



# Supplementary Operation Manual

PRODUCT NAME

## ***Step Motor Controller With Step data Teaching Function (Servo / 24VDC)***

MODEL / Series / Product Number

**LECP6###-#-XB120**  
(Number of Step Data: 32 points)



**SMC Corporation**

## •**Scope of the supplementary operation manual**

Applicable Product No.: LECP6###-#-XB120

Applicable model: LECP6 controller

Product specification with teaching function  
(Number of Step Data: 32 points)

**This supplementary operation manual specifies only the “Product specification with teaching function” as well as the changes between this special product and the standard LECP6 series step motor controller due to the addition of the teaching function.**

**Refer to Operation Manual “LECP6 series Step Motor Controller” for handling method and precautions other than “Positional registration function with parallel I/O”**

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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: 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

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

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

### **Limited warranty and Disclaimer/Compliance Requirements**

The product used is subject to the following "Limited warranty and Disclaimer" and "Compliance Requirements".

Read and accept them before using the product.

#### **Limited warranty and Disclaimer**

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

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

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

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

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

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

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

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

#### **Compliance Requirements**

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

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

### Caution

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

Products that SMC manufactures or sells are not measurement instruments that are qualified by pattern approval tests relating to the measurement laws of each country.

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

## 2. Product Outline

### 2.1 Product features

This controller can provide the JOG operation and teaching operation by switching the functions using the MODE input.

- 32 points positioning / pushing are available (MODE=OFF)  
Control the electric actuator according to the step data specified by the input of parallel I/O.  
It is possible to set up various parameters for each operation pattern.
- Jog operation is available via the parallel I/O (MODE=ON)  
It is possible to instruct the jog operation using JOG- input and JOG+ input via the parallel I/O.
- Teaching is available via parallel I/O (MODE=ON)  
It is possible to register the current position in the step data via the parallel I/O.

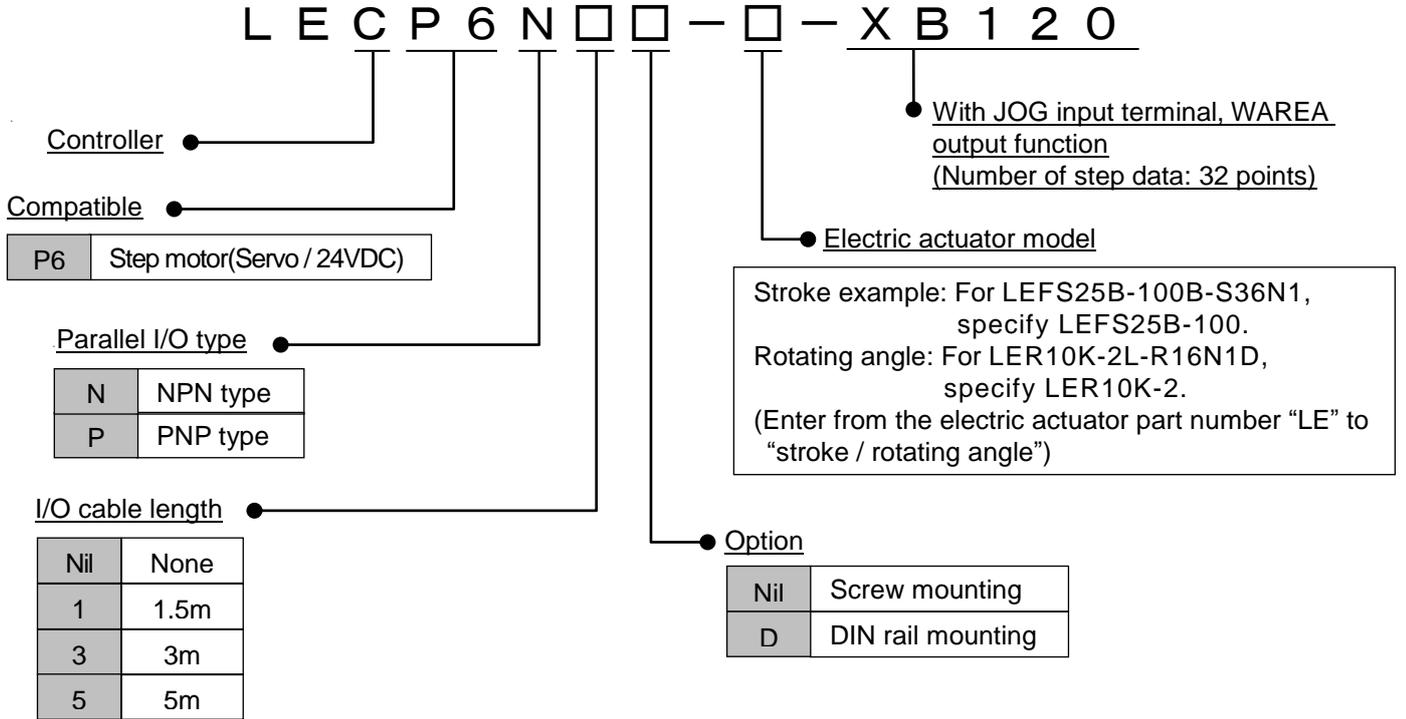
### Caution

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 How to Order

The part number construction for this product is as follows:



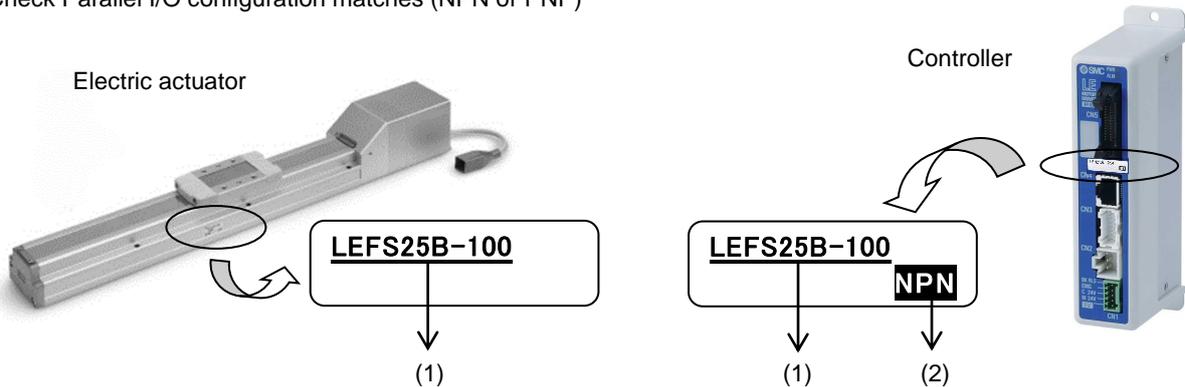
### ! Caution

**Products are shipped after setting the electric actuator specification parameters.**

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)



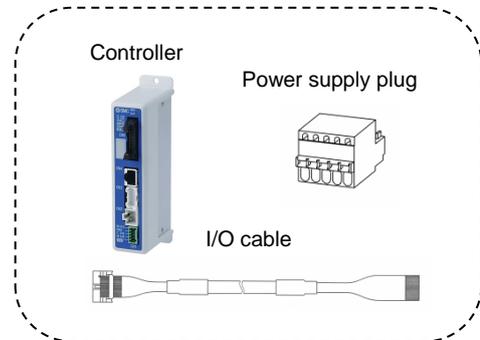
## 2.3 Startup Procedures (changed)

### 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###-#-XB55)	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

