Doc. No. JXC※-OMT0011-A

Operation Manual

PRODUCT NAME

Step Motor Controller (Servo / 24 VDC)

MODEL / Series / Product Number

LECP6 Series

SMC Corporation

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LECP6 Series / Controller
1. Safety Instructions

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

*1) ISO 4414: Pneumatic fluid power -- General rules relating to systems.
ISO 4413: Hydraulic fluid power -- General rules relating to systems.
IEC 60204-1: Safety of machinery -- Electrical equipment of machines. (Part 1: General requirements)
ISO 10218-1992: Manipulating industrial robots -Safety.
etc.

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

⚠ Warning

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

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

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

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

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

The product specified here may become unsafe if handled incorrectly.

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

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

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

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

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

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

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

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

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

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

LECP6 Series / Controller
1. Safety Instructions

⚠Caution

The product is provided for use in manufacturing industries.
The product herein described is basically provided for peaceful use in manufacturing industries.
If considering using the product in other industries, consult SMC beforehand and 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 regulations of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

⚠ Caution

SMC products are not intended for use as instruments for legal metrology.
Measurement instruments that SMC manufactures or sells have not been qualified by type approval tests relevant to the metrology (measurement) laws of each country.
Therefore, SMC products cannot be used for business or certification ordained by the metrology (measurement) laws of each country.

2. Product Outline

2.1 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.

- Separated power supply

  The power supply is separated into the drive power and the control power. Therefore, even when the drive power is off, if the control power is on, the position information from the encoder will be maintained and the serial communication and parallel I/O control are still available.

- 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 kit or the teaching box.

- Easy mode and Normal mode

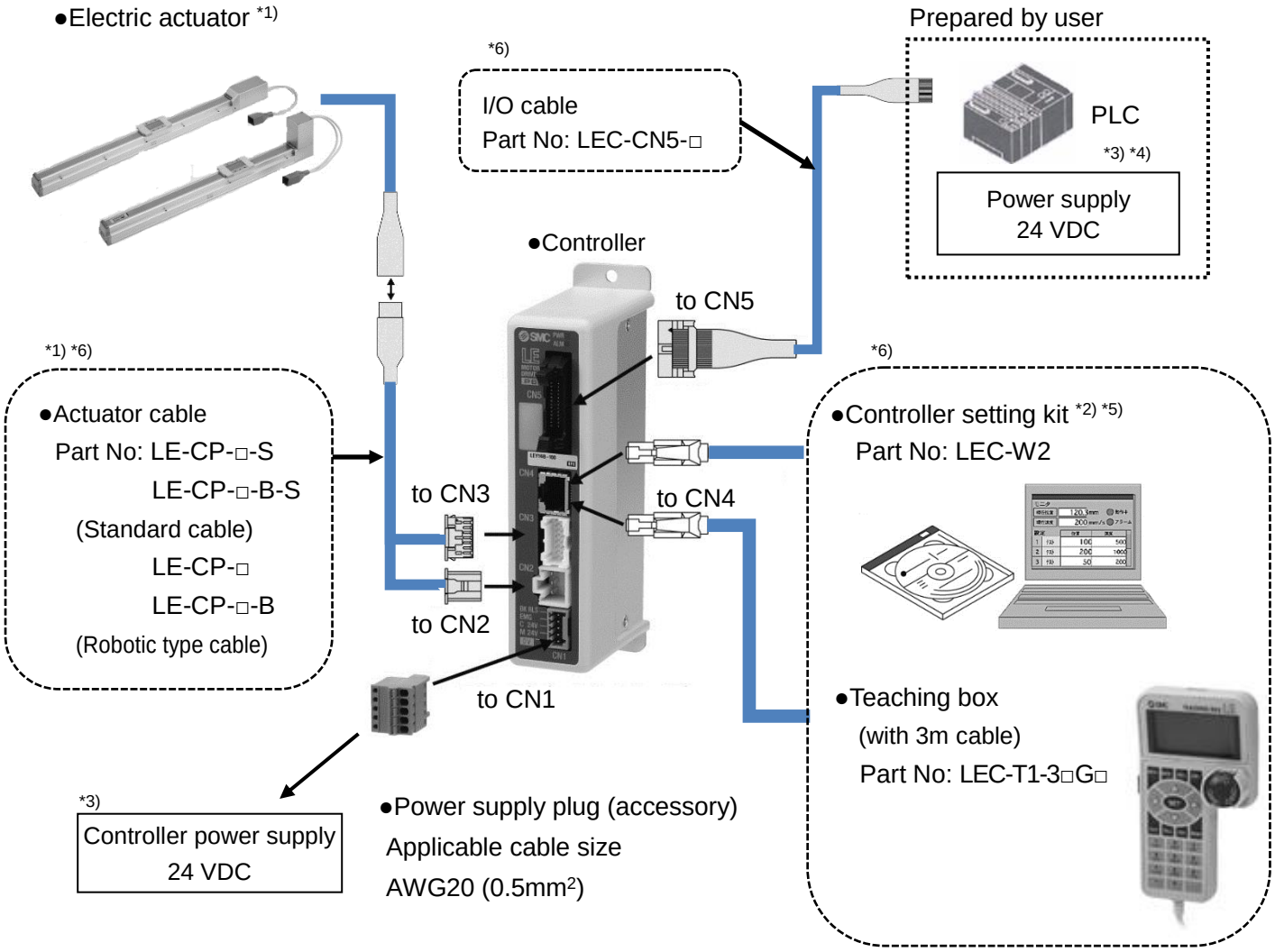
  There are two available modes for the controller setting kit and the teaching box. In Easy mode, you can start the operation by only setting the speed, position, etc. In Normal mode, further detailed setup can be performed.

⚠ Caution

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 kit at installation and fault finding.
Keep this operation manual accessible for reference.

2.2 Product configuration

The product configuration of this controller is as follows.



*1) These items are included when ordered using the part number for the electric actuator set.
*2) The controller setting software must use the latest version.
For version information and upgrade, please refer to the SMC website. http://www.smcworld.com/
*3) When conformity to UL is required, the electric actuator and controller should be used with a UL1310 Class 2 power supply.
*4) 24 VDC power supply for controller input and 24 VDC power supply for 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. Precautions for wiring and cables"** 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:

L E C P 6 N □ □ – □

- Controller
- Compatible

P	Step motor (Servo / 24 VDC)

- Number of step data

6	64 data

- Parallel I/O type

N	NPN type
P	PNP type

- I/O cable length

Nil	None
1	1.5m
3	3m
5	5m

- Option

Nil	Screw mounting
D	DIN rail mounting

- Electric actuator model

Stroke example: For LEFS25B-100B-S36N1, specify LEFS25B-100.
Rotating angle: For LER10K-2L-R16N1D, specify LER10K-2.
(Enter from the electric actuator part number "LE" to "stroke/ rotating angle")

BC	Blank controller *1)

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

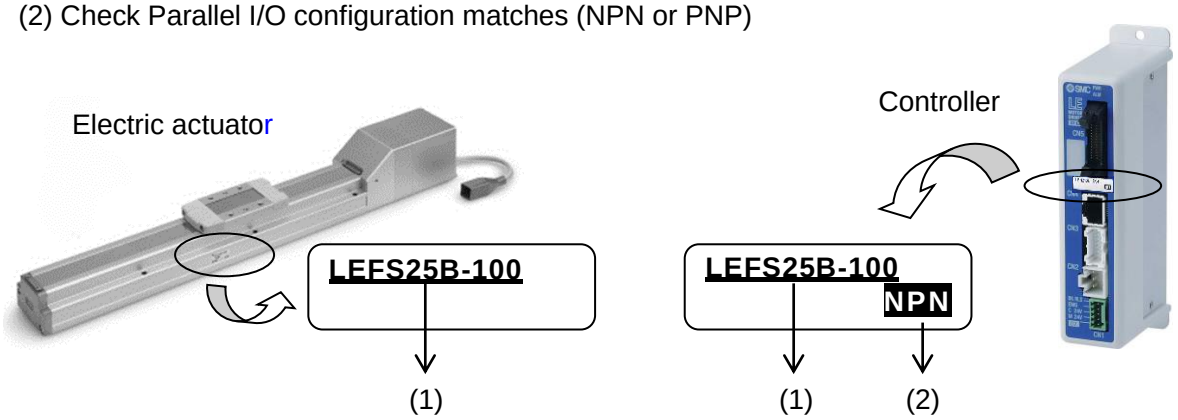
⚠ Caution

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)



2.4 Option

(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	Terminal no.
A	B-1
$\overline{A}$	A-1
B	B-2
$\overline{B}$	A-2
COM-A/COM	B-3
COM-B/ -	A-3
Vcc	B-4
GND	A-4
$\overline{A}$	B-5
A	A-5
$\overline{B}$	B-6
B	A-6

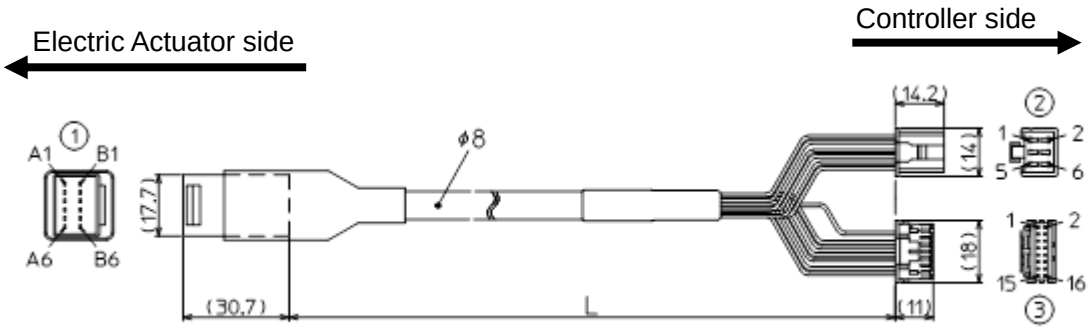
②

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

Shield

③

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



(2) Actuator cable (8-20m)

LE-CP-□

Cable length (L)

8	8m *1)
A	10m *1)
B	15m *1)
C	20m *1)

*1) produced upon receipt of order. Only Robotic type cable can be selected.

①

signal	Terminal no.
A	B-1
$\overline{A}$	A-1
B	B-2
$\overline{B}$	A-2
COM-A/COM	B-3
COM-B/ -	A-3
Vcc	B-4
GND	A-4
$\overline{A}$	B-5
A	A-5
$\overline{B}$	B-6
B	A-6

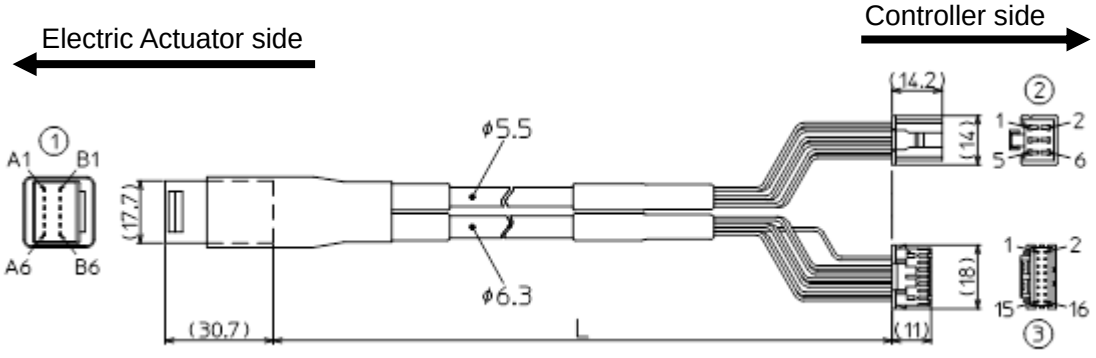
②

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

Shield

③

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



(3) Actuator cable for with lock and sensor (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	Terminal no.
A	B-1
$\overline{A}$	A-1
B	B-2
$\overline{B}$	A-2
COM-A/COM	B-3
COM-B/ -	A-3
Vcc	B-4
GND	A-4
$\overline{A}$	B-5
A	A-5
$\overline{B}$	B-6
B	A-6

②

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

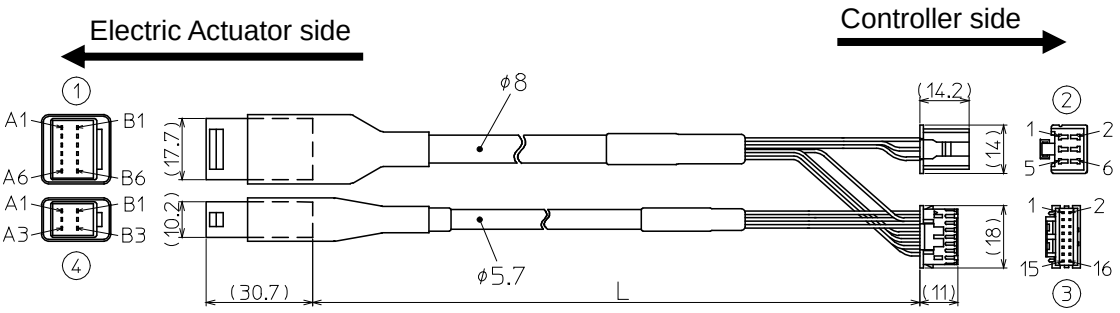
Shield

③

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

④

signal	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



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

LE-CP-□-B

Cable length (L)

8	8m *1)
A	10m *1)
B	15m *1)
C	20m *1)

*1) produced upon receipt of order
Only "Robotic type cable" can be selected.

①

signal	Terminal no.
A	B-1
$\overline{A}$	A-1
B	B-2
$\overline{B}$	A-2
COM-A/COM	B-3
COM-B/ -	A-3
Vcc	B-4
GND	A-4
$\overline{A}$	B-5
A	A-5
$\overline{B}$	B-6
B	A-6

②

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

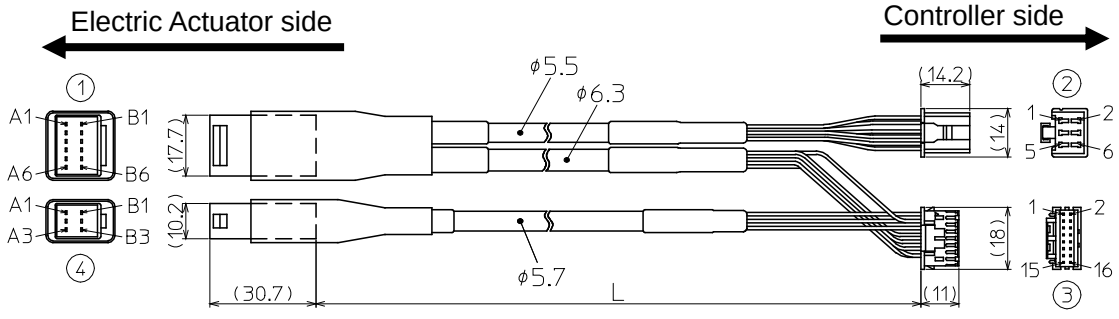
Shield

③

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

④

signal	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



(5) I/O Cable

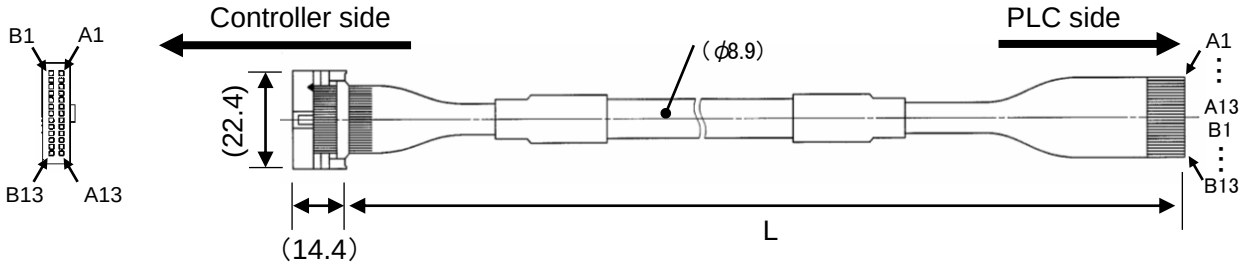
L E C - C N 5 - □

Cable length (L)

1	1.5m
3	3m
5	5m

Pin No.	# of wire	Color of insulation	Dot mark	Dot color
A1	1	Light brown	■	Black
A2		Light brown	■	Red
A3	2	Yellow	■	Black
A4		Yellow	■	Red
A5	3	Light green	■	Black
A6		Light green	■	Red
A7	4	Grey	■	Black
A8		Grey	■	Red
A9	5	White	■	Black
A10		White	■	Red
A11	6	Light brown	■■	Black
A12		Light brown	■■	Red
A13	7	Yellow	■■	Black

Pin No.	# of wire	Color of insulation	Dot mark	Dot color
B1	7	Yellow	■■	Red
B2	8	Light green	■■	Black
B3		Light green	■■	Red
B4	9	Grey	■■	Black
B5		Grey	■■	Red
B6	10	White	■■	Black
B7		White	■■	Red
B8	11	Light brown	■■■	Black
B9		Light brown	■■■	Red
B10	12	Yellow	■■■	Black
B11		Yellow	■■■	Red
B12	13	Light green	■■■	Black
B13		Light green	■■■	Red
-	Shield			



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.

