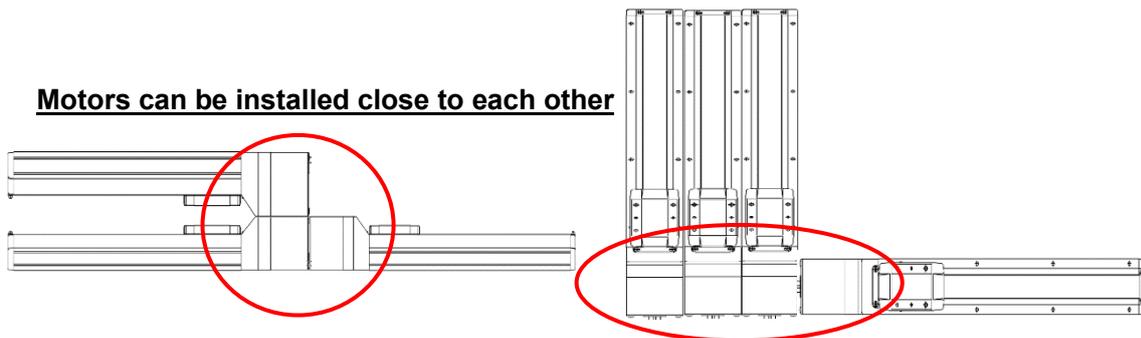
4. External Wiring Diagram

Examples of standard wiring are shown for each connector of the controller.

4.1 PWR: Power connector

(The 24 VDC power supply and the power cable should be obtained separately.)
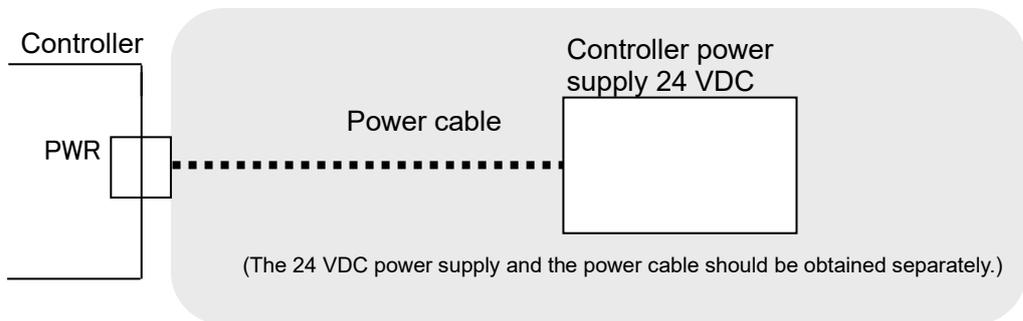
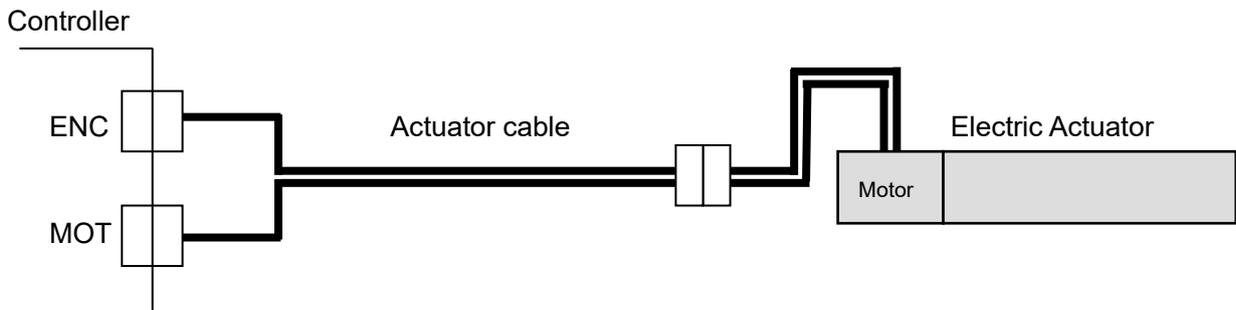Please refer to **"5. PWR: Power supply plug"** for how to wire the PWR connector.

⚠Caution

The controller power supply (24 VDC) do not use the power supply of "inrush current restraining type".

4.2 MOT: Motor power connector and ENC: Encoder connector

Connect the controller and the electric actuator with the actuator cable.

Battery-less absolute encoder compatible: LE-CE-#-#
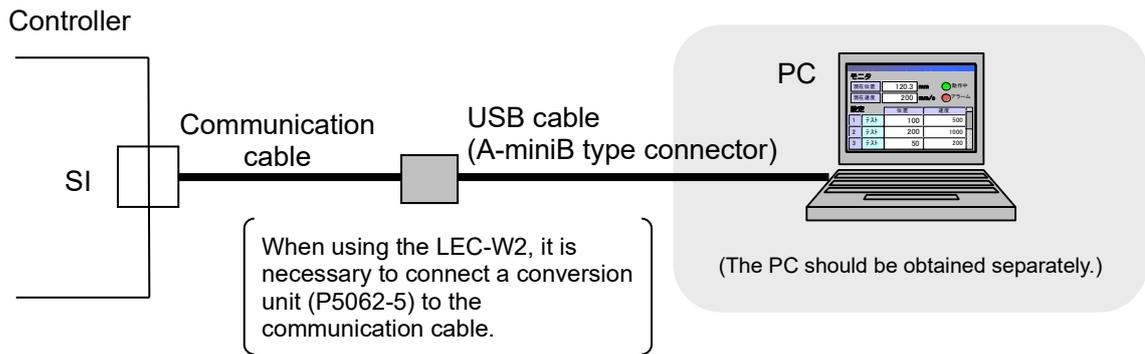
Incremental encoder compatible: LE-CP-#-#-#
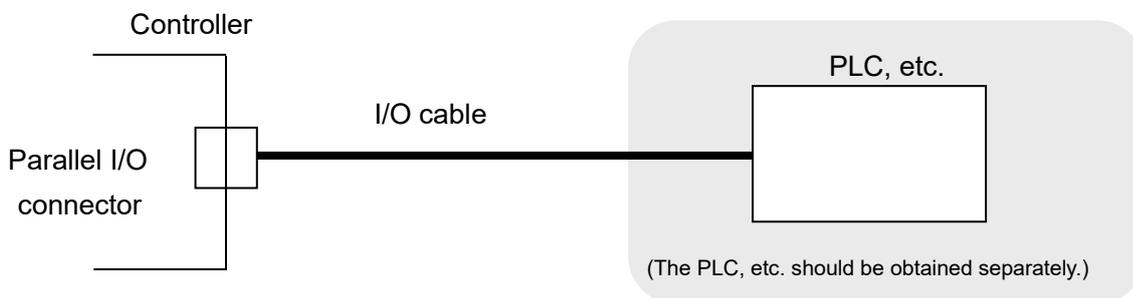

4.3 SI: Serial I/O connector

(1) Connection with the teaching box

(2) Connection with a PC

Controller

SI

Communication cable

USB cable
(A-miniB type connector)

PC

(The PC should be obtained separately.)

When using the LEC-W2, it is necessary to connect a conversion unit (P5062-5) to the communication cable.

4.4 Parallel I/O connector

Controller

Parallel I/O connector

I/O cable

PLC, etc.

(The PLC, etc. should be obtained separately.)

Please refer to **"6.4 Parallel I/O Wiring Example"** for how to wire the Parallel I/O connector.

Please refer to **"6.3 The parallel I/O signal is detailed"** for details of each signal of parallel I/O.

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5. PWR: Power supply plug

5.1 Power supply plug specifications

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

Power supply plug
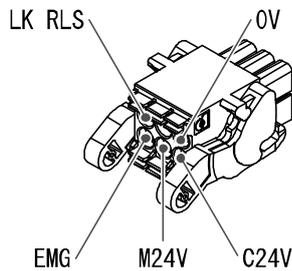
Pin No.	Terminal	Function	Descriptions
1	C24V	Control power (+)	The positive control power.
2	M24V	Motor power (+)	The positive power for the electric actuator motor to be supplied via the controller.
3	EMG	Stop signal (+)	The positive power for Stop signal.
4	0V	Common power (-)	The negative common power for M24V, C24V, EMG and LK RLS.
5	-	NC	Not connected.
6	LK RLS	Lock release (+)	The positive power for lock release.

∗ Equivalent to Phoenix Contact: FMC1,5/3-ST-3,5-LR

5.2 Electric wire specifications

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

Item	仕様
Applicable wire size	Single, stranded wire ⇒ AWG20 (0.5mm^2) ∗ The rated temperature for the insulation coating: 60ºC or more, Cable sheath O.D. ø2.5mm or less
Stripped section length	 φ2.5mm or less 8mm

⚠Caution

Multiple electric wires should not be connected to one terminal.

Arrange wiring so that conductors of each terminal do not contact other lines.

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

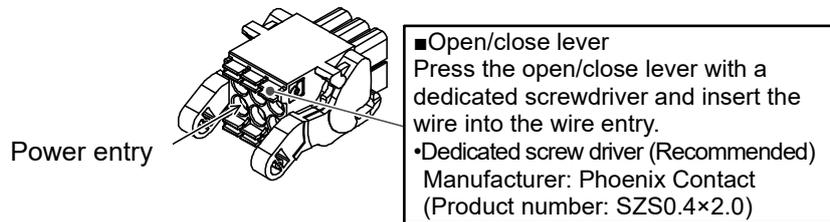Refer to **5.3. Power supply plug** for wiring.

Power plug

To PWR

SMC
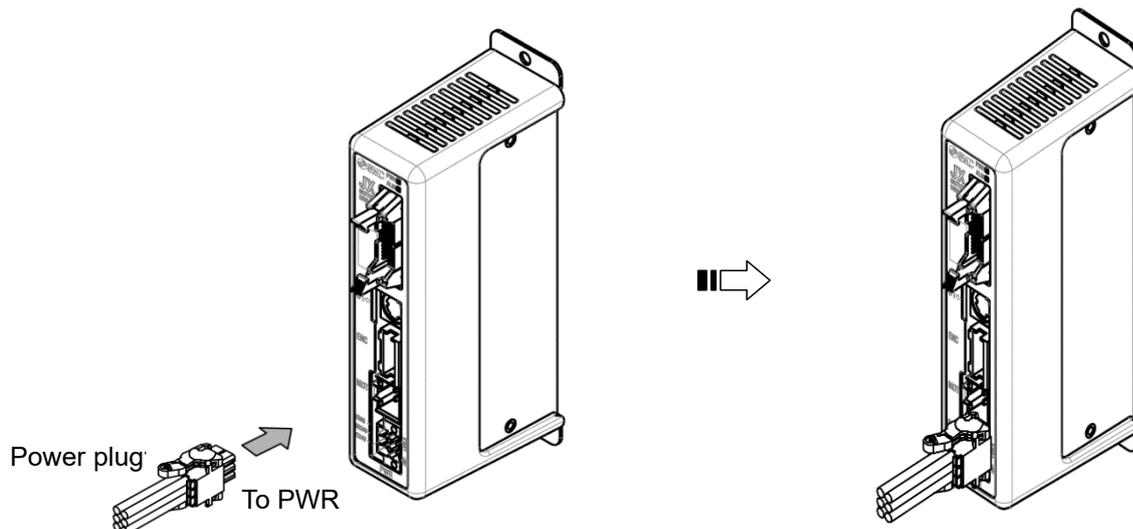
5.3 Wiring of power supply plug

Connect the power supply plug to the 24 VDC controller power supply according to instructions (1) (2) and (3) and then, insert it into the CN1 connector of the controller.

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

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

Power entry

■Open/close lever
Press the open/close lever with a dedicated screwdriver and insert the wire into the wire entry.
•Dedicated screw driver (Recommended)
 Manufacturer: Phoenix Contact
 (Product number: SZS0.4×2.0)

⚠Caution

For controller input power supply (24 VDC) use a power supply with a capacity not less than the "momentary maximum power" of the electric actuator specification. Do not use "inrush current restraining type" power supply.
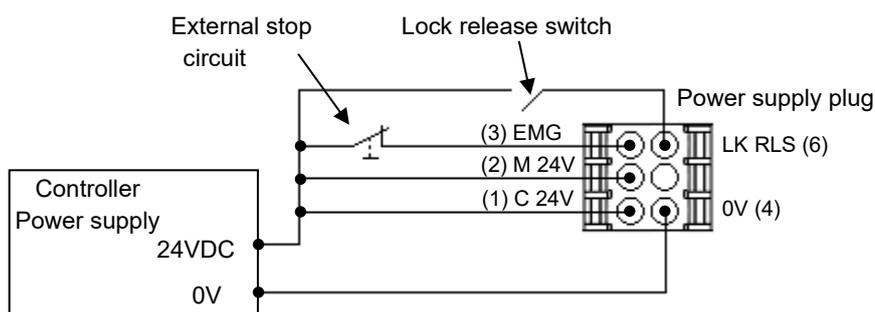
(2) Wiring of the stop switch (EMG)

By connecting 24V to EMG, motor becomes operable. Without connect the 24V to EMG, motor does not move. Stop switch must be installed by the user to stop the electric actuator in abnormal situations. Please refer to **"5.4 Stop circuits"** for examples of how to wire stop switches.

⚠Caution

The Servo is not ON unless a voltage of 24 VDC is applied to the EMG terminal.

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

Install an unlocking switch for adjustment or recovery during an emergency of the electric actuator with lock. The switch (24 VDC, Contact capacity: 0.5A or more) should be obtained separately.
One terminal of the lock release switch should be connected to the 24 VDC power supply and the other should be connected to the LK RLS terminal. When this is switched on, the lock will be released forcibly.

External stop circuit | Lock release switch

Power supply plug

(3) EMG
(2) M 24V
(1) C 24V

LK RLS (6)
0V (4)

Controller
Power supply
24VDC
0V

⚠Caution

(1) If the electric actuator is a non-lock type, it is not necessary to wire the LK RLS terminal.
(2) Do not supply power to the LK RLS (lock release) during normal operation.
The 24 VDC supply to the LK RLS (lock release) is only required for the adjustment and the recovery in the emergency.

After the wiring of the power supply plug is completed, connect it to the CN1 connector of the controller. Please refer to **"5.3 Wiring of power supply plug"** for how to wire the power supply plug.

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5.4 Stop circuits

When the external switch to stop or the stop switch of the teaching box is enabled on this controller, the electric actuator will stop.

(1) Example circuit 1 - Single controller with teaching Box

When the teaching box is connected to the controller, the teaching box's stop switch will become effective.
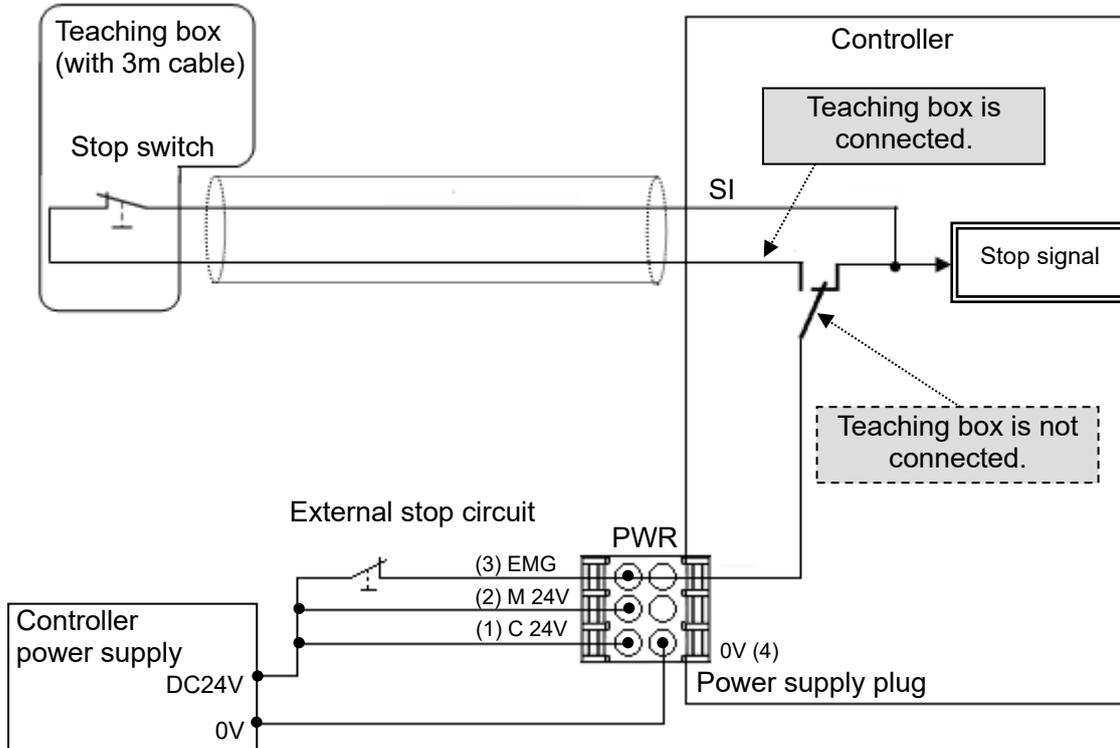

⚠ **Warning**
The teaching box's stop switch is effective only to the controller that is connected with it.

(2) Example circuit 2 - multiple controllers (Relay contact (1))

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

(Circuit example: The figure below shows the stopped state.)
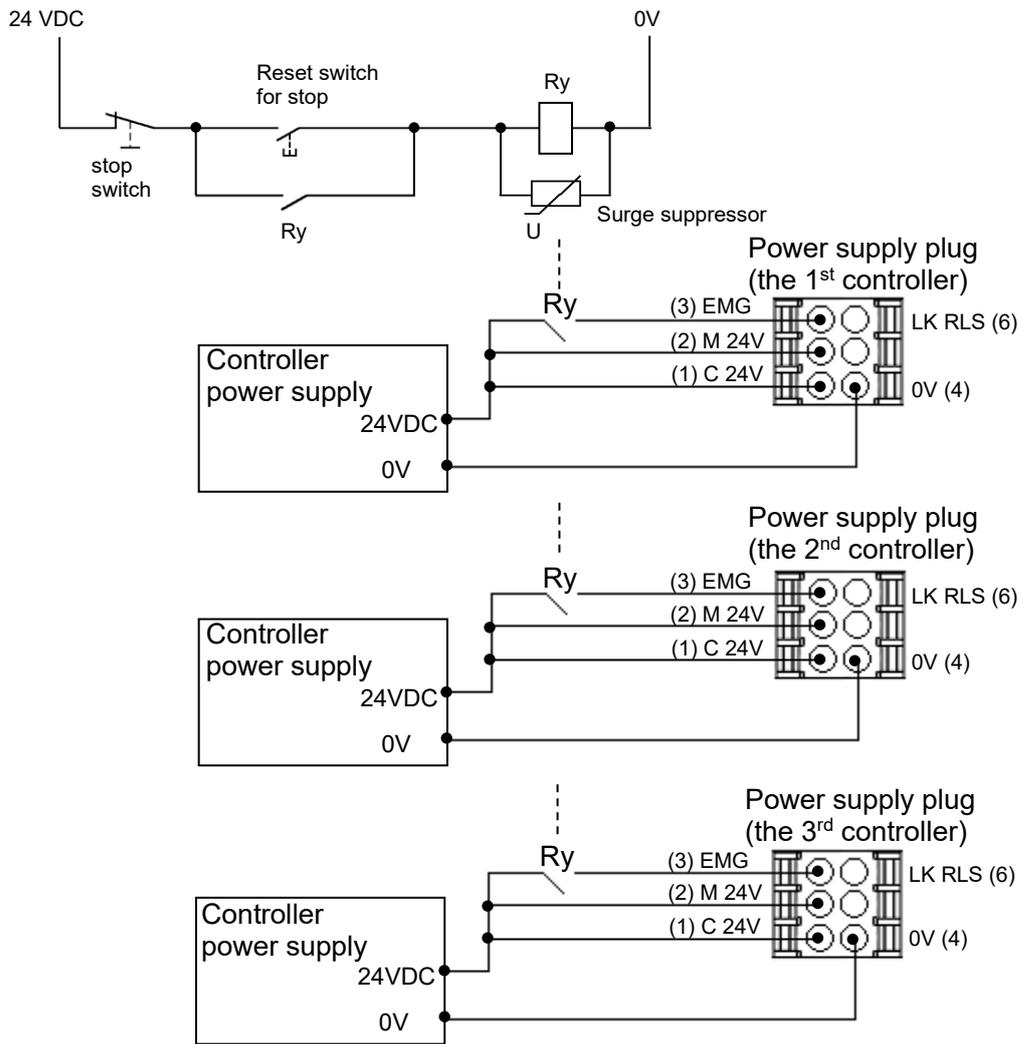
⚠ **Caution**
When shutdown is input, the controller stops with maximum deceleration, then the motor is turned off.