Teaching box



Controller setting kit



Actuator cable

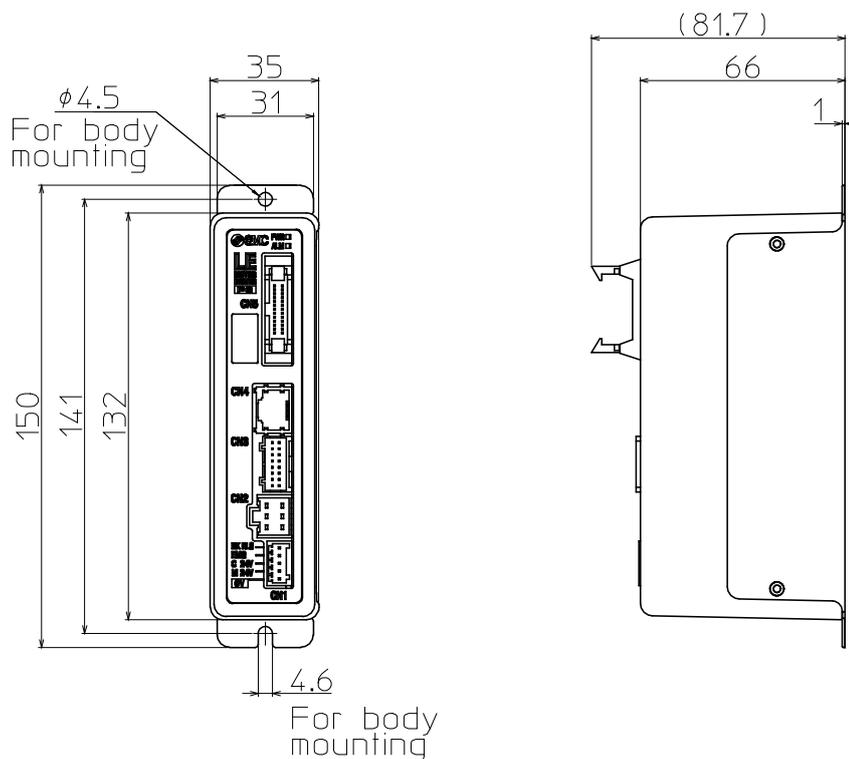


## 3. Product Specifications

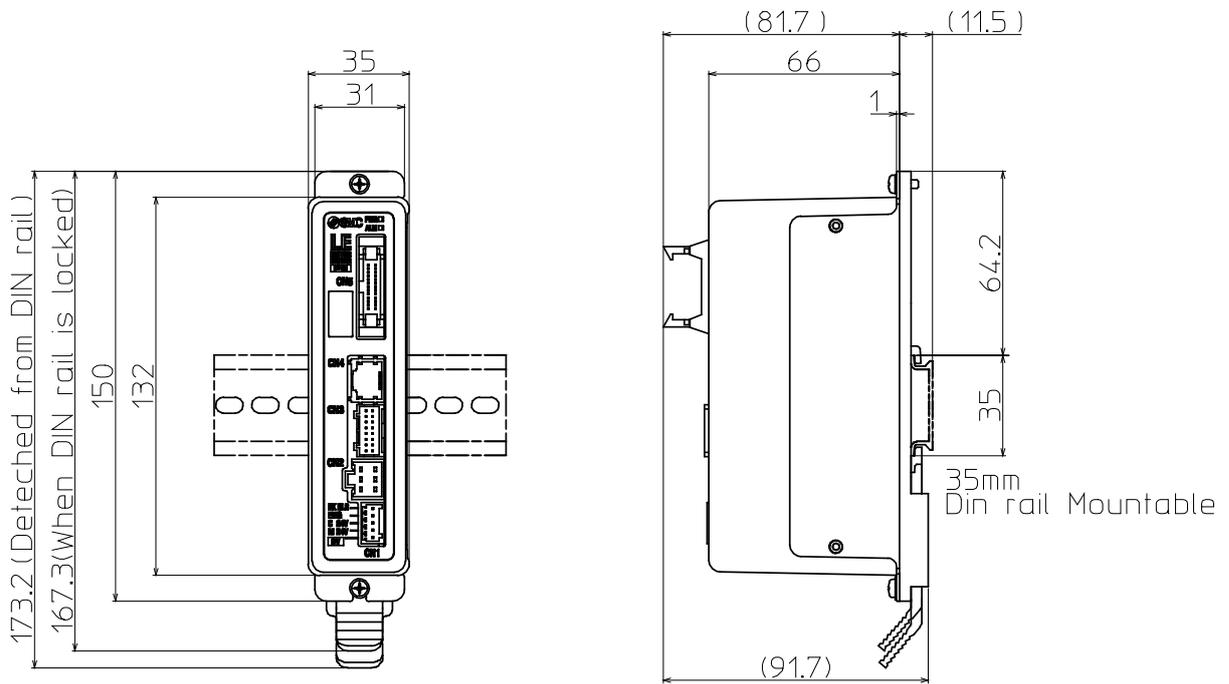
### 3.1 Outside dimension diagram

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

#### (1) Screw mount type (LECP6##-#-X120)



**(2) DIN rail mount type (LECP6##D-#-XB120)**



**3.2 How to install**

**How to install**

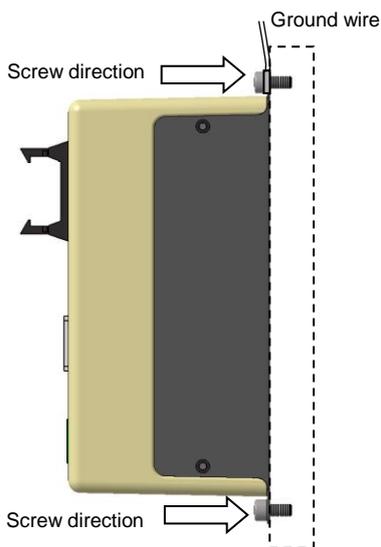
The controller can be direct mounted using screws or mounted on a DIN rail.

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

**1) Screw mount type**

**(LECP6##-#-XB120)**

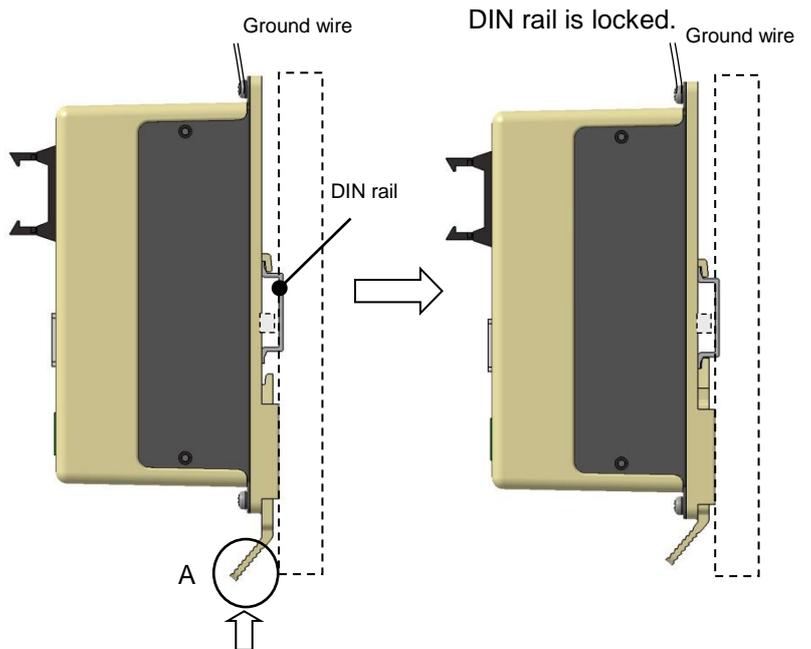
(Installation with two M4 screws)



**2) DIN rail mount type**

**(LECP6##D-#-XB120)**

(Installation with the DIN rail)

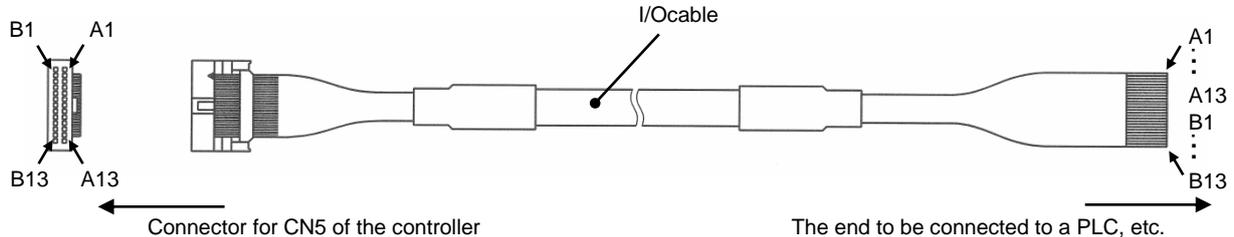


Hook the controller on the DIN rail and press the lever of section A in the arrow direction to lock it.

## 4. CN5: Parallel I/O Connector

### 4.1 Parallel I/O signals (changed)

Parallel input / output signal functions can be switched using the MODE input (terminal No. A8). Functions when the MODE input is OFF and ON are explained as follows.