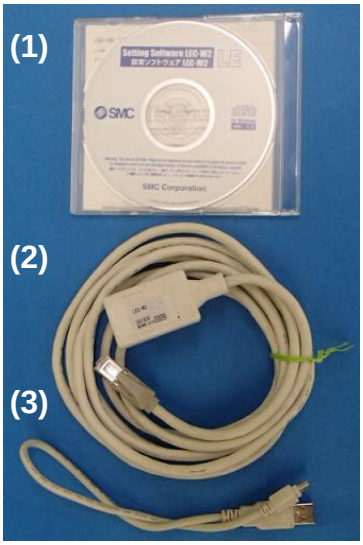
(6) Controller setting kit

L E C-W 2

Contents

Description	Product No. *1)	Quantity
(1) Controller setting software (CD-ROM)	LEC-W2-S	1
(2) Communication cable(3m)	LEC-W2-C	1
(3) USB cable(0.3m)	LEC-W2-U	1

*1) Can be ordered separately.



Hardware requirements

PC/AT compatible machine installed with Windows®XP and Windows®7 Windows®8.1 and equipped with USB1.1 or USB2.0 ports.

Windows® and Windows®XP, Windows®7, Windows®8.1 are registered trademarks of Microsoft Corporation.

⚠ Caution

The controller setting software must use the latest version.
Upgrade software be able to download on SMC website. http://www.smcworld.com/

(7) Teaching box

LEC – T1 – 3 E G □

Teaching box

Cable length

3	3m

Initial language

E	English
J	Japanese

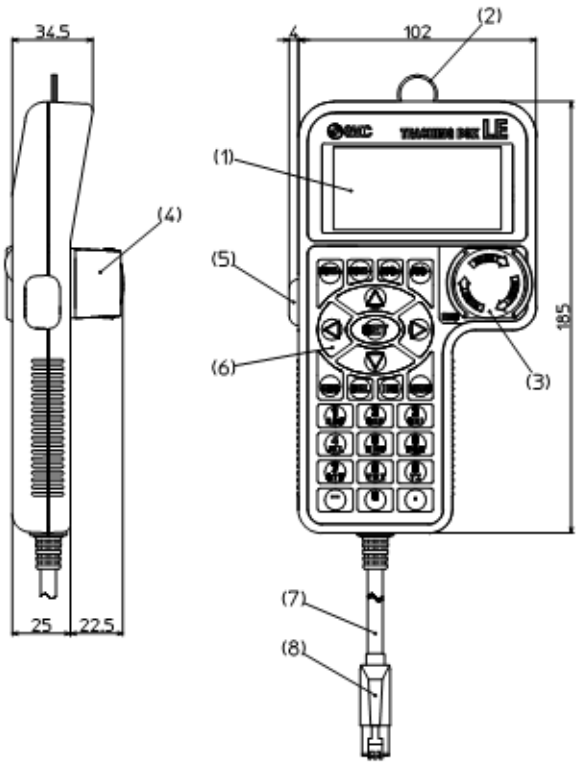
Stop switch

G	Equipped with stop switch

Enable switch

Nil	No enable switch
S	Equipped with enableswitchchluded.

Dimensions



No.	Name	Function
(1)	LCD	A screen ofliquid crystal display (with backlight)
(2)	Ring	A ring for hanging the teaching box.
(3)	Stop switch	When swich is pushed in, the swich locks and stops. The lock is released when it is turned to the right.
(4)	Stop switch guard	A guard for the stop guard
(5)	Enable switch (Option)	Prevent unintentional operation (unexpected operation) of the Jog test function. Other functions such as data change are not covered.
(6)	Key switch	Switch for each input
(7)	Cable	Length: 3 meaters
(8)	Connector	A connector connected to CN4 of the controller

2.5 Startup Procedures

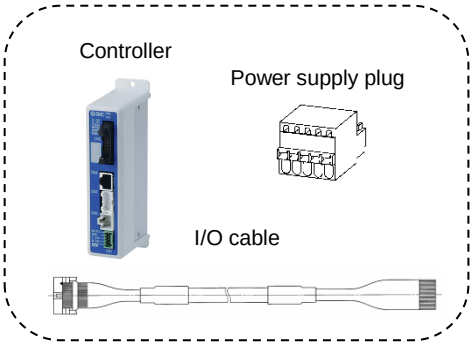
Be sure to check the procedure below before use.

(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.

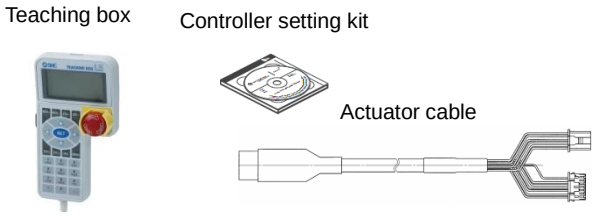
Item	Quantity
Controller (LECP6□□□-□)	1 unit
Power supply plug (LEC-D1-1)	1 piece
I/O cable (LEC-CN5-□) *1)	1 piece

*1) Included in the package only when the I/O cable length is specified.



【Option】

- ●Teaching box
- ●Controller setting kit
- ● Actuator cable
- ●I/O cable



(2) Installation

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

(3) Wiring and connection

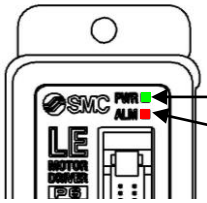
Prepare the electric actuator and the cable.

Connect cables, etc. to the connector (CN1 to CN5) of the controller.

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

(4) Power ON alarm (error)

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



Controller

Function	LED color	Status
PWR	Green	Normal
ALM	Red	Problems

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

In case of alarm (error) condition:

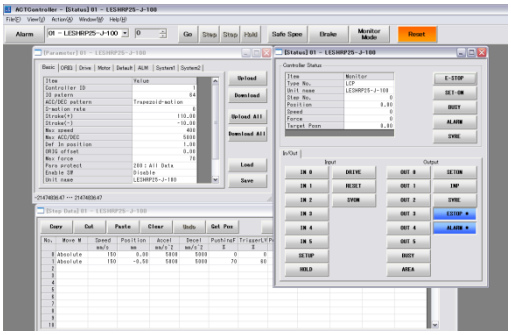
Connect a PC or the teaching box to the CN4 serial I/O connector and check the details of the alarm. Then, remove the cause of the error referring to the **"12. Alarm Detection"**

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

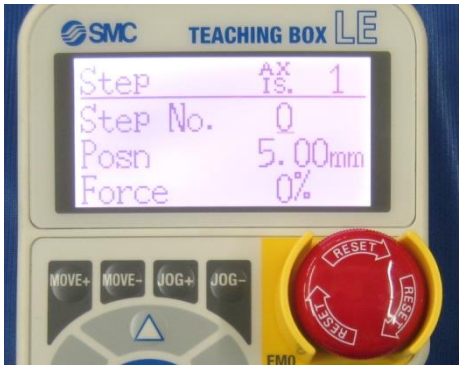
(5) Operation pattern setting

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

●Controller set up kit



●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 kit 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) *2)	Power voltage: 24 VDC +/-10% Max. current consumption: 3A (Peak 5A) *3) (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	Incremental A/B phase (800 pulse / rotation)
Serial communication	Conforming to RS485. (Modbus protocol compliant)
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 40ºC (No freezing)
Operating humidity range	90%RH or less (No condensation)
Storage temperature range	-10 to 60ºC (No freezing)
Storage humidity range	90%RH or less (No condensation)
Insulation resistance	Between external terminals and case 50MΩ (500VDC)
Mass	150g (screw mount type) 170g (DIN rail mount type)

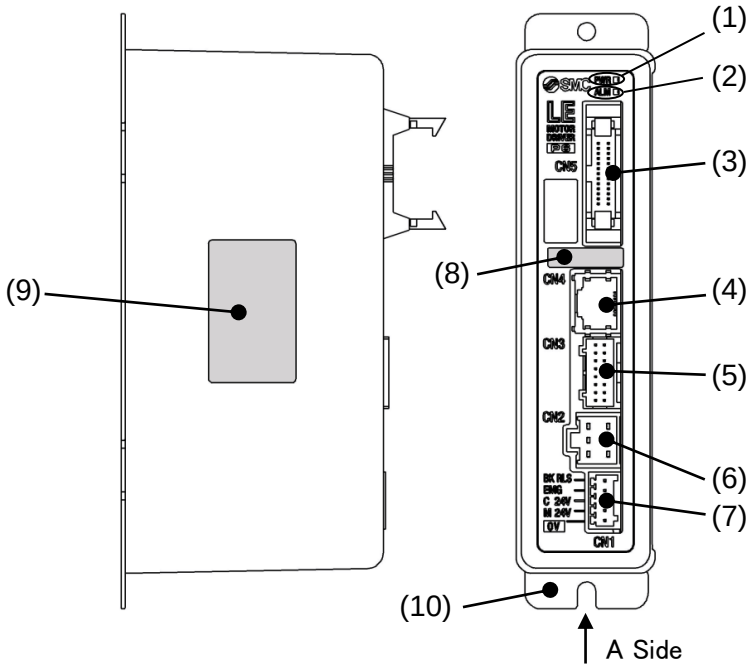
*1) The controller power supply do not use the power supply of "inrush current restraining type".

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

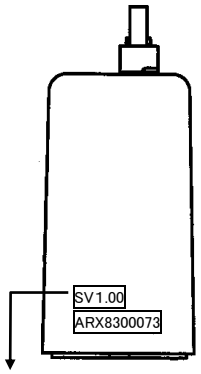
*3) The power consumption changes depending on the electric actuator model.
Please refer to the specifications of the electric actuator for more details.

3.2 Parts description

The detailed descriptions of each part are as follows:



A side (controller version)



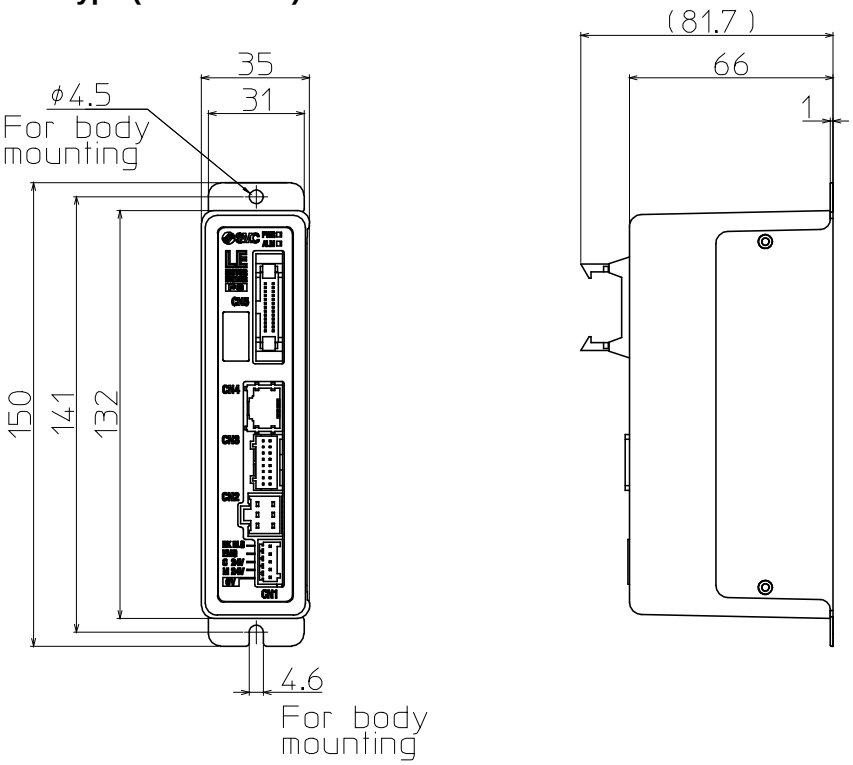
Label of controller version
Example) controller version “SV1.00”

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)	CN5	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)	CN4	Serial I/O Connector (8 pins)	Used to connect the teaching box, PC, etc.
(5)	CN3	Encoder connector (16 pins)	Used to connect the actuator cable.
(6)	CN2	Motor power connector (6 pins)	
(7)	CN1	Power connector (5 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)

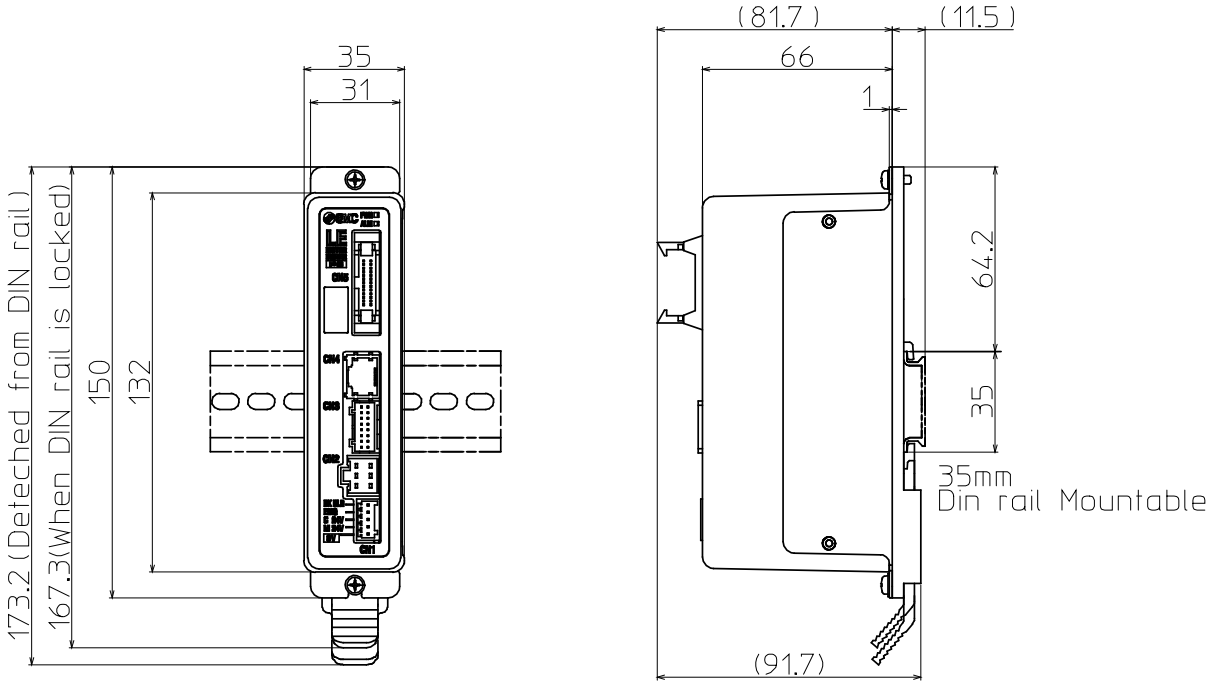
3.3 Outside dimension diagram

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

(1) Screw mount type (LECP6□□-□)



(2) DIN rail mount type (LECP6□□D-□)



3.4 How to install

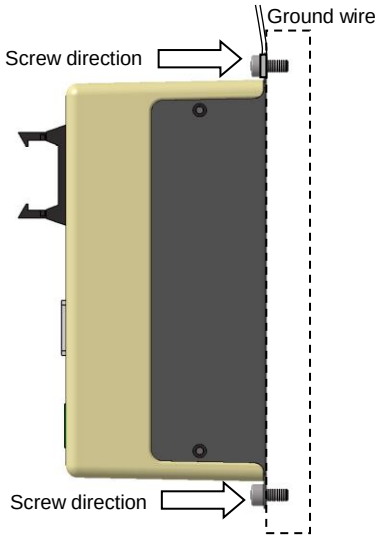
(1) How to install

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:

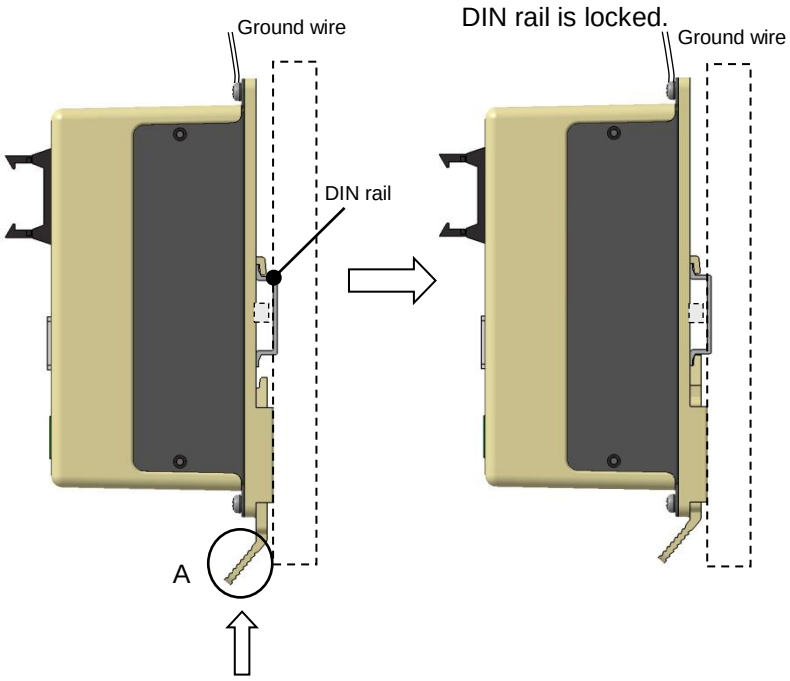
1) Screw mount type (LECP6□□-□)

(Installation with two M4 screws)



2) DIN rail mount type (LECP6□□D-□)

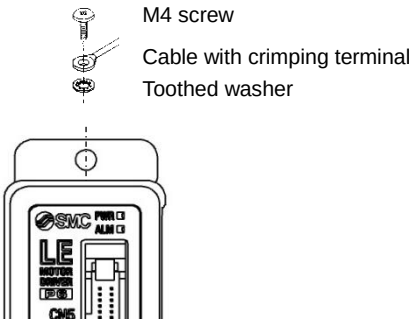
(Installation with the DIN rail)



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.



Controller

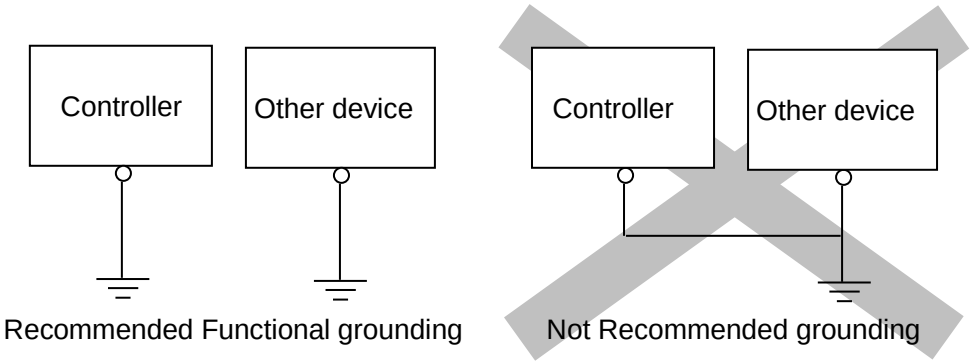
⚠ Caution

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.



(3) Installation location

Select the size and the installation style so that the surrounding temperature of the controller is 40 ºC or less.

Mount the controller vertically on the wall with the space allowed as shown in Fig. 1.

As shown in Fig. 2, establish the construction so that the connectors can be connected and disconnected.

Enough space must be allowed around the controller so that the operating temperature of the controller stays within the specification range.

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

Fig.1

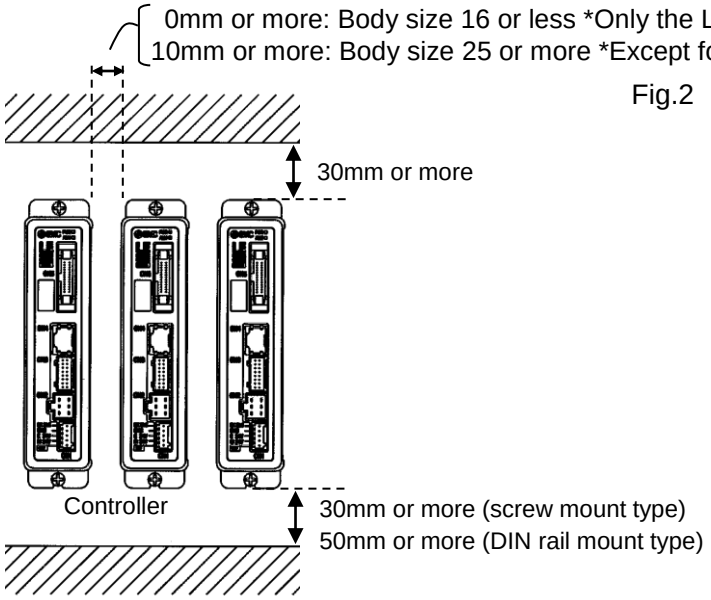
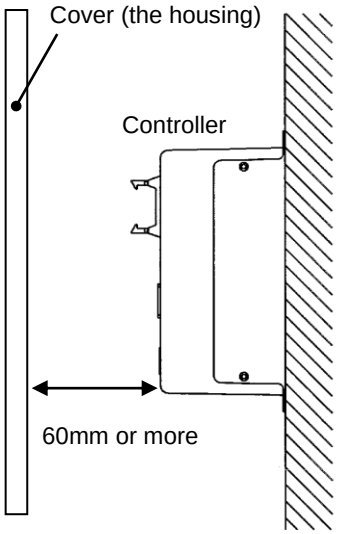


Fig.2



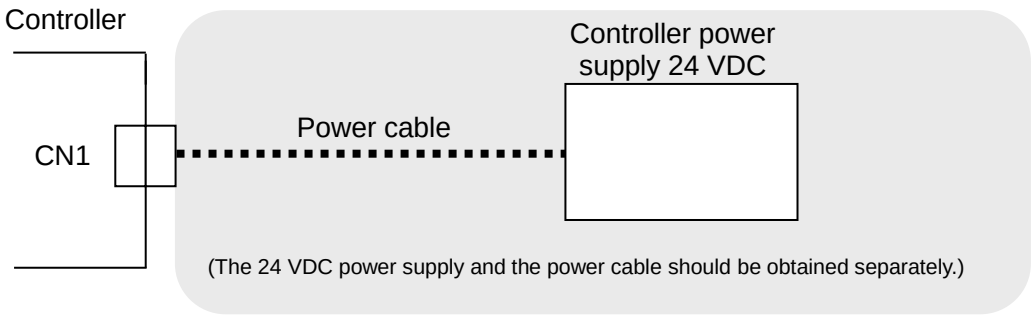
⚠ Caution

If the mounting surface of the controller is distorted or not flat, excessive force may be applied to the housing, etc. causing malfunction.
Mount this product on a plane flat surface.

4. External Wiring Diagram

Examples of standard wiring are shown for each connector (CN1 to CN5) of the controller.

4.1 CN1: Power connector



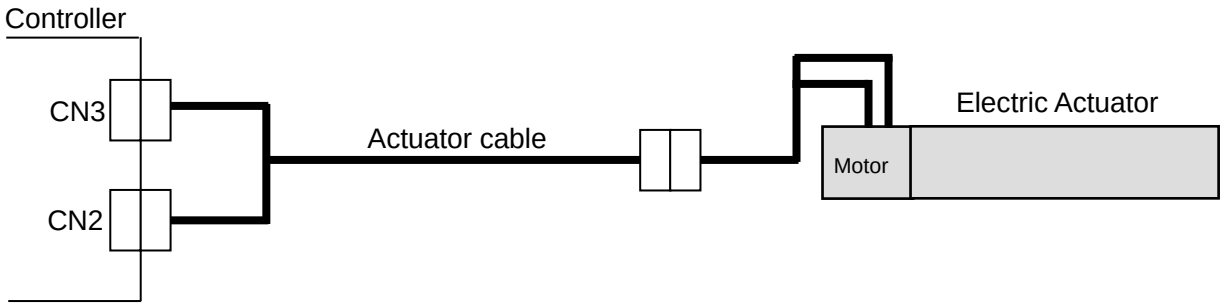
Please refer to **"5. CN1: Power supply plug"** for how to wire the CN1 connector.

⚠ Caution

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

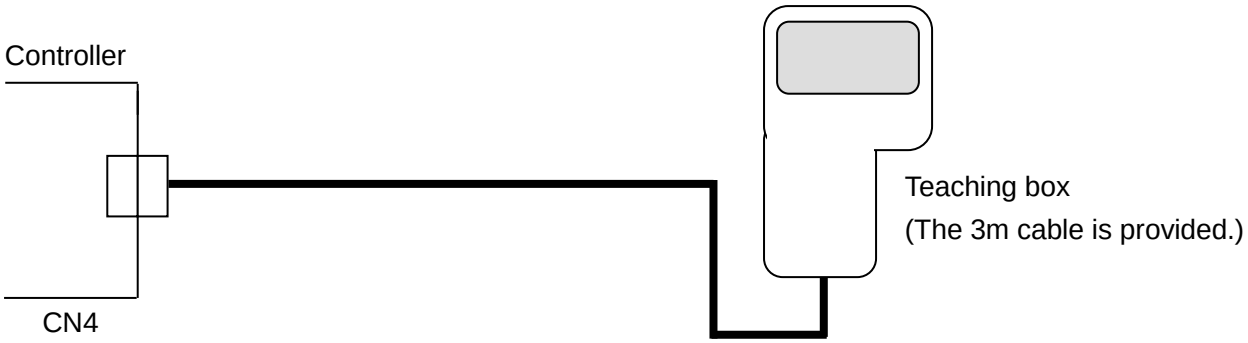
4.2 CN2: Motor power connector and CN3: Encoder connector

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

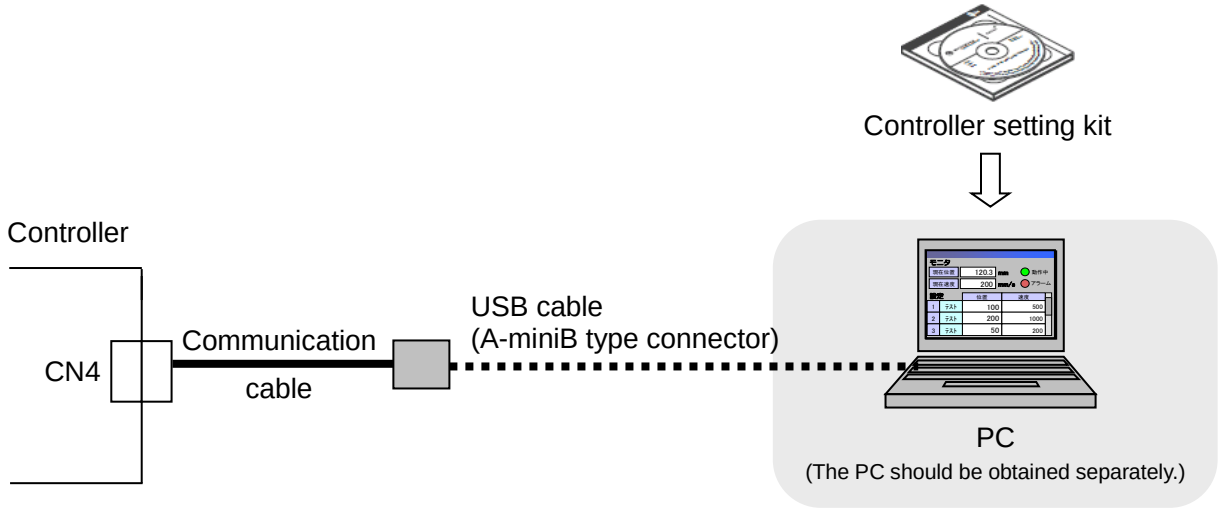


4.3 CN4: Serial I/O connector

(1) Connection with the teaching box



(2) Connection with a PC



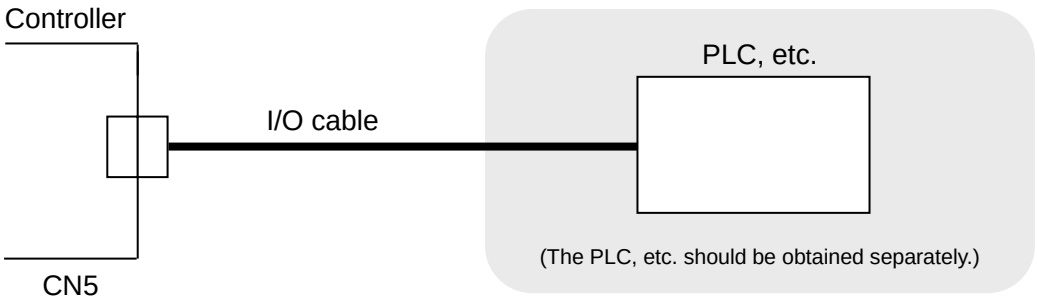
⚠ Caution

(1) Do not connect to equipment other than specified (LEC-W1, LEC-W2, LEC-T1, LEC-G).
When connected to equipment which is not specified, the product will be damaged by incorrect signal wiring.

(2) When connecting the cable, make sure that no electrically conductive materials are present in the connector insertion port.

(3) In the LEC-W1, the 0V of the driver and PC is not insulated.
If the 0V and the PC ground are common and the PC ground makes contact with another voltage, an excessive voltage might be applied to the driver, causing damage to the driver.

4.4 CN5: Parallel I/O connector



Please refer to **“6.4 Parallel I/O Wiring Example”** for how to wire the CN5 connector.

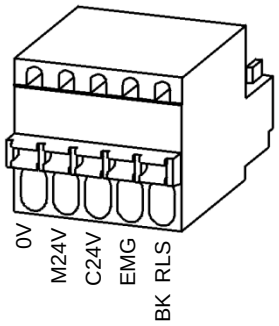
Please refer to **"6.3 The parallel I/O signal is detailed"** for details of each signal of parallel I/O.

5. CN1: Power supply plug

5.1 Power supply plug specifications

.

Power supply plug

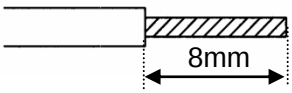


Terminal	Function	Descriptions
0V	Common power (-)	The negative common power for M24V, C24V, EMG and BK RLS.
M24V	Motor power (+)	The positive power for the electric actuator motor to be supplied via the controller.
C24V	Control power (+)	The positive control power.
EMG	Stop signal (+)	The positive power for Stop signal. (Motor is can operate to connect the 24V.)
BK RLS	Lock release (+)	The positive power for lock release.

【Power supply connector】

LEC-D-1-1（FK-MC0.5/5-ST-2.5：Manufactured by Phoenix Contact）

5.2 Electric wire specifications

Item	Specifications
Applicable wire size (Single line, stranded wire, stranded wire with bar terminal (without insulation sleeve))	AWG20 (0.5mm^2) Cable sheath O.D. ø2.0mm or less The rated temperature for the insulation coating: 60ºC or more
Stripped section length	

Please insert only the peel line part when insert the electric wire in the power plug.