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(3) Example circuit 3 - Motor power shutdown (Relay contact (2))

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

(Circuit example: The figure below shows the stopped state.)
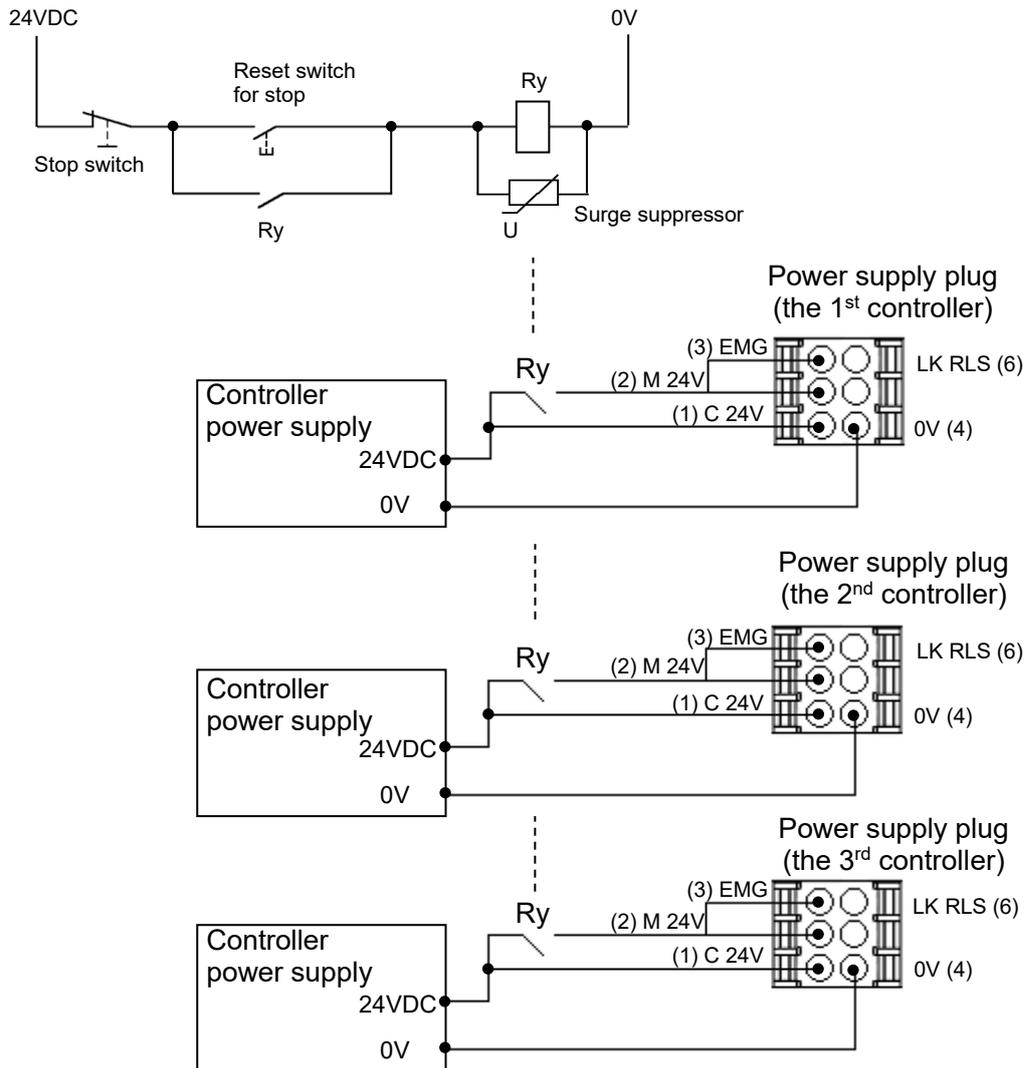
⚠Warning

(1) Relay contacts should be made between the 24 VDC controller power supply and the M24V and EMG terminal of the power supply plug. The electric actuator may make unexpected movement.

(2) When at the same time to OFF EMG and the power, For the inertia of the load, you might have to take time until the motor stops.

(3) Do not perform return to origin (SETUP input ON) 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.

(4) If the electric actuator with lock is used vertically, delay in response of the brake may occur when shutting off the motor power supply (M24V), and the moving part of the electric actuator may drop due to the weight of the electric actuator itself.

(5) Do not energize to the BK R LS terminal when there is a necessity to shut down the motor drive power (M24V) externally.
Because the LK RLS terminal is connected with M24V in the controller, the electric actuator may do unexpected operation. Please turn off the EMG terminal when energizing to the LK RLS terminal at motor drive power is OFF.

6. Parallel I/O Connector

6.1 Parallel I/O specifications

● **Input specifications**

No.	Item	Specification
1	Input circuit	Internal circuit and photo coupler isolation
2	Number of inputs	11 inputs
3	Voltage	24 VDC +/- 10%
4	Input current at ON	3.5mA +/- 20% (at 24 VDC)
5	Input current / voltage at OFF	Current 1.5 mA or less Voltage 11V or less

●**Output specifications**

No.	Item	Specification
1	Output circuit	Internal circuit and photo coupler Isolation
2	Number of outputs	13 outputs
3	Max. voltage between terminal	30VDC
4	Max. output current	10mA supply/sink
5	Saturation voltage	2.0V (Max.)

6.2 Parallel I/O type (NPN/ PNP type)

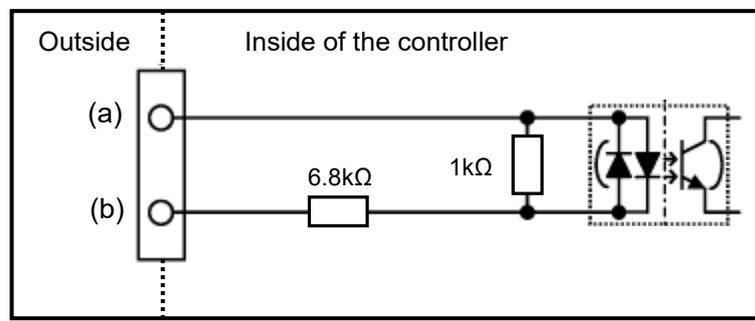There are two types of parallel I/O for this controller: NPN type and PNP type.

(1) Parallel I/O input circuit (same for both NPN and PNP type)

● NPN type（JXC51##-#）

(a)	「COM+」〈A1〉
(b)	IN0〈A3〉～SVON〈A13〉

● PNP type（JXC61##-#）

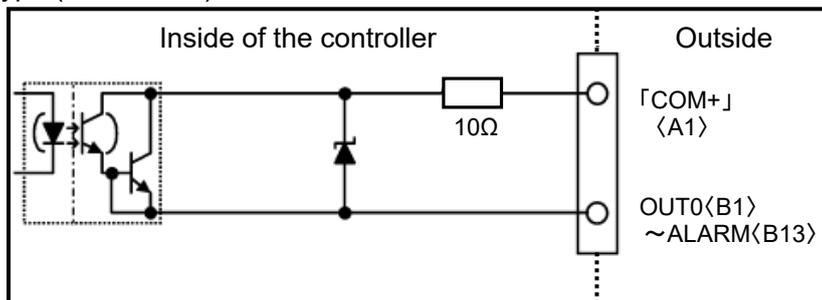| (a)	「COM-」〈A2〉
(b)	IN0〈A3〉～SVON〈A13〉

(2) Parallel I/O output circuit

● NPN type (JXC51##-#)

● PNP type (JXC61##-#)

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6.3 The parallel I/O signal is detailed

To the controller parallel IO connector

The end to be connected to a PLC, etc.

- Input terminal-

No.	Function	Description
A1	COM+	The terminal for the 24V of the 24 VDC I/O signal power.
A2	COM-	The terminal for the 0V of the 24 VDC I/O signal power.
A3	IN0	Bit no. to specify the step data
A4	IN1	(Specify the number by combining On / Off of the terminals.)
A5	IN2	Example: (Bit no. to specify the step data no.3.)
A6	IN3	
A7	IN4	
A8	IN5	
A9	SETUP	When SVRE (B11) is ON, the SETUP operation (return to origin operation) will be performed. During the SETUP operation, BUSY (B7) will be turned ON and after completion of the SETUP operation, SETON (B9) and INP (B10) will be turned ON.
A10	HOLD	If HOLD input is ON during operation, the speed decreases at maximum deceleration speed of the basic parameter until the electric actuator stops. The remaining stroke will be on hold as long as HOLD is ON and when HOLD is turned OFF, the electric actuator restart to travel the remaining stroke. ● When DRIVE or SETUP is ON:
A11	DRIVE	When DRIVE is turned ON, the system scans the input IN0 to IN5 and starts the operation of the electric actuator. Then, when this terminal is turned OFF, the number of the active step data will be output via the terminals OUT0 to OUT5.
A12	RESET	The terminal to reset the alarm and the operation. After RESET, the speed decreases at maximum deceleration speed of the basic parameter until the electric actuator stops. INP and OUT0 to OUT5 will be turned OFF (however, if the electric actuator is stopped within the in-position range, the INP will be turned ON).
A13	SVON	The SVON signals turns the servomotor ON/OFF.

Example table (A3–A8):

IN5	IN4	IN3	IN2	IN1	IN0	
OFF	OFF	OFF	OFF	ON	ON	
0	0	0	0	1	1	← Binary code

A10 HOLD diagram:

DRIVE or SETUP — ON / OFF — On hold
HOLD — ON / OFF
Speed — Restart

⚠ Caution

As long as HOLD is ON, the DRIVE input will be disabled.
The output signals are rendered invalid whilst hold is in operation.

Effective condition of the Parallel I/O signal

Signal name \ Condition	SETON	SVRE	BUSY
SETUP (Return to origin)	-	ON	OFF *1)
DRIVE (Operation start instruction)	ON	ON	-

("-" = It doesn't depend in the ON/ OFF state of the each output signal)
*1) During the positioning operation the SETUP input will be disabled whilst hold is in operation.

> ## ⚠Caution
>
> SETUP and DRIVE can only be accepted during the above conditions. An Alarm condition will happen during all other times. Make sure to have intervals of 15 ms or more and maintain the input state for the same period of time.

-Output terminal-

No.	Function	Description
B1	OUT0	When the operation is started and DRIVE is turned OFF, a Bit no. corresponding to the number of the active step data will be output from these terminals. This output signal will be updated when DRIVE (A11) terminal is be turned ON. ⚠**Caution** When RESET is turned ON, these terminals are turned OFF. During the alarm, these terminals output the alarm group.
B2	OUT1	
B3	OUT2	
B4	OUT3	
B5	OUT4	
B6	OUT5	
B7	BUSY	This terminal is ON during the movement of the electric actuator. (During the positioning operation, etc.). ⚠**Caution** During the pushing operation without movement (no movement but the electric actuator generating the pushing force), BUSY is OFF. BUSY signal stays on for 50ms or longer after operation starts.
B8	AREA	When the electric actuator is within the range between Area 2 and Area1 in the step data, this terminal will be turned ON. The range changes depending on the active step data.
B9	SETON	When the electric actuator is in the SETON status (the position information is established), this terminal is turned ON. When the position status is not established, this terminal is OFF.

B10	INP	Because of the electric actuator action, if output INP is ON, the electric actuator condition can vary.
		●At the origin when within the ± "default in position" in the Basic parameter.
		●During positioning operation
		  Turns ON when the current position is within "Step data position +/- positioning range".
		●During pushing operation.
		  When the pushing force exceeds the value set in the step data "Trigger LV".
		
		⚠**Caution**
		After pushing operation is finished, even if controller changes to energy saving mode, "INP" signal status maintains to ON.
		
		(Example) Step data "force" is 100%
		  Step data "Trigger LV" is 80%
		  The energy saving setting of the electric actuator is 40%
		  The actuator model determines the energy settings. Please refer to the electric actuator's instruction manual for details.

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B10	INP <continue>	If the stop is input from the EMG or RESET terminal or the stop-switch on the connected Teaching Box during pushing operation, the electric actuator stop. ("Busy" signal turns OFF) If the electric actuator stops within the range of "Position" ± "In posn" as defined in the step data, the output signal "INP" will turn ON.
B11	SVRE	When the servomotor is OFF, SVRE is OFF. When the servomotor is ON, SVRE is ON.
B12	*ESTOP [1]	During activation of Teaching Box stop switch, this terminal is OFF. During the normal operation, this is ON. This is synchronized to the input terminal for the EMG signal.
B13	*ALARM [1]	When there are no alarms, this terminal is ON. When there are alarms, this is OFF.

*1) The "*ALARM" and "*ESTOP" are the negative-true logic output

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

Status \ Output signal	BUSY	INP	SVRE	Lock	SETON	OUT0-5
Servo is OFF when the controller is powered for the first time Note 1)	OFF	OFF	OFF	Lock	OFF	OFF
Servo is ON when the controller is powered for the first time	OFF	OFF	ON	Release	OFF	OFF
Controller powered down [SVOFF] with no motion	OFF	OFF[2]	OFF	Lock	ON[3]	ON[4]
Controller powered down [SVON] with no motion	OFF	ON[5]	ON	Release	ON[3]	OFF
During returning to origin, [SETUP].	ON	OFF	ON	Release	OFF	OFF
The electric actuator is at the origin. On completion of [SETUP]	OFF	ON[5]	ON	Release	ON	OFF
During movement by positioning/ pushing operation.	ON	OFF	ON	Release	ON	ON[6]
The electric actuator is paused by [HOLD]	OFF	OFF	ON	Release	ON	ON[6]
On completion of the positioning operation. (within "In position")	OFF	ON[2]	ON	Release	ON	ON[6]
Stopped due to pushing a work-load in pushing operation. (holding)	OFF	ON	ON	Release	ON	ON[6]
Stopped due to no detection of work-load during a pushing operation.	OFF	OFF	ON	Release	ON	OFF
On completion of return to origin and then with [SVON] turned off.	OFF	OFF[2]	OFF	Lock	ON	ON[4]
EMG signal stop from the CN1 connector after the electric actuator is at the origin.	OFF	OFF[2]	OFF	Lock	ON	OFF

*1) Alarm "Absolute encoder ID Alarm error" is canceled.
*2) The output turns on when the electric actuator is "In position" of the step data.
*3) Return to origin completed.
*4) Retains the previous state.
*5) The output turns on when the electric actuator is within the range defined in the basic parameter setup.
*6) The output is updated on the transition of (ON→OFF) of the DRIVE input signal.

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The following table shows the relation of the positon number and the combination of IN0-IN5 or OUT0-OUT5.

0：OFF 1：ON

0：OFF 1：ON

Step No	IN5	IN4	IN3	IN2	IN1	IN0
0	0	0	0	0	0	0
1	0	0	0	0	0	1
2	0	0	0	0	1	0
3	0	0	0	0	1	1
4	0	0	0	1	0	0
5	0	0	0	1	0	1
6	0	0	0	1	1	0
7	0	0	0	1	1	1
8	0	0	1	0	0	0
9	0	0	1	0	0	1
10	0	0	1	0	1	0
11	0	0	1	0	1	1
12	0	0	1	1	0	0
13	0	0	1	1	0	1
14	0	0	1	1	1	0
15	0	0	1	1	1	1
16	0	1	0	0	0	0
17	0	1	0	0	0	1
18	0	1	0	0	1	0
19	0	1	0	0	1	1
20	0	1	0	1	0	0
21	0	1	0	1	0	1
22	0	1	0	1	1	0
23	0	1	0	1	1	1
24	0	1	1	0	0	0
25	0	1	1	0	0	1
26	0	1	1	0	1	0
27	0	1	1	0	1	1
28	0	1	1	1	0	0
29	0	1	1	1	0	1
30	0	1	1	1	1	0
31	0	1	1	1	1	1

Step No	OUT 5	OUT 4	OUT 3	OUT 2	OUT 1	OUT 0
0	0	0	0	0	0	0
1	0	0	0	0	0	1
2	0	0	0	0	1	0
3	0	0	0	0	1	1
4	0	0	0	1	0	0
5	0	0	0	1	0	1
6	0	0	0	1	1	0
7	0	0	0	1	1	1
8	0	0	1	0	0	0
9	0	0	1	0	0	1
10	0	0	1	0	1	0
11	0	0	1	0	1	1
12	0	0	1	1	0	0
13	0	0	1	1	0	1
14	0	0	1	1	1	0
15	0	0	1	1	1	1
16	0	1	0	0	0	0
17	0	1	0	0	0	1
18	0	1	0	0	1	0
19	0	1	0	0	1	1
20	0	1	0	1	0	0
21	0	1	0	1	0	1
22	0	1	0	1	1	0
23	0	1	0	1	1	1
24	0	1	1	0	0	0
25	0	1	1	0	0	1
26	0	1	1	0	1	0
27	0	1	1	0	1	1
28	0	1	1	1	0	0
29	0	1	1	1	0	1
30	0	1	1	1	1	0
31	0	1	1	1	1	1