#### (1) When the MODE input (Terminal No. A8) is OFF

##### - Input terminal-

No.	Function	Description															
A3	INO	Bit no. to specify the step data (Specify the number by combining On / Off of the terminals.) <table border="1" style="margin: 10px auto;"> <thead> <tr> <th>IN4</th> <th>IN3</th> <th>IN2</th> <th>IN1</th> <th>INO</th> </tr> </thead> <tbody> <tr> <td>OFF</td> <td>OFF</td> <td>OFF</td> <td>ON</td> <td>ON</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>1</td> </tr> </tbody> </table> ← Binary code	IN4	IN3	IN2	IN1	INO	OFF	OFF	OFF	ON	ON	0	0	0	1	1
IN4	IN3		IN2	IN1	INO												
OFF	OFF		OFF	ON	ON												
0	0		0	1	1												
A4	IN1																
A5	IN2																
A6	IN3																
A7	IN4																
<b>A8</b>	<b>MODE</b>	<b>The input / output signal functions are changed using this terminal. This table shows the case when the MODE is OFF.</b>															
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. <ul style="list-style-type: none"> <li>• When DRIVE or SETUP is ON:</li> </ul> <div style="border: 1px solid black; padding: 5px; margin-top: 10px; text-align: center;"> <b>⚠ Caution</b>                      As long as HOLD is ON, the DRIVE input will be disabled.                      The output signals are rendered invalid whilst hold is in operation.                 </div>															
A11	DRIVE	When DRIVE is turned ON, the system scans the input IN0 to IN4 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 OUT4.															
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 OUT4 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.

**-Output terminal-**

No.	Function	Description
B1	OUT0	<p>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.</p> <p>This output signal will be updated when DRIVE (A11) terminal is be turned ON</p> <p style="text-align: center;"><b>⚠ Caution</b></p> <p>(1) When RESET is turned ON, these terminals are turned OFF.            (2) During an alarm, these terminals output the alarm group.            (3) During a pushing operation, if the actuator runs over the defined pushing width, these terminals will be turned OFF.</p>
B2	OUT1	
B3	OUT2	
B4	OUT3	
B5	OUT4	
<b>B6</b>	<b>MODE</b>	<p><b>Indicates the MODE input status.</b>  <b>This table shows the case when the MODE is OFF.</b></p>
B7	BUSY	<p>This terminal is ON during the movement of the electric actuator.            (During the positioning operation, etc.).</p> <p style="text-align: center;"><b>⚠ Caution</b></p> <p>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.</p>
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	<p>The condition when the INP output is ON depends on the electric actuator operation.</p> <ul style="list-style-type: none"> <li>•During return to origin operation              After stopping the electric actuator operation (turning OFF the BUSY output), the INP turns ON when the actuator is within the range defined in the origin +/- "Default positioning range" in the basic parameter.</li> <li>• During positioning operation              Turns ON when the current position is within "Step data position +/- positioning range".</li> <li>• During pushing operation.              When the pushing force exceeds the value set in the step data "Trigger LV".</li> </ul> <p style="text-align: center;"><b>⚠ Caution</b></p> <p>After pushing operation is finished, even if controller changes to energy saving mode, "INP" signal status maintains to ON.</p> <p>(Example) Step data "force" is 100%            Step data "Trigger LV" is 80%,            The energy saving setting of the electric actuator is 40%</p> <div style="text-align: right;"> <p>The graph plots force on the y-axis (0, 40, 80, 100) against time on the x-axis. A solid line represents the force, which starts at 100, drops to 40, and then remains constant. A horizontal dashed line is drawn at the 80 level. A bracket labeled 'INP (ON)' spans the period from the start of the force drop to the point where the force reaches 40.</p> </div> <p>[ The electric actuator model determines the energy settings. Please refer to the specifications of the electric actuator for more details. ]</p> <p>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.</p>

B11	SVRE	When the servomotor is OFF, SVRE is OFF. When the servomotor is ON, SVRE is ON. <sup>(*1)</sup>
B12	*ESTOP <sup>*2)</sup>	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.
B13	*ALARM <sup>*2)</sup>	When there are no alarms, this terminal is ON. When there are alarms, this is OFF.

\*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.

**(2) When the MODE input (Terminal No. A8) is ON**

**- Input terminal-**

No.	Function	Description															
A3	IN0	Step data instruction bit No. for writing the current position (input is specified by combination of IN0 to IN4.) Example: (Bit no. to specify the step data no.3.)															
A4	IN1																
A5	IN2																
A6	IN3																
A7	IN4																
		<table border="1"> <thead> <tr> <th>IN4</th> <th>IN3</th> <th>IN2</th> <th>IN1</th> <th>IN0</th> </tr> </thead> <tbody> <tr> <td>OFF</td> <td>OFF</td> <td>OFF</td> <td>ON</td> <td>ON</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>1</td> </tr> </tbody> </table>	IN4	IN3	IN2	IN1	IN0	OFF	OFF	OFF	ON	ON	0	0	0	1	1
IN4	IN3	IN2	IN1	IN0													
OFF	OFF	OFF	ON	ON													
0	0	0	1	1													
A8	MODE	The input / output signal functions are changed using this terminal. This table shows the case when the MODE is ON.															
A9	WRST	Teaching instruction signal When the teaching instruction signal is ON, the current position is written to the specified step data between IN0 and IN1.															
A10	JOG+	When SVRE output is turned ON, the table moves in the positive direction in accordance with the operation parameters "JOG speed" and "JOG acceleration" while the JOG+ input is turned ON. When ALARM and SVRE are turned ON, it is possible to instruct the JOG operation, regardless of the SETON ON / OFF condition.															
A11	JOG-	When SVRE output is turned ON, the table moves in the negative direction in accordance with the operation parameters "JOG speed" and "JOG acceleration" while the JOG- input is turned ON. When ALARM and SVRE are turned ON, it is possible to instruct the JOG operation, regardless of the SETON ON / OFF condition.															
A12	RESET	Same as the description when the MODE (terminal No. A8) is turned OFF.															
A13	SVON	Same as the description when the MODE (terminal No. A8) is turned OFF.															

