

THK Electrical Actuator Economy Series

ES/EC

INSTRUCTION MANUAL

No.1040-1 (2) E

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1. Introduction

About this chapter

This chapter describes the overview of the product.

This chapter includes information that we want you to check and understand before working with the product.



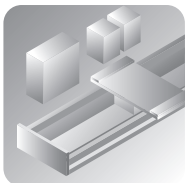
This section includes introduction about the product and this manual.

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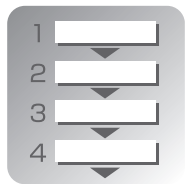
This section includes general precautions to follow when using the product. Be sure to read this section before use and observe the precautions.

2. Safety Precautions	1-4
2-1. About ranks of precautions	1-4
2-2. About description of precautions	1-4
2-3. Safety precautions	1-5



This section includes introduction about peripheral devices to be used with this product.

3. System Configuration	1-6
3-1. System configuration	1-6



This section describes installation and setting processes to make this product ready for use.

4. Flow Until Using the Product ...	1-7
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1. Introduction

1-1 Acknowledgment

Thank you for purchasing our product.

This product is a lightweight, compact, and reasonably-priced actuator which ensures a long-term maintenance-free operation.

This product is designed and manufactured to be incorporated in devices with wide range of application including conveyance system, implementing equipment, automated assemblers, and positioning equipment, etc.

We hope our creative inventions and unique technologies contribute to your further prosperity.

1-2 About this manual

1-2-1 Intended audience

The person in charge of designing embedded systems of the product and installing, wiring, and maintaining the product, and the person who actually uses the product.

1-2-2 Using this manual

This manual describes correct handling methods and precautions for the product.

For the maximum performance and long life of the product, carefully read and understand this manual to safely and correctly use the product.

If you use the printed version of this manual, be sure to keep it in the place that the audience can refer to it when needed.

1-2-3 Notice and attention

- Do not use or handle the product in the ways that are not described in this manual.
- Do not reproduce, reprint, or lend the whole contents or a part of this manual without permission.
- Please note that the description in this manual is subject to change without prior notice in the future, due to improvements of the product or other reasons.
- We have made all possible efforts to make the content of this manual accurate. However, if you find any mistake or uncertainty in this manual, please contact THK.
- Drawings throughout this manual are only intended as typical examples, and may differ from your product.
- Note that THK shall not be liable for any result incurred by applying this manual, regardless of the reason.
- This manual is also applied to special types of product. However, the descriptions provided in the delivery specification drawings or delivery specification documents of those special types take precedence over this manual.

* Special types represent the products that have different materials and specifications from those of the standard products on catalogs.

1-2-4 Notation of this manual

Important

- Notes that can lead to unsatisfactory function, error, or damage of the product if not observed while using the product.

Supplement

- Supplementary information for the description.

Reference

- Reference information for the description.

1-3 How to use this product

- This product must not be used for the devices or systems that are used under the situations that may be fatal to human life.
- If you consider using this product for special applications such as passenger movement vehicle, medical, aerospace, nuclear power, and electric power devices or systems, be sure to consult with THK in advance.
- This product is manufactured under the strict quality control, however, that does not mean that the product is free from failure. For applications to the equipment that may suffer serious accidents or loss from the failure of this product, install safety devices or backup devices that prevent such serious accidents or loss.

Important

- If you purchase this product with a motor, the driver controller to be used is either TSC or TLC. Please note that driver controllers other than the above cannot be used.

1-4 About product support

For the following information, please contact THK.

- Technical support for this product

1-5 About related instruction manuals

- When you use the actuator ES/EC, read the following instruction manuals as necessary.

- Controller series	Driver controller TSC
- Controller series	Driver controller TLC
- Controller series	Network unit TNU
- Controller series	Setup tool D-STEP
- Controller series	Digital operator TDO

1-6 About combination of products

For information on combination of products, see the list of product combination in Chapter 5 (page 5-10) of this manual.

1-7 Product and company information


To find the latest product and company information, we recommend you to periodically access our website.


- Website URL: <http://www.thk.com/>
- Technical support website URL: <https://tech.thk.com/>


2. Safety Precautions

2-1 About ranks of precautions

This manual uses the classifications of "Danger," "Warning," and "Caution" for warning indications for safety matters.













 **Danger** Erroneous handling may urgently cause death or serious injury to a person

 **Warning** Erroneous handling may cause death or serious injury to a person

 **Caution** Erroneous handling may cause injury to a person or property damage only

2-2 About description of precautions

Precautions are classified as "Prohibition," "Instruction," and "Precaution" according to the action.

 This mark indicates "prohibition" of the action.	 Prohibited	 Do not disassemble	
 This mark indicates "instruction" for the action.	 Obligatory	 Provide grounding connection	
 This mark indicates "caution" about the action.	 Caution	 Caution - Electrical shock	 Caution – Flammable
	 Caution – High temperature	 Caution – Getting caught	

2-3 Safety precautions

Warning



Prohibited

- While the actuator is operating or operable, do not enter the working area of any moving part including the load.

Doing so may cause you to touch the moving part and get injured.



Obligatory

- If the product fails or any abnormality is observed, shut down the power of the driver controllers TSC and TLC.

Such abnormality may cause a malfunction of actuator, resulting in damage or injury.



Caution -
Electrical shock

- Do not touch the internal part of driver controllers TSC and TLC.

Doing so may cause electric shocks.

- Do not damage, tuck, or apply excessive stresses on the cable.

Doing so may cause electric shocks.



Do not
disassemble

- Do not modify, disassemble, or alter the product.

Doing so may cause injury or fault.

Caution



Caution -
High temperature

- During the operation, or for a while after turning the power off, do not touch the driver controller TSC, TLC, or motor cover because they should be hot.

Doing so may cause burns.



Prohibited

- Do not impact the product and do avoid rough handling such as throwing it.

Doing so may cause the fault or damage that leads to injury.

- Do not frequently switch the power between on and off.

Doing so may generate heat from the internal part of driver controller TSC or TLC, which results in fault or burns.

- Do not set the speed or acceleration setting or place the load on the table that exceed the actuator specification.

Doing so may cause motor failure, which leads to unexpected accidents or damages.



Obligatory

- If an alarm is generated, remove the cause, check the safety, deactivate the alarm, and restart the operation.

Failure to do so may result in failure, which leads to injury.



Caution -
Flammable

- Use this product with a combination that is specified beforehand.

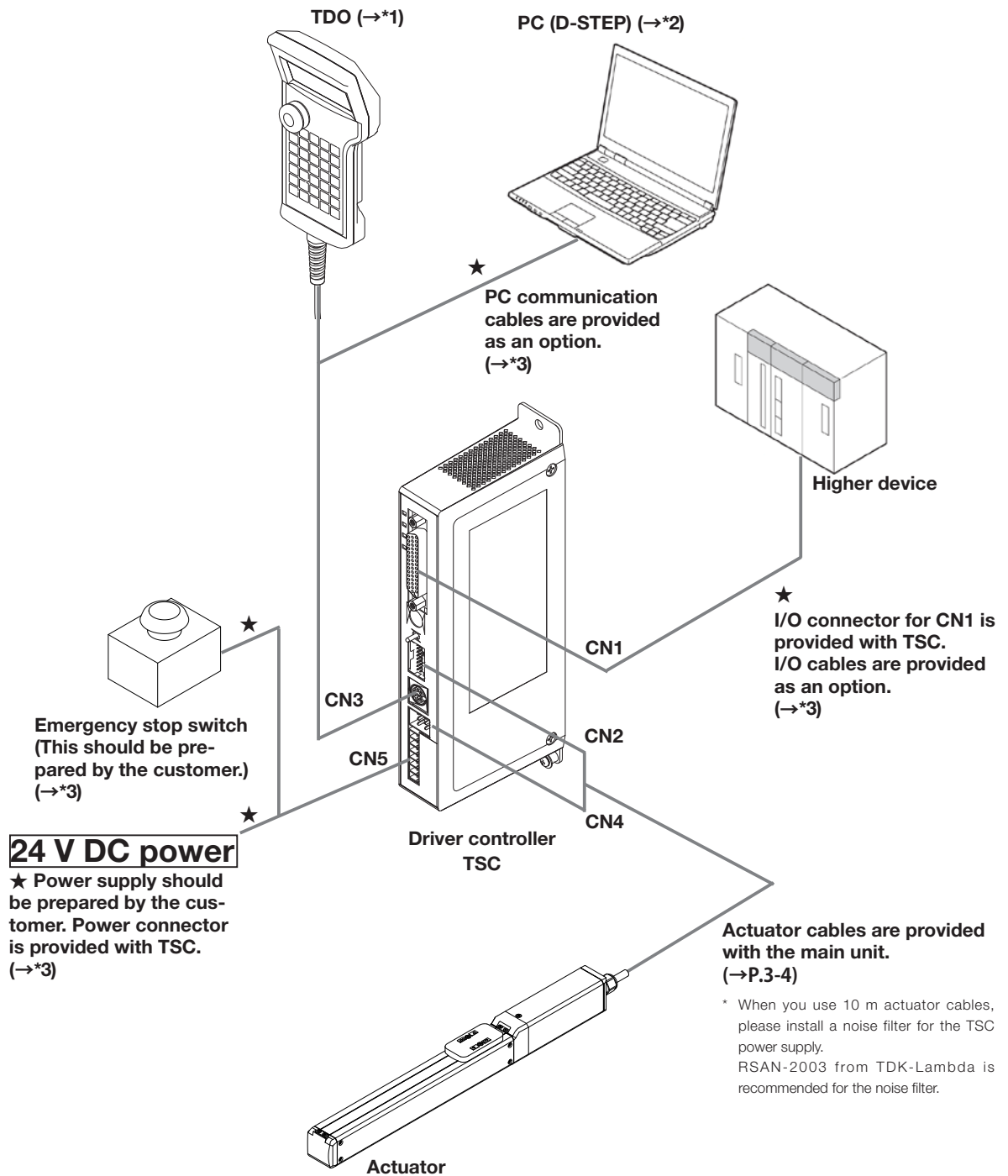
Failure to do so may cause fire or fault.

- Observe the specified input voltage.

Failure to do so may cause fire or fault.

3-1 System configuration

- The diagram below shows the specification of a combination with the driver controller TSC.
- Cables for connecting the devices indicated with ★ should be prepared by the customer.



*1: See the separate TDO Instruction Manual.
 *2: See the separate D-STEP Instruction Manual.
 *3: See the separate TSC Instruction Manual.

1. Safety check

- (1) Safety statement check → P.1-4
- (2) Safety check of the installation location → P.2-19
- (3) Installation check → P.2-20, 2-26

2. Preparation

- (1) Preparation of required devices → P.1-6
- (2) Package contents check → P.2-2 to 2-9

3. Installation

- (1) Installation environment check → P.2-19
- (2) Installation → P.2-19 to 2-31

4. Wiring

- (1) Connection between each device and cable → P.3-2 to 3-7

5. Trial run and adjustment

- (1) For details of setup tool preparation and program input, see the separate D-STEP Instruction Manual.
- (2) Trial run → P.5-5 to 5-18
- (3) Parameter setting → P.5-19 to 5-23

6. Setup tool setting

- (1) For details of setup tool setting, see the separate D-STEP Instruction Manual.

2. Installation

About this chapter

This chapter describes how to check the package contents and to install it to the machine and facilities.
This section is primarily intended for those in charge of installation of this product to a machine and facilities.



This section describes the package contents check and parts of this product.

1. Check the Products 2-2

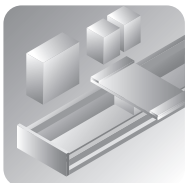
- 1-1. Check the package contents of ES/EC... 2-2
- 1-2. Names of individual parts and functions... 2-9
- 1-3. Store and dispose of the products 2-15



This section describes the precautions on use of this product.

2. Precautions on Use 2-16

- 2-1. Precautions on use ES 2-16
- 2-2. Precautions on use EC 2-17



This section describes the installation procedures of this product.

3. How to Install 2-18

- 3-1. Installation environment 2-18
- 3-2. Install ES 2-19
- 3-3. Install EC 2-25

1. Check the Products

Warning



Prohibited

- For the combination of the actuator ES/EC and the driver controller TSC/TLC, do not use actuators with models other than TSC/TLC. Doing so may cause unexpected motions, accidents or failures.

Example of combination

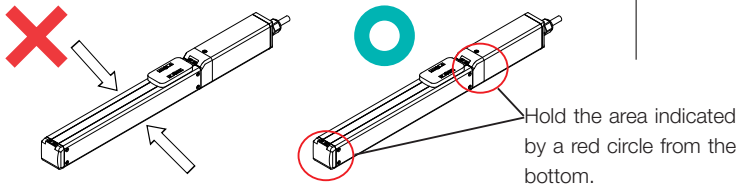
Actuator model: **ES4-06**-0300B-TS/35P-D00-S3Driver controller model: TSC-015B-MOD-**ES4-06-D**

Caution



Prohibited

- Do not stand on the packaging box or this product. Doing so may cause malfunction or damage that leads to injury.
- Do not hold ES by pressing the side covers from both sides when you carry it. Doing so may distort the side cover, which leads to a malfunction.



Prohibited

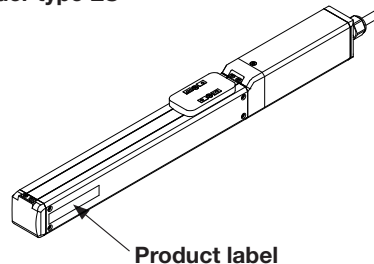
- When carrying the product, do not hold the cable. Doing so may cause damage of the cable that leads to injury.
- Do not use the product if you find any abnormality. Using a fractured product may cause malfunction that leads to injury or fault. If you find any defect, please contact THK.

1-1 Check the package contents of ES/EC

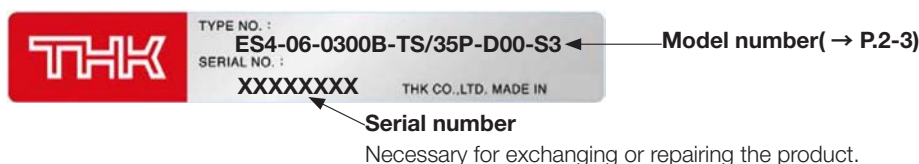
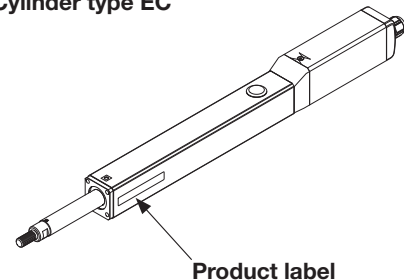
1-1-1 Check the model/type of the product

Check the model indicated on the product label against the purchase information.

Slider type ES



Cylinder type EC



1. Check the Products

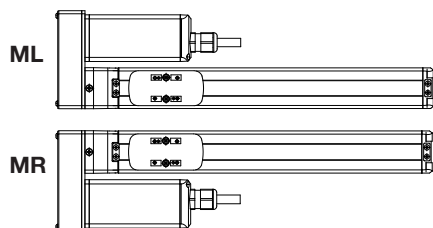
<Model configuration> Specification of TSC with motor

ES4R — 06 — 0150 B — TS — ML-GR-SB-L6/35P — D00 — S3
(1) (2) (3) (4) (5) (6) (7) (8) (9)

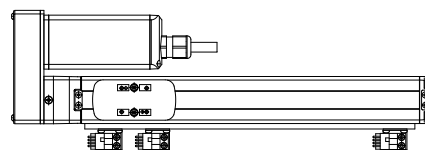
(1) Model number	ES3, ES4, ES5, ES6 (Slider type/direct motor coupling) ES3R, ES4R, ES5R, ES6R (Slider type/motor return) EC3, EC4 (Cylinder type/direct motor coupling) EC3R, EC4R (Cylinder type/motor return) EC3H, EC4H (Cylinder type/direct motor coupling/with linear bush)							
(2) Ball screw lead	06 : 6 mm 12 : 12 mm (ES3, ES3R, EC3, EC3R, and EC3H have the ball screw lead 6 only.)							
(3) Stroke	0150 : 150 mm (50 to 600 mm, 50 mm pitch) The maximum stroke = ES3:300, ES4:400, ES5:500, ES6:600, EC3:200, EC4:300							
(4) Design symbol	B							
(5) Control device	TS : Driver controller TSC							
(6) Option	No symbol : None MR : Motor right return ^{*1} ML : Motor left return ^{*1} GR : Change the cover color to gray SB : With slider base (exclusively for ES) CB : With cylinder base (exclusively for EC) FL : With flange (exclusively for EC) LB : With link ball (exclusively for EC) <input type="checkbox"/> ₁ <input type="checkbox"/> ₂ : Sensor (exclusively for ES) ^{*2*3}							
(7) Motors used	28P : Stepper motor <input type="checkbox"/> 28, 28PB : Stepper motor <input type="checkbox"/> 28 with brake 35P : Stepper motor <input type="checkbox"/> 35, 35PB : Stepper motor <input type="checkbox"/> 35 with brake 42P : Stepper motor <input type="checkbox"/> 42, 42PB : Stepper motor <input type="checkbox"/> 42 with brake ("28P, 28PB": ES3, ES3R, "35P, 35PB": ES4, ES4R, EC3, EC3R, EC3H "42P, 42PB": ES5, ES5R, ES6, ES6R, EC4, EC4R, EC4H)							
(8) Home position	D00 : Motor side R00 : Reverse motor side							
(9) Cable length	No symbol : None S3 : Standard 3 m S5 : Standard 5 m SA : Standard 10 m							

1. Check the Products

*1 Motor return direction



*2 Sensor installation direction (symbol: R6)



*3 Sensor details

Content	Type	Accessory	Symbol	
			<input type="checkbox"/> 1 <input type="checkbox"/> 2	
With sensor rail	-	-	L/R	1
Photo sensor [3 units]	EE-SX674 (OMRON Corporation)	Mounting screw/nut, sensor rail (1 pc), mounting plate (3 pcs), connector (EE-1001, 3 pcs)	L/R	6
Sensor N.O. contact [1 pc] (NPN output) N.C. contact [2 pcs] (NPN output)	GX-F12A (Panasonic Industrial Devices SUNX Co., Ltd.) GX-F12B (Panasonic Industrial Devices SUNX Co., Ltd.)	Mounting screw/nut, sensor rail	L/R	J
Sensor N.O. contact [1 pc] (PNP output) N.C. contact [2 pcs] (PNP output)	GX-F12A-P (Panasonic Industrial Devices SUNX Co., Ltd.) GX-F12B-P (Panasonic Industrial Devices SUNX Co., Ltd.)	Mounting screw/nut, sensor rail	L/R	M

Note) Please prepare a sensor dog separately since it cannot be installed onto the actuator main unit.