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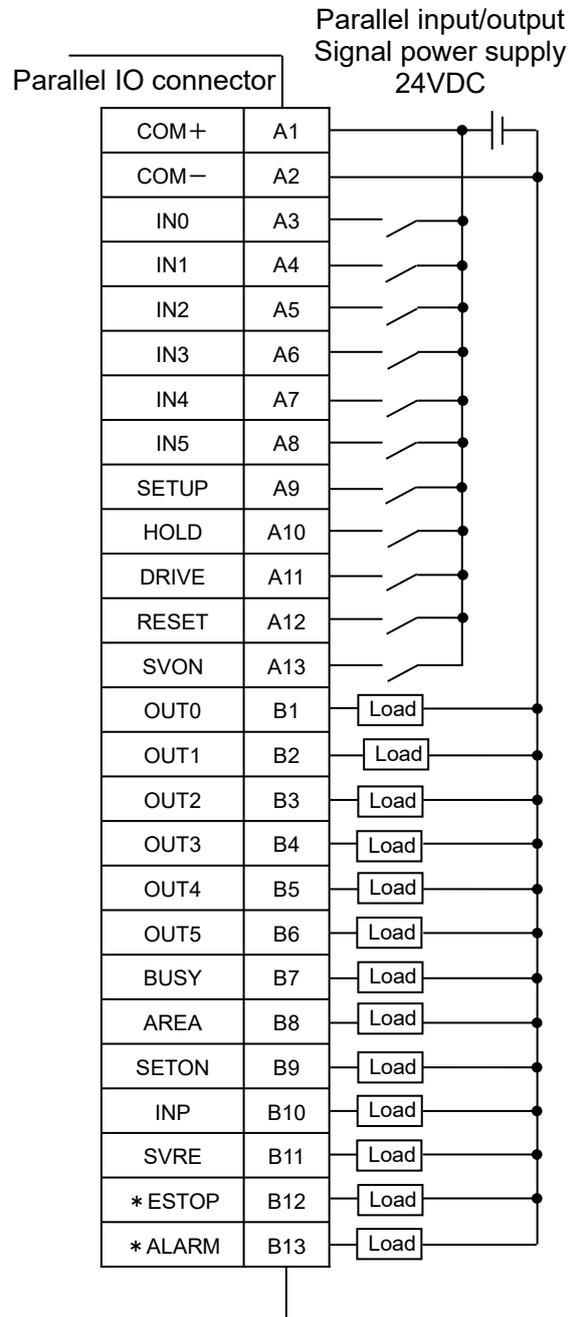| Step No	IN5	IN4	IN3	IN2	IN1	IN0	Step No	OUT5	OUT4	OUT3	OUT2	OUT1	OUT0
32	1	0	0	0	0	0	32	1	0	0	0	0	0
33	1	0	0	0	0	1	33	1	0	0	0	0	1
34	1	0	0	0	1	0	34	1	0	0	0	1	0
35	1	0	0	0	1	1	35	1	0	0	0	1	1
36	1	0	0	1	0	0	36	1	0	0	1	0	0
37	1	0	0	1	0	1	37	1	0	0	1	0	1
38	1	0	0	1	1	0	38	1	0	0	1	1	0
39	1	0	0	1	1	1	39	1	0	0	1	1	1
40	1	0	1	0	0	0	40	1	0	1	0	0	0
41	1	0	1	0	0	1	41	1	0	1	0	0	1
42	1	0	1	0	1	0	42	1	0	1	0	1	0
43	1	0	1	0	1	1	43	1	0	1	0	1	1
44	1	0	1	1	0	0	44	1	0	1	1	0	0
45	1	0	1	1	0	1	45	1	0	1	1	0	1
46	1	0	1	1	1	0	46	1	0	1	1	1	0
47	1	0	1	1	1	1	47	1	0	1	1	1	1
48	1	1	0	0	0	0	48	1	1	0	0	0	0
49	1	1	0	0	0	1	49	1	1	0	0	0	1
50	1	1	0	0	1	0	50	1	1	0	0	1	0
51	1	1	0	0	1	1	51	1	1	0	0	1	1
52	1	1	0	1	0	0	52	1	1	0	1	0	0
53	1	1	0	1	0	1	53	1	1	0	1	0	1
54	1	1	0	1	1	0	54	1	1	0	1	1	0
55	1	1	0	1	1	1	55	1	1	0	1	1	1
56	1	1	1	0	0	0	56	1	1	1	0	0	0
57	1	1	1	0	0	1	57	1	1	1	0	0	1
58	1	1	1	0	1	0	58	1	1	1	0	1	0
59	1	1	1	0	1	1	59	1	1	1	0	1	1
60	1	1	1	1	0	0	60	1	1	1	1	0	0
61	1	1	1	1	0	1	61	1	1	1	1	0	1
62	1	1	1	1	1	0	62	1	1	1	1	1	0
63	1	1	1	1	1	1	63	1	1	1	1	1	1

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6.4 Parallel I/O Wiring Example

When you connect a PLC, etc. to the CN5 parallel I/O connector, please use the I/O cable (LEC-CN5-#).
The wiring should be changed depending on the type of the parallel I/O (NPN or PNP).
Please wire referring to the following diagram.

● **NPN type**

Parallel IO connector

COM＋	A1
COM－	A2
IN0	A3
IN1	A4
IN2	A5
IN3	A6
IN4	A7
IN5	A8
SETUP	A9
HOLD	A10
DRIVE	A11
RESET	A12
SVON	A13
OUT0	B1
OUT1	B2
OUT2	B3
OUT3	B4
OUT4	B5
OUT5	B6
BUSY	B7
AREA	B8
SETON	B9
INP	B10
SVRE	B11
＊ESTOP	B12
＊ALARM	B13

Parallel input/output
Signal power supply
24VDC

● **PNP type**

Parallel IO connector

COM＋	A1
COM－	A2
IN0	A3
IN1	A4
IN2	A5
IN3	A6
IN4	A7
IN5	A8
SETUP	A9
HOLD	A10
DRIVE	A11
RESET	A12
SVON	A13
OUT0	B1
OUT1	B2
OUT2	B3
OUT3	B4
OUT4	B5
OUT5	B6
BUSY	B7
AREA	B8
SETON	B9
INP	B10
SVRE	B11
＊ESTOP	B12
＊ALARM	B13

Parallel input/output
Signal power supply
24VDC

⚠Caution

24 VDC power supply for controller input and 24 VDC power supply for parallel I/O signal should be separate supplies.

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7. Setting Data Entry

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

For the controller setting software and the teaching box, there are two available modes. The appropriate mode can be selected depending on the purpose.

- Easy mode
  In Easy mode, the electric 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 the electric actuator. (combination of data can be selected.)
- Normal mode
  In Normal mode, a more detailed setup can be made (conditions for the electric actuator and controller, etc.) than in Easy mode.
  You can change three kinds of setting data, "Step data", "Basic parameter" and "Return to origin parameter" in this mode.

7.1 Step data

Step data is the actual data relating to the operation of the electric actuator.
There are 64 patterns of step data. Each of them has 12 item to be set.
Each step data will become effective as soon as it is written to the controller.

Example) Step data of the control1ler setting software [Normal mode]

No.	Move	Speed mm/s	Position mm	Accel mm/s^2	Decel mm/s^2	PushingF %	TriggerLV %	PushingSp mm/s	Moving F %	Area1 mm	Area2 mm	In posn mm
0	ABS	100	20.00	1000	1000	0	0	0	100	18.00	22.50	0.5
1	ABS	50	10.00	1000	1000	70	60	5	100	6.0	12.0	1.5
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
63	ABS	20	5.00	500	500	0	0	0	100	3.0	8.0	1.2

⚠Caution

Writing of the step data should be performed while the electric actuator is stopped.

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Details of step data

Setting name	Range	Description
No.	0 to 63	Number of the step data.
Movement MOD	3 options (See the right descriptions.)	The setting to specify the coordinate system for the target position. | Software	TB	Description
Blank	Disable	The step data is ineffective.
Absolute	Absolute	The target position will be defined by the absolute coordination based on the zero point.
Relative	Relative	The target position will be defined by the relative coordination based on the current position.	
Speed	Minimum value to "Max speed" of the basic parameter [*1]	The speed to move to the target position (Unit: mm/s)
Position	"Stroke (-)" to "Stroke (+)" of the basic parameter	The target position (Unit: mm)
Acceleration	1 to "Max ACC/ DEC" of the basic parameter	The acceleration to reach to the Speed (Unit: mm/s^2)
Deceleration	1 to "Max ACC/ DEC" of the basic parameter	The deceleration to reach to the Speed (Unit: mm/s^2)
Pushing force	0 or Minimum value to "Max force" of the basic parameter [*1]	The setting to define the pushing operation or the positioning operation. For the positioning operation, the value specifies the force as the percentage against the maximum force (Unit: %). The maximum force changes depending on the electric actuator. Please refer to the manual and the rated force of the electric actuator. | Value	Operation	Description
0	Positioning operation	The electric actuator moves to the position specified in the "Position".
1-100	Pushing operation	The electric actuator moves to the position specified in the "Position" and then, performs a pushing action with a force not more than the set force.	
Trigger LV	Minimum value to "Max force" of the basic parameter [*1]	●Effective only for the pushing operation (when the value for the "Pushing force" is from 1 to 100). This is the setting to define the conditions where the INP will be turned ON. When the electric actuator generates a force over this value, INP will be turned ON. (Unit: %) ●For the positioning operation, this value is ignored.

Pushing speed	Minimum value to "Max force" of the basic parameter [1]	●Effective only for the pushing operation (when the value for the "Pushing force" is from 1to 100). This defines the movement speed during the pushing operation. If this Speed is too high, it may cause damage to the electric actuator or work piece due to impacts. Therefore, enter a value within the range appropriate for the electric actuator. (Unit: mm/s) Please refer to the electric actuator manual for the appropriate range of the speed. ●For the positioning operation, this value is ignored.
Moving force	[1]	The setting to define the maximum torque during the positioning operation. Enter a value within the range appropriate for the electric actuator. (Unit: %). Please refer to the electric actuator manual for the appropriate range of the speed.
Area1	"Stroke (-)" to "Area2" of step data	The setting to define the conditions where the AREA output will be turned ON (Unit: mm). If the current position is within the range between the Area1 and Area2, the AREA output will be turned ON.
Area2	"Area1" of step data to "Stroke (+)" of the basic parameter	If Area1 >Area2, the alarm "Step Data ALM1" will be activated. (However, no alarm is generated if "Area1" = "Area2" = 0, the AREA output will be turned OFF).
In position	[1]	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). See sub-table below.

Operation	Description
Positioning operation	This is the setting to define the conditions where the INP output will be turned ON. When the electric actuator enters within this range from the target position, the INP will be turned ON. (It is unnecessary to change this from the initial value.) If it is required to get a signal before the electric actuator completes the positioning operation, this value should be larger. The INP output will be turned on. Target position - in position $\leqq$ electric actuator position $\leqq$ target position + in position
Pushing operation	This is the setting to define the distance pushed by the electric actuator during the pushing operation. When the electric actuator pushed exceeding this distance, the pushing operation will end. In case of such stop exceeding the pushing distance, the INP will not be turned ON.

[1] The range varies depending on the electric actuator.

Please refer to the manual of the electric actuator for more details.

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7.2 Basic parameter

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

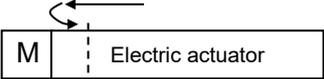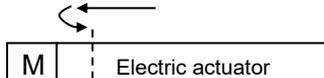| ⚠**Caution** |
|---|
| Writing of the parameter should be performed while the electric actuator is stopped. |

Details of basic parameter

Activation: "XX" = Become effective just after recorded into the controller

"X" = Become effective after restarting the controller

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

Parameter name	Range	Description	Activation
Controller ID	1 to 32	Identification number (axis) parameters of serial communications are set.	X
IO pattern	Fixed value	This is the fixed value for this controller (It should not be changed). The value for this should be 64(Standard).	-
ACC/ DEC pattern	Fixed value	This is the fixed value for this controller (It should not be changed). This defines the trapezoid acceleration/ deceleration parameter.	-
S-motion rate	Fixed value	This is the fixed value for this controller (It should not be changed).	-
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.	XX
Stroke (-)	[*1]	This defines the negative (-) 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.	XX
Max speed	[*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. [*2]	XX
Max ACC/DEC	[*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.	XX
Def In position	[*1]	This defines the range to activate the INP output when the electric actuator is within it after the return to origin operation. (Unit: mm)	XX

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ORIG offset	*1)	This defines the position of the electric actuator after the return to origin operation. (Unit: mm) ● The ORIG offset is 0 (mm). M : Electric actuator The position recognized by the controller after the return to the origin operation (0mm). ● The ORIG offset is 100 (mm). M : Electric actuator The position is identified by the controller after the return to the origin operation (100mm). ⚠**Caution** If the value for the "ORIG offset" is changed, the "Stroke (+)" and "Stroke (-)" of the basic parameters should be checked again. "ORIG offset" becomes valid after the return to origin operation, make sure that return to origin operation is performed after change. Between the left examples, the electric actuator positions are not different but the reference point that the controller recognizes will be changed after the return to origin operation.	XX
Max force	*1)	The maximum force for the pushing operation (Unit: %).	XX
Para protect	1 to 2	Sets the range in which parameter and step data can be changed. <table><tr><td>Value</td><td>Description</td></tr><tr><td>1：Common + Step data</td><td>Basic parameter + Return to origin parameter + Step data</td></tr><tr><td>2：Common</td><td>Basic parameter + Return to origin parameter</td></tr></table>	XX
Enable SW	1 to 2	This defines the status of the Enable switch of the teaching box. <table><tr><td>Value</td><td>Description</td></tr><tr><td>1</td><td>Enable</td></tr><tr><td>2</td><td>Disable</td></tr></table>	XX
Unit name	Fixed value	Indication of the electric actuator type compatible to the controller. It should not be changed	-
W-AREA1 W-AREA2 ORG Correct [Link Offset] Sensor type Option 1 Undefined parameter No.11 Undefined parameter No.12	Fixed value	This is the fixed value for this controller. It should not be changed.	-

*1) The range varies depending on the electric actuator. Please refer to the manual of the electric actuator for more details.
*2) It is recommended to set the "maximum speed" for the electric actuator operation. Control is restricted so that the set value is not exceeded. The response will be slower because of this.

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7.3 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: "XX" = Become effective just after recorded into the controller
"X" = Become effective after restarting the controller
"-" = The parameter cannot be changed (fixed value)

Parameter name	Range	Description	Activation
ORIG direction	1 to 2	Sets the direction of return to origin operation. Note1) 1. CW 2. CCW	X
Return to origin mode	1 to 2	The setting for the return to origin operation. 1: Pushing origin operation [Stop] 2: Limit switch origin [SW]	XX
ORIG limit	Note2)	A pushing force level at which to set the origin.	XX
ORIG time	Fixed value	This is a fixed value for the controller. (Do not change the setting)	—
ORIG speed	Note2)	The allowable speed to move to origin.	XX
ORIG ACC/ DEC	Note2)	The acceleration and deceleration during return to origin operation.	XX
Creep speed	Fixed value	This is a fixed value for the controller. (Do not change the setting)	—
ORIG sensor	0 to 2	The setting for the 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].	XX
ORIG SW DIR	Fixed value	This is a fixed value for the controller. (Default value is "0")	—
Undefined parameter No.21	Fixed value	This is a fixed value for the controller. (Default value is "0")	—

Note1) When power is applied again after changing Return to origin parameter "Return to Origin Direction", the SETON output is turned OFF.
Perform return to origin operation again.

Note2) The actuator model determines the available input values. Refer to the operation manual of the actuator for details.

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8. Perations

8.1 Return to origin position

Return to origin operation should be performed first in the following cases.
- (1) When the power is turned on.
    - Battery-les absolute encoder compatible:
        - When the power is turned on for the first time, it is necessary to return to origin operation.
        - It is not necessary to return to origin operation when the power is turned on again after the next time.
    - Incremental encoder compatible:
        - It is necessary to return to origin operation every time the power is turned on.
- (2) When the actuator or motor is replaced.
    - It is necessary to return to origin operation both battery-less aboslute encoder compatible and incremental encoder comapible.
- (3) When alarm "Group E" is cleared by applying the power again.
    - It is necessary to return to origin operation both battery-less aboslute encoder compatible and incremental encoder comapible.

For (1) and (2) with battery-less absolute compatible, "Absolute encoder ID Alarm error (01-153)" is generated after the power is turned on, so perform the return to origin operation after resetting the alarm.

If the electric actuator and controller are purchased as a set part number, "Absolute encoder ID Alarm error (01-153)" does not occur when the power is turned on in (1) because the alarm is reset at the factory.

However, when multiple units with the same set part number are purchased, If the electric actuator and controller are connected in a different combination from the factory default, the "Absolute encoder ID Alarm error (01-153)" will occur when the power is turned on in (1).

■Return to origin operation
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 signal
↓
Move in the return to origin direction
↓
Stop the movement
↓
Move in the opposite direction
↓
Origin position

(Example) Return to origin operation

Basic parameter "Def in position"
Load
Motor
Electric actuator
(2)
Origin position
electric Actuator end
(1)
Initial position
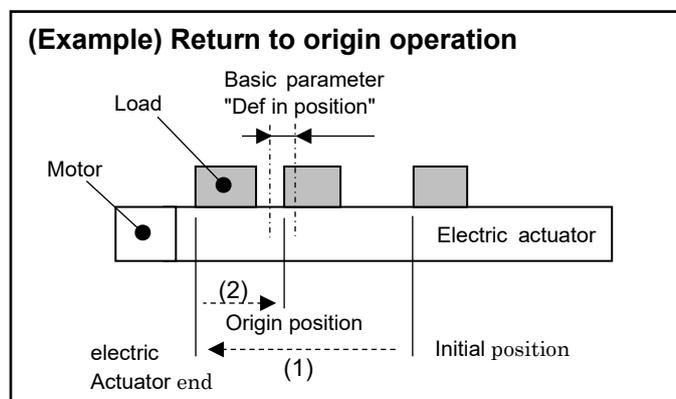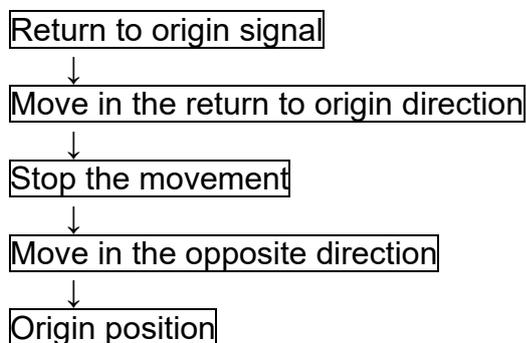
⚠ Caution

This direction is dependent on the electric actuator.

8.2 Positioning operation

Step data "Pushing force" is 0.
The electric actuator moves to the target position specified by the step data "Position".

●**Positioning operation (Example)**

Motor

Load

Step data
"In position"

Step data
"Speed"

Electric actuator

Origin position

Target position
→Step data "Position"
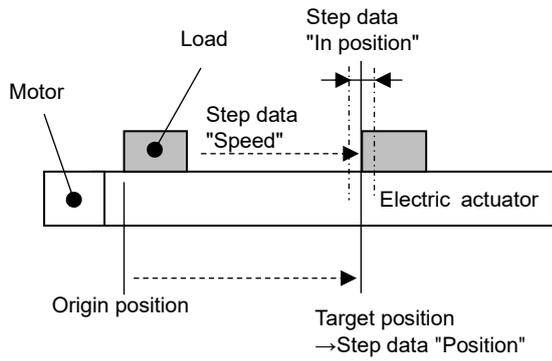
● **Positioning operation [Speed/ Position] (Example)**

Positioning range
(In position)

Speed

Position

Target position
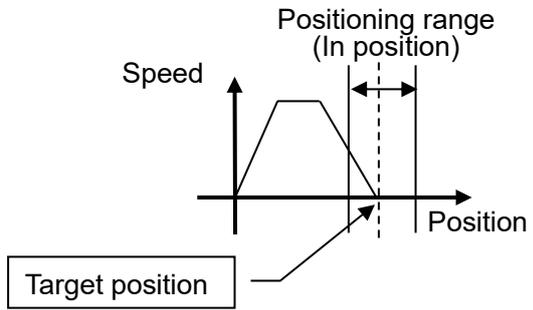
8.3 Pushing operation

The pushing operation is active when a Value greater than "1" is set in the Step data "pushing force".
Similar to the positioning operation, the electric actuator moves according to the settings of "Position" and "Speed" in the step data and then, when it reaches to the target position, it starts the pushing process.
The electric actuator pushes the load with the 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, the INP output will be turned ON. Even after this completion of pushing operation, the electric actuator keeps generating the force setup in the step data.

