



# Operation Manual

PRODUCT NAME

## Electric Actuator / Slider Type

《 AC Servo Motor 》

MODEL / Series

### LEF Series

Applicable models: LEFS

#### ***LEF Series***

(Slider type)



AC Servo Motor  
Controller

#### ***LECS Series***



***LECSA***  
(Incremental  
Encoder)



***LECSB***  
(Absolute  
Encoder)

# SMC Corporation

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# LEF Series / Slider type 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), Japan Industrial Standards (JIS)\*1) and other safety regulations\*2).

\*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

JIS B 8370: General rules for pneumatic equipment.

JIS B 8361: General rules for hydraulic equipment.

JIS B 9960-1: Safety of machinery -- Electrical equipment for machines. (Part 1: General requirements)

JIS B 8433-1993: Manipulating industrial robots - Safety. etc.

\*2) Labor Safety and Sanitation Law, 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.

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.

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.

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.



# LEF Series / Slider type 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**

**The warranty period of the product is 1 year in service or 1.5 years after the product is delivered.\*3) Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.**

**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.**

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

**\*3) Vacuum pads are excluded from this 1 year warranty.**

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

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

### **Compliance Requirements**

When the product is exported, strictly follow the laws required by the Ministry of Economy, Trade and Industry (Foreign Exchange and Foreign Trade Control Law).

# 1. Procedure before operation

## 1.1 Preparation

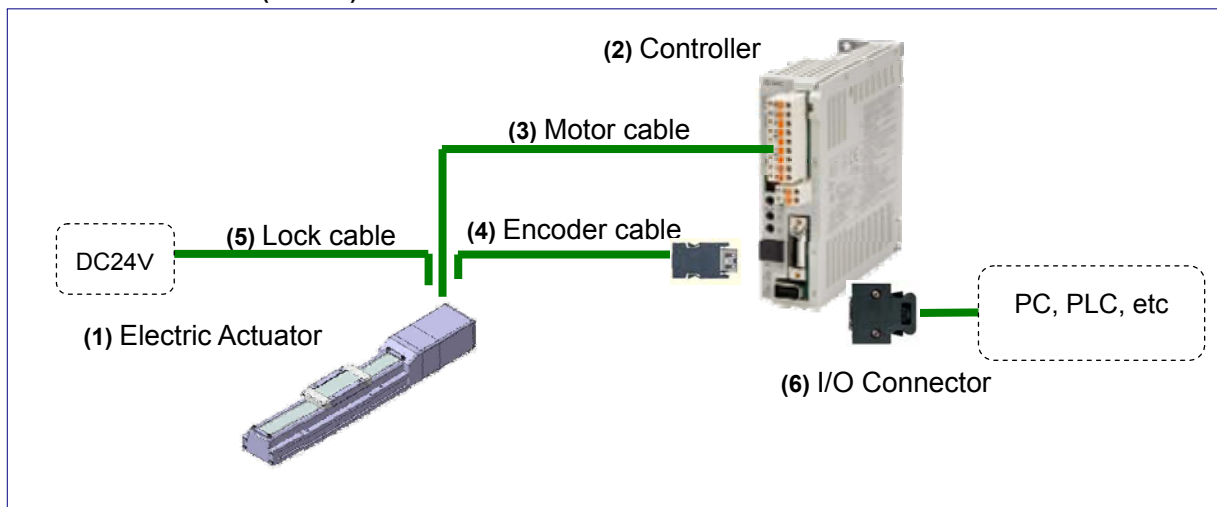
### (1) Items to be prepared

Please check on the label, and the quantity of accessories, to confirm that it is the product that was ordered.

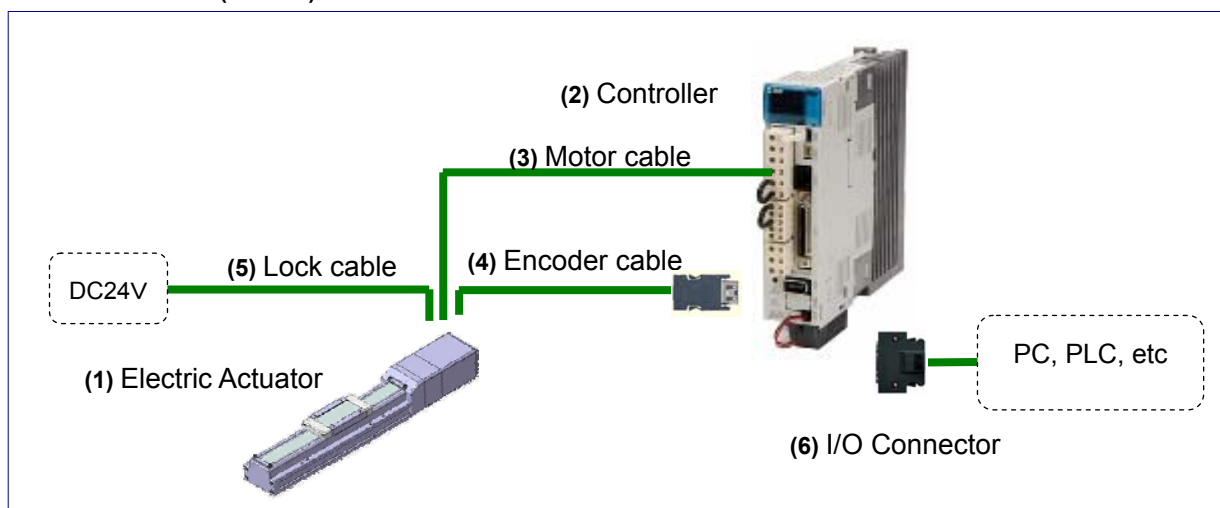
Table 1. Components

| No. | Part name                                | Qty |
|-----|--|-----|
| (1) | Electric Actuator /LEF Series            | 1   |
| (2) | Controller /LECSA Series or LECSB Series | 1   |
| (3) | Motor cable                              | 1   |
| (4) | Encoder cable                            | 1   |
| (5) | Lock cable                               | 1   |
| (6) | I/O Connector                            | 1   |