Note) Please note the followings when selecting the product of TSC specification:

- There is no compatibility between the actuator cable and the stepper driver controller TSC (TSC, hereinafter) of the existing product and the design symbol B.
You cannot use the actuator main unit/actuator cable of the existing product with the TSC of the design symbol B.

1. Check the Products

<Model configuration> Specification of TLC with motor

ES5R — **06** — **0150 B** — **TL** — **ML-GR-SB-L6/M05 L** — **D00** — **F3**
(1) **(2)** **(3)** **(4)** **(5)** **(6)** **(7)** **(8)** **(9)** **(10)**

(1) Model number	ES5, ES6 (Slider type/direct motor coupling) ES5R, ES6R (Slider type/motor return) EC4 (Cylinder type/direct motor coupling) EC4R (Cylinder type/motor return) EC4H (Cylinder type/direct motor coupling/with linear bush)								
(2) Ball screw lead	06 : 6 mm 12 : 12 mm								
(3) Stroke	0150 : 150 mm (50 to 600 mm, 50 mm pitch) The maximum stroke = ES5:500, ES6:600, EC4:300								
(4) Design symbol	B								
(5) Control device	TL : Driver controller TLC								
(6) Option	No symbol : None MR : Motor right return ^{*1} ML : Motor left return ^{*1} GR : Change the cover color to gray SB : With slider base (exclusively for ES) CB : With cylinder base (exclusively for EC) FL : With flange (exclusively for EC) LB : With link ball (exclusively for EC) <input type="checkbox"/> ₁ <input type="checkbox"/> ₂ : Sensor (exclusively for ES) ^{*2*3}								
(7) Motors used	M05 : AC servo motor: 50 W M05B : AC servo motor: 50 W (with brake)								
(8) Motor cable direction	R : Right U : Up L : Left D : Down (ES: If you select "MR" as an option, "R", "U", or "D" cannot be selected. If you select "ML" as an option, "L", "U", or "D" cannot be selected.) (EC: If you select "MR" as an option, "R" cannot be selected. If you select "ML" as an option, "L" cannot be selected.)								
(9) Home position	D00 : Motor side R00 : Reverse motor side								
(10) Cable length	F3 : 3 m fixed F5 : 5 m fixed FA : 10 m fixed H3 : 3 m high flex H5 : 5 m high flex HA : 10 m high flex								

For details on *1, *2, or *3, please see *1, *2, or *3 of the previous page (P.2-4) respectively.

Note) Please prepare a sensor dog separately since it cannot be installed onto the actuator main unit.

1. Check the Products

<Model configuration> Without motor type

ES4R — 06 — 0150 B — 0 — A — ML-GR-SB-L6

(1) (2) (3) (4) (5) (6) (7)

(1) Model number	ES3, ES4, ES5, ES6 (Slider type/direct motor coupling) ES3R, ES4R, ES5R, ES6R (Slider type/motor return) EC3, EC4 (Cylinder type/direct motor coupling) EC3R, EC4R (Cylinder type/motor return) EC3H, EC4H (Cylinder type/direct motor coupling/with linear bush)
(2) Ball screw lead	06 : 6 mm 12 : 12 mm (ES3, ES3R, EC3, EC3R, and EC3H have the ball screw lead 6 only.)
(3) Stroke	0150 : 150 mm (50 to 600 mm, 50 mm pitch) The maximum stroke = ES3:300, ES4:400, ES5:500, ES6:600, EC3:200, EC4:300
(4) Design symbol	B
(5) With/without motor	0 : Without motor 1 : With motor (purchased from THK)
(6) Intermediate flange ^{*4}	N : None A B C
(7) Option	No symbol : None MR : Motor right return*5 ML : Motor left return*5 GR : Change the cover color to gray SB : With slider base (exclusively for ES) CB : With cylinder base (exclusively for EC) FL : With flange (exclusively for EC) LB : With link ball (exclusively for EC) <input type="checkbox"/> ₁ <input type="checkbox"/> ₂ : Sensor (exclusively for ES)*6*7

* Continue to the next page →

*4 Intermediate flange

Motor type			Motor rated output	Flange angle	Intermediate flange model number											
					ES3		ES4		ES5		ES6		EC3		EC4	
					Direct coupling	Return	Direct coupling	Return	Direct coupling	Return	Direct coupling	Return	Direct coupling	Return	Direct coupling	Return
Yasukawa Electric Corporation	Σ V-mini	SGMMV-A2	20 W	<input type="checkbox"/> 25	A	A	-	-	-	-	-	-	-	-	-	-
		SGMMV-A3	30 W		-	-	A	A	-	-	-	-	A	A	-	-
	Σ V	SGMJV-A5	50 W	<input type="checkbox"/> 40	-	-	-	-	N	A	N	A	-	-	N	A
		SGMAV-A5			-	-	-	-	N	A	N	A	-	-	N	A
Mitsubishi Electric Corporation	J3	HG-AK0236	20 W	<input type="checkbox"/> 25	A	A	-	-	-	-	-	-	-	-	-	-
		HG-AK0336	30 W		-	-	A	A	-	-	-	-	A	A	-	-
		HF-KP053		<input type="checkbox"/> 40	-	-	-	-	N	A	N	A	-	-	N	A
		HF-MP053			-	-	-	-	N	A	N	A	-	-	N	A
	J4	HG-KR053			-	-	-	-	N	A	N	A	-	-	N	A
		HG-MR053			-	-	-	-	N	A	N	A	-	-	N	A
	JN	HF-KN053			-	-	-	-	N	A	N	A	-	-	N	A
Panasonic Corporation	A5	MSME 5A		<input type="checkbox"/> 38	-	-	-	-	B	-	B	-	-	-	B	-
OMRON Corporation	G5	R88M-K05030		<input type="checkbox"/> 40	-	-	-	-	N	-	N	-	-	-	N	-
Oriental Motor Co., Ltd.	α step	ARM24*		<input type="checkbox"/> 28	B	-	-	-	-	-	-	-	-	-	-	-
		ARLM46*		<input type="checkbox"/> 42	-	-	-	-	C	-	C	-	-	-	C	-
		ARM46*			-	-	-	-	C	-	C	-	-	-	C	-
	5-phase	PK523*		<input type="checkbox"/> 28	B	-	-	-	-	-	-	-	-	-	-	-
		RK54*		<input type="checkbox"/> 42	-	-	-	-	C	-	C	-	-	-	C	-
	2-phase	PK23*		<input type="checkbox"/> 35	-	-	B	-	-	-	-	-	B	-	-	-

N model number indicates that you can install a relevant motor without an intermediate flange.

For details on *5, *6, or *7, please see *1, *2, or *3 of the previous page (P.2-4) respectively.

1-1-2

Check the type and number of accessories

Actuator

ES ☐ (With/without motor)

Type of parts	Qty.
Actuator main unit	1

ES ☐ R (With motor)

Type of parts	Qty.
Actuator main unit	1

ES ☐ R (Without motor)

Type of parts	Qty.
Actuator main unit	1
Timing pulley	1
Timing belt	1

EC3/EC3H (With/without motor)

Type of parts	Qty.
Actuator main unit	1
Supplied nut	1

EC3R (With motor)

Type of parts	Qty.
Actuator main unit	1
Supplied nut	1

EC3R (Without motor)

Type of parts	Qty.
Actuator main unit	1
Supplied nut	1
Timing pulley	1
Timing belt	1

EC4/EC4H (With/without motor)

Type of parts	Qty.
Actuator main unit	1
Supplied nut	1
Square nut	6

EC4R (With motor)

Type of parts	Qty.
Actuator main unit	1
Supplied nut	1
Square nut	6

EC4R (Without motor)

Type of parts	Qty.
Actuator main unit	1
Supplied nut	1
Square nut	6
Timing pulley	1
Timing belt	1

Cable list

Type of parts	Type	Qty.
Actuator cable	CBL-TSC-AC-**-B	1

** is cable length. (03: 3 m, 05: 5 m, 10: 10 m)

Slider base (ES option)

Accessories	Material	ES3/ES3R		ES4/ES4R		ES5/ES5R		ES6/ES6R	
		Type	Qty.	Type	Qty.	Type	Qty.	Type	Qty.
Slider base	Aluminum	-	1	-	1	-	1	-	1
Hexagonal-socket-head type bolt*1	Stainless steel	M3X8L	P	M4X10L	P	M4X10L	P	M4X10L	P
Plain washer*1	Stainless steel	Small washer 3	P	Small washer 4	P	Small washer 4	P	Small washer 4	P
Positioning pin*1	Stainless steel	φ 2x8L	2	φ 3x10L	2	φ 3x10L	2	φ 3x10L	2

*1 Assembly accessories used with the actuator main unit.

Nominal stroke		50	100	150	200	250	300	350	400	450	500	550	600
P	ES3	3	4	5	6	7	8	-	-	-	-	-	-
	ES4	3	4	5	6	7	8	9	10	-	-	-	-
	ES5	4	6	6	8	8	10	10	12	12	14	-	-
	ES6	4	6	6	8	8	10	10	12	12	14	14	16

Cylinder base (EC option)

Accessories	Material	EC3		EC4	
		Type	Qty.	Type	Qty.
Cylinder base	Aluminum	-	1	-	1
Hexagonal-socket-head type bolt*2	Stainless steel	M4X16L	4	M4X10L	P
Plain washer*2	Stainless steel	Small washer 4	4	Small washer 4	P

*2 Assembly accessories used with the actuator main unit.

Nominal stroke		50	100	150	200	250	300
P	EC4	4	4	4	4	6	6

Flange (EC option)

Accessories	Material	EC3/EC3R		EC4/EC4R	
		Type	Qty.	Type	Qty.
Flange	Aluminum	-	1	-	1
Hexagonal-socket-head type bolt*3	Stainless steel	M4X16L	4	M6X25L	4
Plain washer*3	Stainless steel	Small washer 4	4	Small washer 6	4

*3 Assembly accessories used with the actuator main unit.

1. Check the Products

Reference

- For any special type, check against the delivery specification documents.

1-1-3

Check the product for any damage or abnormality

After the checking, keep the product packed in the packaging box until the start of installation work.

1. Check the Products

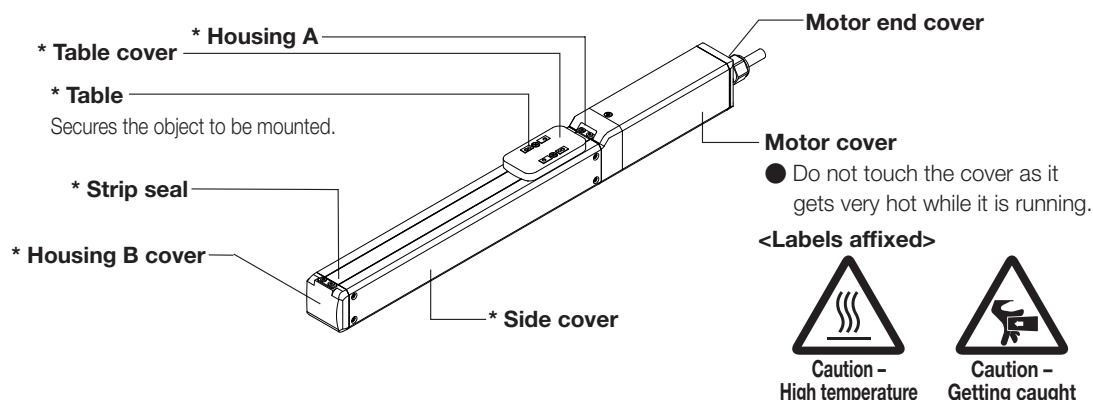
1-2

Names of individual parts and functions

1-2-1

Slider type ES

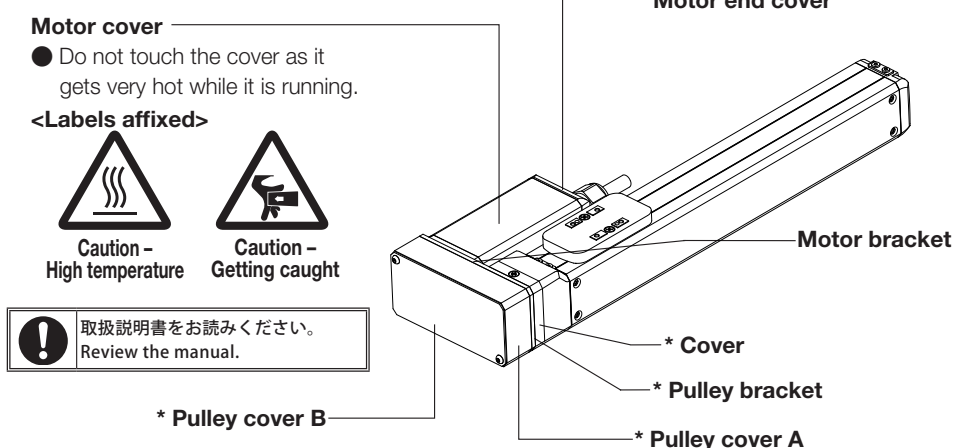
● Direct motor coupling TSC specification



The parts name with * is common to "ES motor return (TSC specification)", "ES direct motor coupling/return (TLC specification)", and "ES without motor (direct coupling/return)".

取扱説明書をお読みください。
Review the manual.

● Motor return



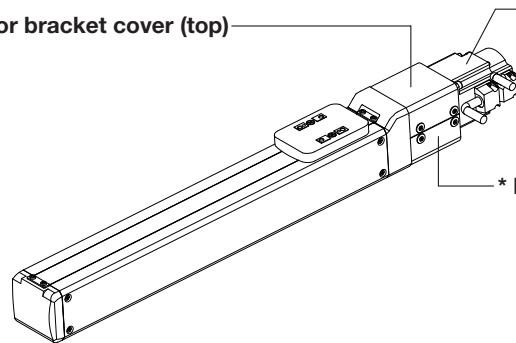
取扱説明書をお読みください。
Review the manual.

The parts name with * is common to the following ES motor return (TLC specification) and "ES without motor return specification".

1. Check the Products

● Direct motor coupling TLC specification

* Motor bracket cover (top)



Motor

- Do not touch the cover as it gets very hot while it is running.

<Labels affixed>



**Caution -
Getting caught**

The parts name with * is common to the following "ES without motor direct coupling specification".



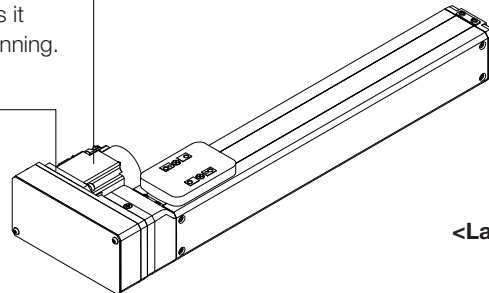
取扱説明書をお読みください。
Review the manual.

● Motor return TLC specification

Motor

- Do not touch the cover as it gets very hot while it is running.

Motor bracket



<Labels affixed>



**Caution -
Getting caught**

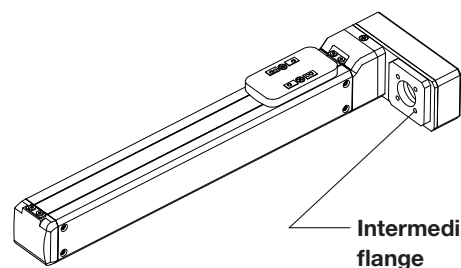
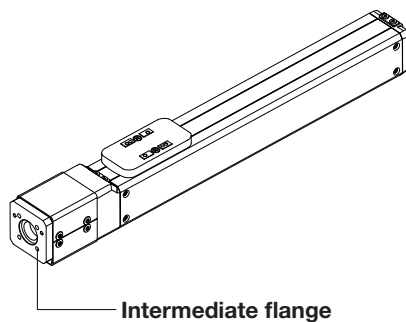


取扱説明書をお読みください。
Review the manual.

● Without motor specification (direct coupling/return type)

• Direct coupling type

• Return type



**Intermediate
flange**

<Labels affixed>



**Caution -
Getting caught**

* For ES4, 5 and 6, the motor bracket cover is same for the top and the bottom.