**-Output terminal-**

No.	Function	Description
B1	-	Unused (OFF)
B2	-	
B3	-	
B4	-	
B5	-	
B6	MODE	Indicates the MODE input status. This table shows the case when the MODE is OFF.
B7	BUSY	Same as the description when the MODE (terminal No. A8) is turned OFF. *3)
B8	AREA	Same as the description when the MODE (terminal No. A8) is turned OFF.
B9	WREND	Signal for showing the completion of the teaching data writing. This terminal turns ON when writing of the current position is complete after turning ON the WRST. When the WRST is turned OFF, WREND is also turned OFF.
B10	INP	Same as the description when the MODE (terminal No. A8) is turned OFF.
B11	SVRE	Same as the description when the MODE (terminal No. A8) is turned OFF.
B12	*ESTOP	Same as the description when the MODE (terminal No. A8) is turned OFF.
B13	*ALARM	Same as the description when the MODE (terminal No. A8) is turned OFF.

\*3) The signal will be unstable (chattering occurs) in the JOG operation due to the lower speed of operation.

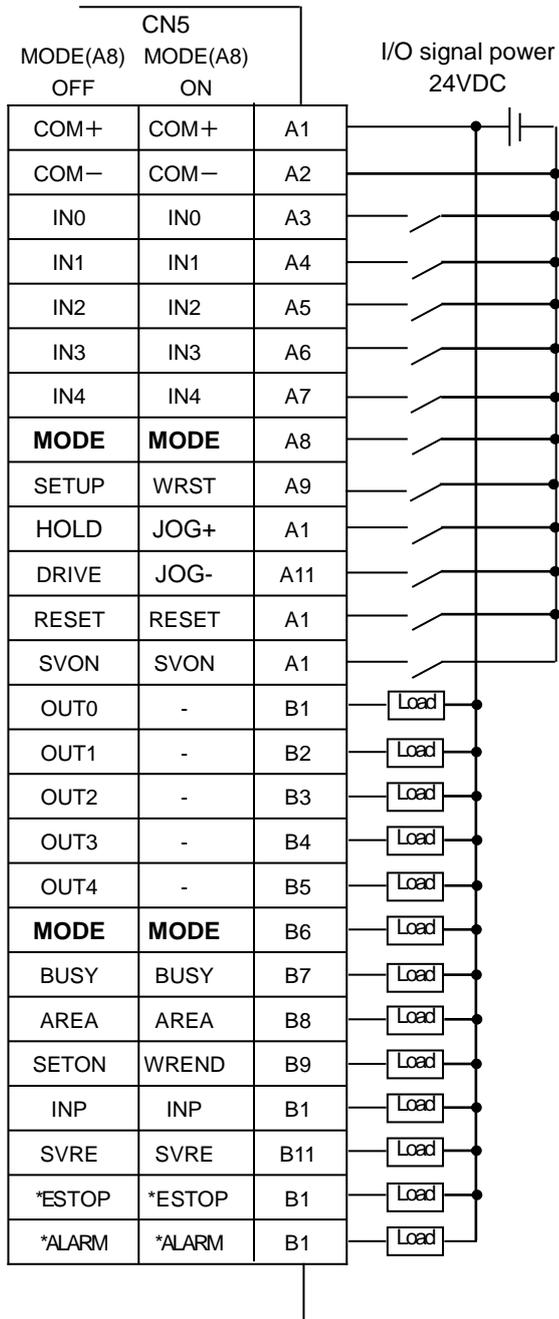
## 4.2 Parallel I/O Wiring Example

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).

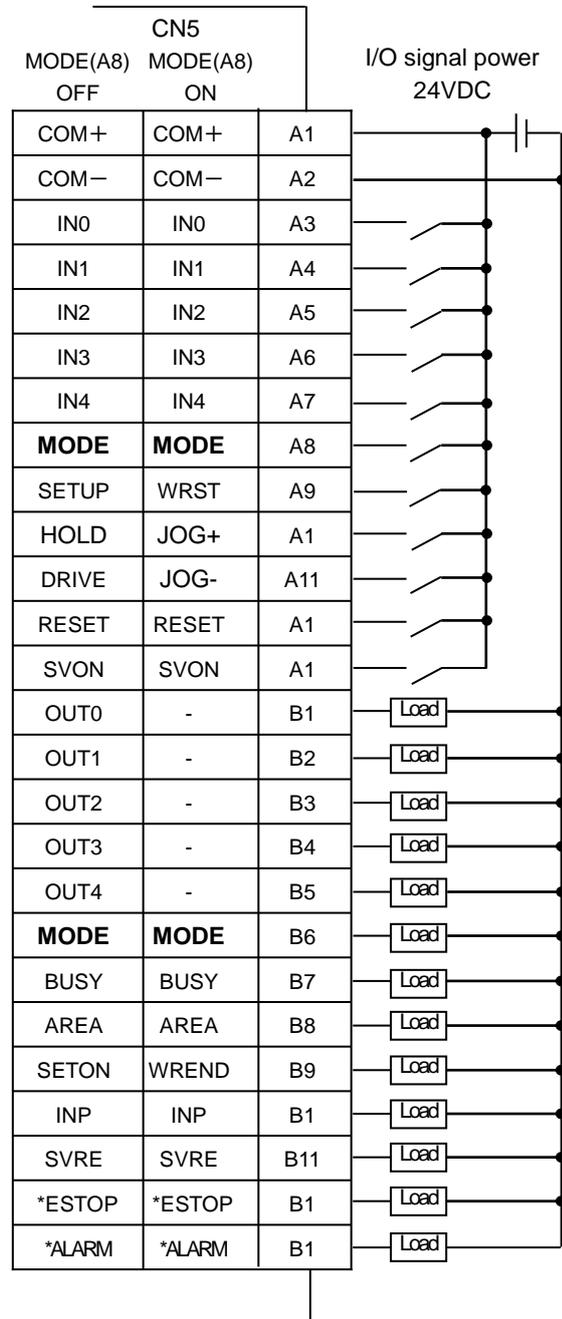
Please wire referring to the following diagram.