### Incremental Encoder (LECSA)

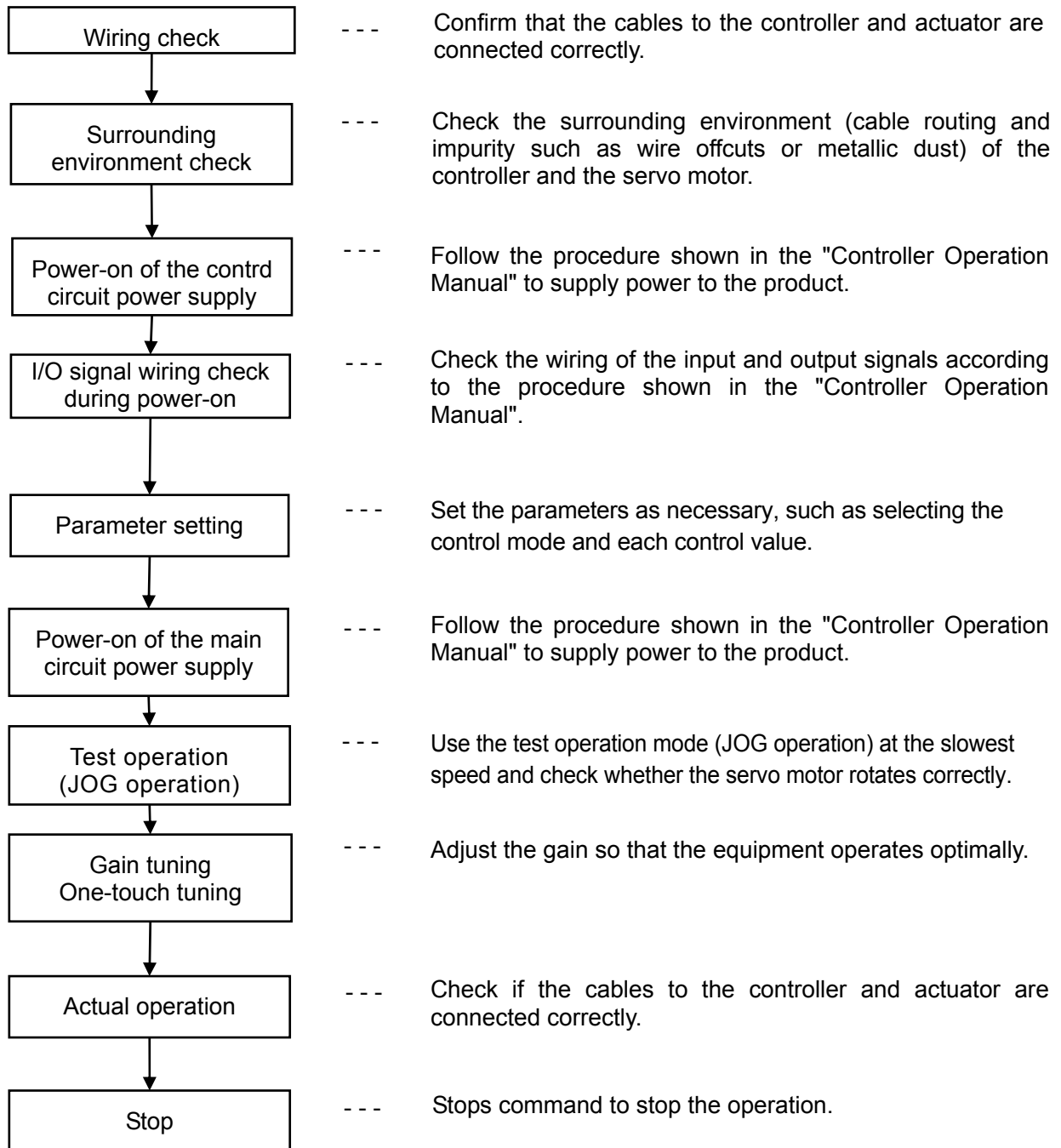


### Absolute Encoder (LECSB)



## 1.2 Startup

When switching the power on for the first time, follow the startup procedure below.  
Refer to the "Controller operation manual" for wiring method and detailed procedure.



## 2. Slider type LEF series

### 2.1 Specification

| Model   |  |                 | LEF25S*   |       |     | LEF32S*                                     |     |      | LEF40S*   |      |     |  |
|---|--|-----------------|---|-------|-----|---|-----|------|---|------|-----|--|
| Actuator specification  | Stroke [mm] <sup>Note 1)</sup>                   |                 | 100,200,300,(400),<br>500,(600)   |       |     | 100,200,300,(400),<br>500,(600),(700),(800) |     |      | 200, 300, (400), 500,<br>(600),(700), 800, (900),<br>(1000) |      |     |  |
|   | Work load [kg]                                   |                 | Horizontal <sup>Note 2)</sup>   |       |     | 20  | 20  | 40   | 45  | 50   | 60  |  |
|   |  |                 | Vertical  |       |     | 8   | 15  | 10   | 20  | 15   | 30  |  |
|   | Maximum Speed <sup>Note 3)</sup><br>[mm/s]       | Range of stroke | to 400  |       |     | 900   | 450 | 1000 | 500   | 1000 | 500 |  |
|   |  |                 | 401 to 500  |       |     | 720   | 360 |      |   |      |     |  |
|   |  |                 | 501 to 600  |       |     | 540   | 270 | 800  | 400   |      |     |  |
|   |  |                 | 601 to 700  |       |     | -   | -   | 620  | 310   | 940  | 470 |  |
|   |  |                 | 701 to 800  |       |     | -   | -   | 500  | 250   | 760  | 380 |  |
|   |  |                 | 801 to 900  |       |     | -   | -   | -    | -   | 620  | 310 |  |
|   | 901 to 1000                                      |                 |   | -     | -   | -   | -   | 520  | 260   |      |     |  |
|   | Acceleration/deceleration [mm/s <sup>2</sup> ]   |                 |   | 5,000 |     |   |     |      |   |      |     |  |
|   | Positioning repeatability [mm]                   |                 |   | ±0.02 |     |   |     |      |   |      |     |  |
| Lead [mm]   |  |                 | 12  | 6     | 16  | 8   | 20  | 10   |   |      |     |  |
| Impact resistance/vibration Resistance [m/s <sup>2</sup> ] <sup>Note 4)</sup> |  |                 | 50 / 20   |       |     |   |     |      |   |      |     |  |
| Drive method  |  |                 | Ball screw  |       |     |   |     |      |   |      |     |  |
| Guide type  |  |                 | Liner guide   |       |     |   |     |      |   |      |     |  |
| Operating temperature range [°C]  |  |                 | 5 to 40   |       |     |   |     |      |   |      |     |  |
| Operating humidity range [%RH]  |  |                 | 90 or less (No condensation)  |       |     |   |     |      |   |      |     |  |
| Electric specification  | Motor output/size                                |                 | 100W / □40  |       |     | 200W / □60                                  |     |      | 400W / □60  |      |     |  |
|   | Type of Motor                                    |                 | AC servo motor (100/200VAC)   |       |     |   |     |      |   |      |     |  |
|   | Encoder  |                 | [Type of Motor: S2,S3,S4] : Incremental 17bit encoder<br>(Resolution: 131072 p/rev)<br>[Type of Motor: S6,S7,S8] : Absolute 18bit encoder<br>(Resolution: 262144 p/rev) |       |     |   |     |      |   |      |     |  |
| Lock specification  | Type <sup>Note 5)</sup>                          |                 | No excitation operating type  |       |     |   |     |      |   |      |     |  |
|   | Holding force [N]                                |                 | 131   | 255   | 197 | 385   | 330 | 660  |   |      |     |  |
|   | Power consumption [W] at 20°C <sup>Note 6)</sup> |                 | 6.3   |       |     | 7.9   |     |      | 7.9   |      |     |  |
|   | Rated voltage [VDC]                              |                 | 24 <sup>0</sup> -10%  |       |     |   |     |      |   |      |     |  |

Note 1) The middle stroke other than the above are produced upon receipt of order.

Note 2) The maximum value of the horizontal workload. (An external guide is necessary).

The actual workload will depend on the type of external guide.

Note 3) The allowable speed changes by the stroke.