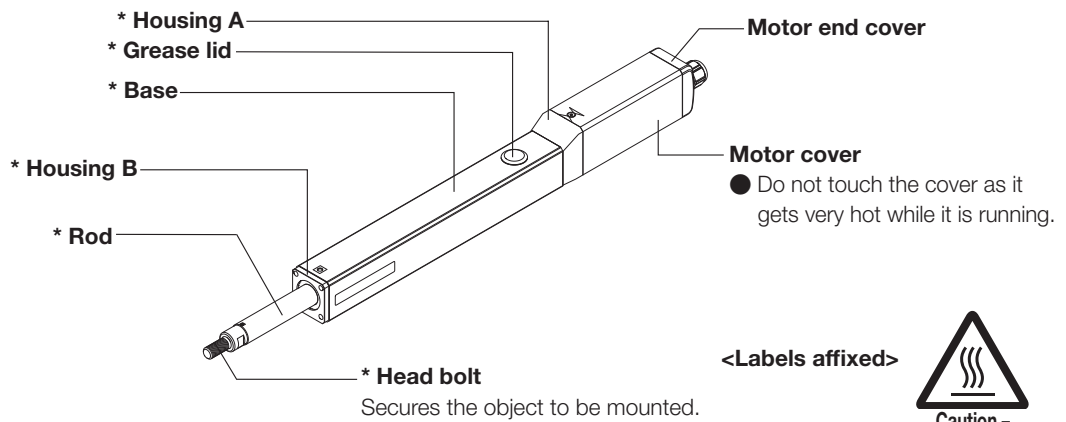


取扱説明書をお読みください。
Review the manual.

1. Check the Products

1-2-2 Cylinder type EC

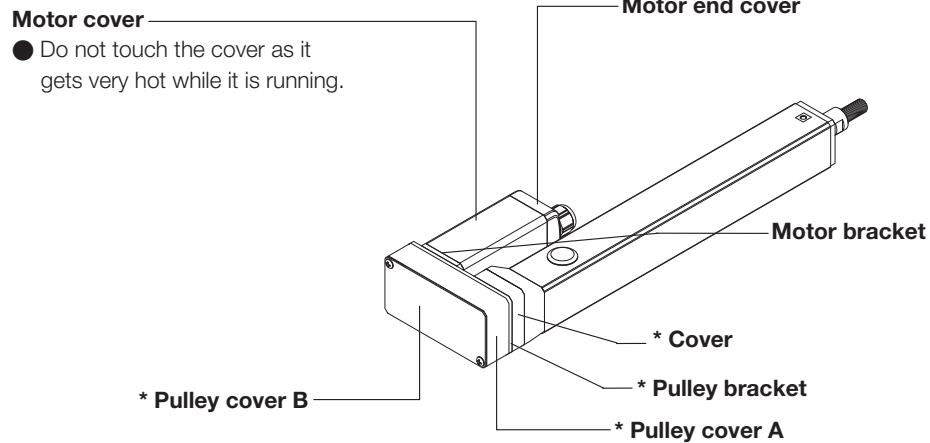
● Direct motor coupling TSC specification



The parts name with * is common to "EC motor return (TSC specification)", "EC direct motor coupling/return (TLC specification)", "EC without motor specification (direct coupling/return)", and EC with linear bush specification".

取扱説明書をお読みください。
Review the manual.

● Motor return TSC specification

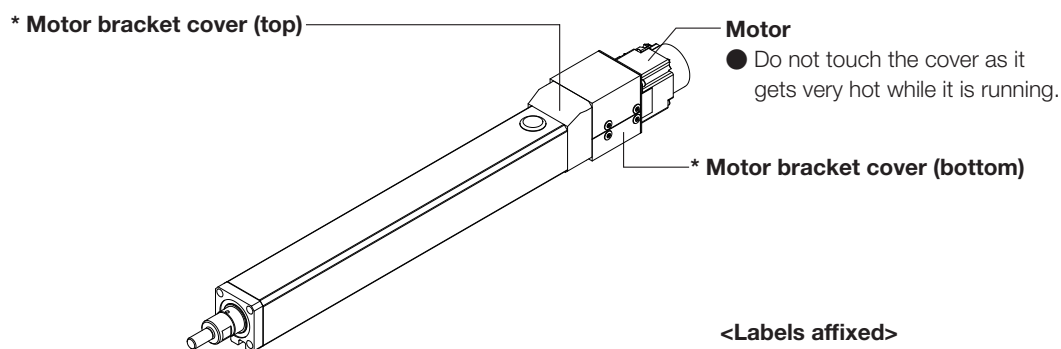


The parts name with * is common to the following "EC motor return (TLC specification)" and "EC without motor return specification".

取扱説明書をお読みください。
Review the manual.

1. Check the Products

● Direct motor coupling TLC specification

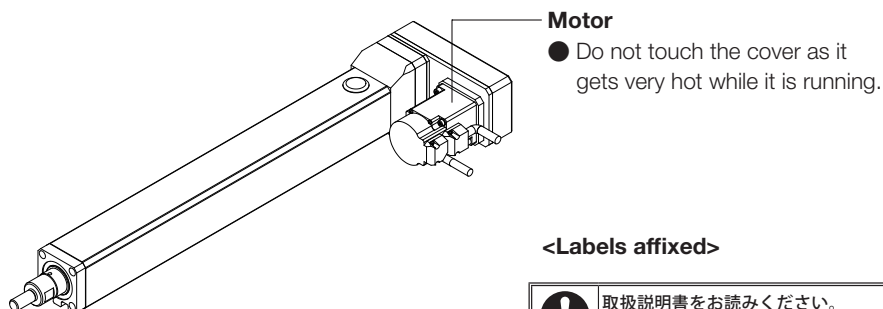


<Labels affixed>



The parts name with * is common to the following "EC with motor (return)" and "EC without motor (direct coupling/return)".

● Motor return TLC specification

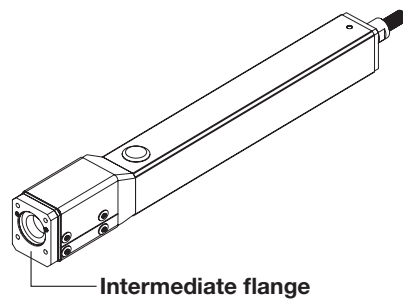


<Labels affixed>

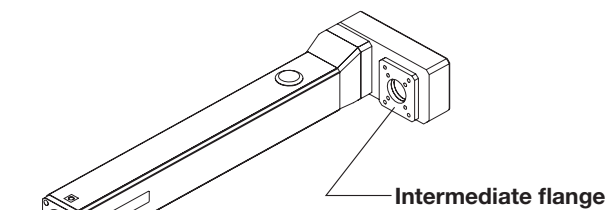


● EC without motor (direct coupling/return type)

• Direct coupling type



• Return type



<Labels affixed>



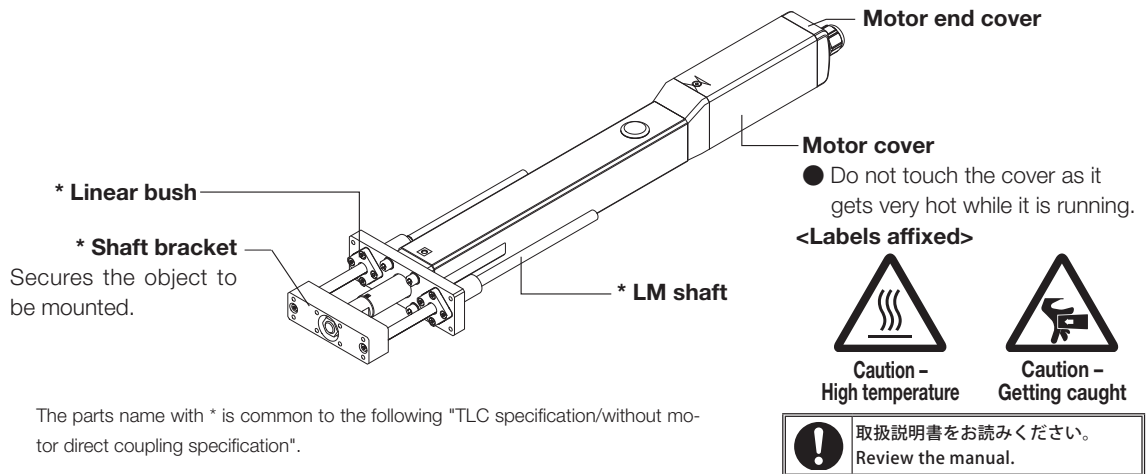
取扱説明書をお読みください。
Review the manual.

1. Check the Products

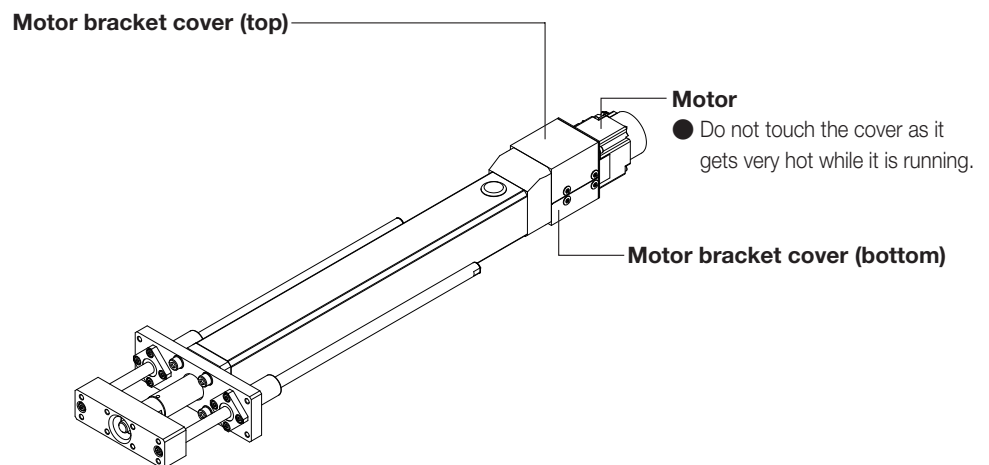
1-2-3

Cylinder type EC □ H with linear bush

● Direct motor coupling TSC specification

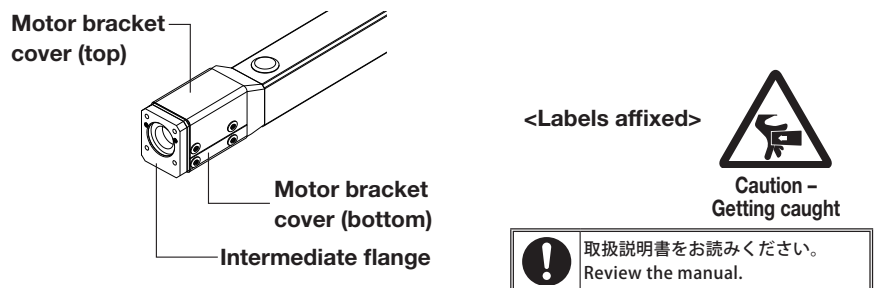


● Direct motor coupling TLC specification



The parts name with * is common to the following "TLC specification/without motor direct coupling specification".

● EC □ H without motor



1. Check the Products

1-3 Store and dispose of the products

1-3-1 For storage

If the product is not used for a while, put the product with packing materials in a packaging box for transportation and store it in the following places:

- Indoor or outdoor at the ambient temperature between -10°C and 50°C
- The ambient humidity must be 20 to 80% RH or less
- Place where no direct sunlight nor radiation heat reaches
- Place where the product is not exposed to water
- Place where no flammable substance exists in the vicinity
- Place where no strong electric field nor strong magnetic field develops
- Place where a vibration or shock does not transmit to the product
- Place where liquid containing impurities such as conductive iron dust, powder such as solid abrasive, dust, oil mist, cutting oil, water content, salt content, organic solvent, or corrosive/flammable gas is not generated or does not float

1-3-2 Restore from the long-term storage

(See → P.4-9) to check each part and take actions as needed before using the product.

1-3-3 For disposal

Disposal of the product should be consigned to a certified industrial-waste disposer.



Warning

- **Do not put the product into fire to dispose of it.**

Doing so may lead the product to burst, generate noxious gas, or cause injury due to bursting.

- **Do not dispose of the product by yourself.**

Be sure to consign disposal of the product as an industrial waste to a certified industrial-waste disposer.

2-1 Precautions on use ES

Caution



Obligatory

- **Be sure to follow the installation procedure, method, and direction described in this manual.**

Failure to do so may cause a malfunction or an alarm generation.

- **Wear gloves when handling.**

Touching the product corner by your bare hands may injure you.

- **Be careful not to have your hand or finger caught between the table and the strip seal or the moving part of the table.**

It may injure you.

- **Be careful not to cut your hand or finger by the edge of the strip seal.**

It may injure you.



Obligatory

- **Use the product within the stroke range.**

Failure to do so may cause a malfunction or an alarm generation.

- **When returning to the home position, be careful not to interfere with the surroundings because it strokes to the stopper position on the returning to home position side.**

Failure to do so may cause fault or damage.



Prohibited

- **Do not perform the positioning by pressing onto the stopper inside mech.**

Failure to do so may cause fault or damage.

(It does not include the pressing operation at returning to home position when using TSC/TLC.)

2-2

Precautions on use EC

⚠ Caution



Obligatory

- **Be sure to follow the installation procedure, method, and direction described in this manual.**

Failure to do so may cause a malfunction or an alarm generation.

- **Wear gloves when handling.**
Touching the product corner by your bare hands may injure you.
- **Be careful not to have your hand or finger caught between the housing B and the object to be mounted or the moving part of the rod.**

It may injure you.

- **Use the product within the stroke range.**
Failure to do so may cause a malfunction or an alarm generation.



Obligatory

- **When returning to the home position, be careful not to interfere with the surroundings because it strokes to the stopper position on the returning to home position side.**

Failure to do so may cause fault or damage.



Prohibited

- **Do not perform the positioning by pressing onto the stopper inside mech.**

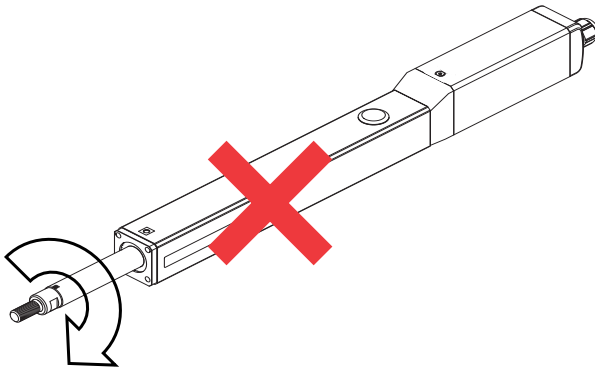
Failure to do so may cause fault or damage.

(It does not include the pressing operation at returning to home position when using TSC/TLC.)

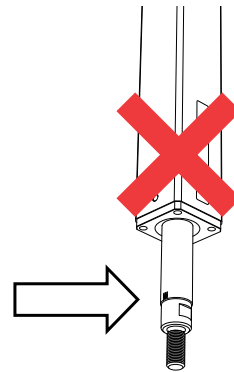
- **Do not apply loads to the rod other than in the axial direction.**

Failure to do so may cause fault or damage.

Use the LM guide together to apply loads other than in the axial direction.



- **Do not apply a moment load to the rod.**



- **Do not apply a radial load to the rod.**

3-1 Installation environment

Warning



Caution –
Flammable

- **Do not put the product into fire to dispose of it.**

Doing so may lead the product to burst, generate noxious gas, or cause injury due to bursting.

3-1-1 ES/EC installation environment

Place it on a flat metal surface that meets the following conditions:

- Indoor or outdoor at the ambient temperature between 0 and 40°C (no freezing)
- Indoor or outdoor at the ambient humidity from 20 to 80% RH or less (no condensation)
- Place where the product is not exposed to water
- Place where no flammable substance exists in the vicinity
- Place where a vibration or shock does not transmit to the product
- Place where liquid containing impurities such as conductive iron dust, powder such as solid abrasive, dust, oil mist, cutting oil, water content, salt content, organic solvent, or corrosive/flammable gas is not generated or does not float
- Place where no direct sunlight nor radiation heat reaches
- Place where no strong electric field nor strong magnetic field develops
- Place where inspections and cleanings can be easily performed

3-1-2 Water drop-, oil drop-, and dust-proof

This product does not have a water drop-, oil drop- and dust-proof structure. If the product is to be used in an environment where it is exposed to water content, oil content, powder or dust, take appropriate measures before using it.

Failure to do so may cause injury, fault or fracture.

In addition, please take note that we take no responsibility for any negative effect of using the product without appropriate measures.

3-2 Install ES

Warning



Obligatory

- **To prevent a collision accident caused by coasting of the slider, we recommend you install it on the outside so that it will hit the shock absorber before reaching to the mech stoppers.**

Failure to do so may injure you or damage the object to be mounted.



Caution -
Electrical shock

- **Before installing or moving the product with the unit energized, shut off the power supply.**

Failure to do so may cause electric shocks or malfunction that could lead to injury.



Caution -
Flammable

- **Before installing or moving the product with the unit energized, shut off the power supply.**

Failure to do so may cause electric shocks, fire or malfunction that could lead to injury.

Caution



Obligatory

- **Be sure to follow the installation procedure, method, and direction described in this manual.**

Failure to do so may cause a malfunction or an alarm generation.

- **Wear gloves when handling.**

Touching the product corner by your bare hands may injure you.