● **Pushing operation (Example)**

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

(2) Pushing operation is failed (pushing the air)

If the pushing process is not completed even after the electric 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 such case, the INP output will be turned OFF.
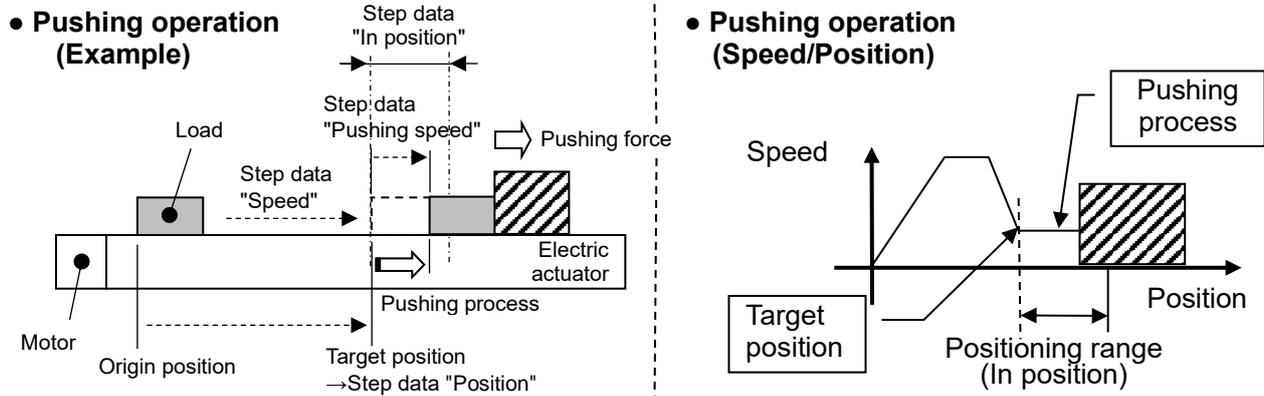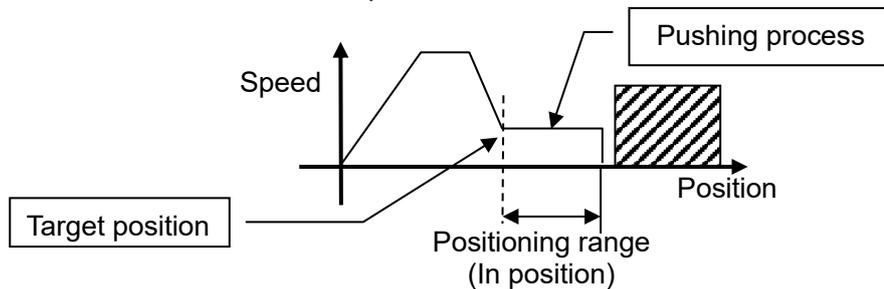
(3) Movement of the work piece after the completion of the pushing process

1) Movement of the work piece in the pushing direction.
After completion of the pushing operation, if the reaction force from the work piece becomes smaller, the electric actuator may move with a force smaller than that specified in the "TriggerLV" of the step data.
In such case, the INP output will be turned OFF and the electric 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, the INP output will be reactivated.
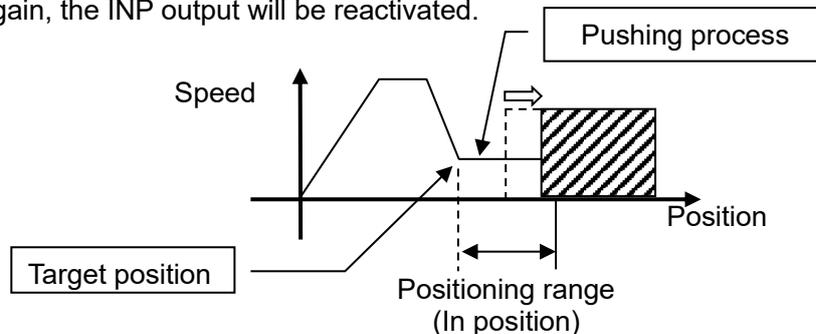
2) Movement of the work piece in the direction opposite to the pushing direction

(The electric actuator is pushed back since the reaction force from the work piece is too large.)

After completion of the pushing operation, if the reaction force from the work piece becomes larger, the electric actuator may be pushed back. In such case, while the INP output is kept be ON, the electric actuator will be pushed back to the point where the reaction force and the electric actuator pushing force are balanced (pushed back toward the target position). If the electric actuator is pushed back over the target position, the alarm (ORIG ALM) will be activated.
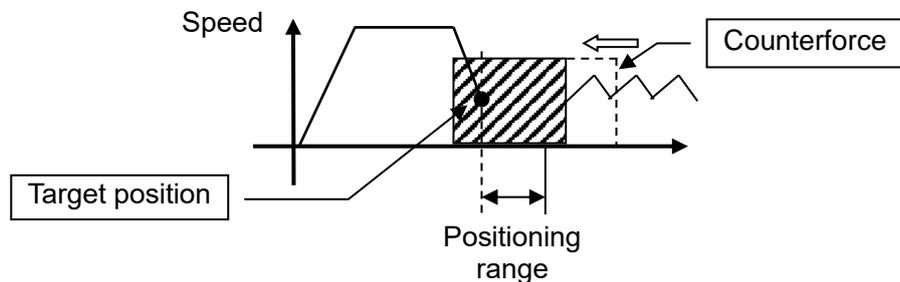
8.4 Controller input signal response time

The factors that may cause the controller to delay's in responding to the input signal are as follows:

(1) The controller delayed in scanning the input signal.

(2) The analysis and computing of the input signal is delayed.

(3) The analysis and processing of the command is delayed.

Both PLC processing delay and controller scan delay are generated. Ensure that 15 ms or more should be maintained between signals.

8.5 Methods of interrupting operation

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

●Stopping by EMG signal

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

●Stopping by RESET signal

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

●Stopped by HOLD signal

The electric actuator decelerates to stop when HOLD signal is ON during operation.

(The servo does not turn OFF.)

⚠ Caution
If instructed to stop by EMG signal and RESET signal, all OUT signals will turn OFF. The RESET signal input during HOLD is valid.

9. Operation (example)

9.1 Positioning operation

Example) Move the electric actuator from the origin to 50mm point with 100mm/s. (Using Step No.1)
Next, it shows setting example to move the electric actuator from the 50mm point to 100mm point by moving it 5 times continuously, 10mm at a time, with a speed of 50 mm/s. (Step No. 2)

● [Normal mode] Step data example

No.	Move ment MOD	Speed mm/s	Position mm	Accele ration mm/s²	Decele ration mm/s²	Pushing force %	Trigger LV %	Pushing speed mm/s	Moving force %	Area1 mm	Area2 mm	In position 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

Controller Parallel I/O signal

Signal	Category
DRIVE	Input
IN0	
IN1	
OUT0	Output
OUT1	
INP	
BUSY	

PLC

(2)(5)(10)(13) → DRIVE
(1) → IN0
(9) → IN1
(6) ← OUT0
(14) ← OUT1
(15)(11)(7)(3) ← INP
(16)(12)(8)(4) ← BUSY

Operation

Load
Motor
Electric actuator
...
0mm Origin
50mm 60mm
100mm End position

Flow chart (example)

(1) Select/ input No.1 (Turn on IN0)
↓
(2) Turn on DRIVE input.
↓
Start moving to the position of No.1
↓
OUT0 to OUT5 turns off.
↓
(3) INP output turns off.
↓
(4) BUSY output turns on.
↓
(5) Turn off DRIVE input.
↓
(6) OUT0 output turns on
  (No.1 output turns on)
↓
(7) INP output turns on.
↓
(8) BUSY output turns off.
↓
Completed to move to the position of No.1.
↓
(9) Select/ input No.2.
  (Turn off IN0 input, and turn on IN1)
↓
(10) Turn on DRIVE input.
↓
Start moving to 10mm away from the current position.
↓
No. output OUT0 to OUT5 turns off.
↓
(11) INP output turns off.
↓
(12) BUSY output turns on.
↓
5 times
(13) Turn off DRIVE input.
↓
(14) OUT1 output turns on
  (No.2 output turns on)
↓
(15) INP output turns on.
↓
(16) BUSY output turns off.
↓
Completed to move to 10mm away.
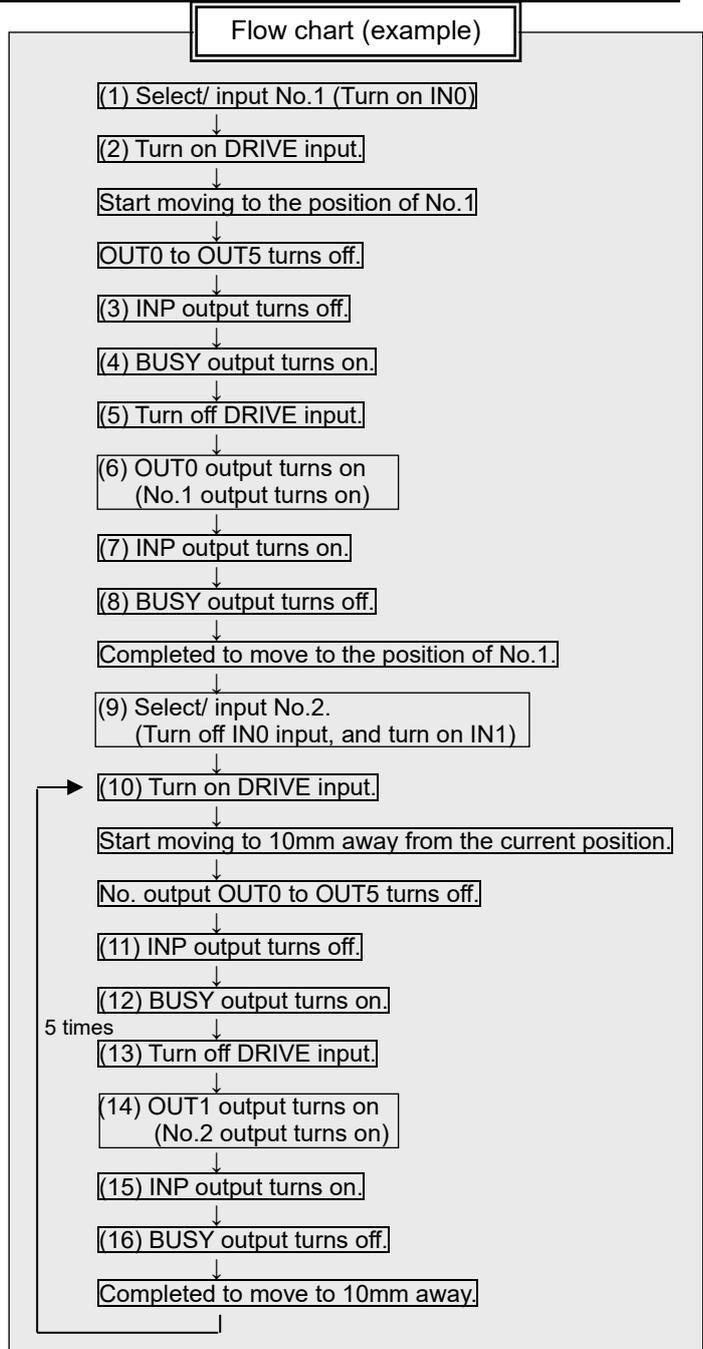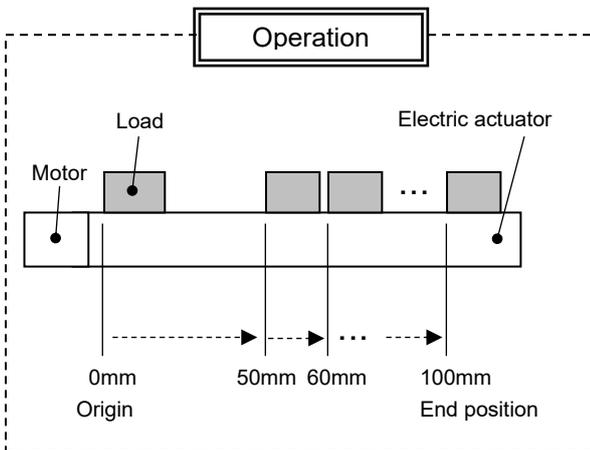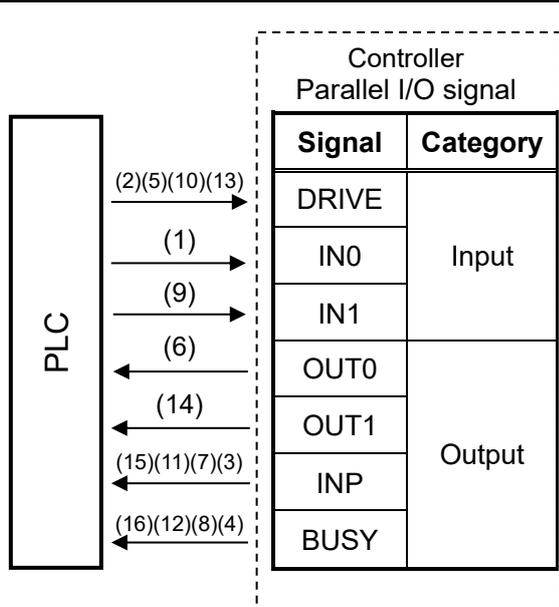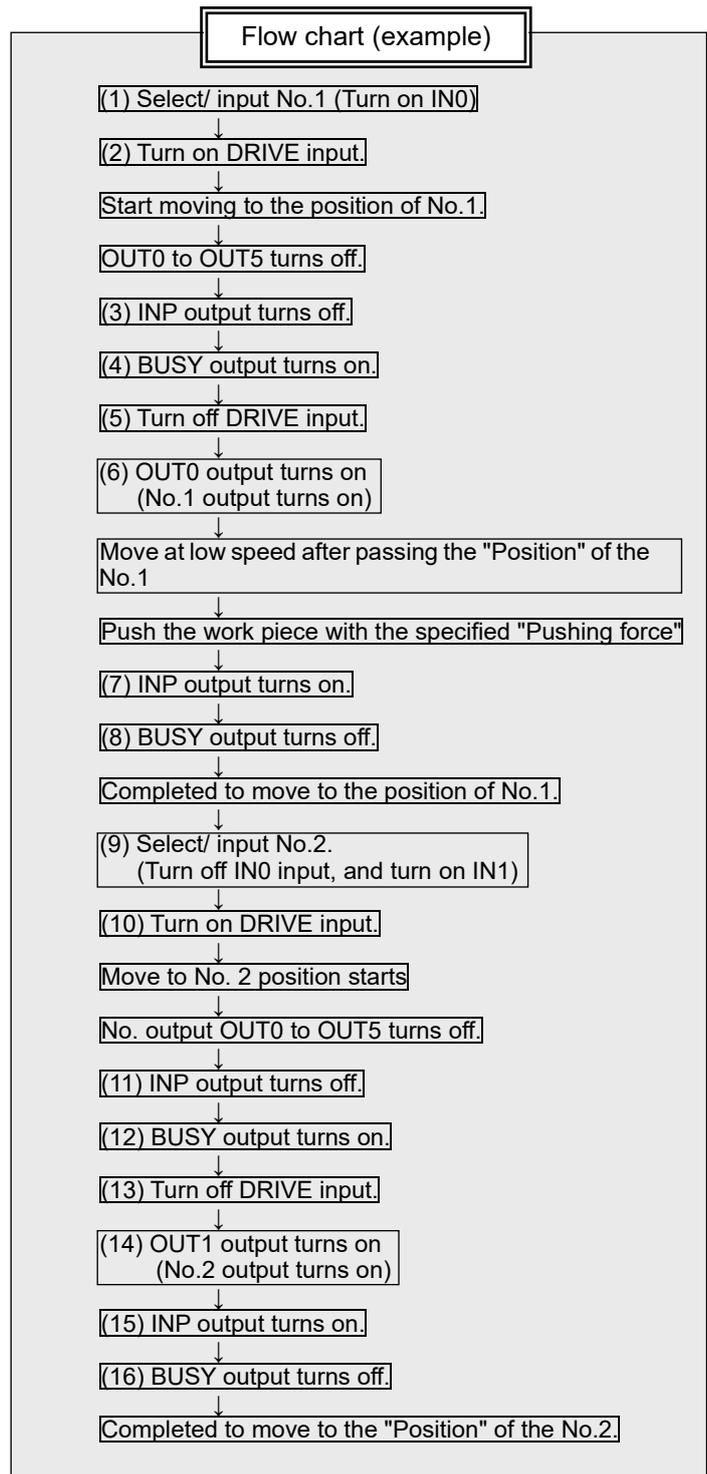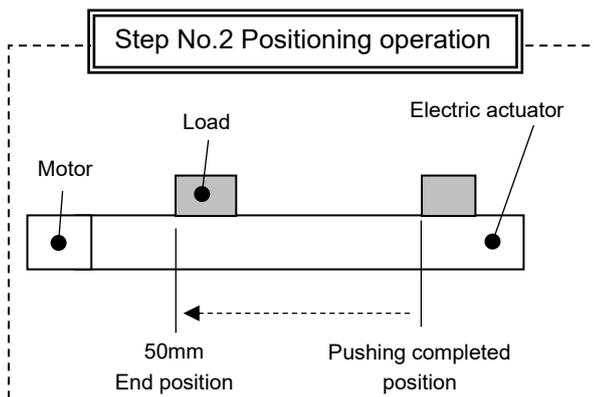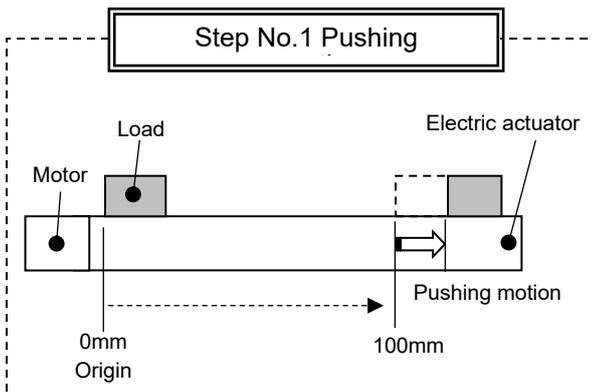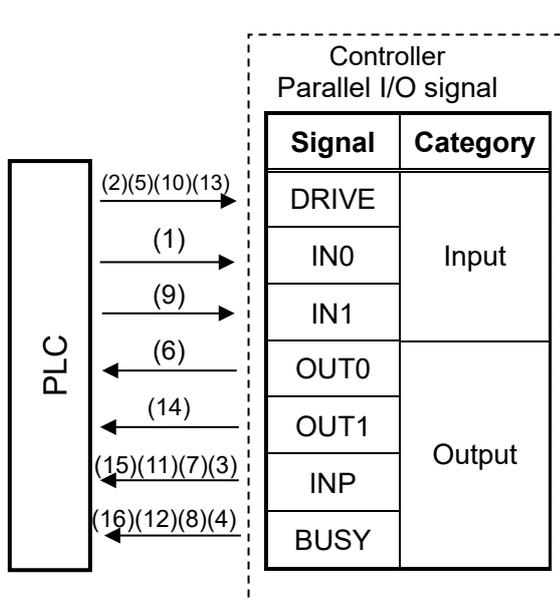
9.2 Pushing operation

Example) Move the electric actuator from the origin to 100mm point with 100mm/s. (Using Step No.1)
From the 100mm point, the electric actuator starts the pushing operation of 10mm/s speed and 50% or less force (the pushing distance is up to 5mm). Then, the electric actuator moves from the position where the pushing operation was completed (where INP was turned on) to the 50mm point with 50mm/s. (Using Step No.2)

● [Normal mode] Step data example

No.	Move ment MOD	Speed mm/s	Position mm	Acceleration mm/s^2	Deceleration mm/s^2	Pushing force %	Trigger LV %	Pushing speed mm/s	Moving force %	Area1 mm	Area2 mm	In position 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

Controller Parallel I/O signal

Signal	Category
DRIVE	Input
IN0	
IN1	
OUT0	Output
OUT1	
INP	
BUSY	

PLC
(2)(5)(10)(13) → DRIVE
(1) → IN0
(9) → IN1
(6) ← OUT0
(14) ← OUT1
(15)(11)(7)(3) ← INP
(16)(12)(8)(4) ← BUSY

Step No.1 Pushing

Load
Motor
Electric actuator
Pushing motion
0mm Origin
100mm

Step No.2 Positioning operation

Load
Motor
Electric actuator
50mm End position
Pushing completed position

Flow chart (example)

(1) Select/ input No.1 (Turn on IN0)
↓
(2) Turn on DRIVE input.
↓
Start moving to the position of No.1.
↓
OUT0 to OUT5 turns off.
↓
(3) INP output turns off.
↓
(4) BUSY output turns on.
↓
(5) Turn off DRIVE input.
↓
(6) OUT0 output turns on
(No.1 output turns on)
↓
Move at low speed after passing the "Position" of the No.1
↓
Push the work piece with the specified "Pushing force"
↓
(7) INP output turns on.
↓
(8) BUSY output turns off.
↓
Completed to move to the position of No.1.
↓
(9) Select/ input No.2.
(Turn off IN0 input, and turn on IN1)
↓
(10) Turn on DRIVE input.
↓
Move to No. 2 position starts
↓
No. output OUT0 to OUT5 turns off.
↓
(11) INP output turns off.
↓
(12) BUSY output turns on.
↓
(13) Turn off DRIVE input.
↓
(14) OUT1 output turns on
(No.2 output turns on)
↓
(15) INP output turns on.
↓
(16) BUSY output turns off.
↓
Completed to move to the "Position" of the No.2.