Note 4) Impact resistance:

No malfunction occurred when the actuator was tested with a drop tester in both an axial direction and perpendicular direction to the lead screw. (The test was performed with the actuator in the initial state.)

Vibration resistance:

No malfunction occurred in a test ranging between 45 to 2000 Hz, when the actuator was tested in both an axial direction and a perpendicular direction to the lead screw. (The test was performed with the actuator in the initial state.)

Note 5) Only when the motor option, "with lock", is selected.

Note 6) For an actuator with lock, add the power consumption for the lock.

### Product Weight

| Model                          |               |          | LEFS 25S                 |      |       |       |       |       | LEFS32S |       |        |       |      |       |       |       |
|--------------------------------|---------------|----------|--------------------------|------|-------|-------|-------|-------|---------|-------|--------|-------|------|-------|-------|-------|
| Stroke [mm]                    |               |          | 100                      | 200  | 300   | (400) | 500   | (600) | 100     | 200   | 300    | (400) | 500  | (600) | (700) | (800) |
| Weight (kg)                    | Type of motor | S2/S3    | 2.14                     | 2.42 | 2.7   | 2.98  | 3.26  | 3.54  | 3.55    | 3.95  | 4.35   | 4.75  | 5.15 | 5.55  | 5.95  | 6.35  |
|                                |               | S6/S7    | 2.20                     | 2.48 | 2.78  | 3.04  | 3.30  | 3.60  | 3.49    | 3.89  | 4.29   | 4.69  | 5.09 | 5.49  | 5.89  | 6.29  |
| Model                          |               |          | LEFS40S                  |      |       |       |       |       |         |       |        |       |      |       |       |       |
| Stroke[mm]                     |               |          | 200                      | 300  | (400) | 500   | (600) | (700) | 800     | (900) | (1000) |       |      |       |       |       |
| Weight (kg)                    | Type of motor | S4       | 6.15                     | 6.71 | 7.27  | 7.83  | 8.39  | 8.95  | 9.51    | 10.07 | 10.63  |       |      |       |       |       |
|                                |               | S8       | 6.25                     | 6.81 | 7.37  | 7.93  | 8.49  | 9.05  | 9.61    | 10.17 | 10.73  |       |      |       |       |       |
| Additional weight for lock(kg) | Type of motor | S2/S3/S4 | S2:0.2 / S3:0.4 / S4:0.4 |      |       |       |       |       |         |       |        |       |      |       |       |       |
|                                |               | S6/S7/S8 | S6:0.3 / S7:0.7 / S8:0.7 |      |       |       |       |       |         |       |        |       |      |       |       |       |

## 2.2 How to Order

<Ball screw drive>

LEFS 25 S2 B - 100 □ - S 2 A1 □

● **Size**

|    |
|----|
| 25 |
| 32 |
| 40 |

● **Motor**

|    | TYPE                                 | out put [W] | size | Applicable controller |
|----|--------------------------------------|-------------|------|-----------------------|
| S2 | AC servo Motor (incremental encoder) | 100         | 25   | A1, A2                |
| S3 |                                      | 200         | 32   |                       |
| S4 |                                      | 400         | 40   |                       |
| S6 | AC servo Motor (absolute encoder)    | 100         | 25   | B1, B2                |
| S7 |                                      | 200         | 32   |                       |
| S8 |                                      | 400         | 40   |                       |

● **Motor option**

|     |              |
|-----|--------------|
| Nil | Without lock |
| B   | With lock    |

● **Stroke**

|      |
|------|
| 100  |
| S    |
| 1000 |

\*Refer to the table of Applicable stroke

● **Ball screw lead**

|   | Size |      |      |
|---|------|------|------|
|   | 25   | 32   | 40   |
| A | 12mm | 16mm | 20mm |
| B | 8mm  | 8mm  | 10mm |

\*Applicable stroke

|        | ● Standard ○ produced upon receipt of order |     |     |     |     |     |     |     |     |      |
|--------|---|-----|-----|-----|-----|-----|-----|-----|-----|------|
|        | 100   | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 | 1000 |
| LEFS25 | ●   | ●   | ●   | ○   | ●   | ○   | ○   | ○   | ○   | ○    |
| LEFS32 | ●   | ●   | ●   | ○   | ●   | ○   | ○   | ○   | ○   | ○    |
| LEFS40 | ○   | ●   | ●   | ○   | ●   | ○   | ○   | ○   | ●   | ○    |

● **I/O connector**

|     |                |
|-----|----------------|
| Nil | None           |
| H   | With connector |

● **Controller type**

|     | Applicable Controller | Power supply voltage |
|-----|-----------------------|----------------------|
| Nil | Without controller    |                      |
| A1  | LECSA1                | 100 to 120VAC        |
| A2  | LECSA2                | 200 to 230VAC        |
| B1  | LECSB1                | 100 to 120VAC        |
| B2  | LECSB2                | 200 to 230VAC        |

● **Cable length [m]**

|     |               |
|-----|---------------|
| Nil | Without cable |
| 2   | 2             |
| 5   | 5             |
| A   | 10            |

The length of motor, encoder, and lock cables are same

● **Cable type**

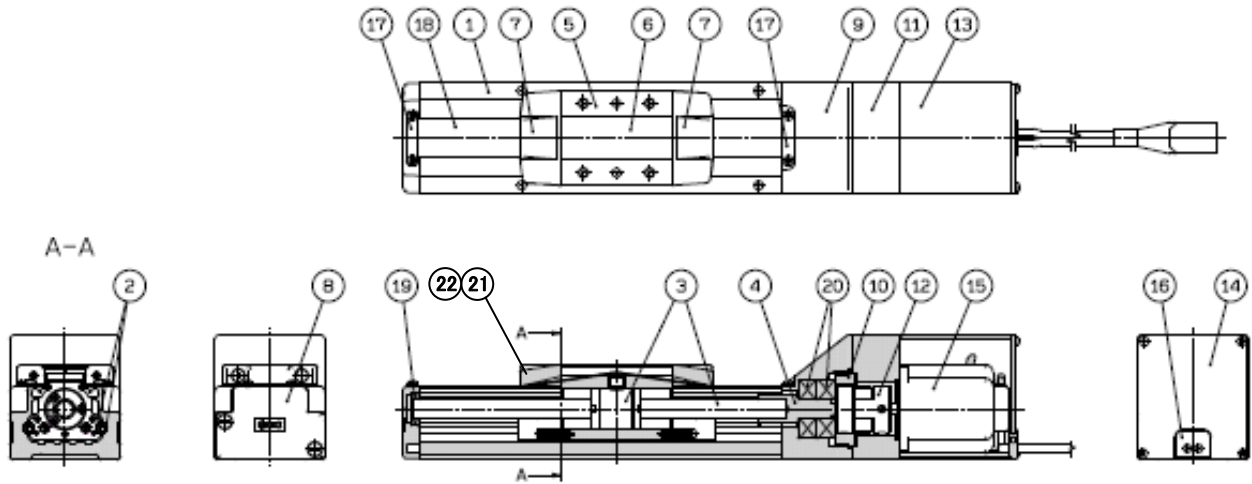
|     |                    |
|-----|--------------------|
| Nil | Without cable      |
| R   | Robotic type cable |
| S*  | Standard cable     |