Obligatory

- **Be careful not to have your hand or finger caught between the table and the strip seal or the moving part of the table.**

It may injure you.

3. How to Install

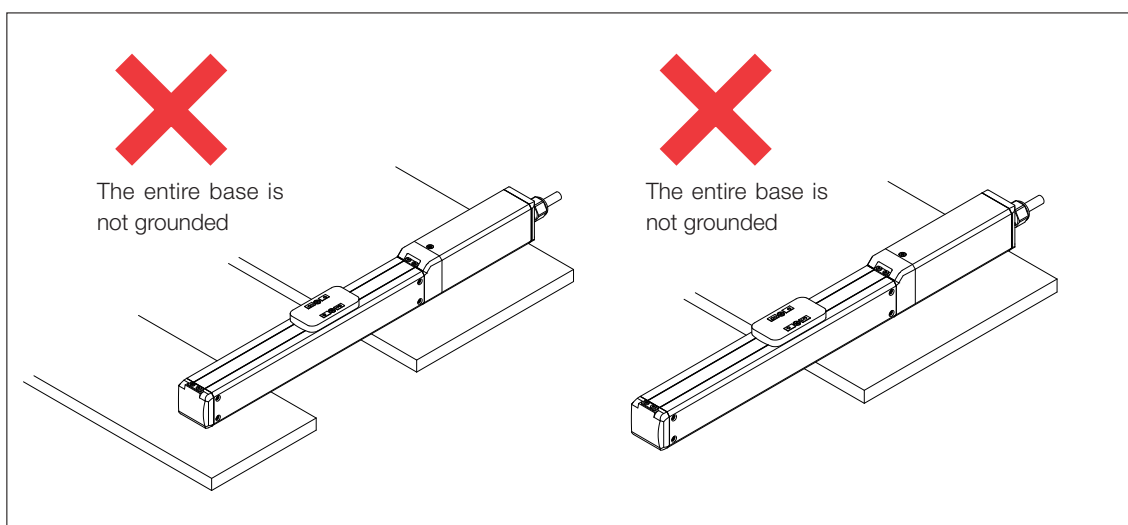
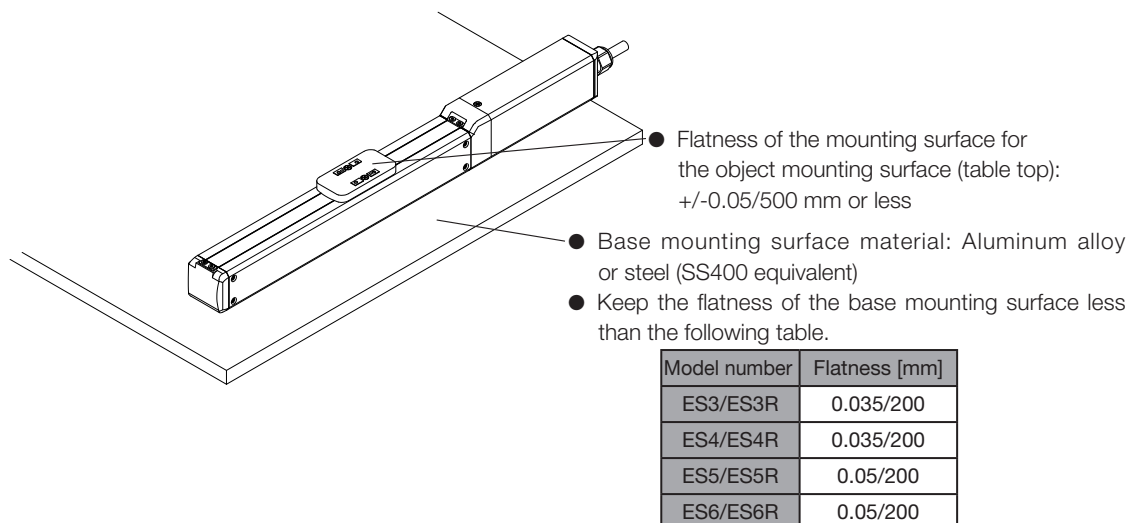
3-2-1 Stand to install ES and installation standards

Install ES on a sufficiently rigid and stable stand to prepare a space for maintenance.

Important

- If the stands are not rigid or stable enough, a vibration (resonance) occurs during the operation that makes the table operation unstable to cause a malfunction.

Stand to install and installation standards



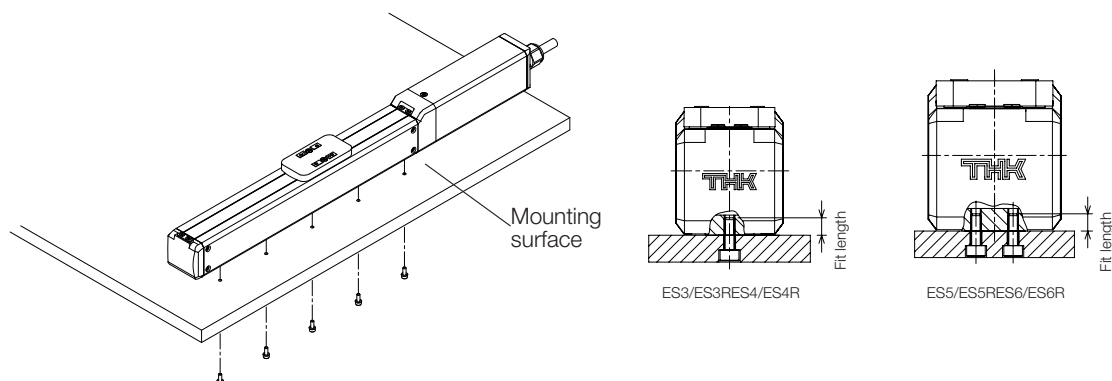
3-2-2 Tools used

Please prepare the tools on your side.

Model number	At use	Tools used
ES3/ES3R	Installation of main unit(→ P.2-21)	Hexagonal wrench
	Installation of object to be mounted(→ P.2-23)	
ES4/ES4R	Installation of main unit(→ P.2-21)	
	Installation of object to be mounted(→ P.2-23)	
ES5/ES5R	Installation of main unit(→ P.2-21)	
	Installation of object to be mounted(→ P.2-23)	
ES6/ES6R	Installation of main unit(→ P.2-21)	
	Installation of object to be mounted(→ P.2-23)	

3-2-3 Install ES

Attach ES on the mounting surface and secure it by bolts. Refer to the following table for the bolts and tightening torques to use.* Please prepare the bolts and tools to be used on your side.



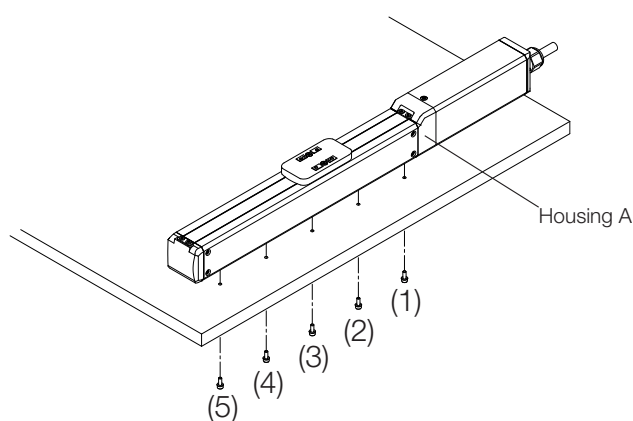
Model number			ES3/ES3R		ES4/ES4R		ES5/ES5R		ES6/ES6R	
Screw type			Hexagonal-socket-head type bolt		Hexagonal-socket-head type bolt		Hexagonal-socket-head type bolt		Hexagonal-socket-head type bolt	
Size			M3		M4		M4		M4	
Material of screw			Steel	SUS	Steel	SUS	Steel	SUS	Steel	SUS
			10.9	A2-70	10.9	A2-70	10.9	A2-70	10.9	A2-70
Fit length of screw [mm]			4		6		6		6	
Tightening torque [N · cm]	Material of mounting surface	Iron	170	100	345	230	345	230	345	230
		Aluminum	130	100	265	230	265	230	265	230

Important

- Be sure to use all the securing taps and fasten it by the designated tightening torque. If there are unused securing taps or the tightening torque is insufficient, it will cause a vibration or misalignment to prevent the product from running normally.

Supplement

- We recommend you fasten the bolts after temporarily fastening from the housing A side using the designated tightening torque.



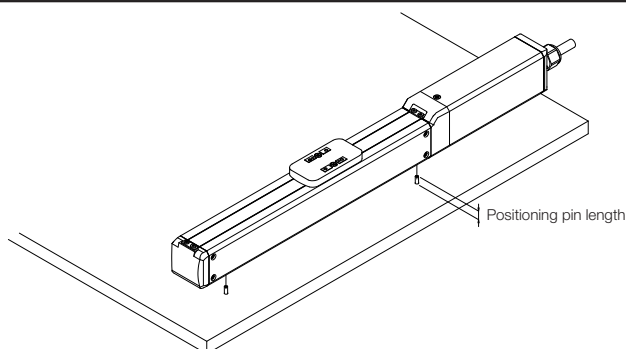
The number is in the order of assembly.

3. How to Install

2. Installation

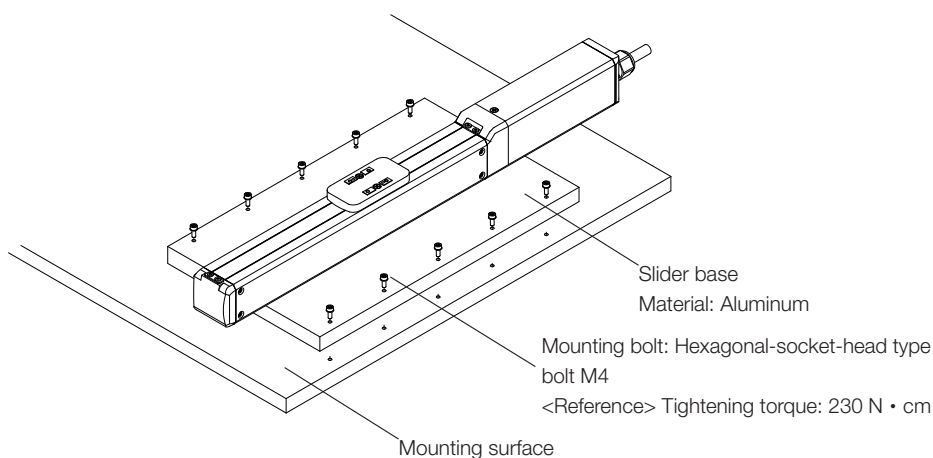
Supplement

- If you use the hole for positioning pins in securing ES on the mounting surface, assemble it so that the length of the positioning pin will not be more than the values shown in the table below.



Model number	ES3/ES3R	ES4/ES4R	ES5/ES5R	ES6/ES6R
Main unit hole depth [mm]	2	3	3	3
Positioning pin length [mm]	1.5	2.5	2.5	2.5

For the slider base (ES option) installation



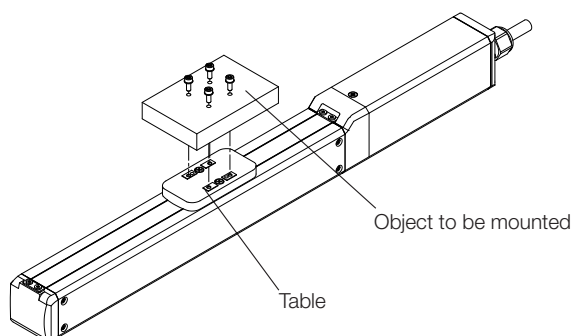
● Tightening torque to the main unit (slider base)

Model number	ES3/ES3R	ES4/ES4R	ES5/ES5R	ES6/ES6R
Screw type	Hexagonal-socket-head type bolt	Hexagonal-socket-head type bolt	Hexagonal-socket-head type bolt	Hexagonal-socket-head type bolt
Size	M3	M4	M4	M4
Material of screw	SUS (A2-70)	SUS (A2-70)	SUS (A2-70)	SUS (A2-70)
Fit length of screw [mm]	3.5	5.5	5.5	5.5
Tightening torque [N · m]	104	240	240	240

3-2-4 Mount the objects to be mounted on ES

Mount the object to be mounted on the table as shown in the figure.

* Please prepare the bolts and tools on your side.



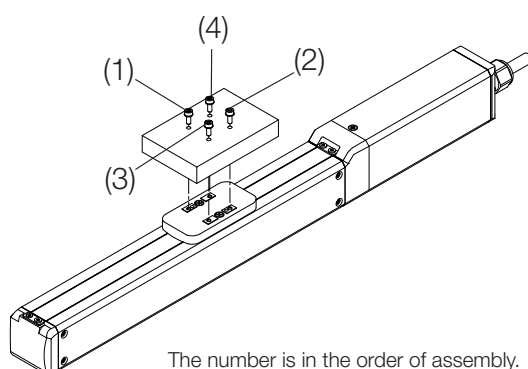
Model number			ES3/ES3R		ES4/ES4R		ES5/ES5R		ES6/ES6R	
Screw type			Hexagonal-socket-head type bolt		Hexagonal-socket-head type bolt		Hexagonal-socket-head type bolt		Hexagonal-socket-head type bolt	
Size			M3		M3		M4		M5	
Material of screw			Steel	SUS	Steel	SUS	Steel	SUS	Steel	SUS
			10.9	A2-70	10.9	A2-70	10.9	A2-70	10.9	A2-70
Fit length of screw [mm]			4.5		6		6		7.5	
Tightening torque [N・m]	Material of mounting surface	Iron	137	100	137	100	320	229	614	467
		Aluminum	131	100	131	100	266	229	474	467

Important

- Be sure to use the designated screws and all the securing taps, and securely fasten it by the designated tightening torque. If you use screws other than those specified or there are unused securing taps or the tightening torque is insufficient, it will cause a vibration or misalignment to prevent the product from running normally.

Supplement

- We recommend you fasten the bolts in the order of the opposite angle after temporarily fastening using the designated tightening torque.

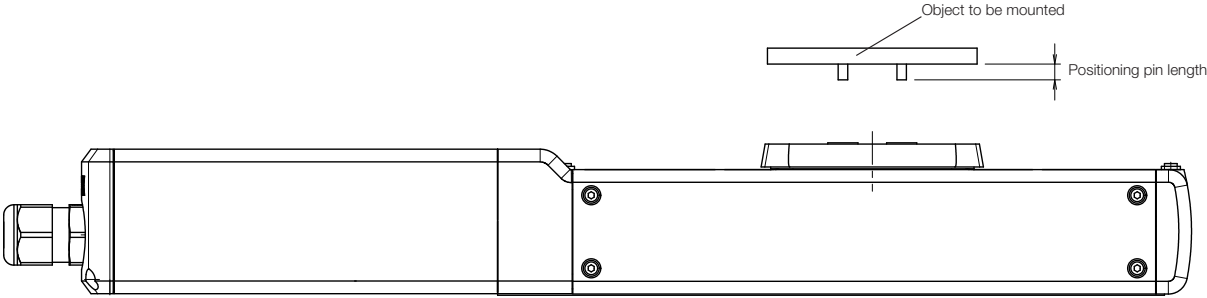


The number is in the order of assembly.

3. How to Install

Supplement

- If you use the hole for positioning pins in securing the object to be mounted, assemble it so that the length of the positioning pin will not be more than the values shown in the table below.



Model number	ES3/ES3R	ES4/ES4R	ES5/ES5R	ES6/ES6R
Main unit hole depth [mm]	5	6	5	5
Positioning pin length[mm]	4.5	5.5	4.5	4.5

3-3

Install EC

Warning



Obligatory

- **To prevent a collision accident caused by coasting of the rod, we recommend you install it on the outside so that it will hit the shock absorber before reaching to the mech stoppers.**

Failure to do so may injure you or damage the object to be mounted.



Caution -
Electrical shock

- **Before installing or moving the product with the unit energized, shut off the power supply.**

Failure to do so may cause electric shocks or malfunction that could lead to injury.



Caution -
Flammable

- **Before installing or moving the product with the unit energized, shut off the power supply.**

Failure to do so may cause electric shocks, fire or malfunction that could lead to injury.

Caution



Obligatory

- **Be sure to follow the installation procedure, method, and direction described in this manual.**

Failure to do so may cause a malfunction or an alarm generation.

- **Wear gloves when handling.**

Touching the product corner by your bare hands may injure you.



Obligatory

- **Be careful not to have your hand or finger caught between the housing B and the object to be mounted or the moving part of the rod.**

It may injure you.

3-3-1 Stand to install EC and installation standards

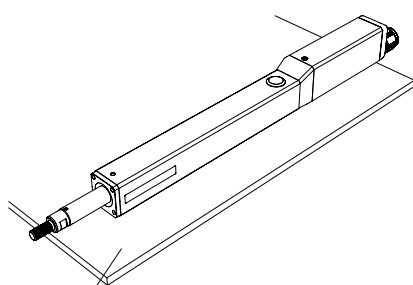
Install EC on a sufficiently rigid and stable stand to prepare a space for maintenance.

Important

- If the stands are not rigid or stable enough, a vibration (resonance) occurs during the operation that makes the rod operation unstable to cause a malfunction.