The functions described in the wiring examples below show the case when the MODE is turned OFF.

### • NPN type



### • PNP type

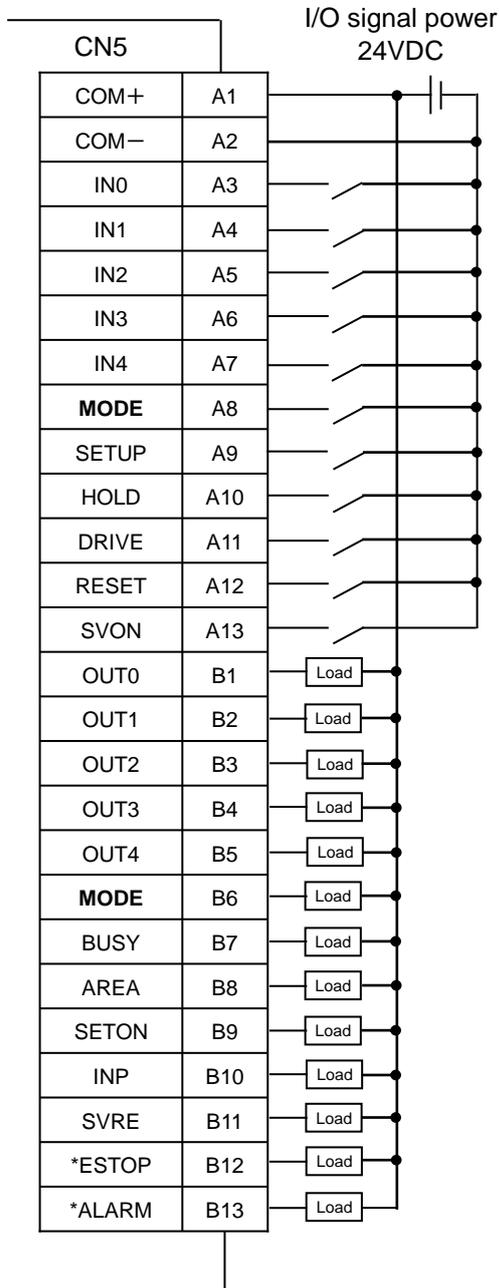


### ⚠ Caution

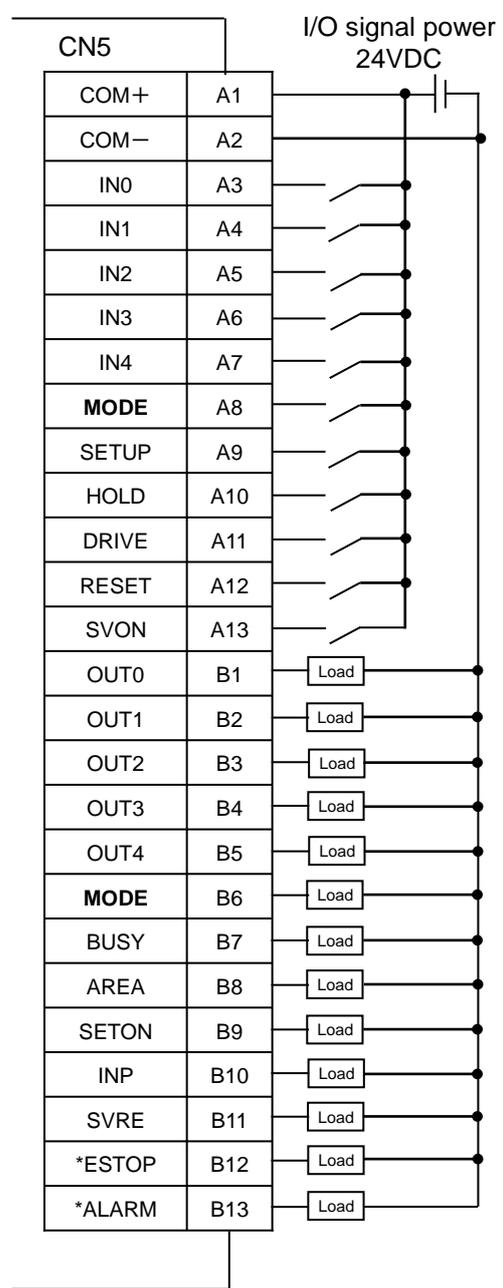
The 24VDC controller power supply for CN1 and the 24VDC I/O power supply for CN5 should be separated.

The functions described in the wiring examples below show the case when the MODE is turned OFF.