Motor cable and encoder cable are included (if motor option 'With Lock' was selected, lock cable is included too)



## 2.3 Construction

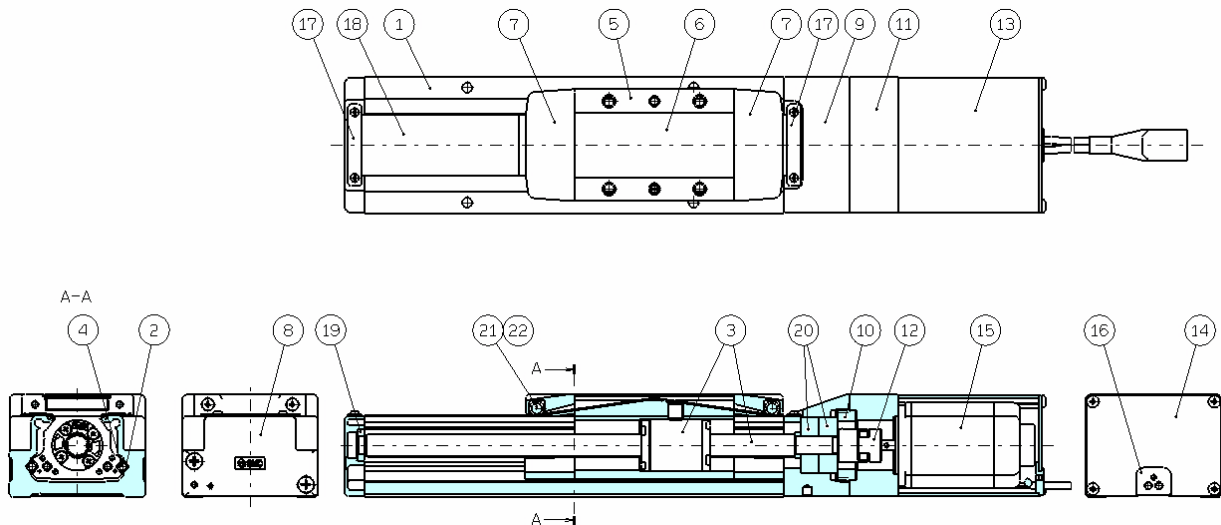
### <Ball screw drive (25/32)>



#### Parts list

| No. | Description      | Material          | Remarks    | No. | Description    | Material        | Remarks  |
|-----|------------------|-------------------|------------|-----|----------------|-----------------|----------|
| 1   | Body             | Aluminium alloy   | Anodized   | 12  | Coupling       | -               |          |
| 2   | Rail guide       | -                 |            | 13  | Motor cover    | Aluminium alloy | Anodized |
| 3   | Ball screw Ass'y | -                 |            | 14  | End cover      | Aluminium alloy | Anodized |
| 4   | Connector shaft  | Stainless steel   |            | 15  | Motor          | -               |          |
| 5   | Table            | Aluminium alloy   | Anodized   | 16  | Rubber bushing | NBR             |          |
| 6   | Blanking plate   | Aluminium alloy   | Anodized   | 17  | Band holder    | Stainless steel |          |
| 7   | Seal band holder | Synthetic resin   |            | 18  | Dust seal band | Stainless steel |          |
| 8   | Housing A        | Aluminum die-cast | Chromating | 19  | Bearing        | -               |          |
| 9   | Housing B        | Aluminium alloy   | Anodized   | 20  | Bearing        | -               |          |
| 10  | Bearing holder   | Aluminium alloy   |            | 21  | Roller shaft   | Stainless steel |          |
| 11  | Motor mount      | Aluminium alloy   | Anodized   | 22  | Wiper          | -               |          |