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10. Start up procedure for battery-less absolute encoder

10.1 Procedure for start up

Procedure for start up of the battery-less absolute encoder for every occasion when the power is applied.

* For the procedure for turning on the power with the incremental encoder, please refer to "11 Operation instruction (1) Power on to origin return".

10.1.1 When power is supplied for the first time (Refer to 10.2 for details)
In the following cases, Alarm No.10-153 "Absolute encoder ID does not match controller data" is generated after the power is applied, so perform the return to origin operation after resetting the alarm.

In addition, "When power is supplied for the first time" indicates the following cases.
- When connecting the electric actuator and turning on the power for the first time after purchase.
- When the actuator or motor has been replaced.
- When replacing the controller.

If the electric actuator and controller have been purchased as a set part number, the alarm may not be generated by the customer because the alarm No. 01-153 "Absolute encoder ID does not match controller data" is reset at the factory.
(If multiple units are purchased with the same set part number, alarm No. 01-153 "Absolute encoder ID does not match controller data" will occur depending on the combination of the connected electric actuator and controller.)

10.1.2 When the power is supplied again (Refer to 10.3 for details)

10.1.3 Alarm (group E) is cleared by a cut to the power supply (Refer to 10.4 for details).
SETON output is turned OFF. Perform return to origin operation.
When the power is applied again after changing Return to origin parameter "Return to Origin Direction", follow the same start up procedure.

10.2 When supplying power for the first time

Please refer to the following [Procedures and Timing diagram] for each operation.

-Procedure-

1) Supply power
   ↓
2) ESTOP output is turned OFF
   ALARM output is turned ON
   OUT3 output is turned ON
   ([1-153: Absolute encoder ID does not match controller data] alarm is generated)
   ↓
3) RESET is turned ON.
   ↓
4) ALARM output is turned OFF.
   ↓
5) SVON input is turned ON
   ↓
6) SVRE output is turned ON.
   * The actuator with lock is unlocked.
   ↓
7) SETUP input is turned ON.
   ↓
8) BUSY output is turned ON.
   (Starts the operation.)
   ↓
9) SETON, INP output turns ON.
   Return to origin is completed when BUSY output is turned OFF.
   When return to origin operation is completed, DRIVE is available.

-Timing diagram-
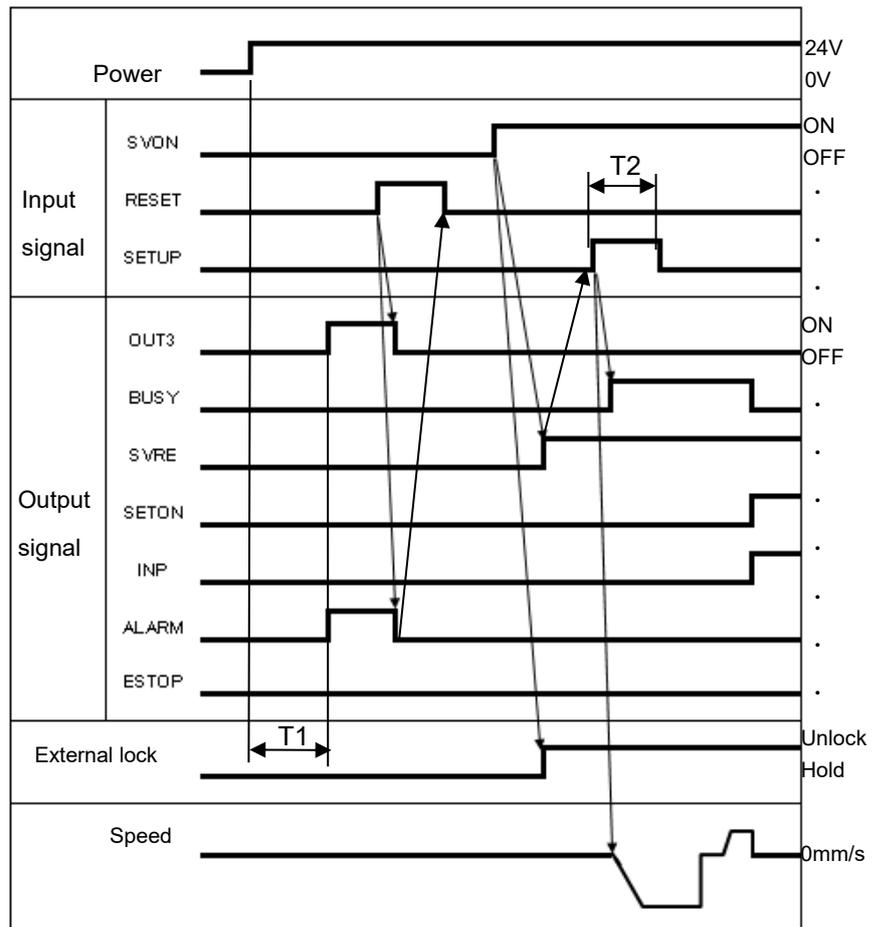
T1: 1.6 s or less (System initialize time + Time required to activate alarm)

T2: 15 ms or more
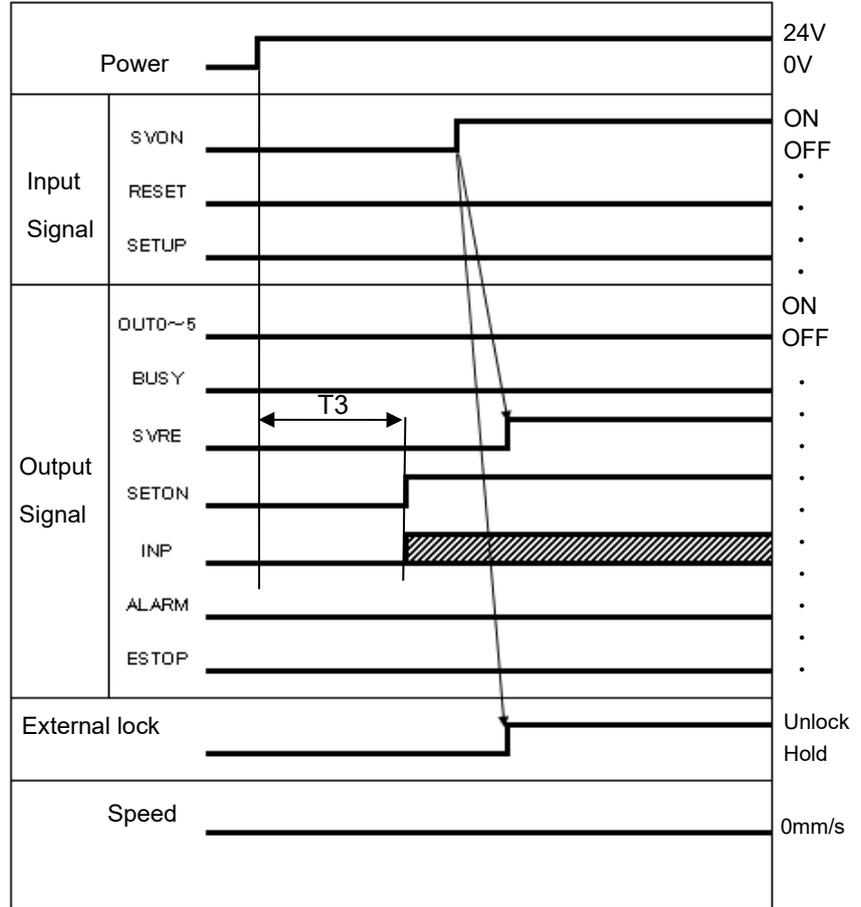
10.3 Supply of power

(1) Power supply is turned back on (Normal)

> If [ALARM] is OFF (no alarm) after supplying power again, SETON output is ON after T3.

-Procedure-

1) Supply power
   ↓
2) ESTOP output is turned OFF
   ALARM output is turned OFF
   ↓
3) SETON output is turned ON
   after T3
   ↓
4) SVON input is turned ON.
   ↓
5) SVRE output is turned ON.
   When return to origin
   operation is completed,
   DRIVE is available.

-Timing diagram-

Power			24V / 0V
Input Signal	SVON		ON / OFF
	RESET		·
	SETUP		·
Output Signal	OUT0~5		ON / OFF
	BUSY		·
	SVRE	T3	·
	SETON		·
	INP		·
	ALARM		·
	ESTOP		·
External lock			Unlock / Hold
Speed			0mm/s

T3: 3 s or less

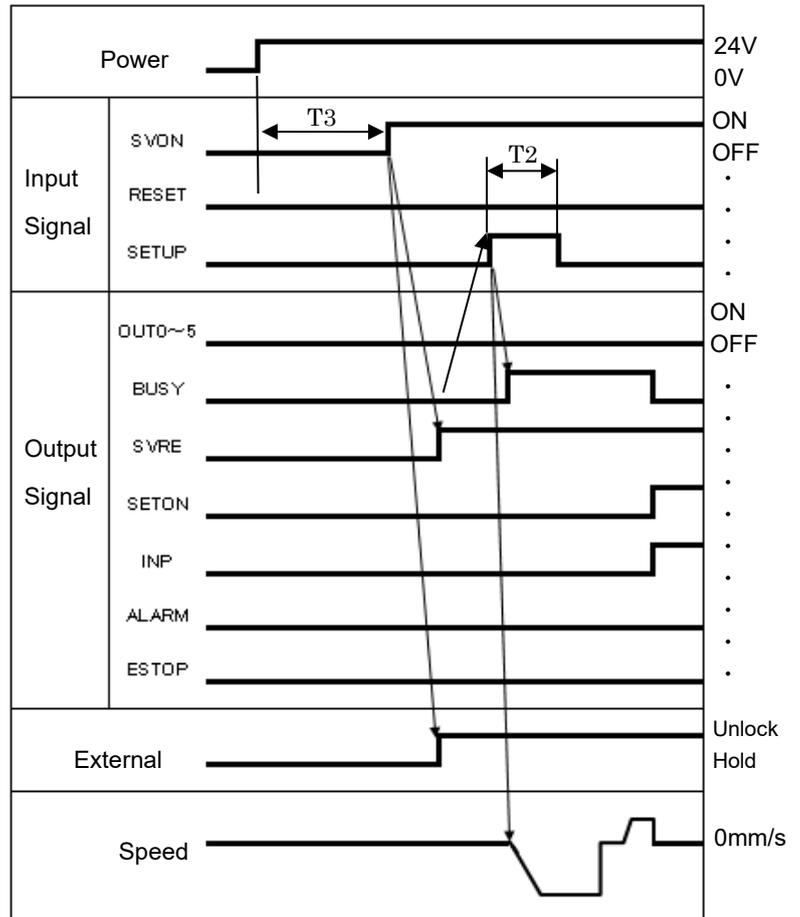(System initialize time ＋ Time required for reading position data)

10.4 Alarm (group E) is cleared by a cut to the power supply

It is necessary to perform the return to origin operation when alarm (group E) is generated and the alarm is cleared by shutting off the power supply.
When the power is applied again after changing Return to origin parameter "Return to Origin Direction", follow the same start up procedure.

-Procedure-

1) Supply power
   ↓
2) ALARM output turns OFF
   ESTOP output is turned OFF
   ↓
3) SVON input turns ON after T1 passed
   ↓
4) SVRE output is turned ON.
   *The time taken for SVRE output to turn ON depends on the actuator type and the operating conditions.
   *The actuator with lock is unlocked.
   ↓
5) SETUP input is turned ON.
   ↓
6) BUSY output is turned ON.
   (Starts the operation.)
   ↓
7) Return to origin is completed when SETON, INP output is turned ON and ONBUSY output is turned OFF.
   When return to home position is completed, .DRIVE etc. is available.

-Timing diagram-

T2: 15 ms or more

T3: 3 s or less (System initialize time ＋ Time required for reading position data)

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11. Operation instruction

The controller is operated by selecting step data preset in the controller using the parallel I/O signals.
The operating conditions are shown below.

(1) Power on → Return to origin

- Procedures-

1) Apply the power.

↓

2) *ALARM is turned ON.

*ESTOP is turned ON.

↓

3) SVON is turned ON.

↓

4) SVRE is turned ON.

The time taken for SVRE output to turn on depends on the electric actuator type and the operating conditions

The electric actuator with lock is unlocked.

↓

5) SETUP is turned ON.
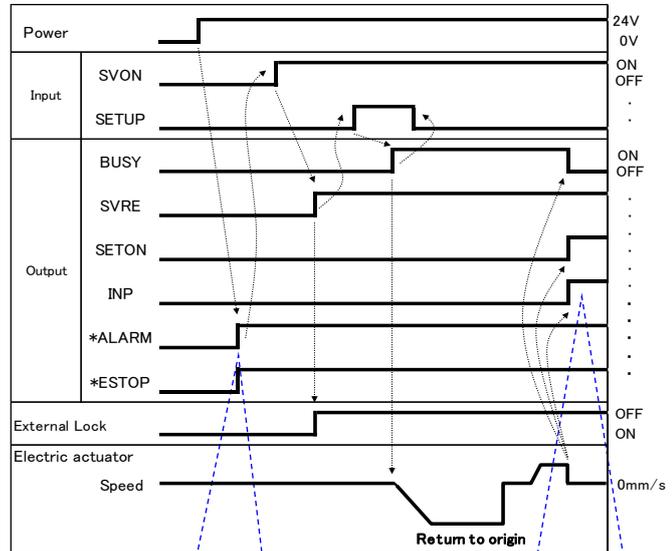
↓

6) BUSY is turned ON.

(The electric actuator moves.)

↓

7) SETON and INP are turned ON.

When the BUSY output is turned OFF, the return to origin operation has been completed.

- Timing chart Power on → Return to origin -

After the reset, the controller will be turned ON.

If the electric actuator is within the "In position" range, INP will be turned ON but if not, it will remain OFF.
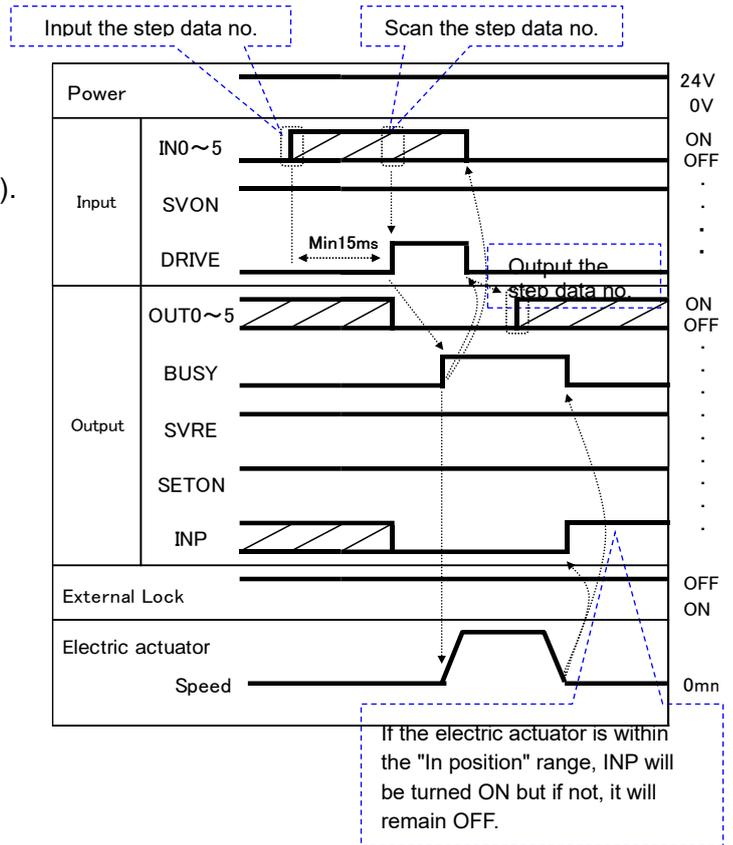
The "*ALARM" and "*ESTOP" are expressed as negative-logic circuit.

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(2) Positioning operation

- Procedures-

1) Input step data No. (IN0 to IN5)
   ↓
2) DRIVE is turned ON.

   (OUT0 to OUT 5 is turned off)

   →Scan the step data number (from IN0 to IN5).

   Then, if DRIVE is turned OFF, the step data

   number will be output (from the output

   OUT0 to OUT5).
   ↓
3) BUSY is turned ON.

   (The positioning operation starts.)
   ↓
4) When INP turns ON and BUSY turns OFF, the

   positioning operation will be completed.
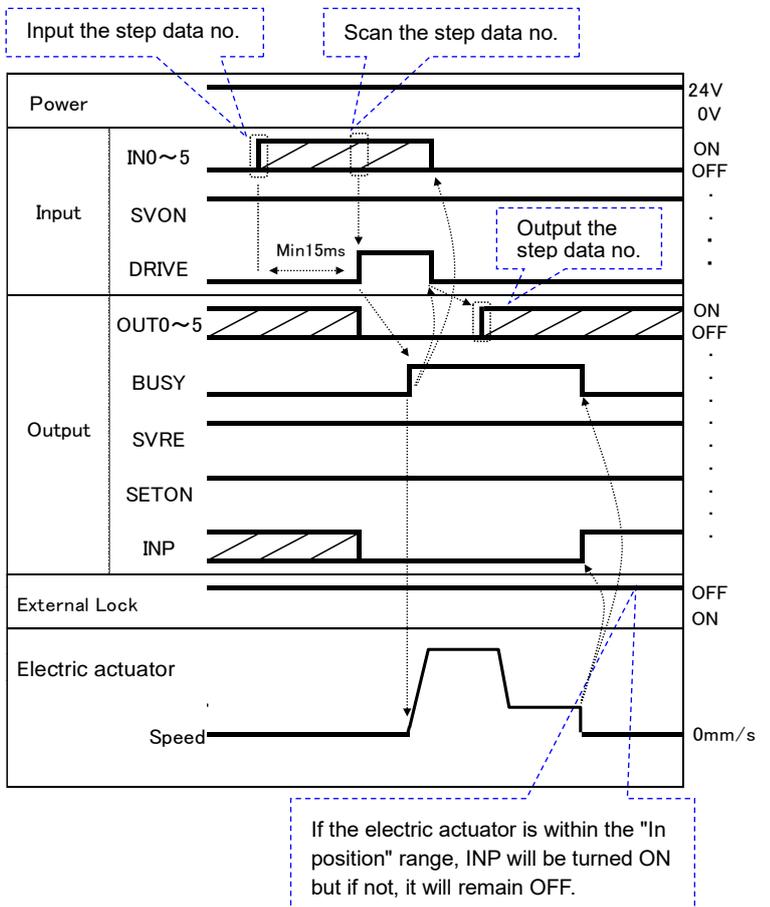
- Timing chart Positioning operation -

Input the step data no.