⚠ Caution

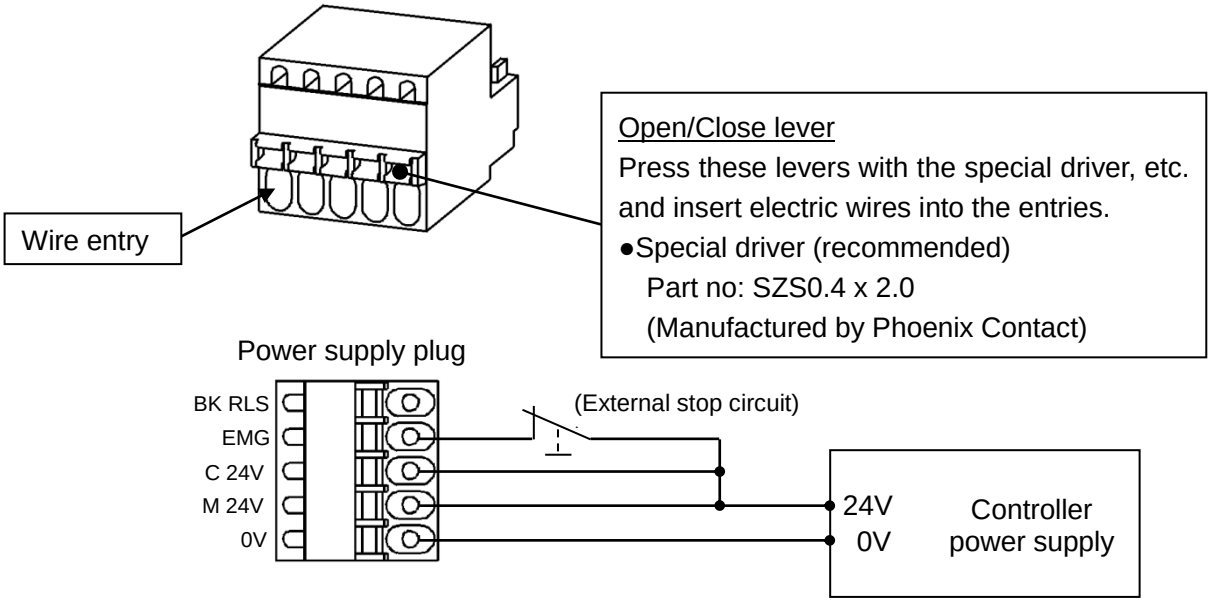
Multiple electric wires should not be connected to one terminal.
Arrange wiring so that conductors of each terminal do not contact other lines.

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

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.



⚠ 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

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.

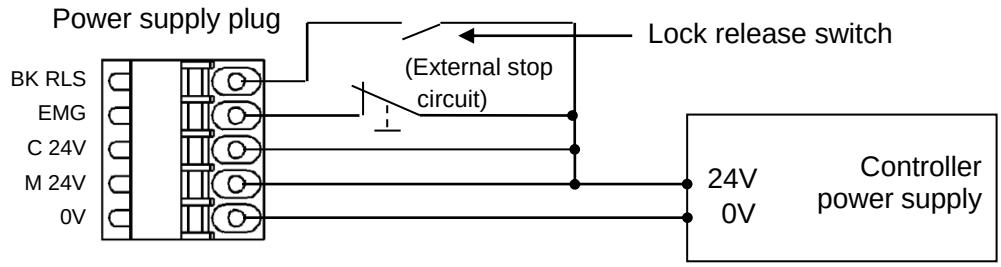
⚠ Caution

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

(3) Wiring of the lock release

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 BK RLS terminal. When this is switched on, the lock will be released forcibly.



⚠ Caution

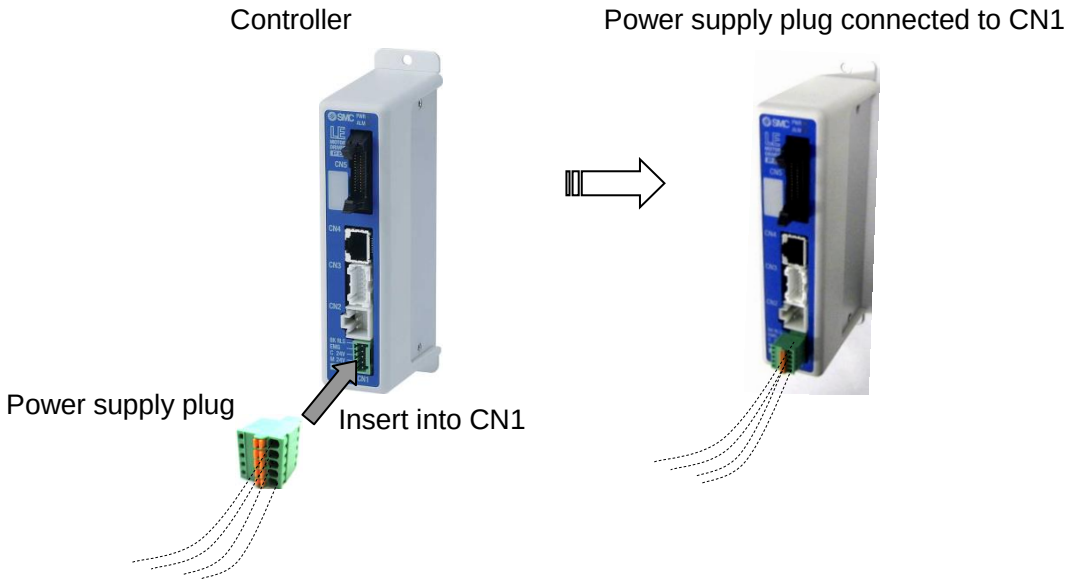
(1) If the electric actuator is a non-lock type, it is not necessary to wire the BK RLS terminal.

(2) Do not supply power to the BK RLS (lock release) during normal operation.

The 24 VDC supply to the BK 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.

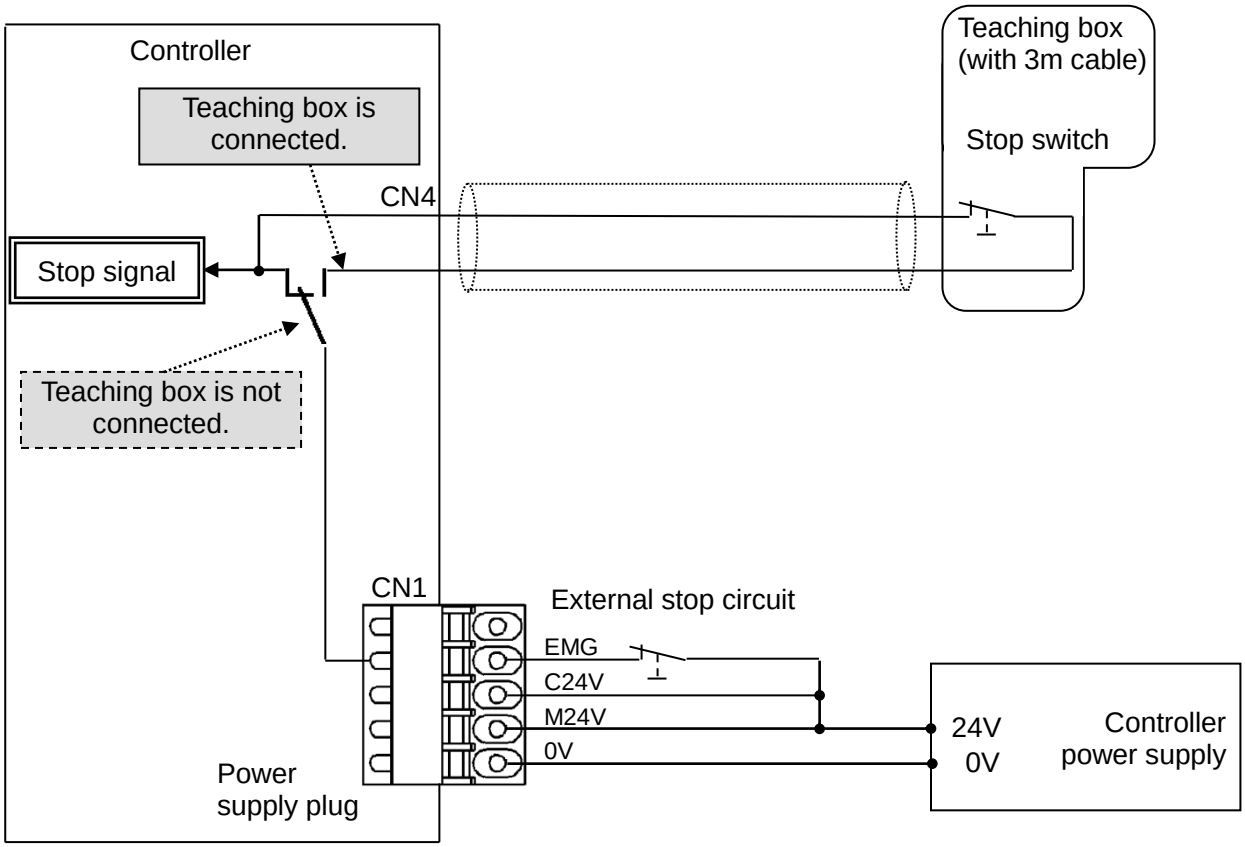


5.4 Stop circuits

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.



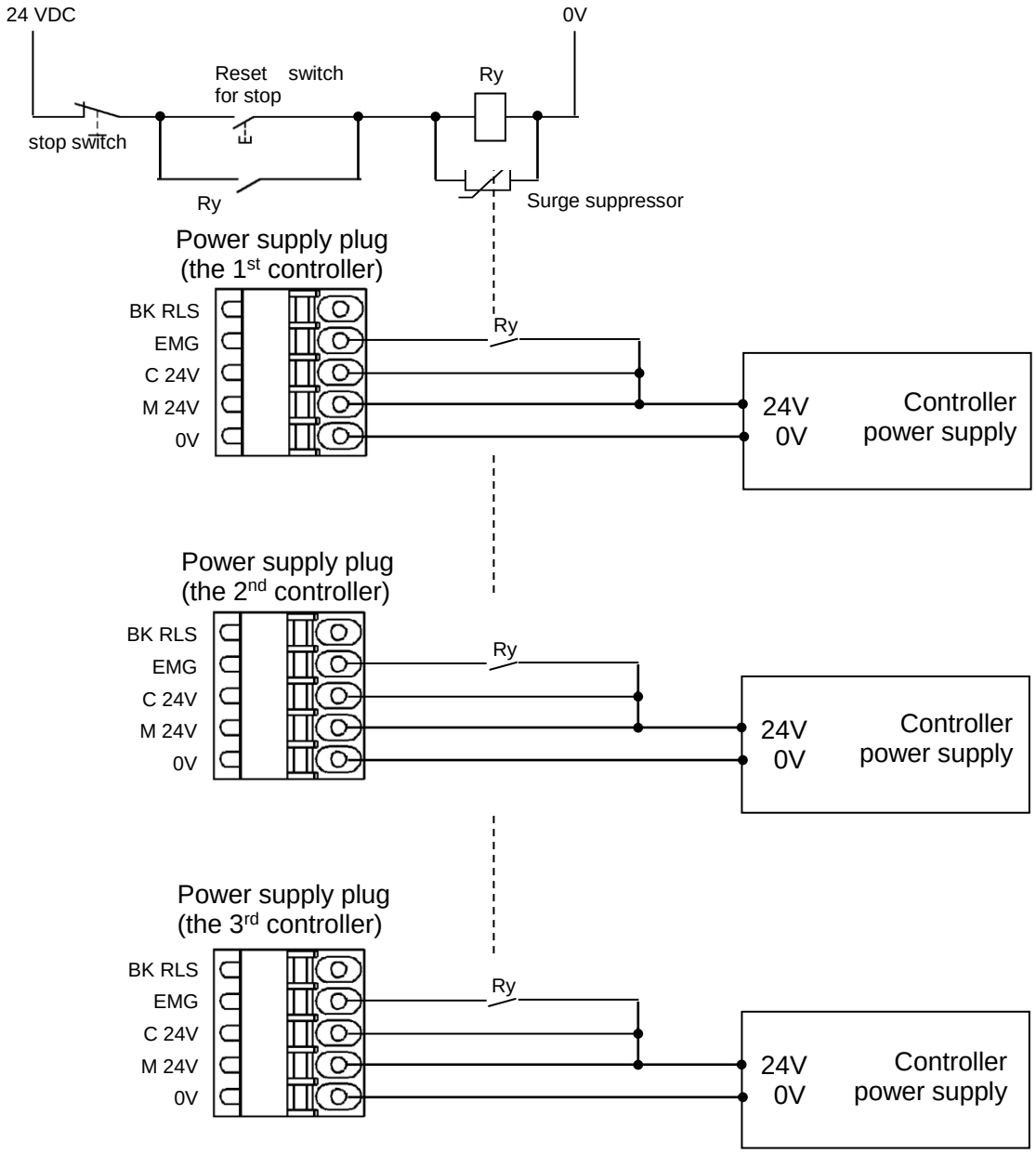
⚠ Warning

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

(2) Example circuit 2 - multiple controllers

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.)

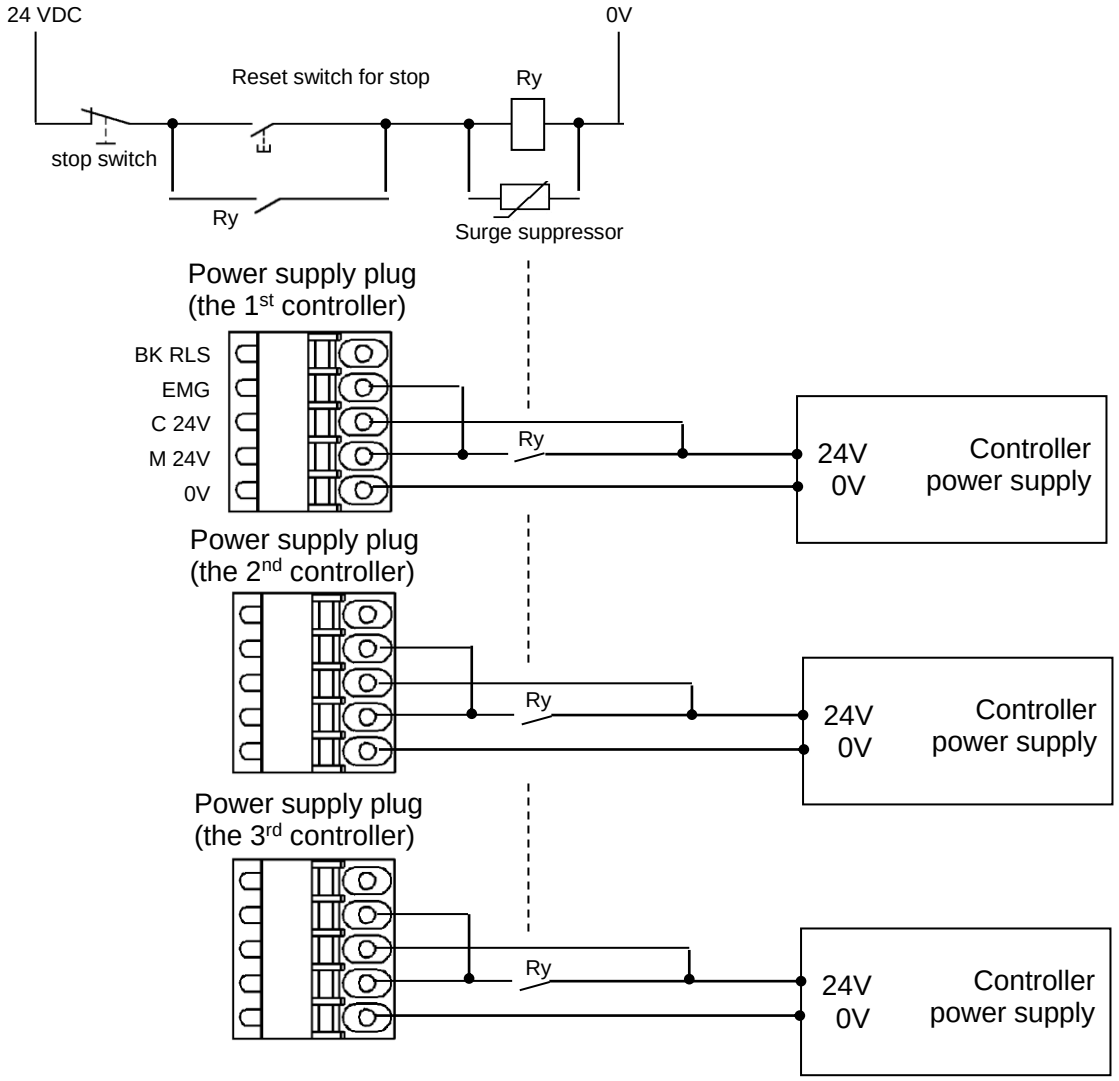


⚠ Caution
When shutdown is input, the controller stops with maximum deceleration, then the motor is turned off.