### <Ball screw drive (40)>



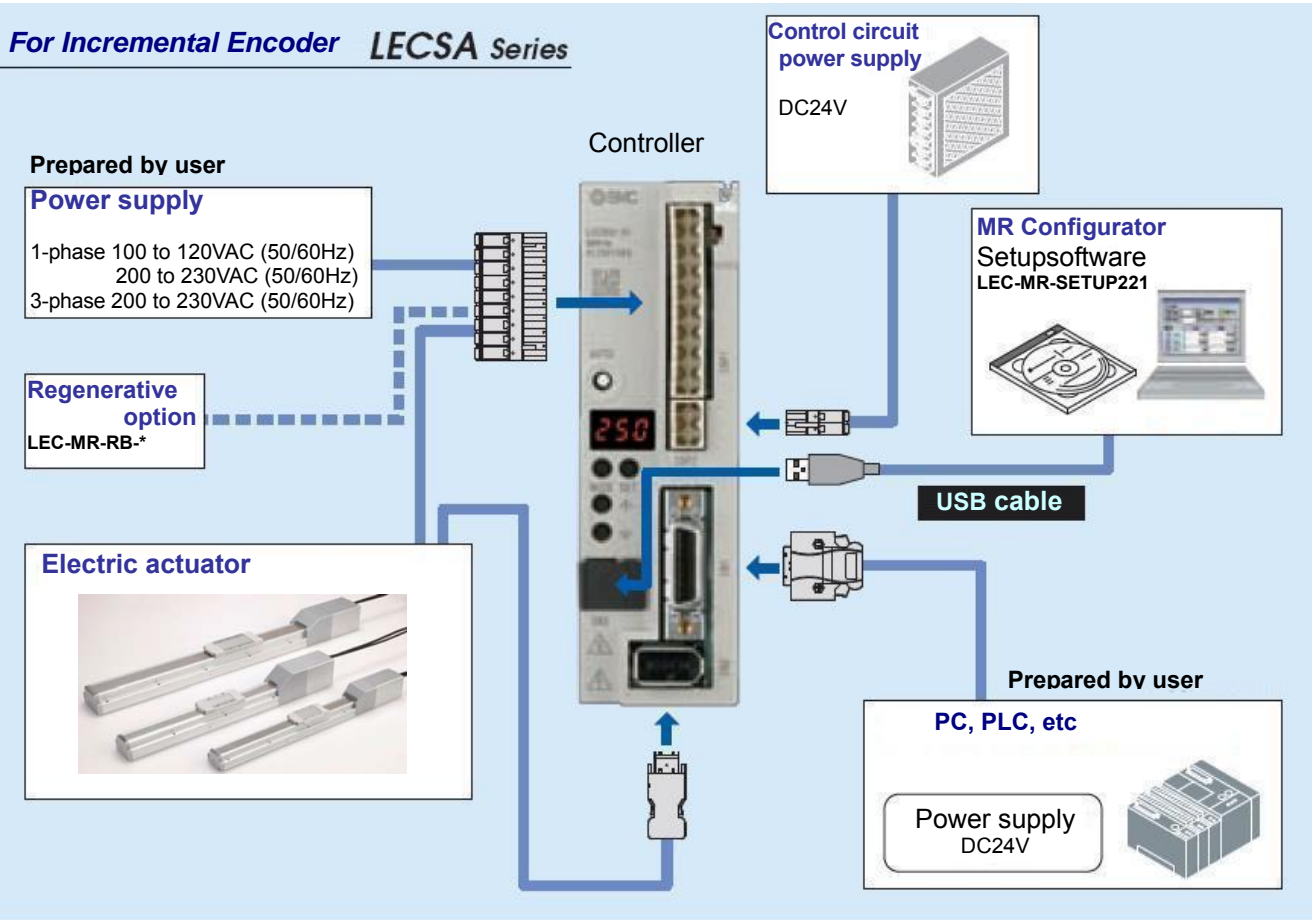
#### Parts list

| No. | Description      | Material          | Remarks    | No. | Description    | Material        | Remarks  |
|-----|------------------|-------------------|------------|-----|----------------|-----------------|----------|
| 1   | Body             | Aluminium alloy   | Anodized   | 12  | Coupling       | -               |          |
| 2   | Rail guide       | -                 |            | 13  | Motor cover    | Aluminium alloy | Anodized |
| 3   | Ball screw Ass'y | -                 |            | 14  | End cover      | Aluminium alloy | Anodized |
| 4   | Ball             | -                 |            | 15  | Motor          | -               |          |
| 5   | Table            | Aluminium alloy   | Anodized   | 16  | Rubber bushing | NBR             |          |
| 6   | Blanking plate   | Aluminium alloy   | Anodized   | 17  | Band holder    | Stainless steel |          |
| 7   | Seal band holder | Synthetic resin   |            | 18  | Dust seal band | Stainless steel |          |
| 8   | Housing A        | Aluminum die-cast | Chromating | 19  | Bearing        | -               |          |
| 9   | Housing B        | Aluminium alloy   | Anodized   | 20  | Bearing        | -               |          |
| 10  | Bearing holder   | Aluminium alloy   |            | 21  | Roller shaft   | Stainless steel |          |
| 11  | Motor mount      | Aluminium alloy   | Anodized   | 22  | Wiper          | -               |          |

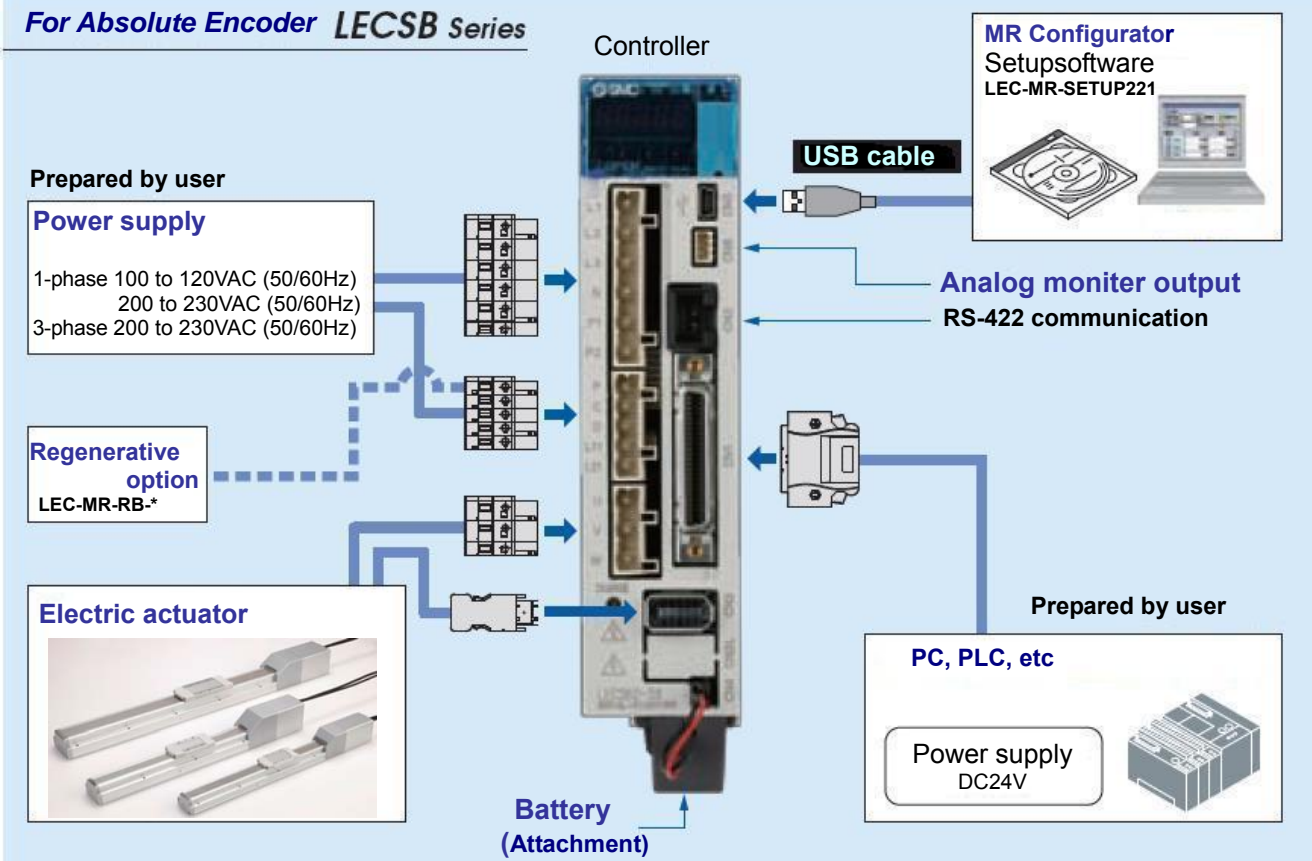
### 3. Product Outline

#### 3.1 System construction

##### For Incremental Encoder *LECSA Series*



##### For Absolute Encoder *LECSB Series*



### 3.2 Function/Configuration

The following control mode can be selected for applicable actuators.

Please refer to the "Controller Operation Manual" about wiring and parameter setting.

Table. Applicable control mode.

(○: Applicable)

| Controller                    | Control mode <sup>Note 1)</sup> (Selected by parameter number PA1.) |                         |                          |  |  |
|-------------------------------|---|-------------------------|--------------------------|--|--|
|                               | Position control  | Speed control           | Torque control           | Positioning  |  |
|                               |   |                         |                          | Point table method                                     | Program method   |
| <b>LECSA</b><br>(Incremental) | ○   | ○ <sup>Note 2)</sup>    | ○ <sup>Note 3)</sup>     | ○<br>3 Points<br>(Max. 7 Points)<br><sup>Note 4)</sup> | ○<br>4 Programs<br>(Max. 8 Programs)<br><sup>Note4) 5)</sup> |
| <b>LECSB</b><br>(Absolute)    | ○   | ○                       | ○                        |  |  |
| Command method                | [Pulse train]   | [ON/OFF Signal]         | [ON/OFF Signal]          | [ON/OFF Signal]  | [ON/OFF Signal]  |
| Operation method              | Positioning operation   | Setting speed operation | Setting torque operation | Positioning operation<br>by point table No.<br>setting | Positioning operation<br>by program setting                  |

Note 1 The control change mode cannot be used.

Note 2 Make the moving range limitation by external sensor etc to avoid actuator hitting to the work piece or stroke end.

Note 3 When using the pushing operation, the following parameter should be set.

If not, it will cause malfunction.