Scan the step data no.

Output the step data no.

If the electric actuator is within the "In position" range, INP will be turned ON but if not, it will remain OFF.

(3) Pushing operation

- Procedures-

1) Input step data No. (IN0 to IN5)
   ↓
2) DRIVE is turned ON.

   (OUT0 to OUT5 is turned off.)

   →Scan the step data number (from IN0 to IN5).

   After this, if DRIVE is turned OFF, the

   step data number will be output (from

   the outputs OUT0 to OUT5).
   ↓
3) BUSY is turned ON.

   (The Pushing operation starts.)
   ↓
4) When INP output is turned ON and

   BUSY is turned OFF, the pushing

   operation will be completed

   (The electric actuator generates the force

   larger than that specified in "TriggerLV"

   of the step data).

- Timing chart Pushing operation -

Input the step data no.

Scan the step data no.

Output the step data no.

If the electric actuator is within the "In position" range, INP will be turned ON but if not, it will remain OFF.

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(4) HOLD

-Procedures-

1) HOLD is turned ON during the operation
   (When HOLD is ON).

   ↓

2) BUSY is turned OFF
   (The electric actuator stops).

   ↓

3) HOLD is turned OFF.

   ↓

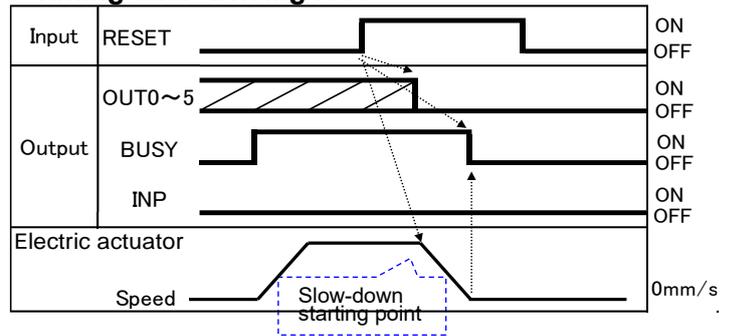4) BUSY is turned ON
   (The electric actuator restarts).
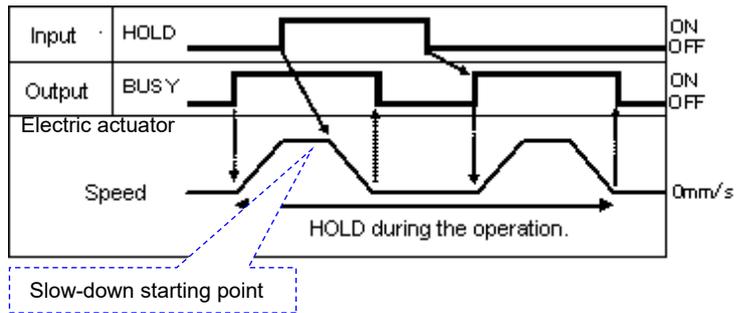
(5) Reset

-Procedures- [Driving reset]

1) RESET is turned ON during the operation
   (BUSY output is ON).

   ↓

2) The OUT0 to OUT5 (OUT) are turned OFF.

   ↓

3) The "BUSY" output turns OFF.
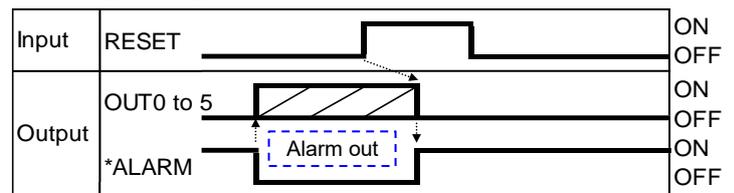   (The electric actuator stops.)

-Procedures- [Alarm reset]

1) An alarm is activated.
   (*ALARM is turned OFF and the output OUT0
   to OUT3 is turned ON.)

   ↓

2) RESET is turned ON.

   ↓

3) *ALARM is turned ON and the output OUT0 to
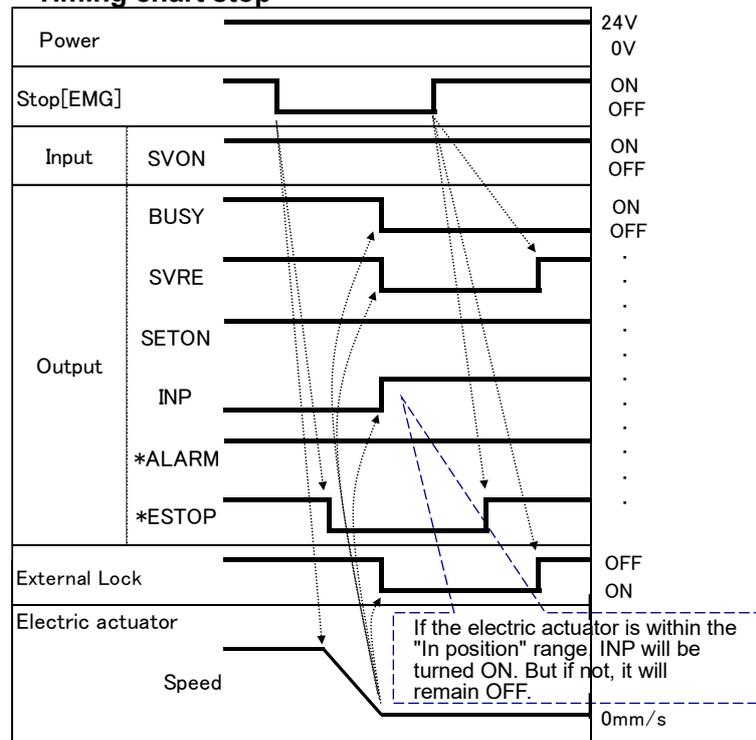   OUT3 is turned OFF (The alarm is
   deactivated).

(6) Stop

-Procedures-

1) The stop [EMG] input is turned OFF during the
   operation (when BUSY is ON). [stop
   command]

   ↓

2) *ESTOP is turned OFF.

   ↓

3) BUSY is turned OFF (The electric actuator stops).
   SVRE is turned OFF (If the electric actuator
   has a lock).

   ↓

4) The stop [EMG] input is turned ON.
   [The stop release command]

   ↓

5) *ESTOP is turned ON.
   SVRE is turned ON. (Lock release)
   If the electric actuator has a lock.

- Timing chart HOLD -

Slow-down starting point

HOLD during the operation.

- Timing chart Driving reset -

Slow-down starting point

If the electric actuator is within the "In position" range, INP will be turned

-Timing chart Alarm reset -

Alarm out

The "*ALARM" is expressed as negative-logic circuit.

- Timing chart stop -

If the electric actuator is within the "In position" range, INP will be turned ON. But if not, it will remain OFF.

The "*ALARM" and "*ESTOP" are expressed as negative-logic circuit.
When "Stop" is OFF, the stop is activated.

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(7) Area output

-Procedures-

● Operation of Step Data No.1

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

  ↓

2) DRIVE is turned ON.

   → Receive the step data no.1
   (From the input IN0 to IN5).
   Then, if the DRIVE is turned OFF, the
   step data will be output (from the output
   OUT0 to OUT5).

  ↓

3) BUSY is turned ON.

   (The electric actuator starts the operation).
   INP is turned OFF.

  ↓

4) AREA output is turned ON for the step
   data no.1 (at 150mm from the origin
   point).

  ↓

5) BUSY is turned OFF. (The electric actuator stops.)
   INP is turned ON.

  ↓

● Operation of Step Data No.2

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

  ↓

7) DRIVE is turned ON.

   → Receive the step data no.2 (from the input IN0 to IN5).
     Then, if the DRIVE is turned OFF, the step data will be output (from the output OUT0 to OUT5).

  ↓

8) AREA is turned OFF.
   BUSY is turned ON. (The electric actuator starts the operation.)

  ↓

9) AREA output is turned ON for the step data no.2 (at 170mm from the origin point).

  ↓

10) AREA output is turned OFF for the step data no.2 (at 130mm from the origin point).

  ↓

11) BUSY is turned OFF. (The electric actuator stops.)
   INP is turned ON.

-Timing chart Area output -

Example:
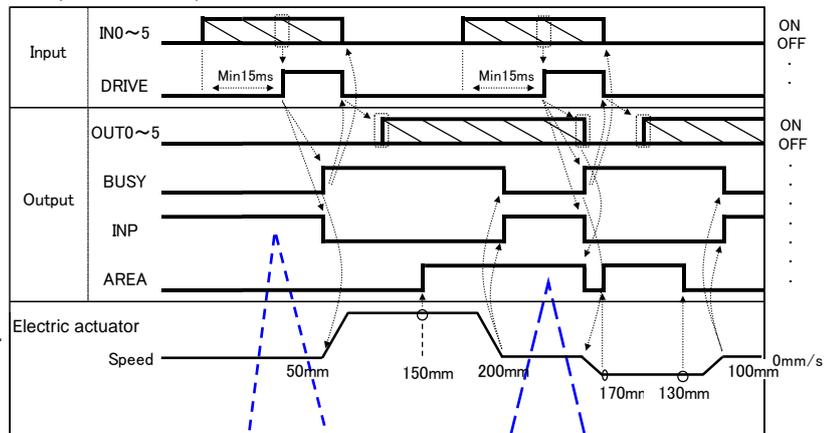 The initial position: 50mm
   ↓
 Operation of step data No.1: Position: 200mm, Area1-Area2: 150-250mm
   ↓
 Operation of step data No.2: Position: 100mm, Area1-Area2: 130-170mm

If the now position is inside of step data positioning. The INP signal is ON. Otherwise, the signal is OFF.

If the now position is inside of 1 and 2 area scope for step data. The AREA signal is ON. Otherwise, the signal is OFF

12. Alarm Detection

The details of the alarm can be checked using 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.

Please refer to section **"12.2 Alarm details"** of this manual on how to, deactivate the alarm.

12.1 Parallel output for the alarm group

In case of an alarm, this controller outputs a signal that informs the type of alarm.

Alarms are classified into 4 groups. When an alarm is generated, it is output in OUT0 to 3. OUT4 and OUT5 are OFF.

The status of output terminal for each alarm group is as follows:

Alarm group	Parallel output				
	*ALARM	OUT0	OUT1	OUT2	OUT3
Alarm group B	OFF	OFF	ON	OFF	OFF
Alarm group C	OFF	OFF	OFF	ON	OFF
Alarm group D	OFF	OFF	OFF	OFF	ON
Alarm group E	OFF	OFF	OFF	OFF	OFF

The "*ALARM" is expressed as negative-logic circuit.

When multiple alarms go off and there are different alarm groups, multiple OUT signals will turn on.

When the alarm has activated, the status of output terminal will be as follows:

Alarm group	Parallel output		Procedure of restart
	SVRE	SETON	
Alarm group B	There is no change.	There is no change.	RESET input
Alarm group C	There is no change.	There is no change.	RESET input
Alarm group D	OFF	There is no change	RESET input
Alarm group E	OFF	OFF	Power off ⇒Turn on the power again

12.2 Alarm details

Controller Setting Software (code)	Teaching box	Group	How to deactivate	Alarm contents/ Countermeasure
Drive data value is wrong (01-048)	Operation data error	B	RESET input	**\<Contents\>** The step data is in-correct for the following conditions (Assignable value range) (1) "Area1" < "Area2" 　(If both "Area1 and Area2" is 0, the alarm will not be activated.) (2) "Trigger LV" ≤ "Pushing force" 　(If Pushing force< "Trigger LV" at the time of "Pushing force" = 0, the alarm will not be activated.) (3) Minimum speed of the electric actuator ≤ "Pushing speed" ≤ "Speed" (4) "Pushing speed" ≤ Maximum pushing speed of the electric actuator (5) Pushing force ≥ Minimum pushing force of the electric actuator (6) Basic parameters "Max force" ≥ Minimum pushing force of the electric actuator (7) Basic parameters "Max force" ≥ "Trigger LV" **\<Countermeasure\>** Modify the step data and basic parameters setting. ⚠**Caution** Please confirm this pushing force and minimum speeds of Data maximum speed and 0 or more of the electric actuator with the electric actuator manual or the catalog.
The Parameter value is incorrect (01-049)	System parameter error	B	RESET input	**\<Contents\>** The basic parameter is not correct for the following condition: (Assignable value range) (1) Stroke (-) < Stroke (+) (2) W-Area 1 < W-Area2 　(If both W-Area1 and W-Area2 is 0, the alarm will not be activated.) (3) Maximum pushing force < Maximum pushing force of the electric actuator **\<Countermeasure\>** Modify the basic parameter setting. ⚠**Caution** Please refer to the manual or the catalogue of the electric actuator for the max/ min pushing force / speed for the electric actuator.
The deceleration value is too small. (01-050)	Small Dec	B	RESET input	**\<Contents\>** Step data in which a deceleration speed exceeding the stroke limit is specified. **\<Countermeasure\>** Modify the Deceleration value to a value with a sufficient margin so that the electric actuator can stop within the stroke limit.

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The step data is not registered. (01-051)	Operation data error	B	RESET input	**<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 input signal interval and the holding time of signals)
				<Countermeasure> (1) Make sure that the "Movement MOD" of the step data is not "Blank (Disabled)". (2) Process delay of PLC or scanning delay of the controller may occur. Keep the input signal combination for 15 ms (30 ms if possible) or longer. **"9.1 Positioning operation"**
The stroke is outside the stroke limit. (01-052)	Stroke limit	B	RESET input	**<Contents>** The electric actuator goes out 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 parameter, "Stroke (+)" and "Stroke (-)" are consistent with the distance of the electric actuator movement specified in the step data. ⚠ **Caution** If the operation method of step data is INC, take care with the position where operation starts and the travel distance.
The reacting force is outside the limits for a pushing operation. The position is unstable. (01-096)	Pushing operation error	C	RESET input	**<Contents>** In the pushing operation, if push back is bigger than pushing operation, the push back is requested.
				<Countermeasure> Increase the distance from the pushing operation origin position to the object being pushed. Or, increase the pushing force.
Return to Origin [ORIG] was not completed within the set time. (01-097)	Returning to origin error	C	RESET input	**<Contents>** Return to origin is not completed within the set time.
				<Countermeasure> Check if the travel of the actuator was interrupted.
The Drive operation [DRIVE] is ON when servo [SVRE] is OFF (01-098)	Servo off ALM	C	RESET input	**<Contents>** While the servo is off (when EMG terminal is not energized), the return to origin operation, positioning operation, pushing operation or JOG operation is requested. When the "Maximum speed" of the basic parameter is set low, change the speed to the maximum speed of the electric actuator to check the operation.
				<Countermeasure> Command operation while the servomotor is on (SVRE output is on). Apply 24 VDC to the EMG terminal.
The Drive operation [DRIVE] was turned ON when the Return to Origin was not completed [SETON is OFF] (01-099)	SET OFF DRV	C	RESET input	**<Contents>** A positioning operation or pushing operation is requested. Before execute the return to origin position.
				<Countermeasure> Modify the setting so that those operations will be requested after the return to origin position is completed.
Motor was not stationary when ABS encoder was communicating. (01-101)	Polarity not found	C	Turn ON RESET	**<Contents>** The power is applied when the actuator is operated by an external force.
				<Countermeasure> Make sure the actuator is stopped and then turn ON RESET.

| ORIG switch direction [ORIG SW DIR] (01-103) | Origin sensor is not detected | C | RESET input | **<Contents>** Alarm is generated when return parameter has the conditions 1, 2 shown below. |

	Return to origin parameter setting	
	ORIG mode	**ORIG sensor**
1	Return to origin by pushing force [pushing]	●Sensor Contact A [contact a]
2	Return to origin with sensor [SW]	●The origin sensor is not effective. [Disabled]] or ●Sensor Contact A [contact a]

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.

| Absolute encoder communication error. (01-106) | AbEnc Comm ALM | C | Input RESET | **<Contents>** When an error is detected in the communication with the absolute encoder when power is applied. When the wiring of the encoder and controller is disconnected. |

<Countermeasure> Check the connector of the controller and actuator wiring is not loose or the cable is not damaged.

| The motor speed has exceeded the set value (01-144) | Over speed | D | RESET SVON Input | **<Contents>** The motor speed exceeds a specific level due to an external force, etc. |

<Countermeasure>
Make improvements such that the motor speed will not exceed the maximum speed of the electric actuator.

⚠ **Caution**

Please refer to the manual or the catalogue of the electric actuator for the maximum speed of the electric actuator.

| The power supply voltage is not within the specification. (01-145) | Motor error | D | RESET SVON Input | **<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.

⚠ **Caution**

If the power supply is "inrush current control type", a voltage drop may cause an alarm during acceleration/deceleration.

<Contents>
The alarm may be increased by regenerative power depending on the method of operation of the electric actuator.

<Countermeasure>
Make sure that the operating conditions are within the specifications.

⚠ **Caution**

Please refer to the manual or the catalogue of the electric actuator for the method of operation of the electric actuator.

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The Controller temperature has exceeded the specification (01-146)	Over Temp.	D	RESET SVON Input	**\<Contents\>** The temperature around the power element of the controller is too high. **\<Countermeasure\>** Make improvements so that the temperature around the controller is kept appropriate.
The Controller supply voltage is outside the specification. (01-147)	Control power error	D	RESET SVON Input	**\<Contents\>** The control power supply voltage within the controller is out of a range. **\<Countermeasure\>** Make sure that the voltage supplied to the control power (C24V) of the controller is appropriate. ⚠ **Caution** If one power supply is commonly used for the control power and the motor power, or the power supply is inrush current restraining type, a power voltage drop may be caused due to a voltage drop during the acceleration/ deceleration.
The current limit has been exceeded (01-148)	Over load	D	RESET SVON Input	**\<Contents\>** The output current accumulated value exceeds the specified value. **\<Countermeasure\>** Check whether the movement of the electric actuator is obstructed. Also confirm whether the electric actuator load, speed, acceleration and deceleration are within the specification range of the electric actuator.
Target position (01-149)	Posn failed	D	RESET SVON Input	**\<Contents\>** Failed to reach to the set position within the set time limit. **\<Countermeasure\>** Eliminate any obstructions that interfere with the electric actuator movement. Also, make sure that the load, speed, acceleration and deceleration are within the range of the electric actuators.
A Communication error occurred (01-150)	Communication failure	D	RESET SVON Input	**\<Contents\>** The connection with the higher-level devices is disconnected. **\<Countermeasure\>** Do not interrupt the connection between the PC and teaching box when the electric actuator is being operated by upper-level devices.
Absolute encoder ID does not match controller data. (01-153)	AbEnc ID ALM	D	Turn ON RESET, SVON and SETUP	**\<Contents\>** The controller detects the absolute encoder specific No. when power is re-applied. This specific No. is different from the number which has been connected before. **\<Countermeasure\>** This alarm is generated when the product is used for the first time, or when the actuator or controller is replaced. Turn ON RESET to reset the alarm.