●NPN Type



●PNP Type



## 5. Setting Data Entry

### Step data changes

Step data is the actual data relating to the operation of the electric actuator.  
There are 32 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/s <sup>2</sup>	Decel mm/s <sup>2</sup>	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

## 6. Supplementary setting data input

### Supplementary operation parameter details

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	Activa tion
JOG speed	Basic parameter The same range as "max. speed"	Sets the speed during jog operation with JOG- / JOG+ input terminal. (Unit mm/s)	XX
JOG acceleration	Basic parameter The same range as "max. Acceleration"	Sets the acceleration when the jog operation starts with JOG- / JOG+ input terminal. (Unit: mm/s <sup>2</sup> )	XX
JOG deceleration	Basic parameter The same range as "max. Acceleration"	Sets the deceleration during jog operation stop with JOG- / JOG+ input terminal. (Unit: mm/s <sup>2</sup> )	XX
JOG thrust	Step data The same range as "positioning force"	Sets the maximum torque during jog operation with JOG- / JOG+ input terminal. (Unit %)	XX

### Caution

Among the operation parameters, please do not change the parameters other than those described in (1), motor parameter, basic value parameter and alarm parameter. Malfunction, damage or burnout might occur.

## 7. Supplementary operation instruction mode

### 7.1 Operation when MODE is ON (Jog operation, teaching)

#### ⚠ Caution

When the MODE is switched from ON to OFF or OFF to ON, the following input signals related to the operation and writing instructions should be turned OFF.

DRIVE, SETUP, HOLD, JOG+, JOG-, WRST.

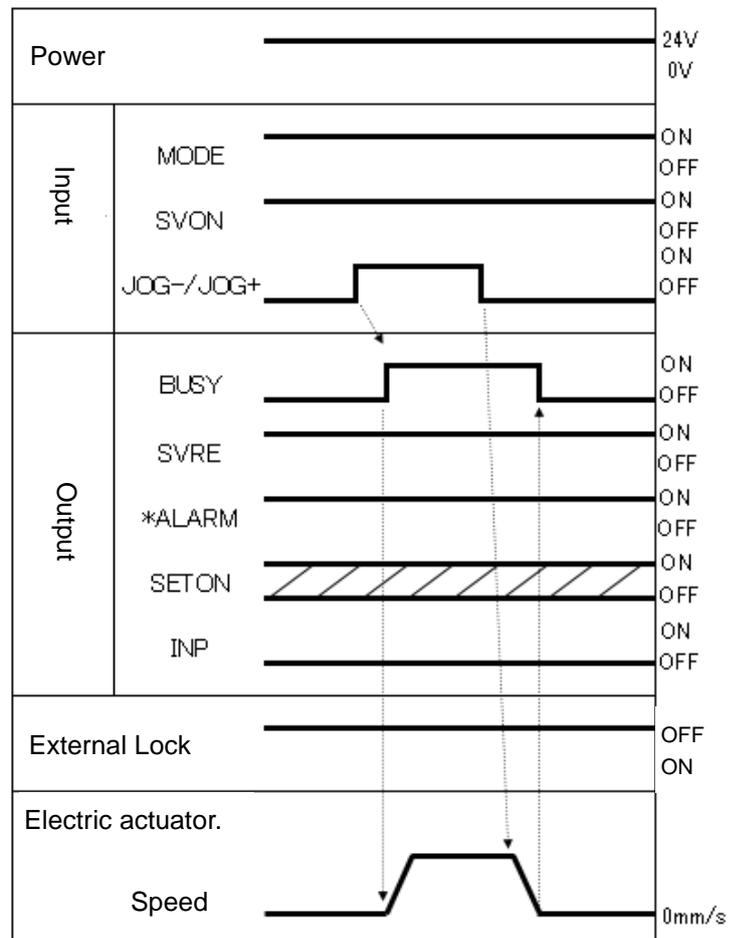
#### (1) Jog operation

##### - Procedure -

- 1) Turn ON the MODE.
- ↓
- 2) JOG- input or JOG+ input is turned ON when there is no alarm (ALARM output is ON) and servo is ON (SVRE output is ON).
- ↓
- 3) The table starts moving and BUSY output is turned ON.
- ↓
- 4) JOG- input or JOG+ input is turned OFF.
- ↓
- 5) The table stops and BUSY output is turned OFF.

- JOG operation can be instructed by JOG- / JOG+ input under the conditions in item (1) above regardless of the ON / OFF condition of the SETON output.
- JOG- input and JOG+ input cannot be turned ON at the same time.
- Chattering may occur depending on the BUSY speed.

#### - Timing chart -



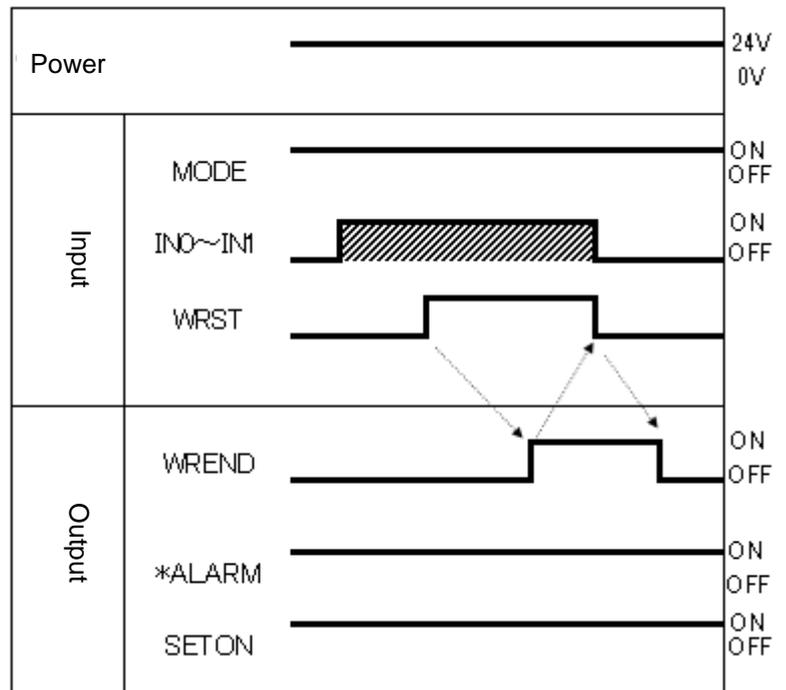
The "\*ALARM" are expressed as negative-logic circuit