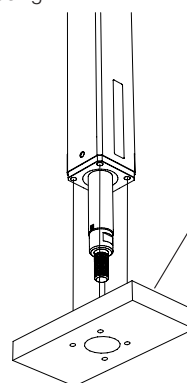
Stand to install and installation standards

Installation of main unit base



- Base mounting surface material: Aluminum alloy or steel (SS400 equivalent)
- Base mounting surface flatness: ± 0.05 mm/500 mm or less

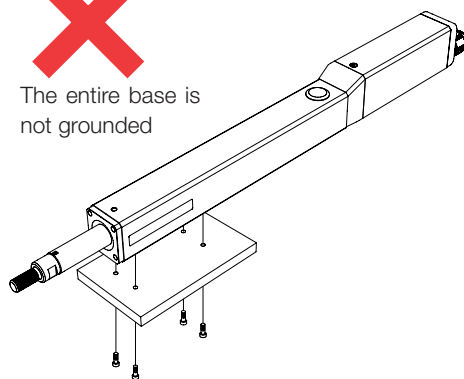
Installation of housing B



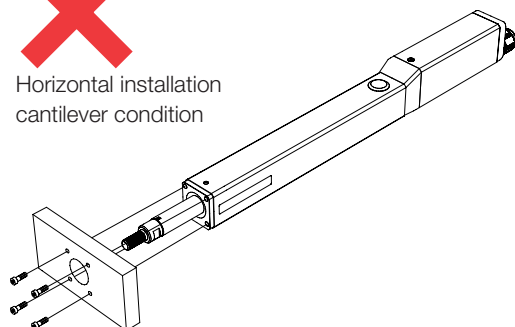
- Base mounting surface material: Aluminum alloy or steel (SS400 equivalent)
- Base mounting surface flatness: ± 0.05 mm/500 mm or less



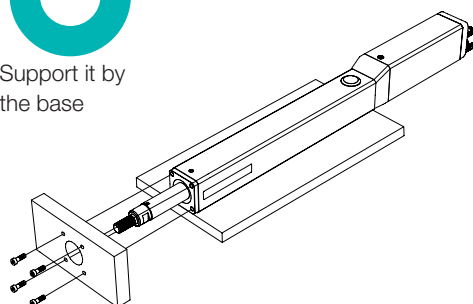
The entire base is not grounded



Horizontal installation cantilever condition



Support it by the base



* Be careful not to make a gap between the base and this product

3. How to Install

2. Installation

3-3-2

Tools used

Please prepare the tools on your side.

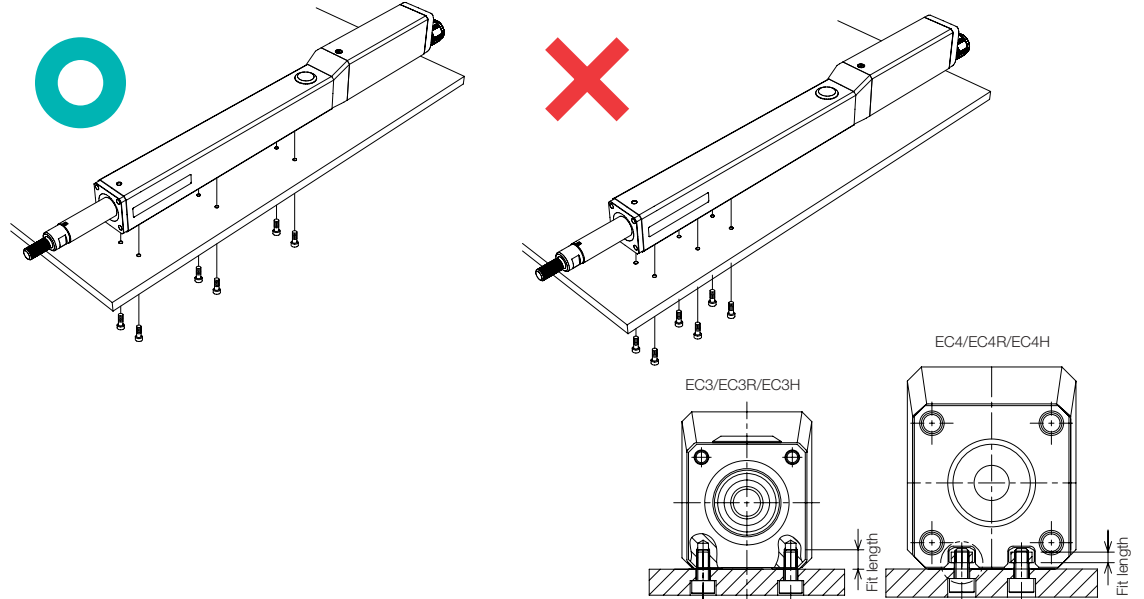
Model number	At use	Tools used	
EC3/EC3R	Installation of main unit housing B(→ P.2-28)	Opposite side distance 3 mm	Hexagonal wrench
	Installation of main unit base(→ P.2-27)		
	Installation of object to be mounted(→ P.2-31)	Opposite side distance 17 mm	Wrench
EC4/EC4R	Installation of main unit housing B(→ P.2-28)	Opposite side distance 5 mm	Hexagonal wrench
	Installation of main unit base(→ P.2-27)	Opposite side distance 3 mm	
	Installation of object to be mounted(→ P.2-31)	Opposite side distance 17 mm	Wrench
EC3H	Installation of main unit bracket(→ P.2-28)	Opposite side distance 3 mm	Hexagonal wrench
	Installation of main unit base(→ P.2-27)		
	Installation of object to be mounted(→ P.2-31)		
EC4H	Installation of main unit bracket(→ P.2-28)	Opposite side distance 4 mm	Hexagonal wrench
	Installation of main unit base(→ P.2-27)	Opposite side distance 3 mm	
	Installation of object to be mounted(→ P.2-31)	Opposite side distance 4 mm	

3-3-3

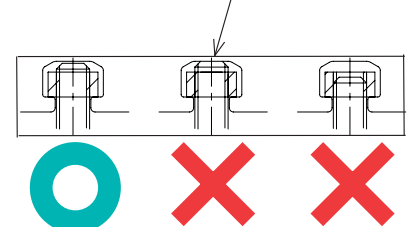
Install EC

Attach EC on the mounting surface and secure it by bolts. Refer to the following table for the bolts and tightening torques to use.* Please prepare the bolts and tools to be used on your side.

For installation of main unit base



Model number		EC3/EC3R/EC3H		EC4/EC4R/EC4H	
Screw type		Hexagonal-socket-head type bolt		Hexagonal-socket-head type bolt	
Size		M3		M4	
Material of screw		Steel	SUS	Steel	SUS
		10.9	A2-70	10.9	A2-70
Fit length of screw [mm]		4		*	
Tightening torque [N · cm]	Material of mounting surface	Iron		206	206
		Aluminum		161	161



* All the screw parts of square nuts that come with the product are fitting

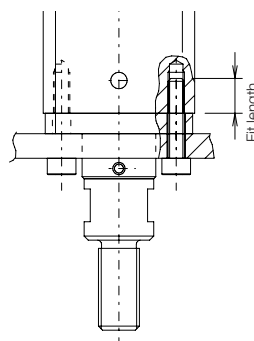
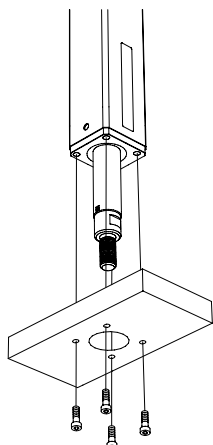
Important

- Be sure to use the designated screws and all the securing taps, and securely fasten it by the designated tightening torque. If you use screws other than those specified or there are unused securing taps or the tightening torque is insufficient, it will cause a vibration or misalignment to prevent the product from running normally.

3. How to Install

2. Installation

For installation of housing B

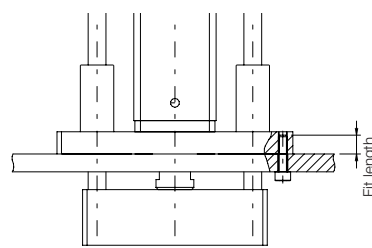
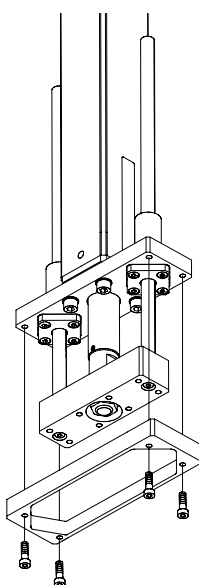


Model number			EC3/EC3R		EC4/EC4R	
Screw type			Hexagonal-socket-head type bolt		Hexagonal-socket-head type bolt	
Size			M4		M6	
Material of screw			Steel	SUS	Steel	SUS
			10.9	A2-70	10.9	A2-70
Fit length of screw [mm]			6		9	
Tightening torque [N・cm]	Material of mounting surface	Iron	320	230	950	780
		Aluminum	265	230	696	696

Important

- Be sure to use the designated screws and all the securing taps, and securely fasten it by the designated tightening torque. If you use screws other than those specified or there are unused securing taps or the tightening torque is insufficient, it will cause a vibration or misalignment to prevent the product from running normally.

For installation of EC □ H bracket



Model number			EC3H		EC4H	
Screw type			Hexagonal-socket-head type bolt		Hexagonal-socket-head type bolt	
Size			M4		M5	
Material of screw			Steel	SUS	Steel	SUS
			10.9	A2-70	10.9	A2-70
Fit length of screw [mm]			6		7.5	
Tightening torque [N・cm]	Material of mounting surface	Iron	320	230	614	457
		Aluminum	265	230	474	457

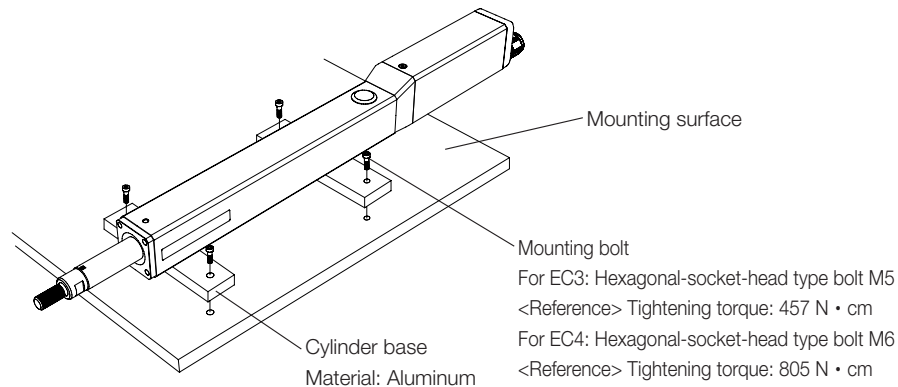
Important

- Be sure to use the designated screws and all the securing taps, and securely fasten it by the designated tightening torque. If you use screws other than those specified or there are unused securing taps or the tightening torque is insufficient, it will cause a vibration or misalignment to prevent the product from running normally.

3. How to Install

2. Installation

For installation of cylinder base (EC option)



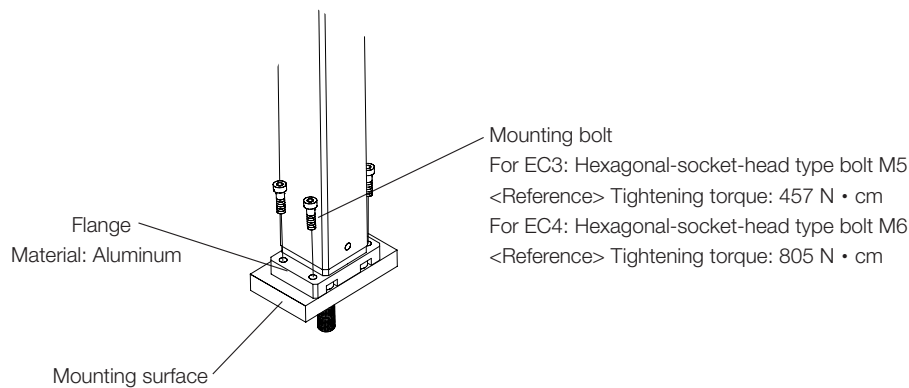
● Tightening torque to the main unit (cylinder base)

Model number	EC3/EC3R/EC3H	EC4/EC4R/EC4H
Screw type	Hexagonal-socket-head type bolt	Hexagonal-socket-head type bolt
Size	M4	M4
Material of screw	SUS (A2-70)	SUS (A2-70)
Fit length of screw [mm]	6.5	*
Tightening torque [N · cm]	240	170

Important

- Be sure to use the designated screws and all the securing holes, and securely fasten it by the designated tightening torque. If you use screws other than those specified or there are unused securing holes or the tightening torque is insufficient, it will cause a vibration or misalignment to prevent the product from running normally.

For installation of flange (EC option)



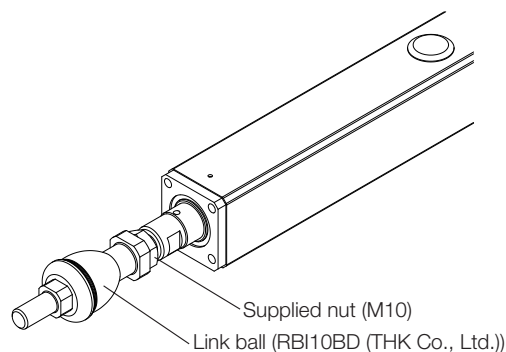
● Tightening torque to the main unit (flange)

Model number	EC3/EC3R	EC4/EC4R/EC4H
Screw type	Hexagonal-socket-head type bolt	Hexagonal-socket-head type bolt
Size	M4	M6
Material of screw	SUS (A2-70)	SUS (A2-70)
Fit length of screw [mm]	5.5	7.7
Tightening torque [N · cm]	240	805

Important

- Be sure to use the designated screws and all the securing holes, and securely fasten it by the designated tightening torque. If you use screws other than those specified or there are unused securing holes or the tightening torque is insufficient, it will cause a vibration or misalignment to prevent the product from running normally.

For installation of link ball (EC option)



● Tightening torque to the main unit (link ball)

Model number	EC3/EC3R	EC4/EC4R
Link ball (THK Co., Ltd.)	RBI10BD	RBI10BD
Size	M10	M10
Material of screw	SS400	SS400
Fit length of screw [mm]	13	13
Tightening torque [N · cm]	1960	1960

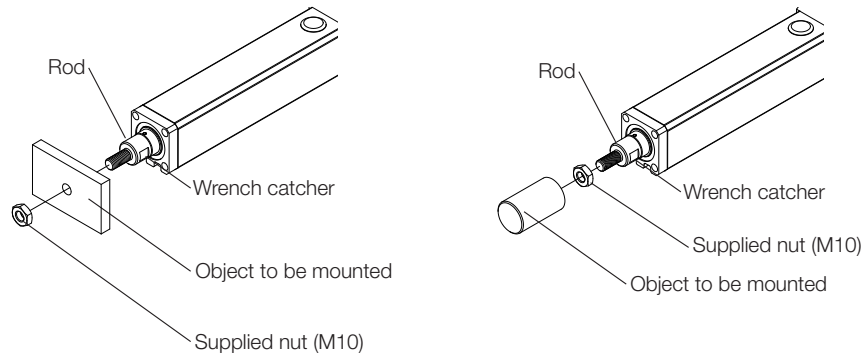
Important

- Be sure to use the designated screws and all the securing holes, and securely fasten it by the designated tightening torque. If you use screws other than those specified or there are unused securing holes or the tightening torque is insufficient, it will cause a vibration or misalignment to prevent the product from running normally.

3-3-4 Mount the objects to be mounted on EC

Mount the object to be mounted using the supplied nut (M10) as shown in the figure.

* Please prepare the tools on your side.

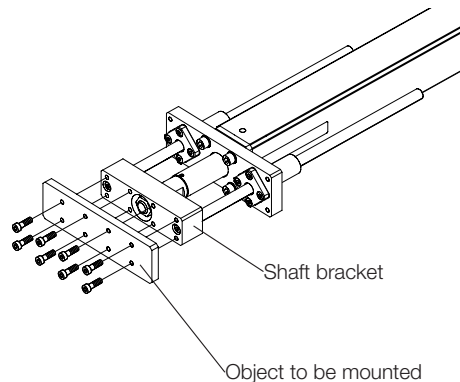


Model number		EC3/EC3R	EC4/EC4R
Size of the supplied nut		M10	M10
Fit length of screw		All the screw parts of the supplied nut are fitting	
Tightening torque [N · cm]	Material of mounting surface	2107	2107
	SS400		

Important

- No load other than the axial direction can be applied to the rod for EC. Thus, when you mount the object, apply a wrench to fix the width across flat of the rod before mounting the supplied nut (M10).

- For installation of object to EC □ H



Model number			EC3H		EC4H	
Screw type			Hexagonal-socket-head type bolt		Hexagonal-socket-head type bolt	
Size			M4		M5	
Material of screw			Steel	SUS	Steel	SUS
			10.9	A2-70	10.9	A2-70
Fit length of screw [mm]			6		7.5	
Tightening torque [N・cm]	Material of mounting surface	Iron	320	230	614	457
		Aluminum	265	230	474	457

Important

- Be sure to use the designated screws and securely fasten it by the designated tightening torque. If you use screws other than those specified or the tightening torque is insufficient, it will cause a vibration or misalignment to prevent the product from running normally.

3. Wiring

About this chapter

This chapter describes the procedures of the connection and wiring for the actuator and peripherals, and handling of the cable.



Connect to peripherals to operate the actuator.

1. How to Wire	3-2
1-1. Entire wiring	3-3
1-2. Connect actuator cable	3-4

1. How to Wire

Warning



Do not
disassemble

- **Do not extend or shorten the provided cables.**

Doing so may cause malfunctions or impair the performance.