(3) Example circuit 3 - Motor power shutdown

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 BK 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 BK RLS terminal at motor drive power is OFF.

6. CN5: 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 (LECP6N□□-□) and PNP type (LECP6P□□-□).

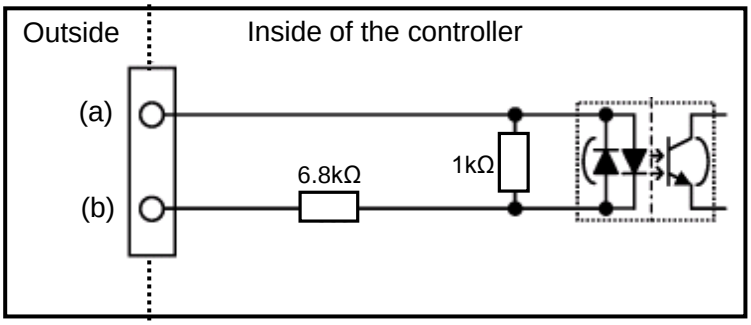
(1) Parallel I/O input circuit (same for both NPN and PNP type)

NPN type

(a)	「COM+」〈A1〉
(b)	IN0〈A3〉-SVON〈A13〉

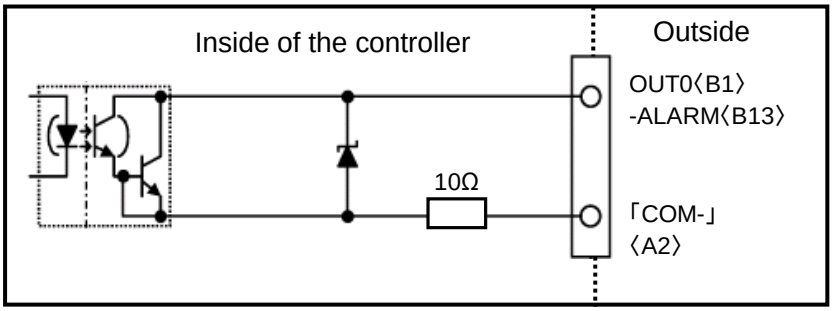
PNP type

(a)	「COM-」〈A2〉
(b)	IN0〈A3〉-SVON〈A13〉

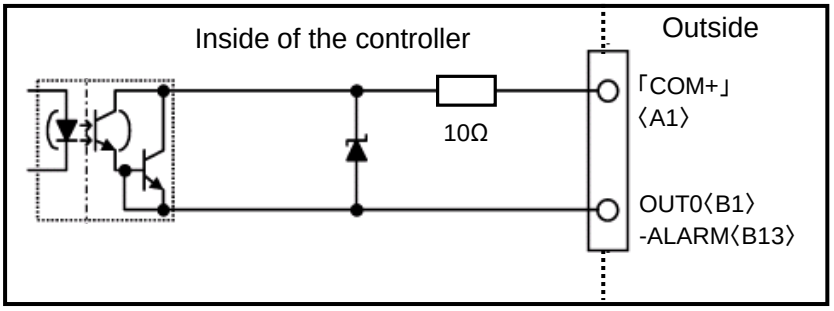


(2) Parallel I/O output circuit

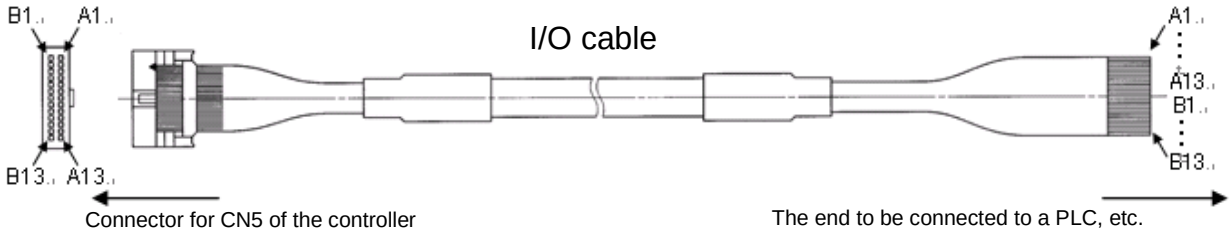
●NPN type



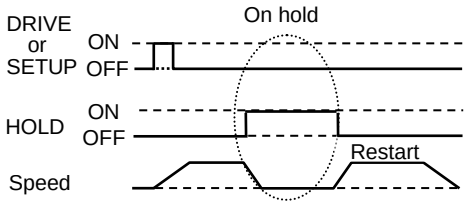
●PNP type



6.3 The parallel I/O signal is detailed



- 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 A4 A5 A6 A7 A8	IN0 IN1 IN2 IN3 IN4 IN5	Bit no. to specify the step data (Specify the number by combining On / Off of the terminals.) Example: (Bit no. to specify the step data no.3.) IN5 | IN4 | IN3 | IN2 | IN1 | IN0 OFF | OFF | OFF | OFF | ON | ON 0 | 0 | 0 | 0 | 1 | 1 ← Binary code
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:  **⚠ Caution** As long as HOLD is ON, the DRIVE input will be disabled. The output signals are rendered invalid whilst hold is in operation.
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.*1)

*1) 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.

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)

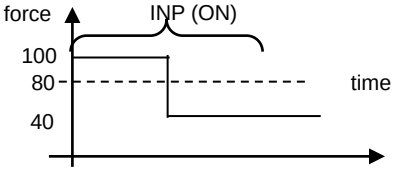
*1) During the positioning operation the SETUP input will be disabled whilst hold is in operation.

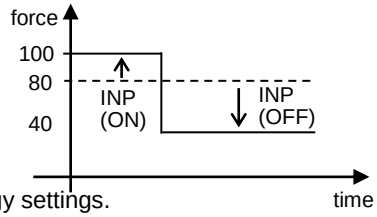
⚠Caution

SETUP and DRIVE can only be accepted during the above conditions. An Alarm condition will happen during all other times. Keep the input signal combination for 15 ms (30 ms if possible) or longer.

-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".

<table>
<tr><td>B10</td><td>INP
continue</td><td>
⚠Caution
(1) 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% *1)


(2) If controller version is below SV1.00.
During pushing operation in energy saving mode, if the energy saving setting is less than the Trigger LV value, the INP output signal will turn OFF.
When movement starts again from the pushing stopped state, it will do pushing operation with energy saving pushing force.
(Example) Step data “force” is 100%
Step data “Trigger LV” is 80%
The energy saving setting of the electric actuator is 40%. *1)


*1) The electric actuator model determines the energy settings.
Please refer to the specifications of the electric actuator for more details.
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.
</td></tr>
<tr><td>B11</td><td>SVRE</td><td>When the servomotor is OFF, SVRE is OFF. When the servomotor is ON, SVRE is ON.(*1)</td></tr>
<tr><td>B12</td><td>*ESTOP *2)</td><td>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 on the controller connector CN1.</td></tr>
<tr><td>B13</td><td>*ALARM *2)</td><td>When there are no alarms, this terminal is ON.
When there are alarms, this is OFF.</td></tr>
</table>

*1) 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.

*2) 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.

State \ Output signal	BUSY	INP	SVRE	Lock	SETON	OUT0-5
Controller powered down [SVOFF] with no motion	OFF	OFF	OFF	Lock	OFF	OFF
Controller powered down [SVON] with no motion	OFF	OFF	ON	Release	OFF	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 *1)	ON	Release	ON	OFF
During movement by positioning/ pushing operation.	ON	OFF	ON	Release	ON	ON *2)
The electric actuator is paused by [HOLD]	OFF	OFF	ON	Release	ON	ON *2)
On completion of the positioning operation. (within “In position”)	OFF	ON *4)	ON	Release	ON	ON *2)
Stopped due to pushing a work-load in pushing operation. (holding)	OFF	ON	ON	Release	ON	ON *2)
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 *4)	OFF	Lock	ON	ON *3)
EMG signal stop from the CN1 connector after the electric actuator is at the origin.	OFF	OFF *4)	OFF	Lock	ON	OFF

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

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

*3) Retains the previous state.

*4) The output turns on when the electric actuator is “In position” of the step data.

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

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

0：OFF 1：ON

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

0:OFF 1:ON

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

0:OFF 1:ON

Step No	OUT 5	OUT 4	OUT 3	OUT 2	OUT 1	OUT 0
32	1	0	0	0	0	0
33	1	0	0	0	0	1
34	1	0	0	0	1	0
35	1	0	0	0	1	1
36	1	0	0	1	0	0
37	1	0	0	1	0	1
38	1	0	0	1	1	0
39	1	0	0	1	1	1
40	1	0	1	0	0	0
41	1	0	1	0	0	1
42	1	0	1	0	1	0
43	1	0	1	0	1	1
44	1	0	1	1	0	0
45	1	0	1	1	0	1
46	1	0	1	1	1	0
47	1	0	1	1	1	1
48	1	1	0	0	0	0
49	1	1	0	0	0	1
50	1	1	0	0	1	0
51	1	1	0	0	1	1
52	1	1	0	1	0	0
53	1	1	0	1	0	1
54	1	1	0	1	1	0
55	1	1	0	1	1	1
56	1	1	1	0	0	0
57	1	1	1	0	0	1
58	1	1	1	0	1	0
59	1	1	1	0	1	1
60	1	1	1	1	0	0
61	1	1	1	1	0	1
62	1	1	1	1	1	0
63	1	1	1	1	1	1

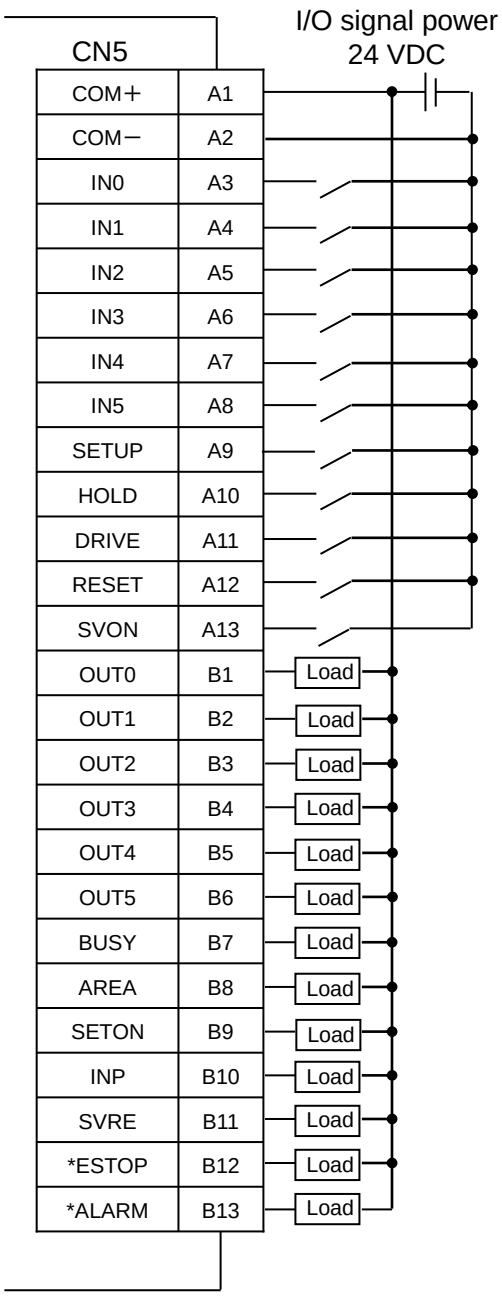
6.4 Parallel I/O Wiring Example

When you connect a PLC, etc. to the CN5 parallel I/O connector, please use the I/O cable (LEC-CN5-□).

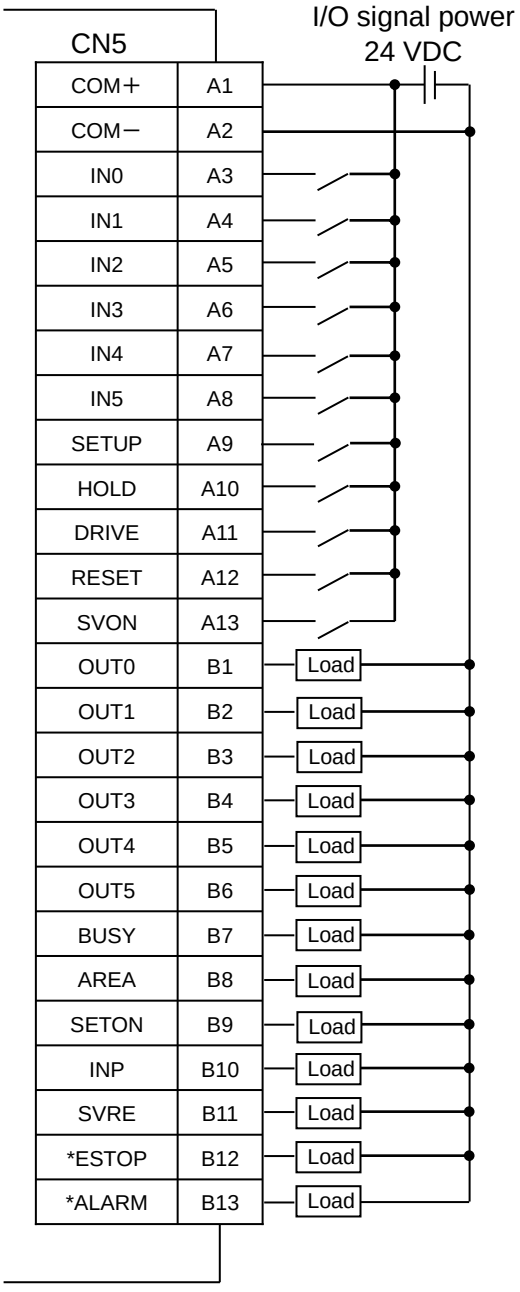
The wiring should be changed depending on the type of the parallel I/O (NPN or PNP).

Please wire referring to the following diagram.

● **NPN type**



● **PNP type**



⚠ Caution

The 24 VDC controller power supply for CN1 and the 24V DC I/O power supply for CN5 should be separated.

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 kit or the teaching box. This setup data input by the controller setting kit or teaching box will be recorded in the memory of the controller.

For the controller setting kit 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 kit 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 1 item to be set.
Each step data will become effective as soon as it is written to the controller.