## (2) Teaching

### - Procedures -

- Step data No.1 operation
- 1) Turn ON the MODE.  
↓
- 2) Input the step data No. to be written in IN0 to IN1.  
↓
- 3) Confirm the \*ALARM and SETON are turned ON, then turn ON the WRST.  
↓
- 4) When the controller recognises that the WRST is turned ON, the WREND is also turned ON along with the data writing to the step data.  
↓
- 5) Turn ON the WREND, then turn OFF the WRST and IN0 to IN1.  
When the WRST is turned OFF, the WREND will also be turned OFF.

### - Timing chart -



The "\*ALARM" are expressed as negative-logic circuit

## ⚠ Caution

In teaching mode, writing to the non-volatile memory in the controller is performed. As the number of write operations is limited by the non-volatile memory (approximately 100,000 times), high frequency writing should not be performed.

Do not turn OFF the power supply of the controller immediately after a teaching operation. Allow approximately 10 seconds between a teaching operation and turning OFF the power supply.

In teaching mode, "position" in the step data is only written. Other items in the step data should be input beforehand using the controller setting kit (LEC-W2) and teaching box (LEC-T1).

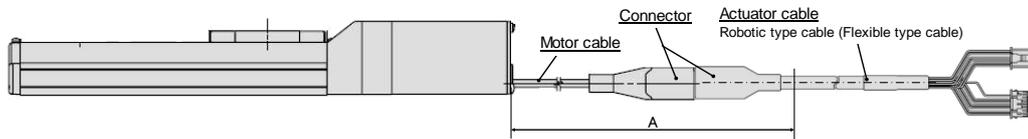
## 8. Wiring of cables / Common precautions

### Warning

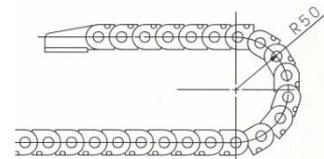
- (1) **Adjusting, mounting or wiring change should never be done before shutting off the power supply to the product.**  
Electrical shock, malfunction and damaged can result.
- (2) **Never disassemble the cable. Use only specified cables.**
- (3) **Do not remove or connect the cable and connector while 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. 50 mm).**  
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 5 m, the speed / pushing force will be reduced by a maximum of 10 % per 5m. (If cable length is 15 m: Maximum 20 % reduction.)

### [Transportation]

#### Caution

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

## 9. Electric actuators / Common precautions

### 9.1 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.**

## 9.2 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.

## 9.3 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.**
- (6) **In the case of the electric actuator that has a servomotor (24VDC), the “motor phase detection step” is done by inputting the servo on signal just after the controller power is turned on. The “motor phase detection step” operates the table / rod to the maximum distance of the lead screw. (The motor rotates in the reverse direction if the table hits an obstacle such as the end stop damper.) Take the “motor phase detection step” into consideration for the installation and operation of this electric actuator.**

### 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) Please give the earth of the electric actuator.**

**(2) Please make it to the earth of the exclusive use. The earth construction is D seed.**

(Below earth resistance 100  $\Omega$ )

**(3) Please shorten the distance until the electric actuator and earth.**

### [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.

## 9.4 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 °C to 60 °C and 35 to 85% No condensation or freezing).**
- (3) **Do not apply vibration and impact to the product during storage.**

## 9.5 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.

## 9.6 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 its holding force and damage to the sliding part of the lock or reduced lifetime can result. The same situations will happen when the lock slips due to a force over the thrust of the product, as this accelerates the wear to the lock.
- (5) **Do not apply liquid or oil and grease to the lock or its surrounding.**  
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 24DCV 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 24VDC power supply constantly to the [BK RLS (Lock release)] terminal.**  
Stop supplying 24VDC 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.

## 10. Controller and its peripheral devices / Specific product precautions

### 10.1 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.**

## 10.2 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 supplies 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.**

## 10.3 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.

## 10.4 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 the 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.

## 10.5 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 supplies should be separated between the controller power and the I/O signal power and both of them do not use the power supply of “rush-current restraining type”.**  
If the power supply is “rush-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.**

## 10.6 Grounding

### Warning

- (1) **It may cause an electric shock or fire.**
- (2) **Dedicated grounding should be used.**  
Grounding should be to a D-class ground (Ground resistance of 100 Ω or less.)
- (3) **Grounding should be performed near the unit as much as possible to shorten the grounding distance.**
- (4) **In the unlikely event that malfunction is caused by the ground, it may be disconnected.**

## 10.7 Maintenance

### 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 abnormalities (in the case that the electric actuator does not 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.

Revision history
A: Contents revised in several places [February 2019]

## SMC Corporation

4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021 JAPAN

Tel: + 81 3 5207 8249 Fax: +81 3 5298 5362

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

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