- LECSA: The value of the parameter value [PC12] "Internal torque command" should be 30% or less.
- LECSB: The value of the parameter value [PC13] "Analog torque maximum output command" should be 30% or less.

(30% = Maximum pushing force of the product.)

Note 4 To set the maximum value for the each method, it is necessary to change the setting.

Please refer "Controller Operation Manual".

Note 5 The MR Configurator is necessary to control by the program method.

Please prepare separately.

- MR Configurator (Setup software Japanese version) / LEC-MR-STUP□□□  
Please refer to "LECSA(11.4 MR Configurator)" for the system requirements of MR Configurator (setup software Japanese version).  
MR Configurator (setup software English version), contact your nearest sales branch.

- USB cable for setup software (3m) / LEC-MR-J3USB

## 4. 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. **Never connect or disconnect the cable or connector with power on.**

### 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 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. **Select “Robotic type cables” in case of inflecting cable(encoder/motor/rock) repeatedly.**  
Refer to the “Controller operation manual” for the bending life of the bending radius of the cable.
9. **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.

## [Transportation]

### Caution

1. **Do not carry or swing the product by the cable.**

## 5. Electric actuators / Common precautions

### 5.1 Design and selection

#### Warning

- 1. Be sure to read the Operation Manual (this manual and the one for the controller: LEC series).**  
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 is prohibited**  
Do not modify or reconstruct (including additional machining) the product. An injury or failure can result.
- 9. 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 every 10 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.
- 4. Refer to a common auto switch /matter (Best Pneumatics No 2) when an auto switch is built in and used.**

## 5.2 Mounting

### Warning

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

After mounting or repair, connect the power supply to the product and perform appropriate functional inspections to check it is mounted properly.
- 8. Cantilever**

When the actuator is operated at high speed while it is fixed at one end and free at the other end (flange type, foot type, double clevis type, direct mount type), a bending moment may act on the actuator due to vibration generated at the stroke end, which can damage the actuator. In such a case, install a support bracket to suppress the vibration of the actuator body or reduce the speed so that the actuator does not vibrate. Use a support bracket also when moving the actuator body or when a long stroke actuator is mounted horizontally and fixed at one end.
- 9. When attaching 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.

## 5.3 Handling

### Warning

1. **If abnormal heating, smoking or fire, etc., occurs in the product, immediately shut off the power supply.**
2. **Immediately stop operation if abnormal operation noise or vibration occurs.**  
If abnormal operation noise or vibration occurs, the product may have been mounted incorrectly. Unless operation of the product is stopped for inspection, the product can be seriously damaged.
3. **Never touch the rotating part of the motor or moving part of the actuator while in operation.**  
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 installing, adjusting, inspecting or performing maintenance on the product, controller and related equipment, be sure to shut off the power supply to 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 power supply line and signal line.
  - b) Looseness of the connector to each power line and signal line.
  - c) Looseness of the 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 do the earth construction surely.**
2. **Please refer to the controller manual for the grounding procedure and notes.**

## [Unpackaging]

### Caution

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

## 5.4 Operating environment

### Warning

1. **Avoid use in the following environments.**
  - 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, sea water, 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).
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 product if there is a heat source nearby.**

When there is a heat source surrounding the product, the radiated heat from the heat source can increase the temperature of the product beyond the operating temperature range. Protect it with a cover, etc.
6. **Grease oil can be 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 a place 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 90%RH or less No condensation or freezing).**
3. **Do not apply vibration and impact to the product during storage.**



## 5.5 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 an injury, damage or malfunction of equipment and machinery.
2. **Removal of product.**  
When equipment is serviced, first confirm that measures are in place to prevent dropping of work pieces and run-away of equipment, etc, and then cut the power supply to the system. When machinery is restarted, check that operation is normal with actuators in the proper positions.

## [Lubrication]

### Caution

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

## 5.6 Precautions for actuator with lock

### Warning

1. **Do not use the lock as a safety lock or a control that requires a locking force.**  
The lock used for the product with a lock is designed to prevent dropping of work 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 high than its holding force, as this will accelerate 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 be 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.

## 6. Electric actuators / Slider type Common precautions

### 6.1 Design and selection

#### Warning

- 1. Do not apply a load in excess of the actuator specification.**  
A product should be selected based on the maximum work load and allowable moment.  
If the product is used outside of the operating specification, eccentric load applied to the guide will become excessive and have adverse effects such as creating play in the guide, reduced accuracy and reduced product life.
- 2. Do not exceed the speed limit of the actuator specification.**  
Select a suitable actuator by the relationship of allowable work load and speed.  
Noise or reduction of accuracy may occur if the actuator is operated in excess of its specification and could lead to reduced accuracy and reduced product file.
- 3. Do not use the product in applications where excessive external force or impact force is applied to it.**  
This can lead to premature failure of the product.
- 4. When the product repeatedly cycles with partial strokes (see the table below), operate it at a full stroke at least once every 10 strokes.**  
Otherwise, lubrication can run out.

| Model  | Partial stroke |
|--------|----------------|
| LEF□16 | 40mm or less   |
| LEF□25 | 65mm or less   |
| LEF□32 | 70mm or less   |
| LEFS40 | 105mm or less  |

- 5. Actuator sizing is necessary with the total workload including the external force if external force is added on the actuator table.**  
When mounting cable-duct to actuator, the resistance of actuator table may increase. It causes an overload alarm, so pay attention to the resistance.

### 6.2 Handling

#### Caution

- 1. Do not use the lock as a safety lock or a control that requires a locking force.**
  - 1) Positioning operation**  
When the product comes within the set range by step data [In position], output signal will be turned on. Set to [0.50] for LEFS and [1] for LEFB, or higher.
- 2. Do not change the positioning force from initial setting.**  
If the positioning force is changed, it may cause a decrease in performance.
- 3. Do not operate by fixing the table and moving the actuator body.**  
An excessive load will be applied to the table, which could lead to damage to the actuator and reduced accuracy and reduced product life.
- 4. Belt drive actuator cannot be used for vertically mounted applications.**
- 5. Check the specification for the minimum speed of each actuator.**
- 6. In the case of the belt driven actuator, vibration may occur during operation at speeds within the actuator specification, this could be caused by the operating conditions.**  
Change the speed setting to a speed that does not cause vibration.

## 6.3 Mounting

### ⚠ Caution

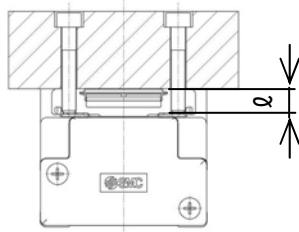
**1. Keep the flatness of mounting surface to within 0.1mm or less.**

Insufficient flatness of the work piece or the surface onto which the actuator body is to be mounted can cause play in the guide and increased sliding resistance.

**2. When mounting the workpiece or other device to the actuator tighten the fixing screws with adequate torque within the specified torque range**

Tightening the screws with a higher torque than the maximum may cause malfunction, whilst tightening with a lower torque can cause the displacement of the mounting position or in extreme conditions detaching of the work piece.