Example) Step data of the controller setting kit [Normal mode]

No.	Move	Speed mm/s	Position mm	Accel mm/s²	Decel mm/s²	PushingF %	TriggerLV %	PushingSp mm/s	Moving F %	Area1 mm	Area2 mm	In posn mm
0	Absolute	100	20.00	1000	1000	0	0	0	100	18.00	22.50	0.5
1	Absolute	50	10.00	1000	1000	70	60	5	100	6.0	12.0	1.5
63	Absolute	20	5.00	500	500	0	0	0	100	3.0	8.0	1.2

⚠ Caution

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

Details of step data

<table>
<tr><th>Setting name</th><th>Range</th><th>Description</th></tr>
<tr><td>No.</td><td>0 to 63</td><td>Number of the step data.</td></tr>
<tr><td>Movement MOD</td><td>3 options
(See the right descriptions.)</td><td>The setting to specify the coordinate system for the target position.
<table>
<tr><th>Software</th><th>TB</th><th>Description</th></tr>
<tr><td>Blank</td><td>Disable</td><td>The step data is ineffective.</td></tr>
<tr><td>Absolute</td><td>Absolute</td><td>The target position will be defined by the absolute coordination based on the zero point.</td></tr>
<tr><td>Relative</td><td>Relative</td><td>The target position will be defined by the relative coordination based on the current position.</td></tr>
</table></td></tr>
<tr><td>Speed</td><td>Minimum value to “Max speed” of the basic parameter *1)</td><td>The speed to move to the target position (Unit: mm/s)</td></tr>
<tr><td>Position</td><td>“Stroke (-) ” to “Stroke (+) ” of the basic parameter</td><td>The target position (Unit: mm)</td></tr>
<tr><td>Acceleration</td><td>1 to “Max ACC/ DEC” of the basic parameter</td><td>The acceleration to reach to the Speed (Unit: mm/s^2)</td></tr>
<tr><td>Deceleration</td><td>1 to “Max ACC/ DEC” of the basic parameter</td><td>The deceleration to reach to the Speed (Unit: mm/s^2)</td></tr>
<tr><td>Pushing force</td><td>0 or

Minimum value to “Max force” of the basic parameter *1)</td><td>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.
<table>
<tr><th>Value</th><th>Operation</th><th>Description</th></tr>
<tr><td>0</td><td>Positioning operation</td><td>The electric actuator moves to the position specified in the “Position.</td></tr>
<tr><td>1-100</td><td>Pushing operation</td><td>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.</td></tr>
</table></td></tr>
<tr><td>Trigger LV</td><td>Minimum value to “Max force” of the basic parameter *1)</td><td>●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.</td></tr>
</table>

<table>
<tr><td>Pushing speed</td><td>Minimum value to “Max force” of the basic parameter *1)</td><td>●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.</td></tr>
<tr><td>Moving force</td><td>*1)</td><td>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.</td></tr>
<tr><td>Area1</td><td>“Stroke (-)” to “Area2” of step data</td><td rowspan="2">The setting to define the conditions where the AREA output will be turned ON (Unit: mm).
If the current position is within the range between the Area1 and Area2, the AREA output will be turned ON.
If Area1 >Area2, the alarm “Step Data ALM1” will be activated.
(However, no alarm is generated if “Area1”= “Area2”= 0, the AREA output will be turned OFF).</td></tr>
<tr><td>Area2</td><td>“Area1” of step data to “Stroke (+)” of the basic parameter</td></tr>
<tr><td>In position</td><td>*1)</td><td>The functions of this will be different between the pushing operation and the positioning operation.
●Positioning operation: Positioning range (Unit: mm).
●Pushing operation: Pushing distance (Unit: mm).
<table>
<tr><th>Operation</th><th>Description</th></tr>
<tr><td>Positioning operation</td><td>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 ≦electric actuator position ≦ target position + in position</td></tr>
<tr><td>Pushing operation</td><td>This is the setting to define the distance pushed by the 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.</td></tr>
</table></td></tr>
</table>

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

7.2 Basic parameter

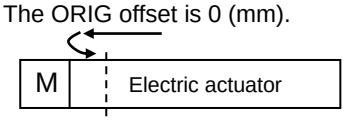
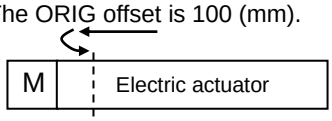
The “Basic parameter” is the data to define the operating conditions of the controller, conditions of the electric actuator, etc.

⚠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

<table>
<tr><td>ORIG offset</td><td>*1)</td><td>This defines the position of the electric actuator after the return to origin operation. (Unit: mm)
● The ORIG offset is 0 (mm).
 
The position recognized by the controller after the return to the origin operation (0mm).
● The ORIG offset is 100 (mm).
 
The position is identified by the controller after the return to the origin operation (100mm).
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.
⚠ Caution
If the value for the “ORIG offset” is changed, the “Stroke (+)” and “Stroke (-)” of the basic parameters should be checked again.</td><td>XX</td></tr>
<tr><td>Max force</td><td>*1)</td><td>The maximum force for the pushing operation (Unit: %).</td><td>XX</td></tr>
<tr><td>Para protect</td><td>1 to 2</td><td>Sets the range in which parameter and step data can be changed.
<table><tr><th>Value</th><th>Description</th></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></td><td>XX</td></tr>
<tr><td>Enable SW</td><td>1 to 2</td><td>This defines the status of the Enable switch of the teaching box.
<table><tr><th>Value</th><th>Description</th></tr><tr><td>1</td><td>Enable</td></tr><tr><td>2</td><td>Disable</td></tr></table></td><td>XX</td></tr>
<tr><td>Unit name</td><td>Fixed value</td><td>Indication of the electric actuator type compatible to the controller.
(It should not be changed)</td><td>-</td></tr>
<tr><td>W-AREA1</td><td rowspan="8">Fixed value</td><td rowspan="8">This is the fixed value for this controller.
(It should not be changed)</td><td rowspan="8">-</td></tr>
<tr><td>W-AREA2</td></tr>
<tr><td>ORG Correct [Link Offset]</td></tr>
<tr><td>Sensor type</td></tr>
<tr><td>Option 1</td></tr>
<tr><td>Undefined parameter No.11</td></tr>
<tr><td>Undefined parameter No.12</td></tr>
</table>

*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.

7.3 Return to origin parameter

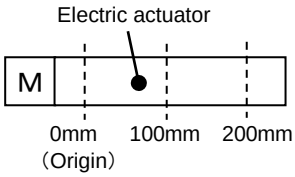
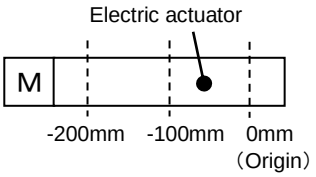
The “Return to origin parameter” is the setting data for the return to origin operation.

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).

<table>
<tr><th>Name</th><th>Range</th><th>Description</th><th>Activation</th></tr>
<tr><td>ORIG direction</td><td>1 to 2</td><td>Sets the direction of return to origin operation.
<table><tr><th>Value</th><th>Description</th></tr><tr><td>1</td><td>CW</td></tr><tr><td>2</td><td>CCW *1)</td></tr></table>⚠ Caution
Even if “ORIG direction” is changed, direction of + to - of step data is not changed.
●Default value
 
●Value changed from the default value
  </td><td>X</td></tr>
<tr><td>ORIG mode</td><td>1 to 2</td><td>The setting for the return to origin operation
<table><tr><th>Value</th><th>Description</th></tr><tr><td>1</td><td>pushing origin operation [Stop]</td></tr><tr><td>2</td><td>limit switch origin [Sensor]</td></tr></table></td><td>XX</td></tr>
<tr><td>ORIG limit</td><td>*1)</td><td>A pushing force level at which to set the origin.</td><td>XX</td></tr>
<tr><td>ORIG time</td><td>Fixed value</td><td>This is the fixed value for this controller
(It should not be changed).</td><td>-</td></tr>
<tr><td>ORIG speed</td><td>*1)</td><td>The allowable speed to move to origin.</td><td>XX</td></tr>
<tr><td>ORIG ACC/ DEC</td><td>*1)</td><td>The acceleration and deceleration during find origin.</td><td>XX</td></tr>
<tr><td>Creep speed</td><td>Fixed value</td><td>This is the fixed value for this controller
(It should not be changed).</td><td>-</td></tr>
<tr><td>ORIG sensor</td><td>0 to 2</td><td>The setting for ORIG sensor
<table><tr><th>Value</th><th>Description</th></tr><tr><td>0</td><td>The origin sensor is not effective. [Disable]</td></tr><tr><td>1</td><td>The origin sensor is N.O type. [N.O].</td></tr><tr><td>2</td><td>The origin sensor is N.C type. [N.C.]</td></tr></table></td><td>XX</td></tr>
<tr><td>ORIG SW DIR</td><td rowspan="2">Fixed value</td><td rowspan="2">This is the fixed value for this controller.
(it should not be changed)</td><td>-</td></tr>
<tr><td>Undefined parameter No.21</td><td>-</td></tr>
</table>

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

8. Return to origin

8.1 Return to origin

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

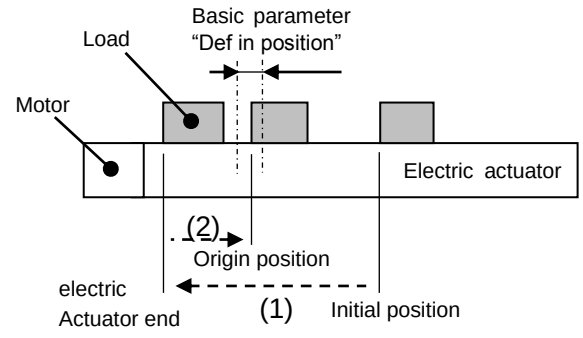
●Return to origin operation

The electric actuator moves in the return to origin direction (this direction is dependent on the electric actuator) from the initial position at the moment of power-on: See (1) in the diagram below.

When the electric 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 electric actuator. Then, the electric actuator moves at a low speed in the direction opposite to the return to origin direction: See (2) in the diagram below.

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



⚠Caution

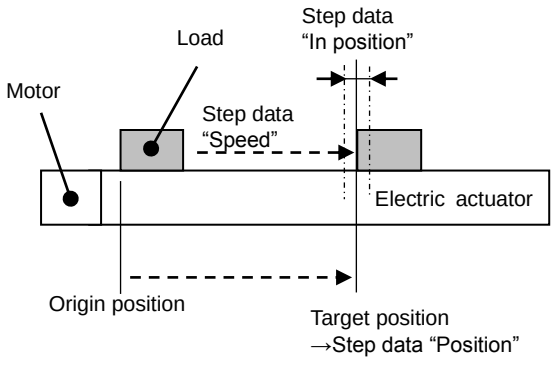
This direction is dependent on the electric actuator.

8.2 Positioning operation

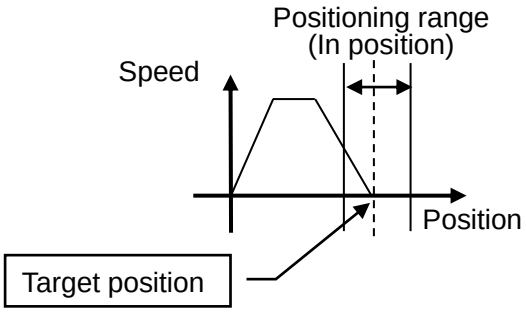
Step data "Pushing force" is 0.

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

●Positioning operation (Example)



● Positioning operation [Speed/ Position] (Example)



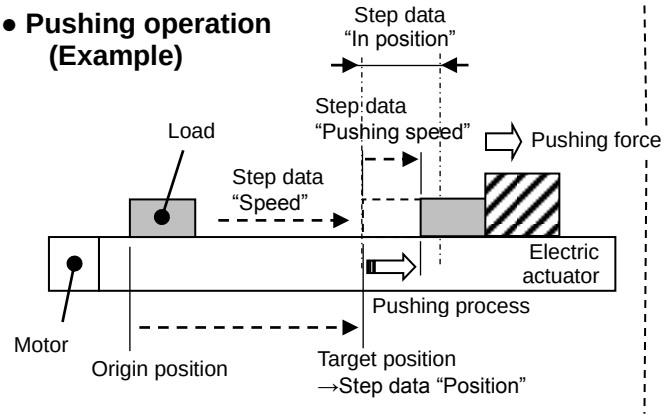
8.3 Pushing operation

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.

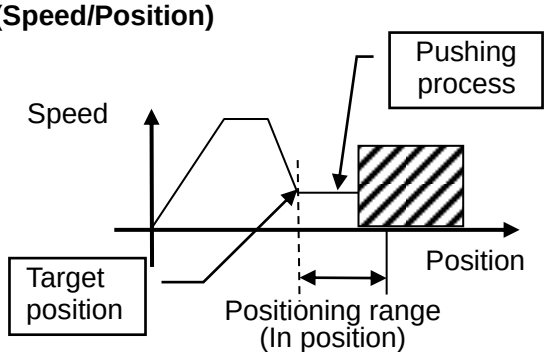
(1) Pushing operation is successfully performed.

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)

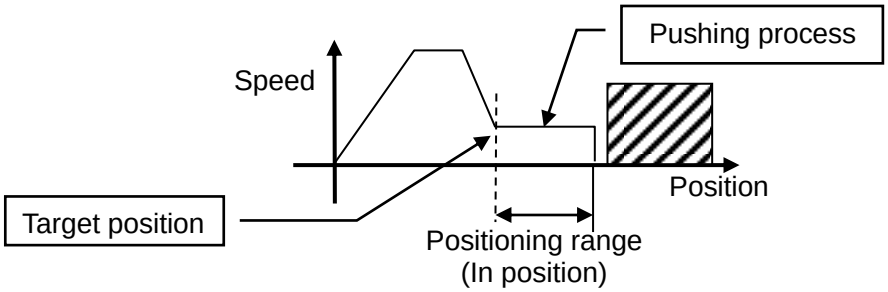


● Pushing operation (Speed/Position)



(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.



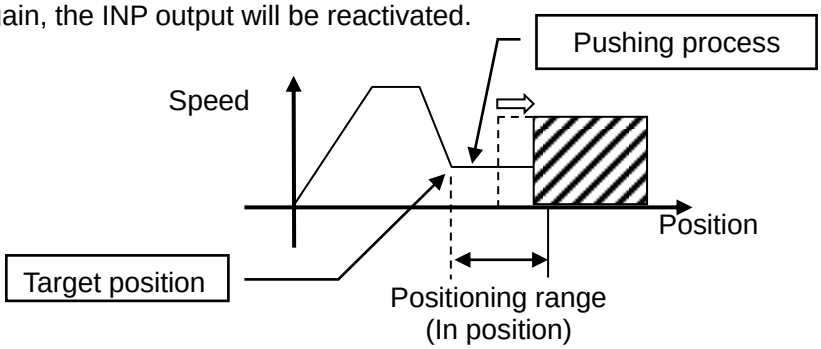
(3) Movement of the work piece after the completion of the pushing process

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.

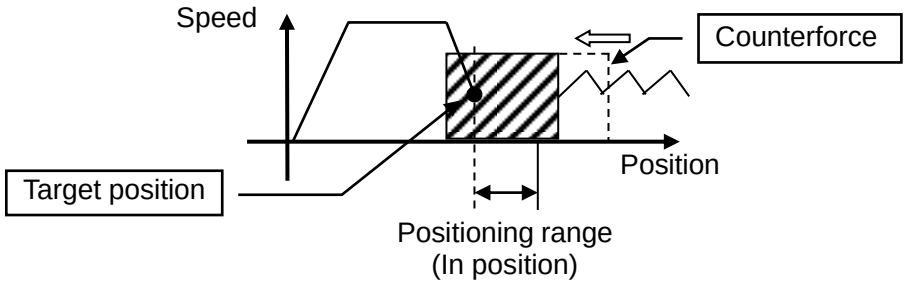
If the pushing force is kept higher than the value specified by “Trigger LV” of the step data for a certain time again, the INP output will be reactivated.



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.

Leave an interval of 15 ms (30 ms if possible) or more between input signals and maintain the state of the signal for 30ms or more, as PLC processing delays and controller scanning delays can occur.

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.