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Encoder error (01-192)	Encoder error	E	Power off	**\<Contents\>** Abnormality in communication with the encoder.
				\<Countermeasure\> Check the connection of the actuator cable.
Unable to find the motor phase in time. (01-193)	Polarity not found	E	Power off	**\<Contents\>** Selected sensor type is not correct
				\<Countermeasure\> Set the sensor type to 2(ABS).
The output current exceeded the specification (01-194)	Over current	E	Power off	**\<Contents\>** The output current of the power circuit is extraordinarily high.
				\<Countermeasure\> Make sure that there are no short circuits of the electric actuator cables, connectors, etc. In addition, make sure that the electric actuator conforms to the controller.
A current sensor abnormality has occurred. (01-195)	I sens ALM	E	Power off	**\<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.
Position deviation counter overflow (01-196)	Err overflow	E	Power off	**\<Contents\>** An overflow of the position error counter inside of the controller is occurred.
				\<Countermeasure\> Make sure there are no obstructions that interfere with the electric actuator movement. Also, make sure that the load, speed, acceleration and deceleration are within the range of the electric actuators.
Memory content error (01-197)	Memory ALM	E	Power off	**\<Contents\>** An error of the EEPROM is occurred.
				\<Countermeasure\> Please contact SMC. (The write limit of the EEPROM is roughly 100,000 times)
CPU error (01-198)	CPU failure	E	Power off	**\<Contents\>** The CPU is not operating normally. (It is possible that the CPU or surrounding circuits is failed or a malfunction of the CPU is occurred due to an electric noise).
				\<Countermeasure\> If the alarm cannot be deactivated even after the power is reapplied, please contact SMC.
Alarm _Comment _0201 (01-201)	C9	E	Shut power supply off	**\<Contents\>** The controller detects an error in the absolute encoder No. when the power is re-applied.
				\<Countermeasure\> If the alarm cannot be deactivated even after the power is re-applied, please contact SMC.
Alarm _Comment _0202 (01-202)	CA	E	Shut power supply off	**\<Contents\>** The controller detects an error in the absolute encoder internal data when the power is re-applied.
				\<Countermeasure\> If the alarm cannot be deactivated even after the power is re-applied, please contact SMC.

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⚠**Warning**

(1) Adjusting, mounting or wiring change should never be done before shutting off the power supply to the product.
 Electrical shock, malfunction and damag can result.

(2) Never disassemble the cable. Use only specified cables.

(3) Do not remove or connect the cable and connector while power is supplied.

⚠**Cution**

(1) Wire the connector securely. Do not apply any voltage to the terminals other than those specified in the product 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, separate high voltage and low voltage cables, and shorten wiring lengths, etc.

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

(5) Take care that electric actuator movement does not catch 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.
 Risk of electric shock, wire break, contact failure and loss of control for the product can happen.

(8) Fix the motor cable protruding from the product in place before using.
 The motor and lock cables are not robotic type cables and can be damaged when moved. Therefore, do not place A part below it in a flexible moving tube.
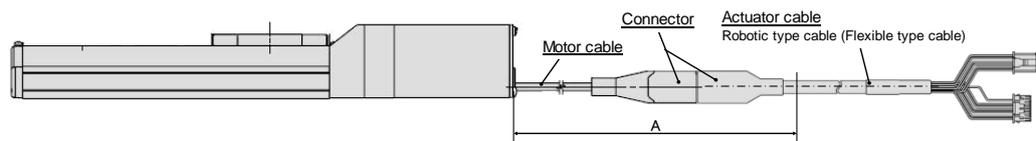
(9) Select "Robotic type cables" in case of inflecting the electric actuator-cable repeatedly. And do not put cables into a flexible moving tube with a radius smaller than the specified value. (Min. 50mm).
 Risk of electric shock, wire break, contact failure and loss of control for the product can happen if "Standard cables" are used in case of inflecting the cables repeatedly.
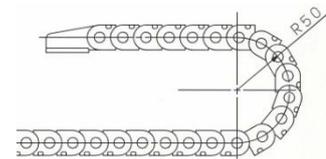
(10) Confirm proper wiring of the product.
 Poor insulation (interference with other circuits, poor insulation between terminals and etc.) can apply excessive voltage or current to the product causing damage.

(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 by a maximum of 10% per 5m. (If cable length is 15m: Maximum 20% reduction.)

[Transportation]
⚠ **Cution**
(1) Do not carry or swing the product by the motor or the cable

14. Electric actuators/Common precautions

14.1 Design and selection

⚠ **Warning**

(1) Be sure to read the Operation Manual.
Handling or usage/operation other than that specified in the Operation Manual may lead to breakage and operation failure of the product.
Any damage attributed to the 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 by catching hands or feet in the machinery, or damage to the machinery itself may occur. Design 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 even in the case of a power source failure.

(6) Consider behavior of emergency stop of 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 whole system.

(7) Consider the action when operation is restarted after an emergency stop or abnormal stop of whole system.
Design the system so that human injury or equipment damage will not occur upon restart of operation of whole system.

(8) Disassembly and modification prohibited
Do not modify or reconstruct (including additional machining) the product. An injury or failure can result.

(9) Do not use stop signal, "EMG" of the controller and stop switch on the teaching box as the emergency stop of system.
The stop signal, "EMG" of controller and the stop switch on the teaching box are for decelerating and stopping the electric actuator.
Design the system with an emergency stop circuit which is applied relevant safety standard separately.

(10) When using it for vertical application, it is necessary to build in a safety device.
The rod may fall due to the weight of work. The safety device should not interfere with normal operation of the machine.

⚠️Cution

(1) Operate within the limits of the maximum usable stroke.
The product will be damaged if it is used with the stroke which is over 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 1000 strokes.
Otherwise, lubrication can run out.

(3) Do not use the product in applications where excessive external force or impact force is applied to it.
The product can be damaged. Each component that includes motor is made with accurate tolerance. So even slightly deformed or miss-alignment of component may lead operation failure of the product.

(4) Return to origin cannot return while operating.
It cannot be done during positioning operation, pushing operation and pushing.

(5) Refer to a common auto switch /matter (Best Pneumatics No 2) when an auto switch is built in and used.

(6) When conformity to UL is required, the electric actuator and controller should be used with a UL1310 Class 2 power supply.

14.2 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 future reference.

(2) Observe the tightening torque for screws.
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 external guide, the guide axis should be parallel to the electric 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 product 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 product tube or piston rod etc., by striking or grasping them with other objects. Components are manufactured to precise tolerances, so that even a slight deformation may cause faulty operation.

(6) Prevent the seizure of rotating parts.
Prevent the seizure of rotating parts (pins, etc.) by applying grease.

(7) Do not use the product until you verify that the equipment can be operated properly.
After mounting or repair, connect the power supply to the product and perform appropriate functional inspections to check it is mounted properly.

(8) At the overhang mounted impeller fixation
There is a possibility that the power at the bending moment damages the electric actuator when moving it at high speed.
The support metal fittings that suppress the vibration of the main body of the electric actuator are installed.
Lower and use speed for the state that the electric actuator doesn't vibrate.

SMC

(9) When mounting the electric 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) Maintenance space.

Allow sufficient space for maintenance and inspection.

14.3 Precautions for Use

⚠ **Warning**

(1) Do not touch the motor while in operation.

The surface temperature of the motor can increase to approx. 90 °C to 100 °C due to operating conditions. Energizing alone may also cause this temperature increase. As it may cause burns, do not touch the motor when in operation.

(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.

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 electric actuator while in operation.

(5) When installing, adjusting, inspecting or performing maintenance on the product, controller and related equipment, be sure to shut off the power supply to each of them. Then, lock it so that no one other than the person working can turn the power on, or implement measures such as a safety plug.

⚠ **Cution**

(1) Keep the controller and product combined as delivered for use.

The product is set in parameters for shipment. If it is combined with a different parameter, failure can result.

(2) Check the product for the following points before operation.

a) Damage to electric driving line and signal lines
b) Looseness of the connector to each power line and signal line
c) Looseness of the electric actuator/cylinder and controller/driver mounting
d) Abnormal operation
e) Emergency stop of the total system

(3) When more than one person is performing work, decide on the procedures, signals, measures and resolution for abnormal conditions before beginning the work. 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 return to origin.

In the case of the 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 nameplate.

(7) Operation test should be done by low speed. Start operation by predefined speed after confirming there is no trouble.

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[Ground]

⚠️ **Warning**

(1) Be sure to ground the electric actuator.

(2) Grounding should be dedicated ground.
Ground construction is Class D grounding. (Ground resistance 100 Ω or less)

(3) Make the grounding as close as possible to the electric actuator and shorten the distance to ground.

[Unpackaging]

⚠️ **Cution**

(1) Check the received product is as ordered.
If a different product is installed from the one ordered, injury or damage can result.

14.4 Operating environment

⚠️ **Warning**

(1) Do not use the product in environment below.
a. Locations where a large amount of dusts and cutting chips are airborne.
b. Locations where the ambient temperature is outside the range of the temperature specification (refer to specifications).
c. Locations where the ambient humidity is outside the range of the humidity specification (refer to specifications).
d. Locations where corrosive gas, flammable gas, seawater, water and steam are present.
e. Locations where strong magnetic or electric fields are generated.
f. Locations where direct vibration or impact is applied to the product.
g. Areas that are dusty, or are exposed to splashes of water and oil drops.
h. Areas exposed to direct sunlight (ultraviolet ray).
i. Environment at an altitude of 1000 meters or higher
Heat radiation and withstand voltage will decrease. Contact SMC for details.

(2) Do not use in an environment where the product is directly exposed to liquid, such as cutting oils.
If cutting oils, coolant or oil mist contaminates the product, failure or increased sliding resistance can result.

(3) Install a protective cover when the product is used in an environment directly exposed to foreign matters 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 valve from radiated heat generated by nearby heat sources.
The radiated heat from the heat source can increase the temperature of the product beyond the operating temperature range.

(6) Grease oil can be decreased due to external environment and operating conditions, and it deteriorates lubrication performance to shorten the life of the product.

[Storage]

⚠️ **Warning**

(1) Do not store the product in direct contact with rain or water drops or is exposed to harmful gas or liquid.

(2) Store in an area that is shaded from direct sunlight and has a temperature and humidity within the specified range (-10 ºC to 60 ºC and 35 to 85% No condensation or freezing).

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

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14.5 Maintenance

⚠️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.
Electrical shock can result.

⚠️Cution
(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., and then cut the power supply to the system. When machinery is restarted, check that operation is normal with the electric actuators in the proper positions.

(3) When moving the electric actuator slider manually by hand, please disconnect the electric actuator cable.
The electric actuator cannot be moved smoothly by the induced voltage of the motor goes to the controller when the electric actuator slider is moved with the electric actuator connected with the controller. Moreover, the controller might break down by the induced voltage when moving the electric actuator slider at high frequency.

[Lubrication]
⚠️Cution
(1) The product has been lubricated for life at manufacturer, and does not require lubrication in service.
Contact SMC if lubrication will be applied.

14.6 Precautions for electric 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 piece.

(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.

(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 it's 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 thurst 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.
When 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 electric actuator is operated manually (when SVRE output signal is off), supply 24 VDC to the [LK RLS] terminal of the power supply connector.
If the product is operated without releasing the lock, wearing of the lock sliding surface will be accelerated, causing reduction in the holding force and the life of the locking mechanism.

(8) Do not supply 24 VDC power supply constantly to the [LK RLS (Lock release)] terminal.
Stop supplying 24 VDC 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 work pieces may be dropped at stop (EMG).
/Refer to the operation manual of LEC (controller) for details of wiring.

15. Controller and its peripheral devices /Specific product precautions

15.1 Design and selection

⚠**Warning**

(1) Be sure to apply the specified voltage.
Otherwise, a malfunction and breakage of the controller may be caused.
If the applied voltage is lower than the specified, it is possible that the load cannot be moved due to an internal voltage drop. Please check the operating voltage before use.

(2) Do not operate beyond the specifications.
It may cause a fire; malfunction or the electric actuator damage can result. Please check the specifications before use.

(3) Install an emergency stop circuit.
Please 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 previously by giving a multiple-layered structure or a fail-safe design to the equipment, etc.

(5) If a fire or danger against the personnel is expected due to an abnormal heat generation, ignition, smoking of the product, etc., cut off the power supply for this product and the system immediately.

15.2 Handling

⚠**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 the operation or setting of this equipment with wet hands.
It may cause an electric shock.

(3) Product with damage or the one lacking of any components should not be used.
It may cause an electric shock, fire, or injury.

(4) Use only the specified combination between the controller and the electric actuator.
It may cause damage to the controller or the electric actuator.

(5) Be careful not to be caught or hit by the work piece while the electric actuator is moving.
It may cause an injury.

(6) Do not connect the power supply or power on the product before confirming the area where the work moves is safe.
The movement of the work may cause accident.

(7) Do not touch the product when it is energized and for some time after power has been disconnected, as it is very hot.
It may lead to a burn due to the high temperature.

(8) Check the voltage using a tester for more than 5 minute after power-off in case of installation, wiring and maintenance.
There is a possibility of getting electric shock, fire and injury.

(9) Do not use in an area where dust, powder dust, water or oil is in the air.
It will cause failure or malfunction.

(10) Do not use in an area where a magnetic field is generated.
It will cause failure or malfunction.

(11) Do not install in the environment of flammable gas, corrosive gas and explosive gas.
It could lead to fire, explosion and corrosion.

(12) Do not apply radiant heat from a large heat source such as direct sunlight or heat treatment furnace.
It will cause failure of the controller or its peripheral devices.

(13) Do not use the product in an environment subject to a temperature cycle.
It will cause failure of the controller or its peripheral devices.

(14) Do not use in a place where surges are generated.
When there are units that generate a large amount of surge around the product (e.g., solenoid type lifters, high frequency induction furnaces, motors, etc.), this may cause deterioration or damage to the product's' internal circuit. Avoid supplys of surge generation and crossed lines.

(15) Do not install this product in an environment under the effect of vibrations and impacts.
It will cause failure or malfunction.

(16) If this product is used with a relay or solenoid valve, they should be the surge absorbing element built-in type.

15.3 Installation

⚠**Warning**
(1) The controller and its peripheral devices should be installed on a fire-proof material.
A direct installation on or near a flammable material may cause fire.

(2) Do not install this product in a place subject to vibrations and impacts.
It may cause an electric shock, fire, or injury.

(3) Take measure 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 50mm or larger spaces between each side of it and the other structures or components.
It may cause a malfunction of the controller and its peripheral devices and a fire.

(4) Do not mount this controller and its peripheral devices together with a large-sized 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 supply.

(5) This controller and its peripheral devices should be installed on a flat surface.
If the mounting surface is distorted or not flat, an unacceptable force may be added to the housing, etc. to cause troubles.

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15.4 Wiring

⚠️**Warning**

(1) Do not apply any excessive force to cables by repeated bending, tensioning or placing a heavy object on the cables.
It may cause an electric shock, fire, or breaking of wire.

(2) Connect wires and cables correctly.
Incorrect wiring could break he controller or its peripheral devices depending on the seriousness.

(3) Do not connect wires while the power is supplied.
It can break the controller or its peripheral devices could be damaged to cause a malfunction.

(4) Do not carry this product by holding its cables.
It may cause an injury or damage to the product.

(5) Do not connect power cable or high-voltage cable in the same wiring route as the unit.
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 and malfunction could be caused.
Separate the wiring of the controller and its peripheral device from that of power line and high voltage line.

(6) Verify the insulation of wiring.
Insulation failure (interference with other circuit, poor insulation between terminals and etc.) could introduce excessive voltage or current to the controller or its peripheral devices and damage them.

15.5 Power supply

⚠️**Warning**

(1) Use a power supply that has low noise between lines and between power and ground.
In cases where noise is high, an isolation transformer should be used.

(2) The power supplys should be separated between the controller power and the I/O signal power and both of them do not use the power supply of "inrush current restraining type".
If the power supply is "inrush current restraining type", a voltage drop may be caused during the acceleration of the electric actuator.

(3) To prevent surges from lightning, an appropriate measure should be taken. Ground the surge absorber for lightning separately from the grounding of the controller and its peripheral devices.

15.6 Ground

⚠️**Warning**

(1) Be sure to ground to ensure noise immunity of the controller.
It may cause electric shock or fire.

(2) Grounding should be dedicated ground.
Ground construction is Class D grounding. (Ground resistance 100 Ω or less)

(3) Grounding should be performed near the unit as much as possible to shorten the grounding distance.

(4) Make the grounding as close as possible to the controller or peripheral equipment and shorten the distance to ground.

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15.7 Maintenance and inspection

⚠Warning

(1) Perform a maintenance check periodically.
Confirm wiring and screws are not loose.
Loose screws or wires may cause unintentional malfunction.

(2) Conduct an appropriate functional inspection after completing the maintenance.
In case of any abnormities (in the case that the electric actuator does no move, etc.), stop the operation of the system. Otherwise, an unexpected malfunction may occur and it will become impossible to secure the safety.

(3) Do not disassemble, modify or repair this controller and the peripheral equipment.

(4) Do not put anything conductive or flammable inside of this controller.
It may cause a fire and explosion.

(5) Do not conduct an insulation resistance test and withstand voltage test on this product.

(6) Ensure sufficient space for maintenance activities. Provide space required for maintenance.
Design the system that allows required space for maintenance.

15.8. Specific Precautions for Battery-Less Absolute Encoder

⚠Warning

(1) Do not use in an environment where strong magnetic field is present.
A magnetic sensor is used in the encoder. Therefore, if the actuator motor is used in a strong magnetic field environment, malfunction or failure may occur.

The major failure is described below.
  • Reduction of transporting ability (pushing force, speed)
  • Damage to the actuator due to collision to the workpiece by positional displacement occurred.

Do not expose the actuator motor to a magnetic field with a magnetic flux density of 1 mT or more.

1) When installing an air cylinder with an auto switch (ex. CDQ2 series) side by side, maintain 40 mm minimum around the motor.
Refer to the construction drawing of the actuator motor.
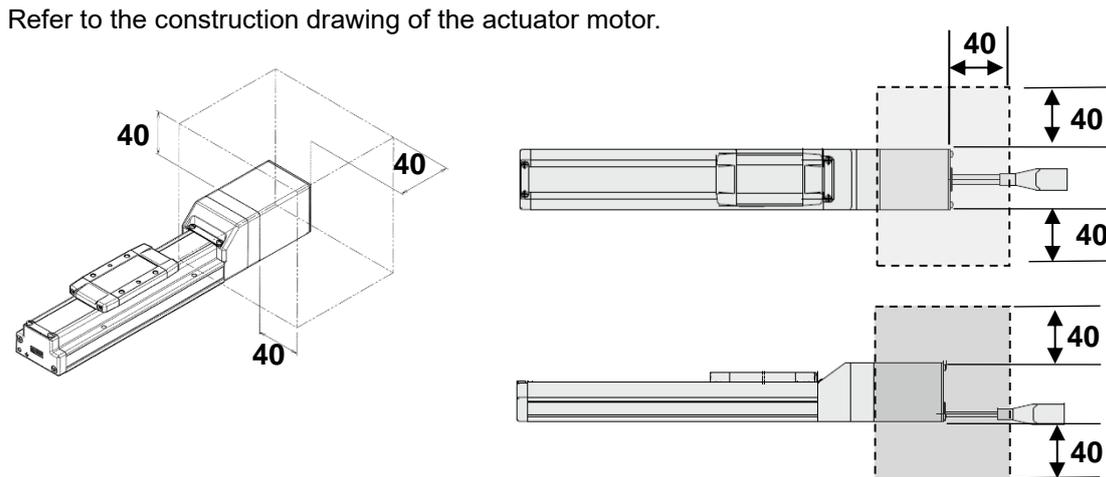
Air cylinder installation with an auto switch is forbidden in the shaded area.