Caution -
Electrical shock

- **Do not change the wiring or remove/insert the cables and connectors while the devices are energized.**

Doing so may cause abnormal operation, fault and electric shocks.

- **Do not damage, tuck, place a heavy object on or apply excessive stress on the cable.**

Doing so may cause electric shocks.

- **Do not touch the energized parts within TSC or TLC.**

Doing so may cause electric shocks.

- **The wiring works must be performed by electric work experts.**

Failure to do so may cause electric shocks.



Caution -
Flammable

- **Be careful to wire for the power connectors properly.**

Otherwise, fault, fire, or injury may result.



Obligatory

- **Perform wiring as described in this manual.**

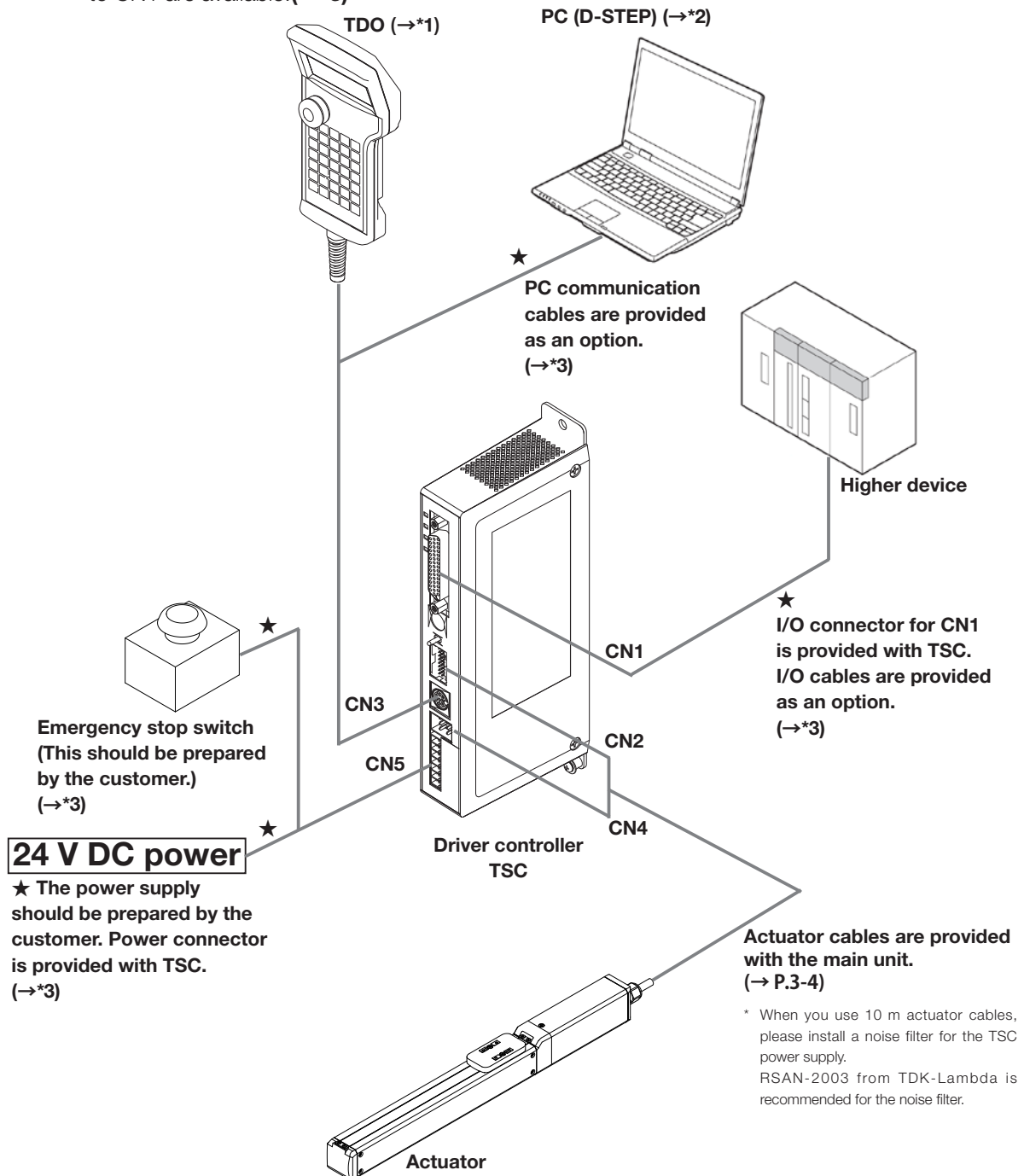
Otherwise, you may be injured due to malfunction.

1. How to Wire

1-1 Entire wiring

See the wiring example below. (The diagram below shows the specification of a combination with the driver controller TSC.)

- The cable that connects to the CN1, CN3, and CN5 connectors with ★ mark is not provided, please prepare it separately. (→P.3-4)
- The optional cable (CBL-COM-03) to connect to CN3 PC and optional I/O cable (CBL-TSC-IO) to CN1 are available. (→*3)



*1: See the separate TDO Instruction Manual.

*2: See the separate D-STEP Instruction Manual.

*3: See the separate TSC Instruction Manual.

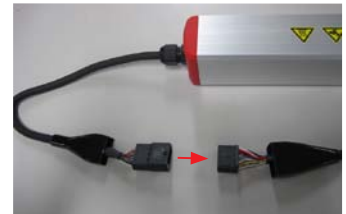
1. How to Wire

1-2 Connect actuator cable

1-2-1 Connect to actuator (for driver controller TSC)

1. Check that the power of TSC is not turned ON.

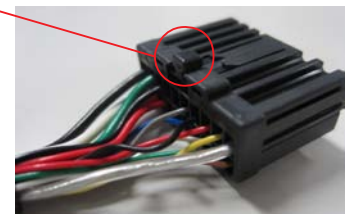
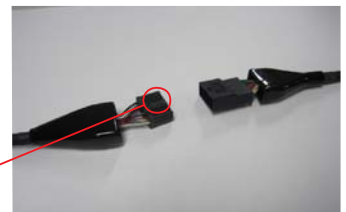
2. Connect the actuator cable to the connector of the actuator.



3. Insert the connector until you hear a click sound. When removing, release the lock in the convex part and pull it out holding the connector.

(1) Actuator cable for TSC
Model: CBL-TSC-AC-**-B (standard)
** represents the cable length
(03: 3 m, 05: 5 m, 10: 10 m).

Convex
part

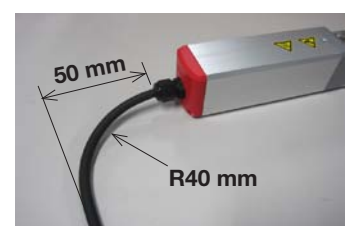


4. Engage the connector cover firmly to prevent dust or other foreign material from entering.

Connector
cover



5. For routing actuator cables, secure sufficient length and bending radius as shown in the picture on the right.



Important

- Ensure that there are no bending or breakages in the connector pins, or damage to the cable before connecting. Connections in such conditions may cause a malfunction of actuator.
- Do not handle the actuator by holding the cables, nor move it by pulling.
- Be aware of the following points when wiring:
 - (1) Minimum bending radius: R40 mm
 - (2) Do not conduct wiring with tension applied.
 - (3) Avoid wiring together with inflexible materials such as an air hose.
 - (4) Avoid wiring together with materials having dissimilar outer diameters.
 - (5) When connecting to the actuator, secure space sufficient to provide 50 mm or more distance from the mounting part.

1. How to Wire

1-2-2 Connect to actuator (for driver controller TLC)

1. Check that the power of TLC is not turned ON.

2. Connect the actuator cable to the connector of the actuator.

(1) Motor brake cable for TLC
Model: CBL-TLC-ACP-**F (For secured)
: CBL-TLC-ACP-**R (High flex)

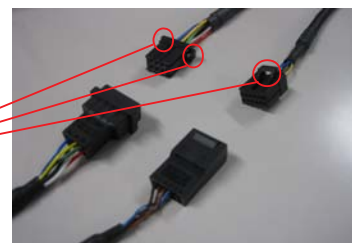
(2) Encoder cable for TLC
Model: CBL-TLC-ACS-**F (For secured)
: CBL-TLC-ACS-**R (High flex)

** represents the cable length (03: 3 m, 05: 5 m, 10: 10 m).

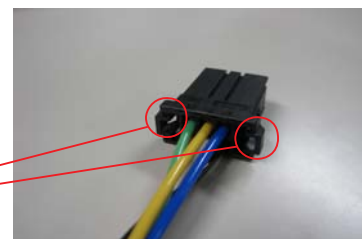


3. Insert the connector until you hear a click sound. When removing, release the lock in the convex part and pull it out holding the connector.

Convex part

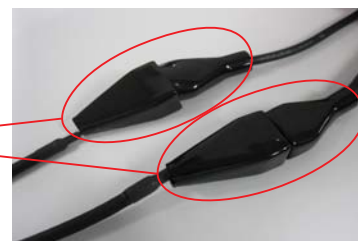


* Convex part (enlarged)



4. Engage the connector cover firmly to prevent dust or other foreign material from entering.

Connector cover



Important

- Ensure that there are no bending or breakages in the connector pins, or damage to the cable before connecting. Connections in such conditions may cause a malfunction of actuator.
- Do not handle the actuator by holding the cables, nor move it by pulling.
- Be aware of the following points when wiring:
 - (1) Do not conduct wiring with tension applied.
 - (2) Avoid wiring together with inflexible materials such as an air hose.
 - (3) Avoid wiring together with materials having dissimilar outer diameters.

4. Maintenance and Warranty

About this chapter

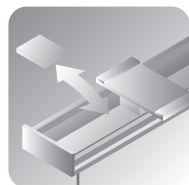
This chapter describes the maintenance, repair and replacement procedures along with the warranty of this product.



Perform correct maintenance works regularly as it could minimize the incidence of troubles.

1. Maintenance and Inspection... 4-2

- 1-1. Daily inspection 4-2
- 1-2. Periodical inspection 4-3
- 1-3. How to grease up..... 4-4
- 1-4. Check points when restoring from
the long-term suspension 4-10



This section describes the parts that can be replaced by the customer and the replacement procedures.

2. Repair/Replacement 4-11

- 2-1. How to replace the strip seal 4-11
- 2-2. How to replace the timing belt..... 4-13



This chapter describes the warranty of this product.

3. Product Warranty 4-15

- 3-1. Free warranty period 4-15
- 3-2. Usage conditions (range) 4-15
- 3-3. Warranty scope 4-15
- 3-4. Exclusion of warranty liability 4-16
- 3-5. Delivery conditions 4-16

1. Maintenance and Inspection

Warning



Obligatory

- Before conducting maintenance and inspection works, be sure to stop the machine and shut off the power supply. Take security measures like locking, etc. to ensure any unauthorized person cannot turn the power ON.

Otherwise, injury caused by unexpected behavior may occur.

1-1 Daily inspection

1-1-1 Daily inspection of ES

- Visually inspect the actuator main unit and cable for any exterior damages or stains*.
- Make sure there is no abnormal sound or vibration while it is running. If any abnormal noise or vibration occurs, immediately stop the machine and inspect the product condition. Check whether there is insufficient lubrication or loosening of a mounting bolt that can cause abnormal noise or vibration.

* Depending on the operating condition of the actuator, stains may accumulate around the stop position in the top surface of the strip seal. If that happens, wipe it off using a clean waste cloth soaked with alcohol-based detergent.

1-1-2 Daily inspection of EC

- Visually inspect the actuator main unit and cable for any exterior damages or stains.
- Make sure there is no abnormal sound or vibration while it is running. If any abnormal noise or vibration occurs, immediately stop the machine and inspect the product condition. Check whether there is insufficient lubrication or loosening of a mounting bolt that can cause abnormal noise or vibration.

1. Maintenance and Inspection

1-2 Periodical inspection

1-2-1 Periodical inspection of ES

Perform the following inspection works once every 3 to 6 months.

If you operate the product continuously day and night or frequently, shorten the inspection interval in accordance with your situation.

- **Inspect whether each mounting bolt has loosened, and if any of them has loosened, retighten it.**
- **Check the ball screw and LM guide for "any looseness" and "vibration during operation".**
- **Supply grease to the ball screw and LM guide.**
- **Check for any looseness of the connector.**
- **For the motor return specification, check the timing belt condition (i.e. wear, scratch, crack, noise). If you find any abnormal symptoms (i.e. wear, scratch, crack, noise) of the belt, replace the timing belt.**

* Basically, this is the long-term maintenance-free product not requiring greasing, but depending on your operating conditions and service environment, greasing may be needed. We recommend you setup a greasing interval at the initial inspection. In addition, if you use the product exceeding 5000 km travel distance, replenish grease approximately every six months or 100 km travel distance, whichever comes first.

1-2-2 Periodic inspection of EC

Perform the following inspection works once every 3 to 6 months.

If you operate the product continuously day and night or frequently, shorten the inspection interval in accordance with your situation.

- **Inspect whether each mounting bolt has loosened, and if any of them has loosened, retighten it.**
- **Check the ball screw for "any looseness" and "vibration during operation".**
- **Supply grease to the ball screw and rod.**
- **Check for any looseness of the connector.**
- **For the motor return specification, check the timing belt condition (i.e. wear, scratch, crack, noise). If you find any abnormal symptoms (i.e. wear, scratch, crack, noise) of the belt, replace the timing belt.**

* Basically, this is the long-term maintenance-free product not requiring greasing, but depending on your operating conditions and service environment, greasing may be needed. We recommend you setup a greasing interval at the initial inspection. In addition, if you use the product exceeding 5000 km travel distance, replenish grease approximately every six months or 100 km travel distance, whichever comes first.

1. Maintenance and Inspection

⚠ Caution



Caution

- **When handling grease, wear protective glasses and protective gloves to prevent grease from getting into your eyes or adhering to your skin.**

Failure to do so may cause inflammation.

If grease gets into your eyes, immediately wash them with clean water for 15 minutes and visit the doctor.

If grease adheres to your skin, immediately wash them with water and soap completely.



Prohibited

- **Do not expose grease to a flame, spark or high-temperature object.**

Doing so may ignite the grease, which could cause fire.

1-3

How to grease up

► Grease for ES/EC

The LM guide and ball screw of this product are filled with the dedicated grease for higher performance.

Make sure to use the dedicated grease (THK AFF grease) when you grease up.

In this case, use the THK AFB-LF grease only for the linear bush area of EC3H and EC4H.

The grease is available from us, so please place an order when you need it.

Do not mix different types of grease. Doing so may affect the performance.

1-3-1

How to grease up ES

⚠ Caution



Caution

- **The strip seal is a thin plate, so be careful not to get hurt by the edges.**
- **When you restore the side cover, be careful not to damage the strip seal.**

Doing so may cause a malfunction.

► How to grease up

1. Turn the power off.

2. Remove the side cover on one side.

Screw used: Thin head FH
(ES3,4=M2.6 ES5/,6=M3)

Tool used: Hexagonal wrench (opposite side distance 1.5 mm)



1. Maintenance and Inspection

3. Supply grease to the LM guide from the lubrication hole.

- * Wipe off the old grease or stains using a clean waste cloth. Please use the grease gun MG70 (P type attachment). You can spread the grease in every corner while moving the table.
- * If the stroke range is 100 mm or less, the lubrication will not be spread to all the balls of the LM guide part, so please supply the grease from the end plate lubrication hole on the both sides. Please use the grease gun MG70 (P type or L type attachment).

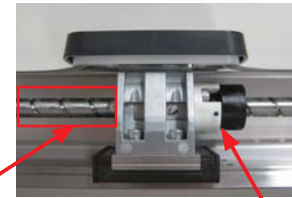


LM guide (lubrication hole)

Model number	ES3	ES4	ES5, 6
Amount of AFF grease [cm ³]	0.2	0.2	0.4

4. To supply grease to the ball screw, directly apply it to the ball screw shaft (groove).

- * Wipe off the old grease or stains using a clean waste cloth. You can spread the grease in every corner by applying the grease to the overall length of the ball screw shaft while moving the table.
- * The lubrication device QZ allows you to spread the grease in every corner when you apply it from the reverse motor side (the opposite side of QZ).

Ball screw shaft
(directly apply to the screw groove)

* Lubrication device QZ

Model number	Ball screw lead	Amount of AFF grease [cm ³]
ES3	6 mm	0.1+0.002x Stroke
ES4	6 mm	0.2+0.002x Stroke
	12 mm	0.2+0.003x Stroke
ES5, 6	6 mm	0.2+0.002x Stroke
	12 mm	0.2+0.003x Stroke

5. Wipe off grease leaking or accumulating in the corner.

6. Restore the side cover you have removed.

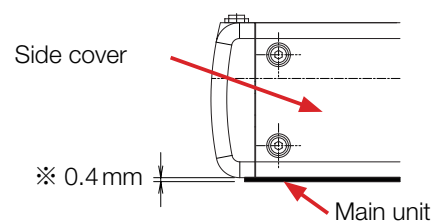
- * Secure the reverse motor side using items such as a SIM plate, and adjust the height between the main unit bottom and the side cover bottom.