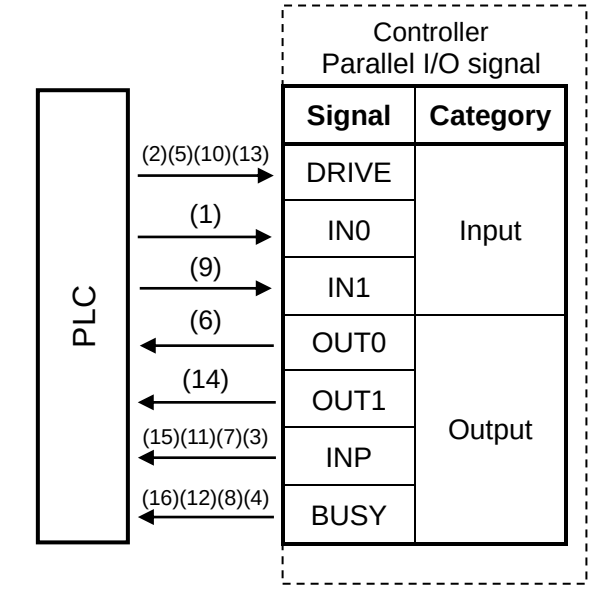
9. Operation (example)

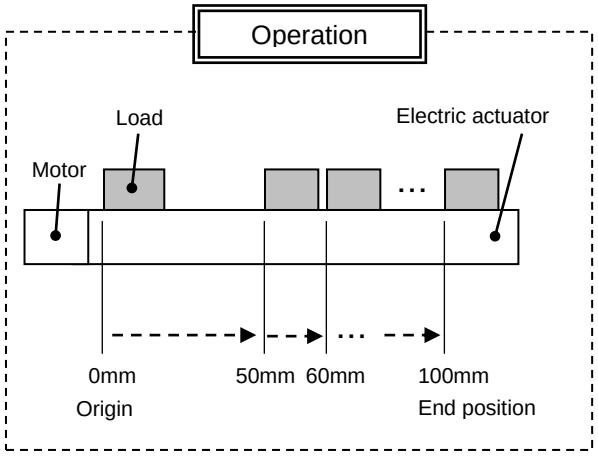
9.1 Positioning operation

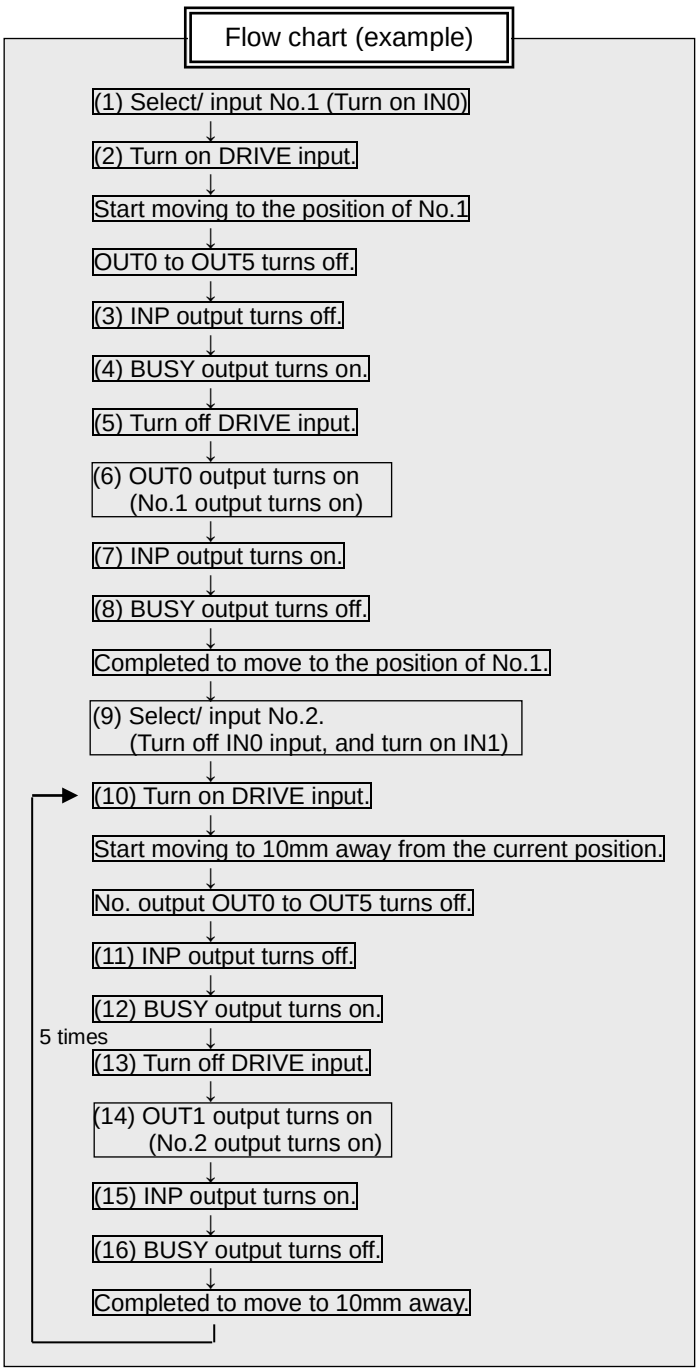
Example) Move the electric actuator from the origin to 50mm point with 100mm/s. (Using Step No.1)
Next, it shows setting example to move the electric actuator from the 50mm point to 100mm point by moving it 5 times continuously, 10mm at a time, with a speed of 50 mm/s. (Step No. 2)

● [Normal mode] Step data example

No.	Movement 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	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





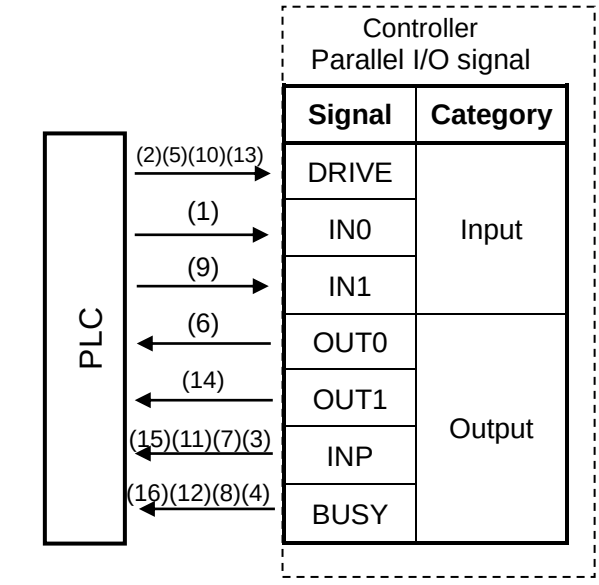


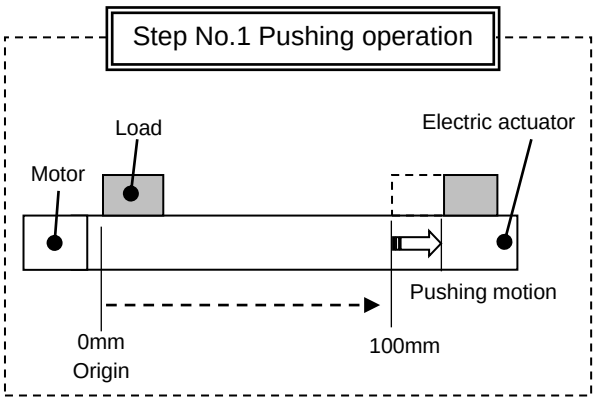
9.2 Pushing operation

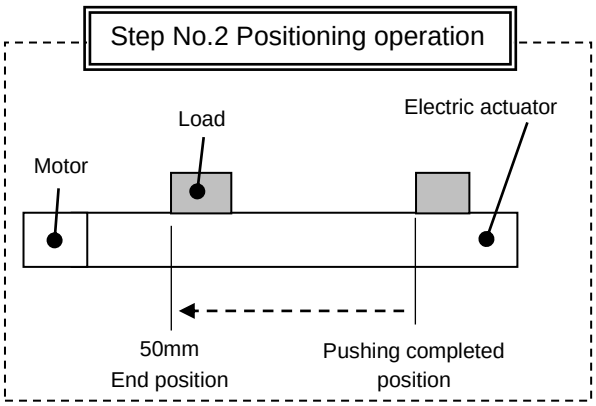
Example) Move the electric actuator from the origin to 100mm point with 100mm/s. (Using Step No.1)
From the 100mm point, the electric actuator starts the pushing operation of 10mm/s speed and 50% or less force (the pushing distance is up to 5mm). Then, the electric actuator moves from the position where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







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.

10. 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 (When power is applied, it may take up to 10 seconds (max. 20 sec.) depending on the position of the electric actuator).

The electric actuator with lock is unlocked.

↓

5) SETUP is turned ON.

↓

6) BUSY is turned ON.

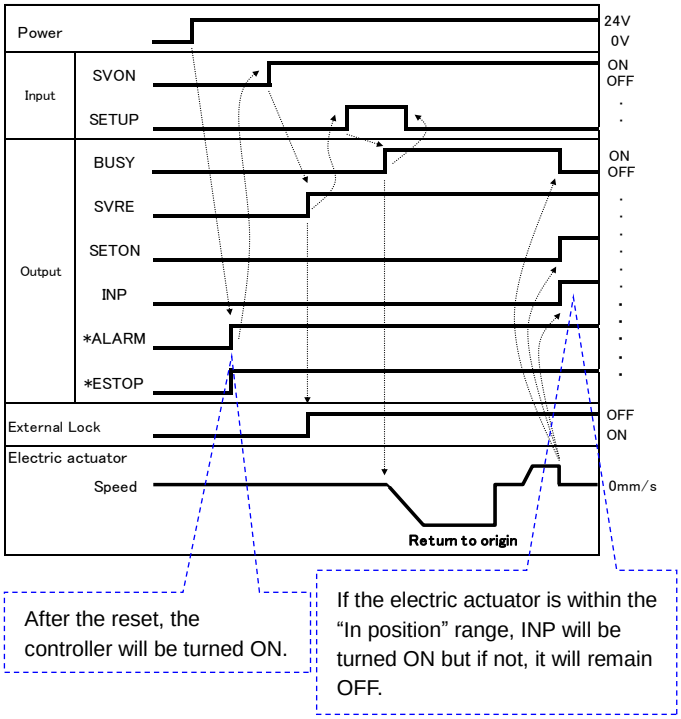
(The electric actuator moves.)

↓

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 -



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

(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).

↓

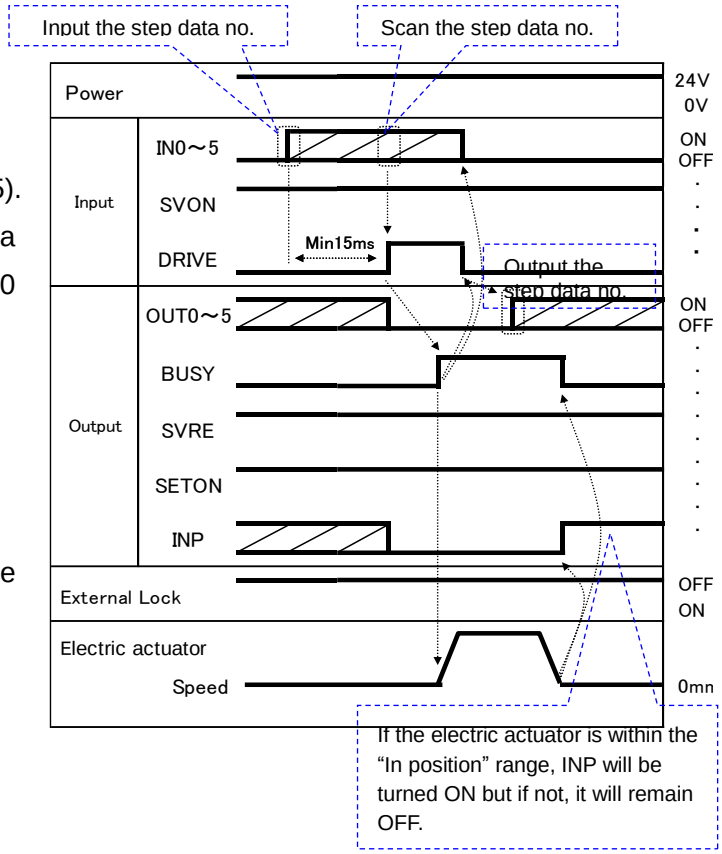
3) BUSY is turned ON.

(The positioning operation starts.)

↓

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

- Timing chart Positioning operation -



(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.

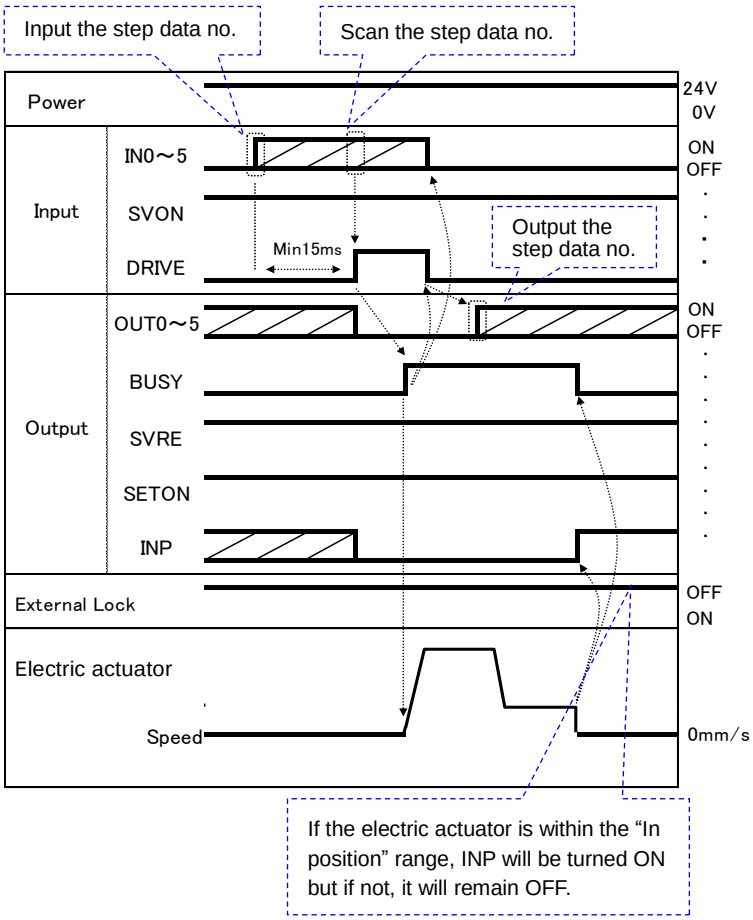
(The Pushing operation starts.)

↓

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 -



(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).

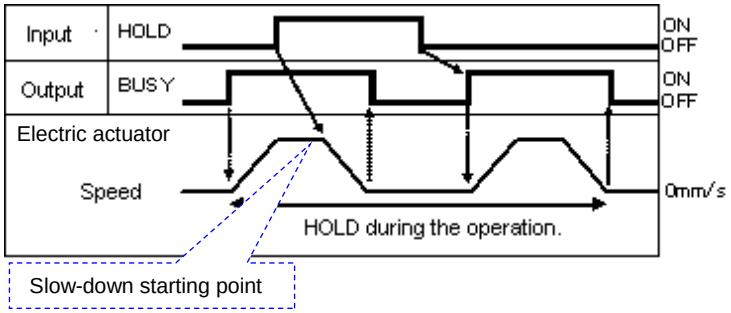
↓

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

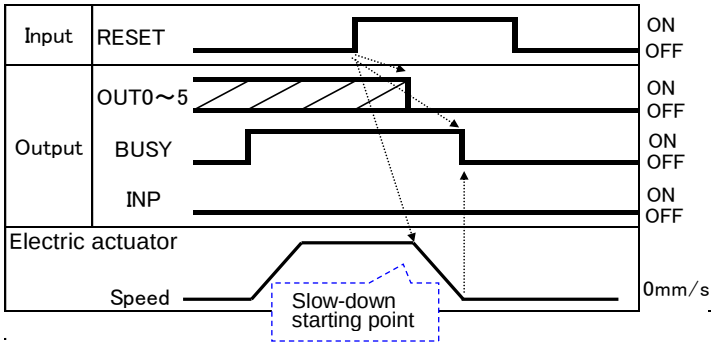
↓

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

- Timing chart HOLD -

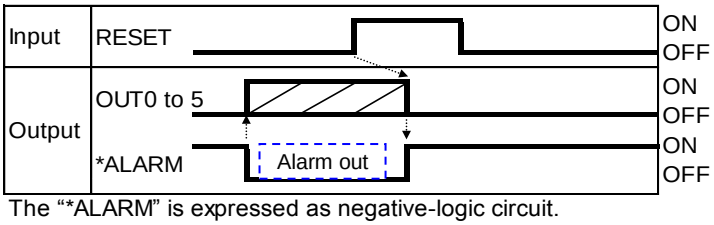


- Timing chart Driving reset -



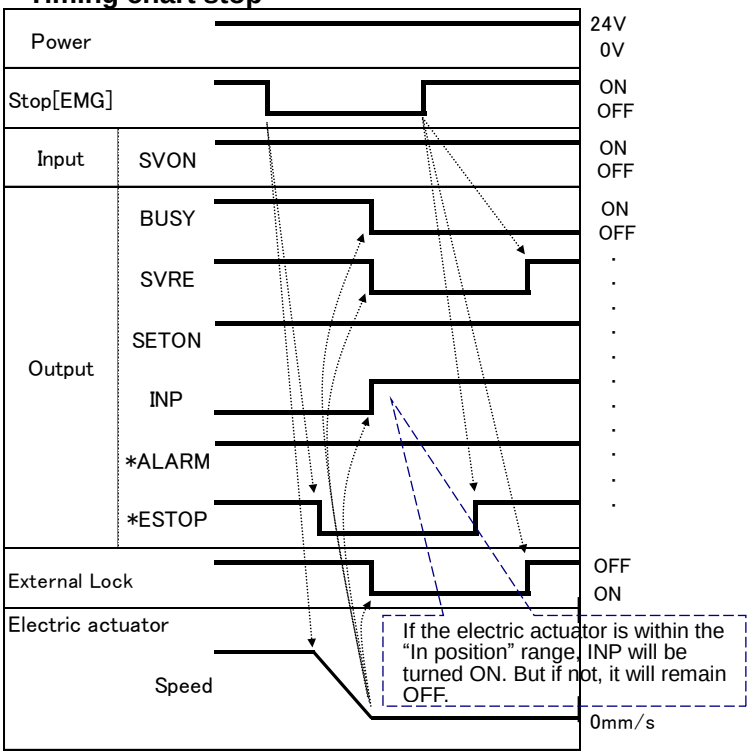
If the electric actuator is within the “In position” range, INP will be turned ON.