2) When installing electric actuator LEY(G) or LEF series with an auto switch by side,

leave a gap of 40 mm or more with respect to the position where the magnet passes.

<u>Keep away from the magnet passing position and leave a space of 40 mm or more.</u>

Magnet
passing position

Magnet mouting position
LEY(G) / Piston part

Magnet
passing position

Magnet mouting position
LEFS / Table center
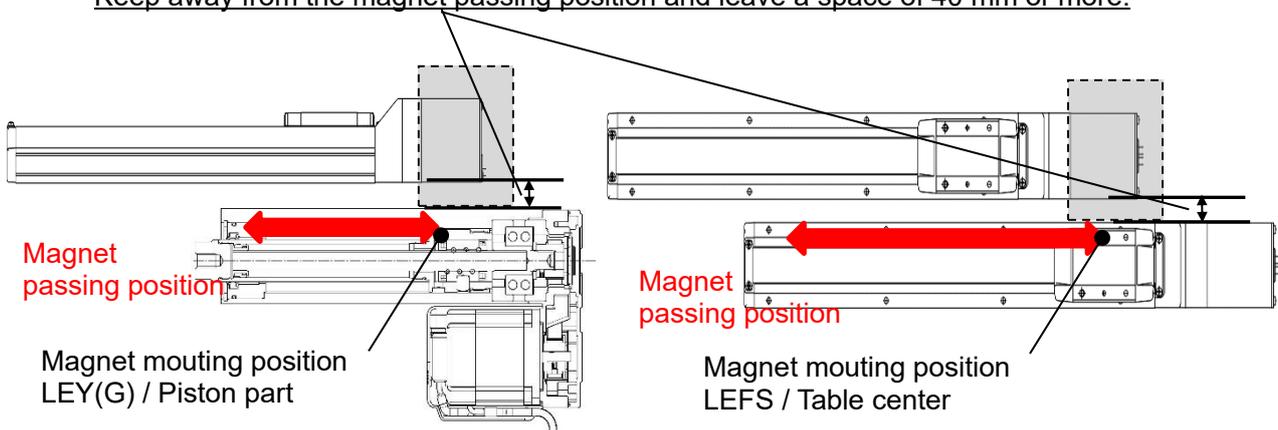
The motors of the electric actuator can be installed close to each other.

Motors can be installed close to each other
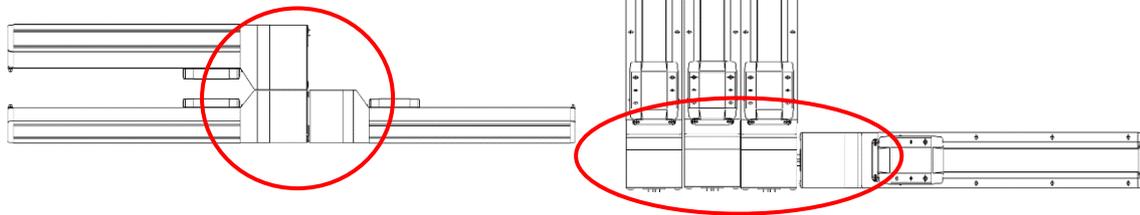
(2) Check whether there are any loose connections between the controller and actuator.
   If contact failure occurs with the motor powerwiring, the motor power will be insufficient, which reduces the holding force.
   Because of this, the actuator moving part will fall downward in a vertical operation.
   (In this operation, the lock function of the actuator with lock does not work).
   The surge voltage generated by contact failure may damage the controller.

(3) The ambient temperature of the controller should be lower than 40℃ depending on the operating conditions of the actuator.
   For the LEY40 and LEYG40 series, if the vertical transfer load is greater than the weight listed below, the controller must be used at an ambient temperature of 40°C or less. Otherwise, damage may occur due to higher temperature of the controller.
     LEY40#EA: 9 kg, LEY40#EB:19 kg, LEY40#EC:38 kg
     LEYG40#EA:7 kg, LEYG40#EB:17 kg, LEYG40#EC:36 kg

⚠ **Cution**

(1) Supply power when the actuator is stationary.
The controller acquires the absolute position data from the absolute encoder when power is applied.
Therefore, if the power is applied to the controller when the actuator is moving with an external force, the controller fails to acquire the absolute position data, which generates an alarm.

(2) When the controller is used for the first time, perform the offset adjustment.
Alarm "Absolute encoder ID Alarm error (code: 1-153)" will be generated when power is applied to the controller for the first time and/or when the actuator is replaced, therefore reset the alarm.
(Resetting the alarm registers the absolute encoder specific ID No. in the controller)
Turn the servo ON after resetting the alarm. Conducting a Return to Origin operation allows the use of the controller.

(3) When a blank controller and actuator absolute encoder with battery are used, write the parameter for the actuator to the absolute encoder with battery before use.
although the actuator type is identical, the actuator parameter in which the encoder and motor specifications are not identical are written, noise or vibration occurs during servo ON or operation.
If the parameter for the actuator with different specification is written, re-write the parameter for the actuator with the battery-less absolute encoder using JXC-BCW.

Refer to the Operation Manual of the controller and actuator for precautions.

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16. Troubleshooting

In case of any troubles, please consult the following table.

Consider replacing controller, if not of the causes on this table are applicable.

It is possible that this product is damaged due to the operating conditions (applications), please contact SMC to discuss appropriate measures.

```
YES  ──────▶
NO   ┄┄┄▶
```

```
┌──────────────────────┐
│ System  does  not    │
│ operate correctly.   │
└──────────────────────┘
            │
┌───────────┼──────────────────────────┐
│ JXC51/JXC61                           │
│           ▼                           │
│      ┌──────────────┐                 │         ┌──────────────┐
│      │ LED is OFF.  │ ──────────────────────────▶│ See problem  │
│      └──────────────┘                 │         │ No. 1.       │
│           ┊                           │         └──────────────┘
│           ▼                           │
│      ┌──────────────┐                 │         ┌──────────────┐
│      │ ALM LED turns│ ──────────────────────────▶│ See problem  │
│      │ on red.      │                 │         │ No. 2.       │
│      └──────────────┘                 │         └──────────────┘
└───────────┊──────────────────────────┘
            ▼
      ┌──────────────┐                           ┌──────────────┐
      │ Communication│ ──────────────────────────▶│ See problem  │
      │ fault. (JXC-W2A-C)                        │ No. 3.       │
      └──────────────┘                           └──────────────┘
            ┊
            ▼
      ┌──────────────┐                           ┌──────────────┐
      │ The electric │ ──────────────────────────▶│ See problem  │
      │ actuator does not                         │ No. 4.       │
      │ operate correctly                         └──────────────┘
      └──────────────┘
            ┊
            ┊                                     ┌──────────────────┐
            ┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄▶│ Please contact your│
                                                  │ SMC representative.│
                                                  └──────────────────┘
```
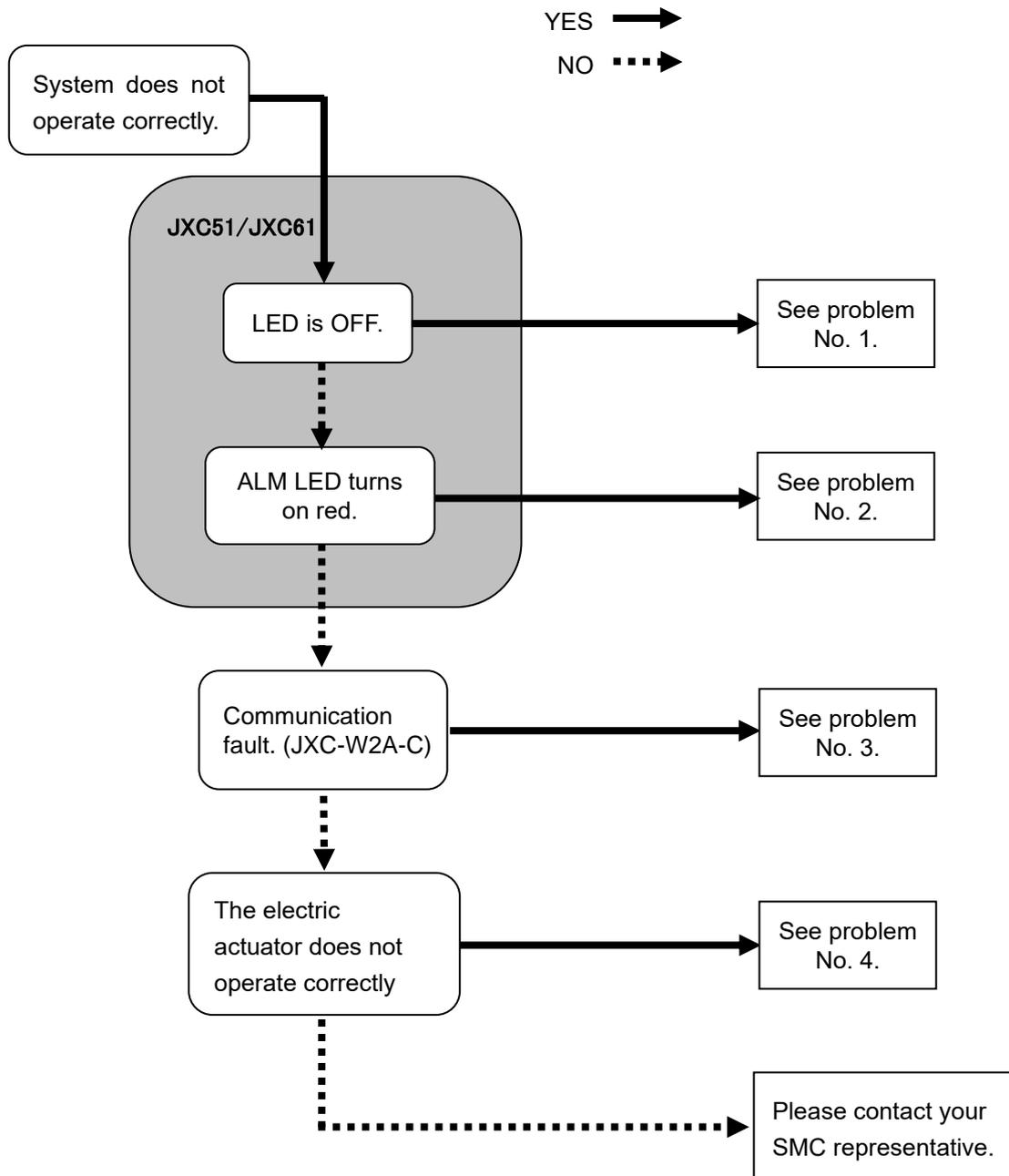
Trouble No.	Trouble	Possible cause	How to diagnose the trouble	Solutions
1	LED is OFF	Power fault	Check if the LED (green) of the controller is lit.	The power supply, voltage or current should be modified to an appropriate one. → **4. External Wiring Diagram** → **5. CN1: Power supply plug**
		Wiring fault	Is the wiring connected correctly?	Check if the wiring is connected correctly or if there is broken wire or short-circuit by referring to this Operation Manual. Correct the wiring and check that the input/output of each signal is correct. Separate the power supply for the controller and the I/O signal power supply. → **4. External Wiring Diagram** → **6.4 Parallel I/O Wiring Example**
2	ALM is ON	Alarm condition	Check if the controller is in the alarm condition.	Refer to the controller operation manual, and take appropriate measures. Take appropriate measures based on the operation manual. → **12. Alarm Detection**
3	Communication fault.(JXC-W2)	USB driver is not installed	Check that the USB driver for the communication cable is installed.	Please install the USB driver of USB cable. The USB driver's installation starts when the communication cable is connected with PC. Refer to the Installation Manual for setting software (JXC-W2) for the installation procedure.
		Incorrect COM port setting	Please confirm if the correct COM port is set to the controller setting software.	The COM port allocated to the communication cable is different for different PC's. Please confirm the COM port number with the communication cable connected. The COM port number can be checked using the Device Manager of the PC. Refer to the Installation Manual for controller setting software (JXC-W2) for the checking and setting method for COM port numbers.
		Inappropriate connection	Check the wiring.	Please confirm motor controller = communications cable = USB cable = PC is connected. As example, cannot make the communication if the connector has been damaged. Please confirm the power supply of motor controller has been turned on. The communication is not made if the Power supply is off. If the equipments (PLC and measurement hardware) except motor controller is connected with PC. (There is a possibility that the communication with other equipment interferes in PC.)

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4	The electric actuator does not move at all.	Lock release error	Check if you can hear the sound of lock release when the manual lock switch is turned on and off.	If there is no sound of lock release from the electric actuator with lock, the lock may be broken. If the trouble continues, please contact SMC.
		External device fault	Check that the PLC connected to the controller operates correctly.	Check the operation by test run using the controller setting software, etc. If the electric actuator is operated, a signal output from the PLC is suspected. Take appropriate measures by referring to the Operation Manual for the controller. → **6.3 The parallel I/O signal is detailed**
		Inappropriate specifications	Check that the combination of the electric actuator and controller is correct?	Check if the product number of the used the electric actuator matches with the electric actuator which is applicable to the controller. → **3. Product Specifications** If the blank controller is used, write the data, which is identical with the product number of the actuator used.
		Influence of a magnetic force	Check if there is equipment which generates the magnetic force, such as a magnet or electro-magnetic coil around the actuator.	The equipment, which generates the magnetic force, should be kept away from the motor. For example, keep 40 mm minimum distance from the cylinder with auto switch.
		Stop command	If it is not energized, the servo will be OFF and does not operate. Check if a voltage of 24 VDC is applied to the EMG terminal.	Apply 24 VDC to the EMG terminal.
	Move occasionally.	Wiring fault	Is the wiring connected correctly?	Check if the wiring is connected correctly or if there is broken wire or short-circuit by referring to this Operation Manual. Correct the wiring and check that the input/output of each signal is correct. Separate the power supply for the controller and the I/O signal power supply. → **4. External Wiring Diagram** → **6.4 Parallel I/O Wiring Example**
		Counter-measures against noise	Check that the Grounding is connected correctly? Are power cables for other equipment and controller cables bundled together?	Connect to Ground correctly. Avoid bundling the cables with power cables of other equipment. Take appropriate measures by referring to the Operation Manual for the controller. → **3.4 How to install**
		Inappropriate parameter	Check that the parameter values are correct.	Check the combination of the electric actuator and controller. Modify the parameters accordingly and check the operation. → **7. Setting Data Entry**
		Voltage drop	Check if there has been any temporary voltage drop in the power supply. (If there is a temporary voltage drop in the power supply, the EMG terminal of PWR power connector will turn OFF so the electric 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 the power supply has inrush current restraining specification. → **3. Product Specifications**

		Inappropriate specifications	Check that the combination of the electric actuator and controller is correct? If the blank controller is used, check that the written data is identical with the actuator used.	Check if the product number of the used electric actuator matches with the electric actuator which is applicable to the controller. → **3. Product Specifications** If the blank controller is used, write the data, which is identical with the product number of the actuator used.
4	Move occasionally	Influence of a magnetic force	Check if there is equipment which generates the magnetic force, such as a magnet or electro-magnetic coil around the actuator.	The equipment, which generates the magnetic force, should be kept away from the motor. For example, keep 40 mm minimum distance from the cylinder with auto switch.
		Signal timing	Check the timing of the signal from the PLC to the controller.	Both PLC processing delay and controller scan delay are generated. Ensure that 15 ms or more time should be maintained between the input signals. → **8.4 Controller input signal response time**
		SVON time	Check if the electric actuator is operated when the SVRE output is turned on after the SVON input is turned on.	When power is applied, it may take up to 10 seconds (max. 20 sec.) from SVON input to SVRE output depending on the electric actuator position. Command operation after SVRE output is turned ON.
		Alarm condition	Is controller alarm generated?	Refer to the controller operation manual, and take appropriate measures. Take appropriate measures based on the operation manual. → **12. Alarm Detection**
	The electric 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 electric actuator returns to the origin correctly.	Perform the return to origin position operation several times to check the origin position. Take measure to make the electric actuator operates normally (remove foreign matters that interferes with the electric actuator movement, etc.)
		Inappropriate basic parameters	Check that the parameter values are appropriate and the program is correct.	Check the max. speed, acceleration speed, and deceleration speed of the electric actuator and be sure to input the correct parameters. → **7. Setting Data Entry**
		Inappropriate specifications	Check that the combination of the electric actuator and controller is correct? If the blank controller is used, check that the written data is identical with the actuator used.	Check if the product number of the used electric actuator matches with the electric actuator which is applicable to the controller. → **3. Product Specifications** If the blank controller is used, write the data, which is identical with the product number of the actuator used.
	The electric actuator does not move correctly.	Wiring fault	Is the wiring connected correctly?	Check if the wiring is connected correctly or if there is broken wire or short-circuit by referring to this Operation Manual. Correct the wiring and check that the input/output of each signal is correct. Separate the power supply for the PWR controller input and the parallel I/O signal power supply. → **4. External Wiring Diagram** → **6.4 Parallel I/O Wiring Example**

	The electric actuator does not move correctly.	Inappropriate specifications	Check that the combination of the electric actuator and controller is correct? If the blank controller is used, check that the written data is identical with the actuator used.	Check if the product number of the used electric actuator matches with the electric actuator which is applicable to the controller. → **3. Product Specifications** If the blank controller is used, write the data, which is identical with the product number of the actuator used.
		Influence of a magnetic force	Check if there is equipment which generates the magnetic force, such as a magnet or electro-magnetic coil around the actuator.	The equipment, which generates the magnetic force, should be kept away from the motor. For example, keep 40 mm minimum distance from the cylinder with auto switch.
		Signal timing	Check the timing of the signal from the PLC to the controller.	Both PLC processing delay and controller scan delay are generated. Ensure that 15 ms or more should be maintained between signals. → **8.4 Controller input signal response time**
		Data writing failure	Is the data (step data or parameters) written correctly?	One of the following actions occurred during data writing (while the power supply LED (green) was on). ・Turn off the controller input power supply ・Disconnected/ connected cables. Input correct data (step data, parameter) again and confirm operation. → **3.2 Parts description** → **7. Setting Data Entry**
4	Insufficient speed	Inappropriate basic parameters	Check that the parameter values are correct.	Check the max. speed and acceleration speed of the electric actuator and be sure to input the correct parameters. → **7. Setting Data Entry**
		Inappropriate step data	Is the operation pattern trapezoidal?	In case of such operation, the electric actuator may start slowing down before it reaches the maximum speed. Modify the setting to make the moving distance longer or the acceleration larger. → **7. Setting Data Entry**
		Inappropriate specifications	Check that the combination of the electric actuator and controller is correct? If the blank controller is used, check that the written data is identical with the actuator used.	Check if the product number of the used electric actuator matches with the electric actuator which is applicable to the controller. → **3. Product Specifications** If the blank controller is used, write the data, which is identical with the product number of the actuator used.
		Influence of a magnetic force	Check if there is equipment which generates the magnetic force, such as a magnet or electro-magnetic coil around the actuator.	The equipment, which generates the magnetic force, should be kept away from the motor. For example, keep 40 mm minimum distance from the cylinder with auto switch.
		Voltage drop	Check if there has been any 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 electric 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 the power supply has inrush current restraining specification. →**3. Product Specifications**

Revision history
A: Contents revised in several places. [Nov 2020] B: Incremental compatible has been added.   [Dec 2020] C: Added supported OS   [Mar 2023]

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