Work piece mounting



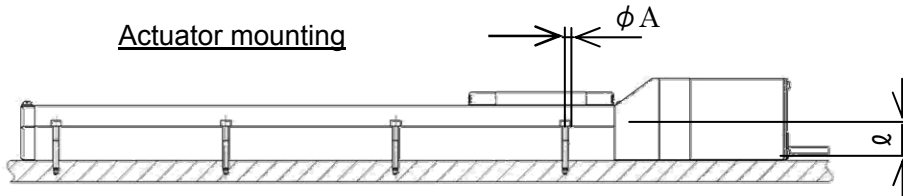
| Model  | Bolt size | Maximum tightening torque [Nm] | ℓ (Maximum thread depth [mm]) |
|--------|-----------|--------------------------------|-------------------------------|
| LEF□16 | M4x0.7    | 1.5                            | 6                             |
| LEF□25 | M5x0.8    | 3                              | 8                             |
| LEF□32 | M6x1      | 5.2                            | 9                             |
| LEFS40 | M8x1.25   | 12.5                           | 14                            |

Use screws with adequate length, but with length less than the maximum thread depth. The use of screws that are too long can touch the body and cause malfunction.

**3. When mounting the actuator, use screws with adequate length and tighten them to the adequate torque. And use all mounting holes to maintain the catalogue performance.**

Tightening the screws with a higher torque than recommended may cause malfunction, whilst the tightening with lower torque can cause the displacement of mounting position or in extreme conditions the actuator could become detached from its mounting position.

Actuator mounting



| Model  | Bolt size | φA (mm) | ℓ (mm) |
|--------|-----------|---------|--------|
| LEF□16 | M3        | 3.5     | 20     |
| LEF□25 | M4        | 4.5     | 24     |
| LEF□32 | M5        | 5.5     | 30     |
| LEFS40 | M6        | 6.5     | 34     |

**4. When mounting the actuator, leave a gap of 40mm or more to allow for bending of the actuator cable.**

## 6.4 Precaution on maintenance

### ⚠ Warning

1. Turn off the power supply before maintenance and replacement of the product..
2. Put on protective goggles when applying grease.

#### [Maintenance frequency]

Perform maintenance according to the table below. Contact SMC if any abnormality is found.

| Frequency   | Appearance check | Internal check |
|---|------------------|----------------|
| Inspection before daily operation                       | ○                |                |
| Inspection every six months / 1000km / 5million cycle * | ○                | ○              |

\*Whichever occurs first.

#### [Items for visual appearance check]

1. Loose screws. Abnormal dirt.
2. Check of flaws/faults and cable connections.
3. Vibration, noise.

#### [Items for internal check]

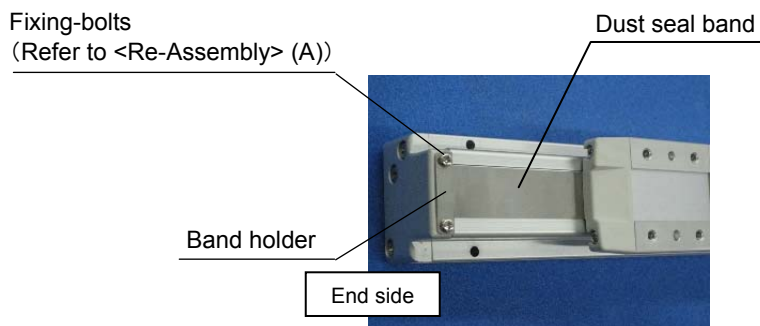
1. Lubricant condition on moving parts
2. Loose or mechanical problem in fixed parts or fixing screws.

## 6.5 How to detach and attach the dust seal band

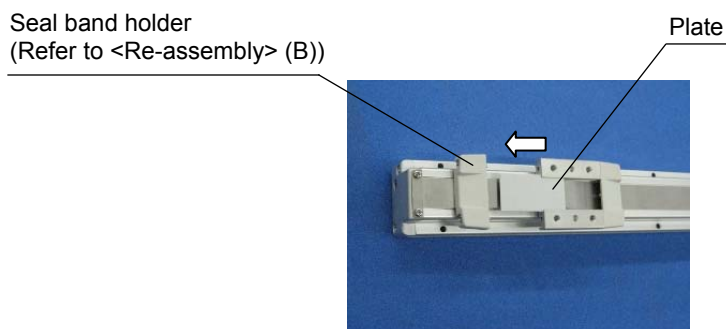
For the internal-check as the maintenance, the method of detaching and attaching the dust seal band is shown as the following.

### <Dis-assembly>

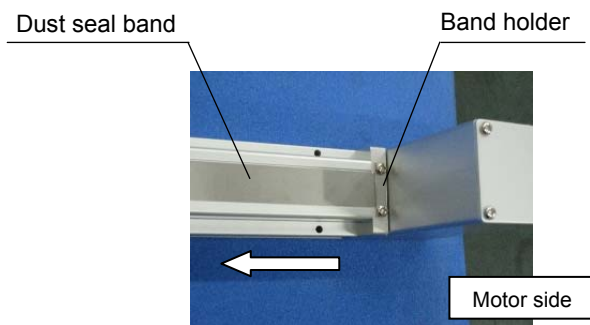
1. Loosen the fixing bolts of end side of the "Band holder".  
(The picture shows LEFB, but LEFS is same instruction as LEFB.)  
Pay attention to not cut hand on the edges of the "Dust seal band".  
Note: The "Dust seal band" can only be removed by loosening the "Band holder" bolts.



2. Remove the "Seal band holder" and the "plate" as shown.



3. Loosen the fixing bolts of motor side of the “Band holder” and then remove the “Dust seal band”.



<Re-assembly>

The re-assembly is completed by the reverse procedure of “Dis-assembly” sections 1, 2 and 3.

(A)

| Model  | Type of bolt                 | Bolt size |
|--------|------------------------------|-----------|
| LEF□16 | Round head combination screw | M2.5x5    |
| LEF□25 | Round head combination screw | M3x6      |
| LEF□32 | Round head combination screw | M3x6      |
| LEFS40 | Round head combination screw | M3x6      |

(B)

| Model  | Type of bolt                    | Bolt size |
|--------|---------------------------------|-----------|
| LEF□16 | Cross recessed round head screw | M2.5x16   |
| LEF□25 | Cross recessed round head screw | M3x20     |
| LEF□32 | Cross recessed round head screw | M4x30     |
| LEFS40 | Round head combination screw    | M4x35     |

## 7. Troubleshooting

### 7.1 Alarms and Warning

When a fault occurs during the operation, the corresponding alarm or warning is displayed. If any alarm or warning has occurred, refer to 「Controller Operation Manual」 and take the appropriate action. After removing the cause of the alarm, the alarm can be deactivated in any of the methods marked ○ in the alarm deactivation column.