-Timing chart Alarm reset -



The “*ALARM” is expressed as negative-logic circuit.

- Timing chart stop -



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

(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:

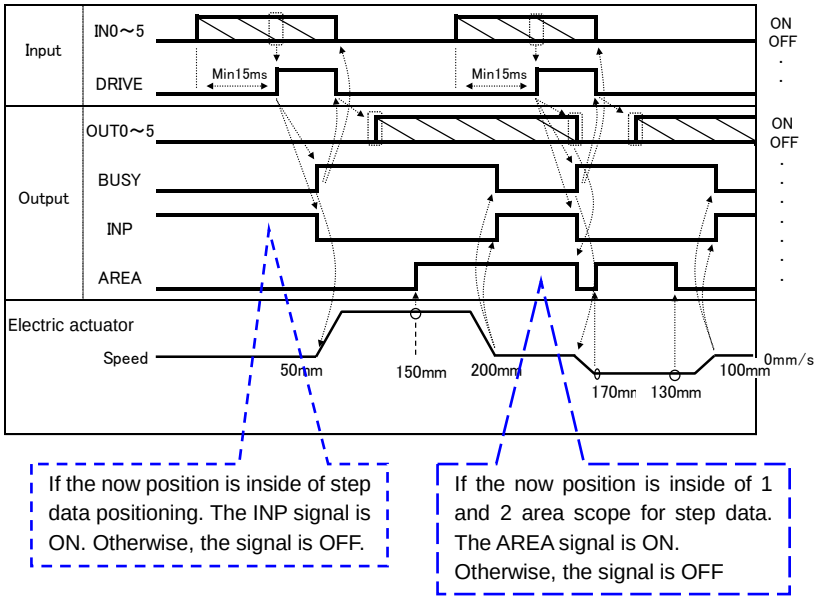
The initial position: 50mm

↓

Operation of step data No.1: Position: 200mm, Area1-Area2: 150-250mm

↓

Operation of step data No.2: Position: 100mm, Area1-Area2: 130-170mm



11. Alarm Detection

The details of the alarm can be checked using the controller setting kit or the teaching box.
Please refer to the manuals of the controller setting kit 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.

11.1 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*1)	RESET input*1)
Alarm group E	OFF	OFF	Power off ⇒Turn on the power again

*1) But if controller version is below SV1.00, SETON turns OFF and it is necessary to perform the procedure to restart 2. below.

<Procedure to restart>

1. Input RESET → SVRE: automatically turned on (if SVON is ON when RESET is input)
2. Input SETUP → Instruction to restart after return to origin is completed

11.2 Alarm details

Alarm (code)	Group	How to deactivate	Alarm contents/ Countermeasure
Step data ALM1 (1-048)	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.
Parameter ALM (1-049)	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.
Small Dec (1-050)	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.

<table>
<tr><td>Step data ALM2
(1-051)</td><td>B</td><td>RESET
input</td><td><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”</td></tr>
<tr><td>Stroke limit
(1-052)</td><td>B</td><td>RESET
input</td><td><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.</td></tr>
<tr><td>Pushing ALM
(1-096)</td><td>C</td><td>RESET
input</td><td><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.</td></tr>
<tr><td>ORIG ALM
(1-097)</td><td>C</td><td>RESET
input</td><td><Contents>
Return to origin is not completed within the set time.
<Countermeasure>
- If the ORIG mode of the return to origin parameter is 1, the models of the controller and the electric actuator may not match. Check the product model. Also, the motor shaft may be loosened. Please refer to the operation manual for the electric actuator.
- If the ORIG mode of the return to origin parameter is 2 or 3, check if the sensor mounting and the cable connection of the</td></tr>
<tr><td>Servo off ALM
(1-098)</td><td>C</td><td>RESET
input</td><td><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.</td></tr>
</table>

<table>
<tr><td>Drive ALM
(1-099)</td><td>C</td><td>RESET
input</td><td><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.</td></tr>
<tr><td>ORIG Sens ALM
(1-103)</td><td>C</td><td>RESET
input</td><td><Contents>
The origin sensor does not respond correctly when return to origin operation is performed with the origin sensor. Alarm is generated depending on the set value of the return to origin parameter.
<table>
<tr><th colspan="2">Return to origin parameter setting</th><th rowspan="2">Alarm generating conditions</th></tr>
<tr><th>ORIG mode</th><th>ORIG sensor</th></tr>
<tr><td rowspan="3">1: Return to origin by pushing force</td><td>0. No sensor</td><td>No alarm will be generated</td></tr>
<tr><td>1. Sensor Contact A</td><td>The end position is detected when the sensor has been off since the return to origin operation started</td></tr>
<tr><td>2. Sensor Contact B</td><td>The end position is detected when the sensor has been on since the return to origin operation started</td></tr>
<tr><td rowspan="3">2,3. Return to origin with sensor</td><td>0. No sensor</td><td>Right after inputting a command of return to origin.</td></tr>
<tr><td>1: Sensor Contact A</td><td>Right after inputting a command of return to origin, the end position is detected when the sensor has been off since the return to origin operation started. Or the end position is detected after the sensor ON is detected and before the return to origin operation is completed.</td></tr>
<tr><td>2. Sensor Contact B</td><td>The end position is detected when the sensor has been on since the return to origin operation started or the end position is detected after the sensor OFF is detected and before the return to origin operation is completed.</td></tr>
</table>
<Countermeasure>
- When ORIG mode is 1:
Set the return to origin sensor at “0”.
- When ORIG mode is 2 or 3:
Set the return to origin sensor in accordance with the sensor specifications. Also, check if the sensor mounting and the cable connection of the sensor are correct.</td></tr>
<tr><td>AbEnc Comm ALM
(1-106)</td><td>C</td><td>RESET
SVON
input</td><td><Contents>
The alarm is generated when the communication between the controller circuit and the absolute circuit is not normal. (This controller has not absolute function.)
<Countermeasure>
Make sure that the sensor type of the basic parameter is 1. After the parameter is changed, it is necessary to reapply the power.</td></tr>
</table>

Over speed (1-144)	D	RESET SVON Input *1)	**<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.
Over motor Vol (1-145)	D	RESET SVON Input *1)	**<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.
Over Temp. (1-146)	D	RESET SVON Input *1)	**<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.
Over Crtl Vol (1-147)	D	RESET SVON Input *1)	**<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. **<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.

Over load (1-148)	D	RESET SVON Input *1)	**<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.
Posn failed (1-149)	D	RESET SVON Input *1)	**<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.
Ctrl Comm ALM (1-150)	D	RESET SVON Input *1)	**<Contents>** The connection with the higher-level devices (such as the PC and teaching box) is disconnected. **<Countermeasure>** Do not remove the cable during operation by the controller setting kit or teaching box.
Encoder ALM (1-192)	E	Power off	**<Contents>** Abnormality in communication with the encoder. **<Countermeasure>** Check the connection of the actuator cable.
Phase Det ALM (1-193)	E	Power off	**<Contents>** Unable to find the motor phase within the set time. (When the servomotor is turned on (SVON is turned on) first time after the power is applied, the electric actuator needs to move a little to find the motor phase. However, if this electric actuator movement is prevented, this alarm will be activated.) **<Countermeasure>** Make sure there are no obstructions that interfere with the electric actuator movement and then, turn on the servomotor (SVON is turned on).
Over current (1-194)	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.
I sens ALM (1-195)	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 BK 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.

Err overflow (1-196)	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 ALM (1-197)	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 ALM (1-198)	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.

*1) Alarm clear method for controller version below SV1.00: input RESET→SVON→SETUP

12. Wiring of cables/Common precautions

⚠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.

⚠Caution

(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.

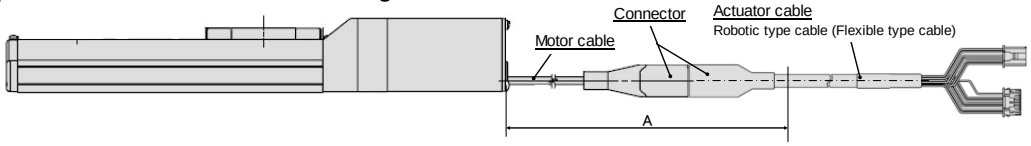
(4) Do not route wires and cables together with power or high voltage cables.
The product can malfunction due to interference of noise and surge voltage from power and high voltage cables to the signal line. Route the wires of the product separately from power or high voltage cables.

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

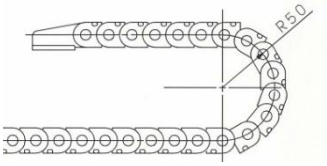
(6) Operate with cables secured. Avoid bending cables at sharp angles where they enter the product.

(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]

⚠Caution

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

13. Electric actuators/Common precautions

13.1 Design and selection

⚠Warning

(1) 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.

⚠ Caution

(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.

13.2 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.

(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.

13.3 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.

⚠ Caution

(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.

[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]

⚠ Caution

(1) Check the received product is as ordered.

If a different product is installed from the one ordered, injury or damage can result.

13.4 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.

13.5 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.

⚠ Caution

(1) Maintenance should be performed according to the procedure indicated in the Operating Manual.
Incorrect handling can cause injury, damage or malfunction of equipment and machinery.

(2) Removal of product.
When equipment is serviced, first confirm that measures are in place to prevent dropping of work pieces and run-away of equipment, etc., 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]

⚠ Caution

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

13.6 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 [BK 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 [BK RLS (Lock release)] terminal.
Stop supplying 24 VDC power supply to the [BK RLS (Lock release)] terminal during normal operation. If power is supplied to the [BK 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.

14. Controller and its peripheral devices /Specific product precautions

14.1 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.

14.2 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.

14.3 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.

14.4 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.

14.5 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.

14.6 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.

14.7 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.

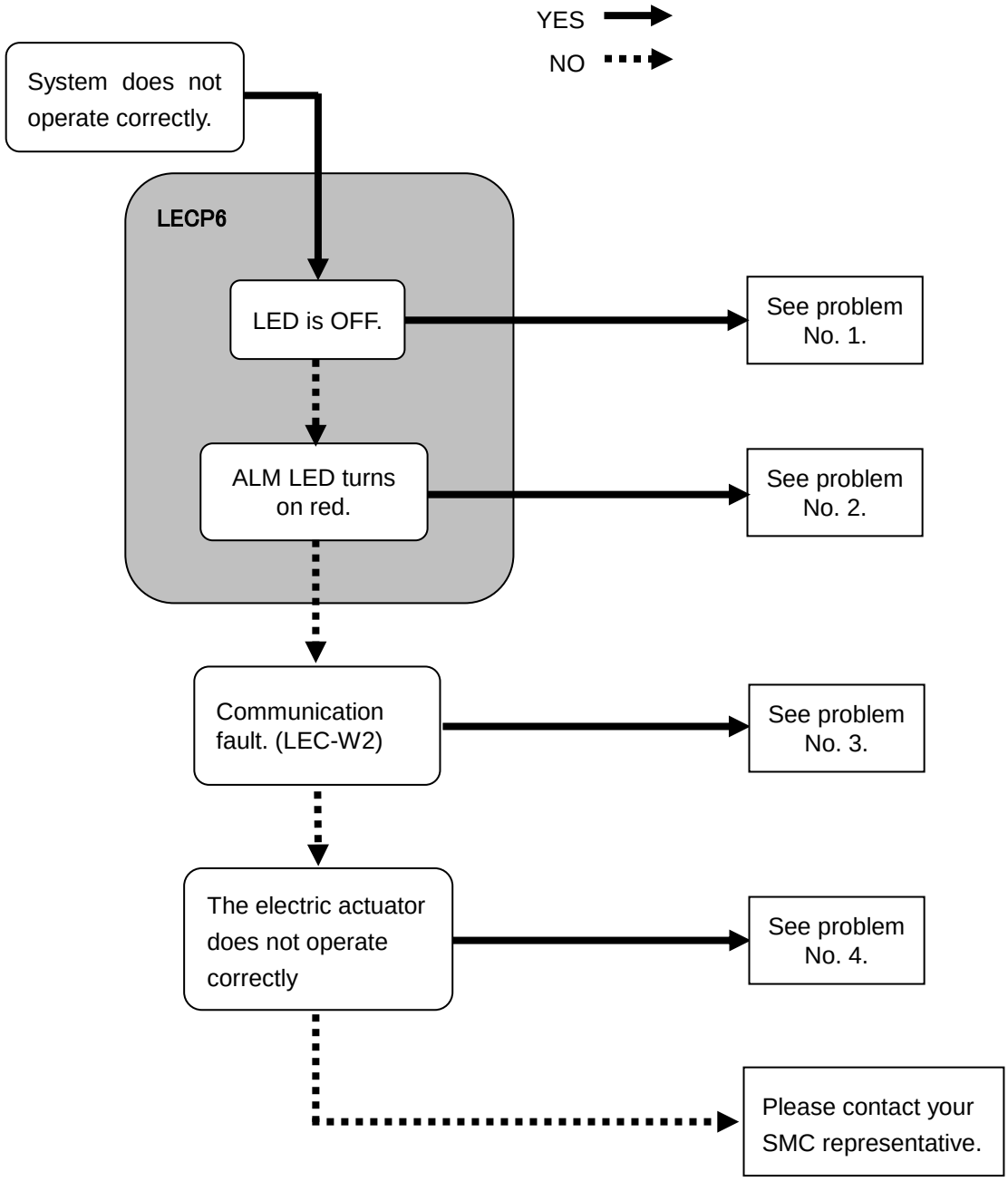
(6) Ensure sufficient space for maintenance activities. Provide space required for maintenance.
Design the system that allows required space for maintenance.

15. 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.



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 CN1controller and the CN5 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.(LEC-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 kit (LEC-W2) for the installation procedure.
		Incorrect COM port setting	Please confirm if the correct COM port is set to the controller setting kit.	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 kit (LEC-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.)

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 kit, 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. → 6.4 Parallel I/O Wiring Example
		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
		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 CN1controller and the CN5 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 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

4	Move occasionally	The pushing operation defective.	Check during pushing operation the INP output signal is turning on. (On completion of pushing the operation the output INP signal is generated, the PLC cannot confirm the completion of driving.)	If the controller version is below SV1.00 The pushing force is reduced when the energy saving mode is turned on. If the pushing force is reduced to a value less than the value in step data “trigger LV” the INP output signal is turned off. Check the INP output signal before the energy saving mode is turned on. → 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 electric actuator matches with the electric actuator which is applicable to the controller. → 3. Product Specifications
		Signal timing	Check the timing of the signal from the PLC to the controller.	Leave an interval of a minimum of 15 ms (recommendation is 30 ms) between input signals and maintain the state of the signal for a minimum of 15 ms (recommendation is 30 ms), because PLC processing delays and controller scanning delays can occur. → 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?	Check if the product number of the used electric actuator matches with the electric actuator which is applicable to the controller. → 3. Product Specifications

4	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 CN1controller and the CN5 I/O signal power supply. → 4. External Wiring Diagram → 6.4 Parallel I/O Wiring Example
		Inappropriate specifications	Check that the combination of the electric actuator and controller is correct?	Check if the product number of the used electric actuator matches with the electric actuator which is applicable to the controller. → 3. Product Specifications
		Signal timing	Check the timing of the signal from the PLC to the controller.	PLC processing delay and controller scan delay are generated. Please ensure an interval of 15ms (30 ms if possible) or more between input signals, and maintain the signal state. → 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
	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? Check if the electric actuator is operating within the specification range.	Check if the product number of the used electric actuator matches with the electric actuator which is applicable to the controller. Check if the operating condition of the electric actuator is within the specification range. → 3. Product Specifications
		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

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