All ES: 0.4 mm

Tightening torque:

M2.6 (ES3, 4) = 30 N · cm

M3 (ES5, 6) = 47 N · cm



1. Maintenance and Inspection

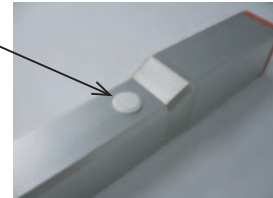
1-3-2 How to grease up EC

► How to grease up the ball screw

1. Turn the power off.

2. Remove the grease lid.

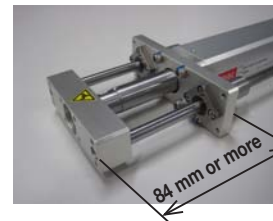
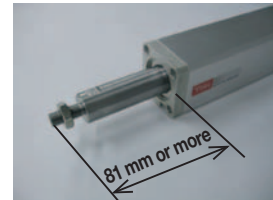
Grease lid



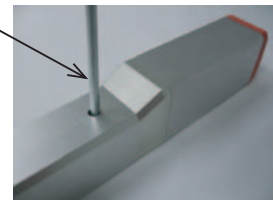
3. Insert the tip of the grease gun to the ball screw lubrication hole and apply grease to the shaft directly while lightly pressing the grease gun to the ball screw shaft.

* After moving the rod to the position where greasing is possible (81 mm or longer), apply grease using the THK grease gun MG70 (P type attachment).

For EC□H (with linear bush), supply grease by moving it by 84 mm or more.



Grease gun

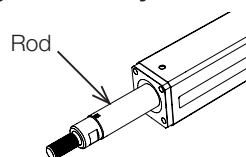


Model number	Ball screw lead	Amount of AFF grease [cm ³]
EC3	6 mm	0.1+0.002x Stroke
EC4	6 mm	0.2+0.002x Stroke
	12 mm	0.2+0.003x Stroke

4. Restore the grease lid.

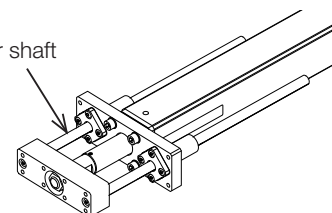
► How to grease up the rod/linear bush

1. Extend the rod/LM shaft and directly apply and spread grease evenly on the entire shaft.



Amount of AFF grease: 0.7 cm³

Linear shaft



Amount of AFB-LF grease : ** cm³ (per linear shaft)

EC3H : 0.07cm³

EC4H : 0.2cm³

1. Maintenance and Inspection

1-3-3 Grease/Grease gun

► Grease

This product is filled with the dedicated grease for higher performance.
The grease is available from us, so please place an order when you need it.
Do not mix different types of grease. Doing so may affect the performance.

Model number	Location
THK AFF grease	LM guide/ball screw shaft
THK AFB-LF grease	Linear bush

• THK original grease AFF grease

The grease made of high-class synthetic oil, lithium-based consistency enhancer and special additives has a stable rolling resistance value, low dust generation, and excellent fretting resistance unlike the existing vacuum grease or low-dust grease.

• Characteristics

- (1) The lower viscous resistance realizes the superior follow-up performance at low speed.
- (2) Excellent low dust generation.
- (3) Excellent abrasion resistance against slight vibration.

• Representative properties

Items	Representative property values	Test method
Consistency enhancer	Lithium-based grease	
Base oil	High-class synthetic oil	
Base oil kinetic viscosity: mm ² /s (40°C)	100	JIS K 2220 23
Worked penetration (25°C, 60 W)	315	JIS K 2220 7
Mixing stability (100,000 W)	345	JIS K 2220 15
Dropping point: °C	220	JIS K 2220 8
Evaporation: mass% (99°C, 22 h)	0.7	JIS K 2220 10
Oil separation rate: mass% (100°C, 24 h)	2.6	JIS K 2220 11
Copper plate corrosion (B method, 100°C, 24 h)	Accepted	JIS K 2220 9
Low temperature torque: mN·m (-20°C)	Startup	220
	Rotation	30
4-ball test (fusion load): N	1236	ASTM D2596
Operating temperature range: °C	-40 to 120	
Appearance color	Brownish-red	



Appearances of the grease tube and product box

1. Maintenance and Inspection

• THK original grease AFB-LF grease

It is universal grease using a lithium-based consistency enhancer with refined mineral oil as the base oil.

• Characteristics

- (1) Excellent abrasion resistance and extreme pressure resistance.
- (2) Not easily softens and excels in mechanical stability.
- (3) Insusceptible to influences of water.

• Representative properties

Items	Representative property values	Test method
Consistency enhancer	Lithium-based grease	
Base oil	Refined mineral oil	
Base oil kinetic viscosity: mm ² /s (40°C)	170	JIS K 2220 23
Worked penetration (25°C, 60 W)	275	JIS K 2220 7
Mixing stability (100,000 W)	345	JIS K 2220 15
Dropping point: °C	193	JIS K 2220 8
Evaporation: mass% (99°C, 22 h)	0.4	JIS K 2220 10
Oil separation rate: mass% (100°C, 24 h)	0.6	JIS K 2220 11
Copper plate corrosion (B method, 100°C, 24 h)	Accepted	JIS K 2220 9
Low temperature torque: mN·m (-20°C)	Startup	130
	Rotation	51
4-ball test (fusion load): N	3089	ASTM D2596
Operating temperature range: °C	-15 to 100	
Appearance color	Brownish yellow	



Appearances of the grease tube and product box

1. Maintenance and Inspection

► Grease gun unit MG70



The grease gun unit MG70 is capable of supplying grease for this product by replacing the dedicated nozzle. The grease gun has a slit window that allows you to visually check the remaining amount of grease.

Since grease is contained in a 70 g bellows cartridge, you can replace the nozzle without soiling your hand.

Specifications of the grease gun

Discharge pressure	20 MPa max
Discharge rate	0.6 cm ³ /Stroke
Grease	70 g bellows cartridge
Overall length	235 mm (excluding nozzle)
Weight	480 g (with nozzle, excluding grease)

1. Maintenance and Inspection

1-4

Check points when restoring from the long-term suspension

When you use this product after storing it for a long period, wipe off stains, if any, using a clean waste cloth and apply grease to the LM guide and ball screw. In addition, check the following points and take necessary actions.

Products	Check points	Check details	Actions
ES	LM guide	No rust	<ul style="list-style-type: none"> • If you find any rust, we recommend you replace the main unit. • If you have applied anti-rust oil, wipe it off completely. • Make sure to grease up. (→ P.4-4)
	Ball screw	No rust	<ul style="list-style-type: none"> • If you find any rust, we recommend you replace the main unit. • If you have applied anti-rust oil, wipe it off completely. • Make sure to grease up. (→ P.4-4)
EC	Rod Head bolt	No rust	<ul style="list-style-type: none"> • If you find any rust, we recommend you replace the main unit. • If you have applied anti-rust oil, wipe it off completely. • Make sure to grease up. (→ P.4-6)
EC □ H	Rod Head bolt Linear bush LM shaft	No rust	<ul style="list-style-type: none"> • If you find any rust, we recommend you replace the main unit. • If you have applied anti-rust oil, wipe it off completely. • Make sure to grease up. (→ P.4-6)

2. Repair/Replacement

Caution



Caution

- The strip seal is a thin plate, so be careful not to get hurt by the edges.
- When you restore the side cover, be careful not to damage the strip seal.
Doing so may cause a malfunction.

2-1

How to replace the strip seal

1. Turn the power off.

2. Remove the table cover.

- **Screw used** : M3 flat head screw
- **Tool used** : Phillips screwdriver (No.2)

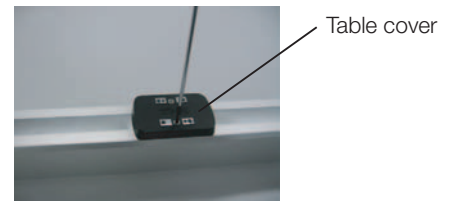
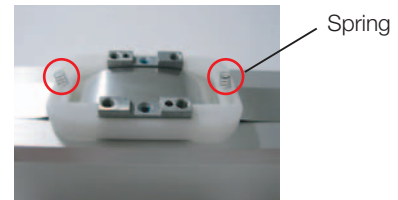


Table cover

3. Remove the springs (2 pcs).

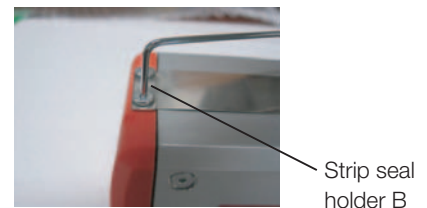
* Be careful not to lose the springs.



Spring

4. Remove the strip seal holder B.

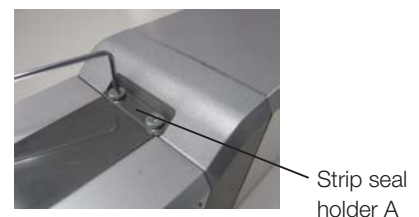
- **Screw used** : Thin head FH
ES3, 4 = M2.6 ES5, 6 = M3
- **Tool used** : Hexagonal wrench
(opposite side distance 1.5 mm)



Strip seal holder B

5. Remove the strip seal holder A.

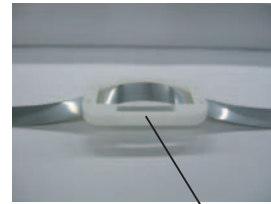
- **Screw used** : Thin head FH
ES3, 4 = M2.6 ES5, 6 = M3
- **Tool used** : Hexagonal wrench
(opposite side distance 1.5 mm)



Strip seal holder A

2. Repair/Replacement

6. Remove the strip seal from the strip seal guide and replace it.



Strip seal guide

7. Place the strip seal guide on the table.

- * Adjust the table and strip seal so that they will not touch each other in the entire area of stroke, then attach the strip seal holder.

Note that a magnet seal is attached to the side cover. (See the photo in the red frame) Adjust the magnet seal so that it will not stick out from the strip seal.

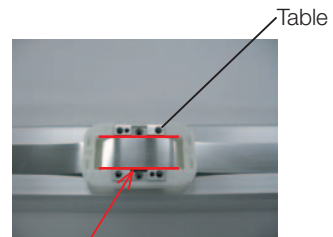


Magnet seal

● Tightening torque (strip seal holder)

M2.6 (ES3, 4) = 30 N · cm

M3 (ES5, 6) = 47 N · cm



Adjust the strip seal and table so that they will not touch each other.

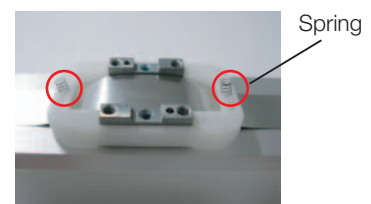


Strip seal holder



Strip seal holder

8. Mount the springs (2 pcs).



Spring

9. Mount the table cover.

- * If the strip seal is lifted, adjust it by loosening the strip seal holder.

● Tightening torque: 47 N · cm

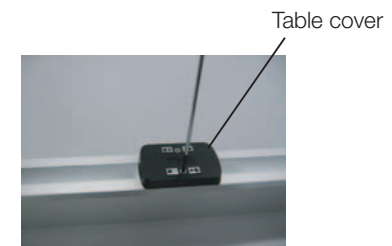


Table cover

2. Repair/Replacement

Caution



Obligatory

- **When using the product in the vertical direction, secure the moving part and replace the timing belt.**
The moving part may fall, resulting in damage or injury.
- **The zero point moves after replacing the timing belt. Be sure to adjust it by re-teaching before using the product.**
The moving part may get in the way, resulting in damage or injury.

2-2

How to replace the timing belt

- The pictures shown are those of ES5R as the representative example.

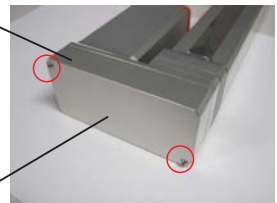
1. Turn the power off.

2. Remove the pulley cover A/B.

- **Screw used** : Hexagonal-socket-head type button bolt (M3X25L)
- **Tool used** : Hexagonal wrench
(opposite side distance 2 mm)

Pulley cover A

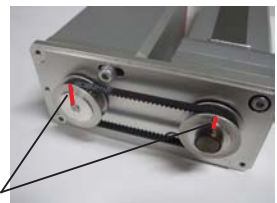
Pulley cover B



3. Place a mark on the timing pulley.

- * Place a mark on each timing pulley as shown in the right picture. (You will perform this to avoid a major deviation of the zero point at a re-assembly. It does not mean that re-teaching will not be necessary.)

Marking



4. Loosen the timing belt.

- * Loosen the bolt and slide it to the arrow direction.
- **Screw used** : Hexagonal-socket-head type bolt
ES3R, 4R = M3 ES5R, 6R = M4
EC3R = M3 EC4R = M4
- **Tool used** : M3: Hexagonal wrench (opposite side distance 2.5 mm)
M4: Hexagonal wrench (opposite side distance 3 mm)

Loosen
the bolt

5. Replace the timing belt.

- * The timing belt to replace is shown in the table below:

Actuator model		ES3R	ES4R	ES5R	ES6R	EC3R	EC4R
Belt manufacturer		Gates Unitt Asia Company					
TSC specifications	Belt model	144-2GT-4	174-2GT-4	200-2GT-4	204-2GT-4	174-2GT-4	200-2GT-4
TLC specifications, without motor type	Belt model	144-2GT-9	174-2GT-9	200-2GT-9	204-2GT-9	174-2GT-9	200-2GT-9

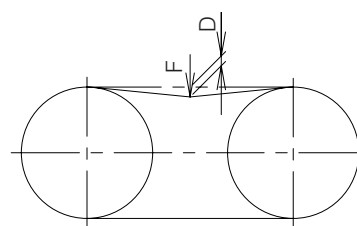
2. Repair/Replacement

6. Adjust the tension of the timing belt.

- * Align the marking position and pull it toward the arrow direction to adjust the tension. Adjust the belt tension to meet the values as shown in the table below using the sonic tensimeter U-507 by Gates Unitta Asia Company.

The table also shows the pressing force and amount of impression for your reference, but we recommend you adjust them by the tensimeter.

Model number		ES3R	ES4R	ES5R	ES6R	EC3R	EC4R
TSC specifications	Installation tension [N]	7 to 12					
	Pressing force F [N]	0.5 to 0.7					
	Amount of impression D [mm]	0.7	0.8	1	1	0.8	1
TLC specifications Without motor type	Installation tension [N]	18 to 23					
	Pressing force F [N]	1.2 to 1.4					
	Amount of impression D [mm]	0.7	0.8	1	1	0.8	1



7. Fasten the bolt.

- * Fasten the bolt by the designated tightening torque. Please measure it by the tensimeter once again after fastening the bolt.

- **Tightening torque:**

$$M3(ES3R,4R) = 110 \text{ N} \cdot \text{cm} \quad M4(ES5R,6R) = 229 \text{ N} \cdot \text{cm}$$

$$M3(EC3R) = 110 \text{ N} \cdot \text{cm} \quad M4(EC4R) = 229 \text{ N} \cdot \text{cm}$$

Fasten
the bolt



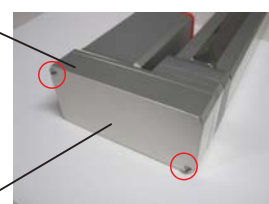
8. Mount the pulley cover A/B.

- * Fasten the bolt by the designated tightening torque.

- **Tightening torque:** 48 N · cm

Pulley cover A

Pulley cover B



3. Product Warranty

Described in this section are the details of the warranty applicable to the product you purchased.

3-1 Free warranty period

The warranty period shall be 12 months from the product delivery date or 18 months from the date of shipping (based on the manufacture date), whichever is earlier.

If the free warranty period has been expired at the time of receiving notice of any defect, repair works will be charged.

3-2 Usage conditions (range)

The normal usage conditions (range) specified in our catalogs and/or instruction manuals shall apply.

3-3 Warranty scope

3-3-1 Failure diagnosis

Please inform THK of the trouble description, content, and model and serial number indicated on the product label. Then we will perform the initial diagnosis of the product failure.

When we recognize that the failure occurred within the free warranty period set forth above and the responsibility of the cause rests on us, the warranty is applied without charge. Otherwise any repair or replacement will be charged.

The final judgment of the warranty qualification is determined when we check the product in our site.

Location of the product label: **1-1 Checking the package contents of ES/EC (→P.2-2)**

3-3-2 Consumables and spare parts

- Cables, strip seals, a strip seal guide, and timing belt are the consumables.

3. Product Warranty

3-3-3

Repair

We will perform free repair works or replacement for any failure occurred within the free warranty period set forth above.

However, it is our discretion whether we provide repair or replacement.

Free warranty is not applicable even within the warranty period for any of the following cases:

- Failure arising out of improper storage or handling by the customer, or software and/or hardware installed by the customer.
- Failure arising out of any alteration of our products by the customer.
- Failure arising out of any use of our products out of the usage conditions set forth in section 3-2 of this manual.
- Failure arising out of any use of the product without taking appropriate water-, oil-, and dust-proof measures.
- Lack of maintenance works specified in our instruction manual.
- Wearing caused by usage conditions.
- Wearing of consumables including cables, strip seals, a strip seal guide, and timing belt, etc.
- Failure arising out of any convulsion of nature, such as earthquake, lightning, flood and wind damage.
- Failure arising out of any factor that is not recognized as our responsibility.
 - * In case of any free repair work within the free warranty period, the warranty period of the pertinent product shall still be the period set forth in section 3-1, not the period originating from the time of free repair work.
 - * In case of any paid repair work, the warranty period of the repaired section shall be six months from the repair work regardless of the warranty period of the product itself.
 - * Repair works are performed in our plant. Whether free or paid repair work, cost of returning the product to our site shall be customer's responsibility.
 - * The cost of delivering the repaired or replacing product to customer's site is our responsibility in case of free warranty, or included in the repair charge in case of a paid repair service. However, the destination must be in Japan.