#### •Incremental Encoder(LECSA)

|        | Display  | Name                                  | Alarm deactivation |                                      |                   |
|--------|----------|---------------------------------------|--------------------|--------------------------------------|-------------------|
|        |          |                                       | Power OFF→ON       | Press "SET" on current alarm screen. | Alarm reset (RES) |
| Alarms | A.10     | Undervoltage                          | ○                  | ○                                    | ○                 |
|        | A.12     | Memory error 1 (RAM)                  | ○                  | -                                    | -                 |
|        | A.13     | Clock error                           | ○                  | -                                    | -                 |
|        | A.15     | Memory error 2 (EEP-ROM)              | ○                  | -                                    | -                 |
|        | A.16     | Encoder initial communication error1  | ○                  | -                                    | -                 |
|        | A.17     | Board error                           | ○                  | -                                    | -                 |
|        | A.19     | Memory error 3 (Flash-ROM)            | ○                  | -                                    | -                 |
|        | A.1A     | Motor combination error               | ○                  | -                                    | -                 |
|        | A.1C     | Software combination error            | ○                  | -                                    | -                 |
|        | A.1E     | Encoder initial communication error 2 | ○                  | -                                    | -                 |
|        | A.1F     | Encoder initial communication error 3 | ○                  | -                                    | -                 |
|        | A.20     | Encoder normal communication error 1  | ○                  | -                                    | -                 |
|        | A.21     | Encoder normal communication error 2  | ○                  | -                                    | -                 |
|        | A.24     | Main circuit error                    | ○                  |                                      |                   |
|        | A.30     | Regenerative error                    | ○(Note 1)          | ○(Note 1)                            | ○(Note 1)         |
|        | A.31     | Overspeed                             | ○                  | ○                                    | ○                 |
|        | A.32     | Overcurrent                           | ○                  |                                      |                   |
|        | A.33     | Overvoltage                           | ○                  | ○                                    | ○                 |
|        | A.35     | Command frequency error               | ○                  | ○                                    | ○                 |
|        | A.37     | Parameter error                       | ○                  | -                                    | -                 |
|        | A.39     | Program error                         | ○                  | -                                    | -                 |
|        | A.45     | Main circuit device overheat          | ○(Note 1)          | ○(Note 1)                            | ○(Note 1)         |
|        | A.46     | Servo motor overheat                  | ○(Note 1)          | ○(Note 1)                            | ○(Note 1)         |
|        | A.50     | Overload 1                            | ○(Note 1)          | ○(Note 1)                            | ○(Note 1)         |
|        | A.51     | Overload 2                            | ○(Note 1)          | ○(Note 1)                            | ○(Note 1)         |
|        | A.52     | Error excessive                       | ○                  | ○                                    | ○                 |
|        | A.61     | Operation alarm                       | ○                  | ○                                    | ○                 |
|        | A.8E     | USB communication error               | ○                  | ○                                    | ○                 |
| 888    | Watchdog | ○                                     | -                  | -                                    |                   |

|         | Display | Name                           |
|---------|---------|--------------------------------|
| Warning | A.90    | Amplifier overheat warning     |
|         | A.91    | Stroke limit warning           |
|         | A.96    | Excessive regeneration warning |
|         | A.97    | Overload warning 1             |
|         | A.98    | Servo forced stop warning      |
|         | A.99    | Main circuit off warning       |
|         | A.E0    | Overload warning 2             |
|         | A.E1    | Output watt excess warning     |
|         | A.E6    | Tough drive warning            |
|         | A.E9    | Amplifier overheat warning     |
|         | A.EC    | Stroke limit warning           |
|         | A.ED    | Excessive regeneration warning |
|         | A.F0    | Overload warning 1             |

Note 1. Deactivate the alarm about 30 minutes of cooling time after removing the cause of occurrence.

**•Absolute Encoder(LECSB)**

|        | Display                       | Name                            | Alarm deactivation |                                      |                   |
|--------|-------------------------------|---------------------------------|--------------------|--------------------------------------|-------------------|
|        |                               |                                 | Power OFF→ON       | Press "SET" on current alarm screen. | Alarm reset (RES) |
| Alarms | AL.10                         | Undervoltage                    | ○                  | ○                                    | ○                 |
|        | AL.12                         | Memory error 1 (RAM)            | ○                  | -                                    | -                 |
|        | AL.13                         | Clock error                     | ○                  | -                                    | -                 |
|        | AL.15                         | Memory error 2 (EEP-ROM)        | ○                  | -                                    | -                 |
|        | AL.16                         | Encoder error 1(At power on)    | ○                  | -                                    | -                 |
|        | AL.17                         | Board error                     | ○                  | -                                    | -                 |
|        | AL.19                         | Memory error 3(Flash-ROM)       | ○                  | -                                    | -                 |
|        | AL.1A                         | Motor combination error         | ○                  | -                                    | -                 |
|        | AL.20                         | Encoder error 2(during runtime) | ○                  | -                                    | -                 |
|        | AL.21                         | Encoder error 3(during runtime) | ○                  | -                                    | -                 |
|        | AL.24                         | Main circuit error              | ○                  | ○                                    | ○                 |
|        | AL.25                         | Absolute position erase         | ○                  | -                                    | -                 |
|        | AL.30                         | Regenerative error              | ○(Note 1)          | ○(Note 1)                            | ○(Note 1)         |
|        | AL.31                         | Overspeed                       | ○                  | ○                                    | ○                 |
|        | AL.32                         | Overcurrent                     | ○                  | -                                    | -                 |
|        | AL.33                         | Overvoltage                     | ○                  | ○                                    | ○                 |
|        | AL.35                         | Command pulse frequency alarm   | ○                  | ○                                    | ○                 |
|        | AL.37                         | Parameter error                 | ○                  | -                                    | -                 |
|        | AL.45                         | Main circuit device overheat    | ○(Note 1)          | ○(Note 1)                            | ○(Note 1)         |
|        | AL.46                         | Servo motor overheat            | ○(Note 1)          | ○(Note 1)                            | ○(Note 1)         |
|        | AL.47                         | Cooling fan alarm               | ○                  | -                                    | -                 |
|        | AL.50                         | Overload 1                      | ○(Note 1)          | ○(Note 1)                            | ○(Note 1)         |
|        | AL.51                         | Overload 2                      | ○(Note 1)          | ○(Note 1)                            | ○(Note 1)         |
|        | AL.52                         | Error excessive                 | ○                  | ○                                    | ○                 |
| AL.8A  | Serial communication time-out | ○                               | ○                  | ○                                    |                   |
| AL.8E  | Serial communication error    | ○                               | ○                  | ○                                    |                   |
| 88888  | Watchdog                      | ○                               | -                  | -                                    |                   |

|         | Display | Name                                |
|---------|---------|-------------------------------------|
| Warning | A.92    | Battery cable disconnection warning |
|         | A.96    | Home position setting error         |
|         | A.99    | Stroke limit warning                |
|         | A.9F    | Battery warning                     |
|         | A.E0    | Excessive regeneration warning      |
|         | A.E1    | Overload warning 1                  |
|         | A.E3    | Absolute position counter warning   |
|         | A.E5    | ABS time-out warning                |
|         | A.E6    | Servo emergency stop warning        |
|         | A.E8    | Cooling fan speed reduction warning |
|         | A.E9    | Main circuit off warning            |
|         | A.EA    | ABS servo on warning                |
|         | A.EC    | Overload warning 2                  |
|         | A.ED    | Output watt excess warning          |

Note 1. Deactivate the alarm about 30 minutes of cooling time after removing the cause of occurrence.

Revision history

No.LEF-OM00402

Sep/ 2011 Revision

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Note: Specifications are subject to change without prior notice and any obligation on the part of the manufacturer.  
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