3-3-4

Repair period

The warranty period of actuator ES/EC shall be seven years from the date of purchase or five years from the product discontinuation date, whichever comes first.

3-4

Exclusion of warranty liability

- Regardless of whether it is within the free warranty period or not, any damage to the equipment other than our products and opportunity loss incurred by the customer due to the failure of the products are not covered by the warranty.
- We hold no responsibility for removal of the product for repair work, reinstallation after repair work, and other costs caused thereby.
- We hold no responsibility for any damage arising out of any use of the product without taking appropriate water-, oil-, and dust-proof measures.

3-5

Delivery conditions

Delivery products will be shipped by mixed cargo and passed on the car.

Unpacking, transportation, installation, on-site adjustment and commissioning after delivery are not our responsibility.

5. Technical Materials

About this chapter

This chapter summarizes the technical information including specifications and dimensional diagrams of this product. When using this product, refer to this chapter for any details you want to know.



This section describes how to mount the motor.

1. How to Mount the Motor..... 5-2

1-1. ES/EC (direct coupling specification) ... 5-2

1-2. ES/EC (return specification) 5-4



This section describes cables.

2. Cables 5-7

2-1. Connection cable..... 5-7

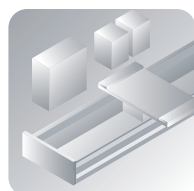


This section describes necessary materials for selection.

3. Materials Required for Selecting the Motor..... 5-8

3-1. ES..... 5-8

3-2. EC..... 5-9



This section describes the actuator combinations.

4. Actuator Combination List... 5-10

4-1. Combination list 5-10

1. How to Mount the Motor

1-1 ES/EC (direct coupling specification)

1-1-1 (Example) How to mount the servo motor onto ES/EC (direct coupling specification)

- The example below is the case of mounting SFC-020DA2 by Miki Pulley Co., Ltd. and TS4602 (50 W) by Tamagawa Seiki Co., Ltd. onto ES.

1. Check that the motor is powered off.

2. Remove the motor bracket cover (top).

- **Screw used:** Thin head screw
 - ES3, ES4 (M2.6X5L, 4 locations)
 - ES5, ES6, EC3, EC3H, EC4, EC4H (M3X6L, 4 locations)
- **Tool used :** Hexagonal wrench
(opposite side distance 1.5 mm)
- **Tightening torque :** 30 N · cm (M2.6)
47 N · cm (M3)

Motor bracket cover (top)

Thin head screw



3. Prepare the coupling and motor.

<Reference>

- **Coupling** : SFC-020DA2-6B-8B
(Miki Pulley Co., LTD.)
- **Servo motor**: TS4602 (Tamagawa Seiki Co., Ltd.)

Motor bracket cover (top)

Coupling

Servo motor (50 W)



4. Mount the coupling to the actuator.

Fasten temporarily



Align the coupling end face and the motor bracket face indicated by the arrow

5. Mount the motor.

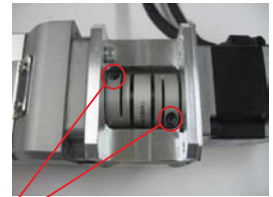
- **Screw used** : Hexagonal-socket-head type bolt
(M4X12L, 2 locations)
- **Tool used** : Hexagonal wrench (opposite side distance 3 mm)
- **Tightening torque** : 200 N · cm



Fasten the bolt

6. Retighten the coupling.

- **Screw used** : Hexagonal-socket-head type bolt
(M2.5, 2 locations)
- **Tool used** : Hexagonal wrench (opposite side distance 2 mm)
- **Tightening torque** : 110 N · cm



Fasten the bolt

7. Mount the motor bracket cover (top).

- **Screw used**: Thin head screw
 - ES3, ES4 (M2.6X5L, 4 locations)
 - ES5, ES6, EC3, EC3H, EC4, EC4H (M3X6L, 4 locations)
- **Tool used** : Hexagonal wrench
(opposite side distance 1.5 mm)
- **Tightening torque** : 30 N · cm (M2.6)
47 N · cm (M3)

Motor bracket
cover (top)



Thin head screw
(M3X6L)

1-2 ES/EC (return specification)

1-2-1 (Example) How to mount the servo motor onto ES/EC (return specification)

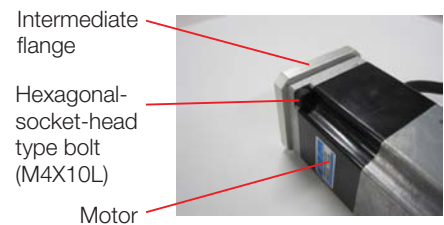
- The example below is the case of mounting TS4602 (50 W) by Tamagawa Seiki Co., Ltd. onto EC (return).
- * Please use the D cut type for the motor output shaft.

1. Check that the motor is powered off.

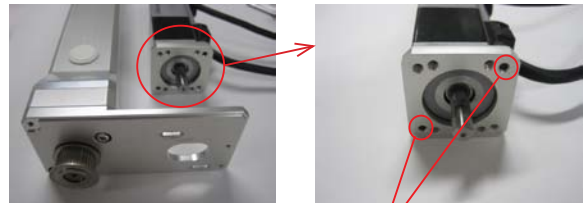
2. Mount the intermediate flange to the motor.

When you mount the motor, be careful with the direction of installing the intermediate flange. Check that the mounting bolt is not sticking out from the intermediate flange.

- **Screw used** : Hexagonal-socket-head type bolt (M4X10L)
- **Tool used** : Hexagonal wrench (opposite side distance 3 mm)
- **Tightening torque** : 110 N · cm



(Note) Installation direction of the intermediate flange



Check that the mounting bolt is not sticking out from the intermediate flange

3. Temporarily fasten the intermediate flange to the pulley bracket.

Bring it closer to the actuator main unit side and temporarily fasten it.

- **Screw used** : Hexagonal-socket-head type bolt
ES3R/ES4R/EC3R (M3X8L, plain washer)
ES5R/ES6R/EC4R (M4X10L, plain washer)
- **Tool used** : Hexagonal wrench
ES3R/ES4R/EC3R
(opposite side distance 2.5 mm)
ES5R/ES6R/EC4R
(opposite side distance 3 mm)

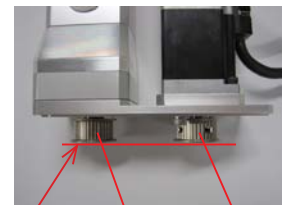
Pulley bracket



4. Mount the pulley to the motor.

Align the end face of pulley A and B and mount the pulley A. At this time, be sure to fit the hexagon socket set screw to the D cut face of the motor shaft.

- **Screw used** : Hexagon socket set screw
(M3X3L, cup point)
- **Tool used** : Hexagonal wrench
(opposite side distance 1.5 mm)
- **Tightening torque**: 50 N · cm



Align the end face Pulley B Pulley A



Fit the hexagon socket set screw and the D cut face of the motor shaft

5. Mount the timing belt.

* The timing belts supported are as shown in the below table.

Actuator model	ES3R	ES4R	ES5R	ES6R	EC3R	EC4R
Belt manufacturer	Gates Unittta Asia Company					
Belt model	144-2GT-9	174-2GT-9	200-2GT-9	204-2GT-9	174-2GT-9	200-2GT-9

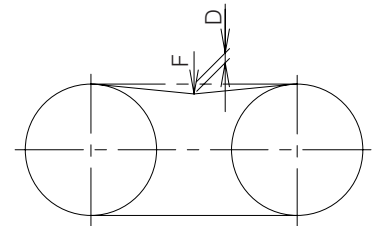
6. Adjust the tension of the timing belt.

- * Pull it toward the arrow direction to adjust the tension.

Adjust the belt tension to meet the values as shown in the table below using the sonic tensimeter U-507 by Gates Unitta Asia Company.

The table also shows the pressing force and amount of impression for your reference, but we recommend you adjust them by the tensimeter.

Model number	ES3R	ES4R	ES5R	ES6R	EC3R	EC4R
Installation tension [N]	18 to 23					
Pressing force F [N]	1.2 to 1.4					
Amount of impression D [mm]	0.7	0.8	1	1	0.8	1



7. Fasten the bolt.

- * Fasten the bolt by the designated tightening torque.
Please measure it by the tensimeter once again after fastening the bolt.

For ES3R/ES4R/EC3R

- **Screw used** : Hexagonal-socket-head type bolt (M3X8L, plain washer, 2 locations)
- **Tool used** : Hexagonal wrench (opposite side distance 2.5 mm)
- **Tightening torque**: 110 N · cm



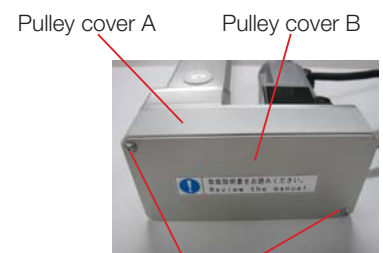
Fasten the bolt

For ES5R/ES6R/EC4R

- **Screw used** : Hexagonal-socket-head type bolt (M4X10L, plain washer, 2 locations)
- **Tool used** : Hexagonal wrench (opposite side distance 3 mm)
- **Tightening torque**: 270 N · cm

8. Mount the pulley cover A/B.

- * Fasten the bolt by the designated tightening torque.
- **Screw used** : Hexagonal-socket-head type button bolt (M3X25L, 2 locations)
- **Tool used** : Hexagonal wrench (opposite side distance 2 mm)
- **Tightening torque**: 48 N · cm



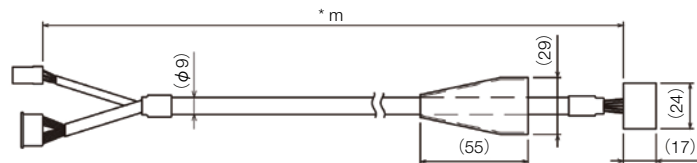
Fasten the bolt

2-1 Connection cable

2-1-1 Actuator cable for TSC

Actuator cable for TSC: CBL-TSC-AC-**-B (Standard)

** indicates cable length (03: 3 m, 05: 5 m, 10: 10 m).

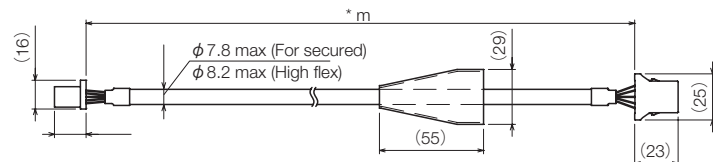


2-1-2 Motor brake cable for TLC

Motor brake cable for TLC: CBL-TLC-ACP-**F (For secured)

CBL-TLC-ACP-**R (High flex)

** indicates cable length (03: 3 m, 05: 5 m, 10: 10 m).

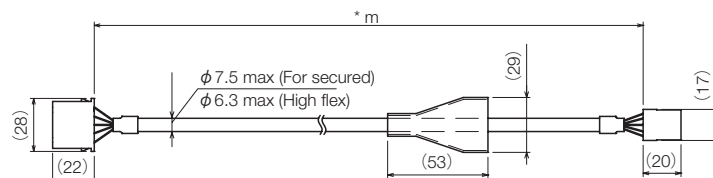


2-1-3 Encoder sensor cable for TLC

Encoder sensor cable for TLC: CBL-TLC-ACS-**F (For secured)

CBL-TLC-ACS-**R (High flex)

** indicates cable length (03: 3 m, 05: 5 m, 10: 10 m).



3. Materials Required for Selecting the Motor

3-1

ES

Refer to the below table when you select a motor to install onto ES.

Please contact each motor manufacturer for selection of a motor and the motor specifications.

Actuator		Ball screw			
Model number	Stroke ^{*1} [mm]	Lead [mm]	Shaft diameter [mm]	Shaft length [mm]	Shaft end outer diameter [mm]
ES3	50	6	φ 6	182	φ 6h7
	300			432	
ES4	50	6	φ 8	191	φ 6h7
	400			541	
	50	12	φ 8	191	φ 6h7
	400			541	
ES5	50	6	φ 8	191	φ 6h7
	500			641	
	50	12	φ 8	191	φ 6h7
	500			641	
ES6	50	6	φ 8	198	φ 6h7
	600			748	
	50	12	φ 8	198	φ 6h7
	600			748	

*1 For details on the strokes, see the dimension chart of the attached catalog.

Recommended couplings		
Model number	Models	Inertia moment [kg·cm ²]
ES3	SFC-005DA2 (Miki Pulley Co., LTD.)	0.0036
	XBW-15C2 (Nabeya Bi-tech Kaisha)	0.0022
ES4	SFC-010DA2 (Miki Pulley Co., LTD.)	0.0079
	XBW-19C2 (Nabeya Bi-tech Kaisha)	0.0067
ES5	SFC-020DA2 (Miki Pulley Co., LTD.)	0.034
	XBW-25C2 (Nabeya Bi-tech Kaisha)	0.023
ES6	SFC-020DA2 (Miki Pulley Co., LTD.)	0.034
	XBW-25C2 (Nabeya Bi-tech Kaisha)	0.023

Model number	Moving part weight [kg]	Sliding friction [N]
ES3	0.17	3
ES4	0.18	4.8
ES5	0.23	6.5
ES6	0.34	6.6

Timing pulley (2 pcs total)	
Model number	Direct motor coupling [kg·cm ²]
ES3	0.0060
ES4	0.0202
ES5	0.0182
ES6	0.0182

Permissible input torque		
Model number	Direct motor coupling [N·m]	Motor return [N·m]
ES3	0.065	0.065
ES4	0.16	0.16
ES5	0.35	0.35
ES6	0.35	0.35

3. Materials Required for Selecting the Motor

3-2

EC

Refer to the below table when you select a motor to install onto EC.

Please contact each motor manufacturer for selection of a motor and the motor specifications.

Actuator		Ball screw			
Model number	Stroke ^{*1} [mm]	Lead [mm]	Shaft diameter [mm]	Shaft length [mm]	Shaft end outer diameter [mm]
EC3	50	6	φ 6	159	φ 6h7
	200			309	
EC4	50	6	φ 8	175	φ 6h7
	300			425	
	50	12	φ 8	175	φ 6h7
	300			425	

*1 For details on the strokes, see the dimension chart.

Recommended couplings		
Model number	Models	Inertia moment [kg·cm ²]
EC3	SFC-010DA2 (Miki Pulley Co., LTD.)	0.0079
	XBW-19C2 (Nabeya Bi-tech Kaisha)	0.0067
EC4	SFC-020DA2 (Miki Pulley Co., LTD.)	0.034
	XBW-25C2 (Nabeya Bi-tech Kaisha)	0.023

Model number	Moving part weight [kg]						Sliding friction [N]
Stroke [mm]	50	100	150	200	250	300	
EC3 ^{*1}	0.53	0.63	0.73	0.83	-	-	7.5
EC4 ^{*1}	0.86	1.02	1.17	1.33	1.48	1.63	10

*1 It is the value with linear bush.

Timing pulley (2 pcs total)	
Model number	Direct motor coupling [kg·cm ²]
EC3	0.0195
EC4	0.0182

Permissible input torque		
Model number	Direct motor coupling [N·m]	Motor return [N·m]
EC3	0.16	0.16
EC4	0.35	0.35

4-1 Combination list

The below table is a combination list of the actuator main unit and the driver controller (TSC). Note that the combination differs depending on the version when you select them.

Model number	Design symbol	Driver controller TSC	Actuator cable
ES/EC	No symbol	TSC-015-MOD- *** - ** - * - *	CBL-TSC-AC- **
	Ver. A	TSC-015-MOD- *** - ** - * - *	CBL-TSC-AC- ** -A
	Ver. B	TSC-015B-MOD- *** - ** - * - *	CBL-TSC-AC- ** -B

* For details on * in the table, please read the electric actuator's catalog or the separate instruction manual. In addition, please read page 5-7 of this instruction manual for details on the actuator cable.

Note) Please note the followings when selecting the product of TSC specification:

- There is no compatibility between the actuator cable and the stepper driver controller TSC (TSC, hereinafter) of the existing product and the design symbol B.

You cannot use the actuator main unit/actuator cable of the existing product with the TSC of the design symbol B.

■ About related instruction manuals

When you use the economy series ES/EC, read the following instruction manuals as necessary.

Model number	Design symbol		
	No symbol	Ver. A	Ver. B
ES/EC	No.364M- *	No.364M- *	No.1040- * (*)
Driver controller TSC	No.6060- * (*)	No.6060- * (*)	No.6120- * (*)
Driver controller TLC	No.6070- * (*)		
D-STEP	No.6100- * (*)		
TDO	No.6110- * (*)		
TNU/TJU	No.6090- * (*)		

* Please read the latest version of each instruction manual.

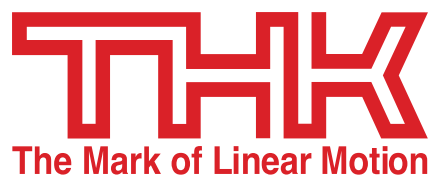
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Appendix

Revision history

The instruction manual No. is described on the back cover.

Date of issue	Instruction manual No.	Details
December 2013	No.1040-1(0)	First edition
February 2014	No.1040-1(1)	Correction of erroneous description
Jun 2014	No.1040-1(2)	Correction of erroneous description



THK Electric Actuator Economy Series

ES/EC

INSTRUCTION MANUAL