



THK Electrical Actuator Economy Series

ET

INSTRUCTION MANUAL

No.1050-3(0)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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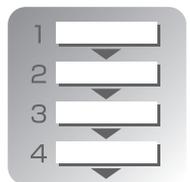
This section includes general precautions to follow when using the product. Be sure to read this section before use and observe the precautions.

2. Safety precautions	1-4
2-1 About ranks of precautions	1-4
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This section includes introduction about peripheral devices to be used with this product.

3. System configuration	1-6
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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 a wide range of applications including conveyance systems, implementing equipment, automated assemblers, positioning equipment and more.

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.

For the following information, 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 custom products. However, the descriptions provided in the delivery specification drawings or delivery specification documents of those custom products take precedence over this manual.
 - * Custom products 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 functions, errors, or damages of the product if not observed while using the product.

Supplement

- Supplementary information for the description.

Reference

- Reference information for the description.

1. Introduction

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, TSC is the applicable driver controller. Please note that driver controllers other than the above cannot be used. This excludes installations of the motor specified by the customer.

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 ET, read the following instruction manuals as necessary.
 - Controller series Driver controller TSC
 - Controller series Setup tool D-STEP

1-6 Product and company information

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

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

<p> This mark indicates “prohibition” of the action.</p>	<p> Prohibited</p> <p> Do not disassemble</p>
<p> This mark indicates “instruction” for the action.</p>	<p> Obligatory</p> <p> Provide grounding connection</p>
<p> This mark indicates “caution” about the action.</p>	<p> Caution</p> <p> Caution - Electrical shock</p> <p> Caution - Flammable</p> <p> Caution - High temperature</p> <p> Caution - Getting caught</p>

2. Safety precautions

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.

Otherwise, it 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 controller TSC.

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



Caution -
Electrical shock

- Do not touch the internal part of the driver controller TSC.

Otherwise, it may cause electric shock.

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

Otherwise, it may cause electric shock.



Do not
disassemble

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

Otherwise, it may cause injury or failures.

Caution



Caution - High
temperature

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

Otherwise, it may cause burns.



Prohibited

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

Otherwise, it may cause the failures or damage that leads to injury.

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

Otherwise, it may generate heat from the internal parts of the driver controller TSC, 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.

Otherwise, it 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.

Otherwise, it may cause fire or failures.

- Observe the specified input voltage.

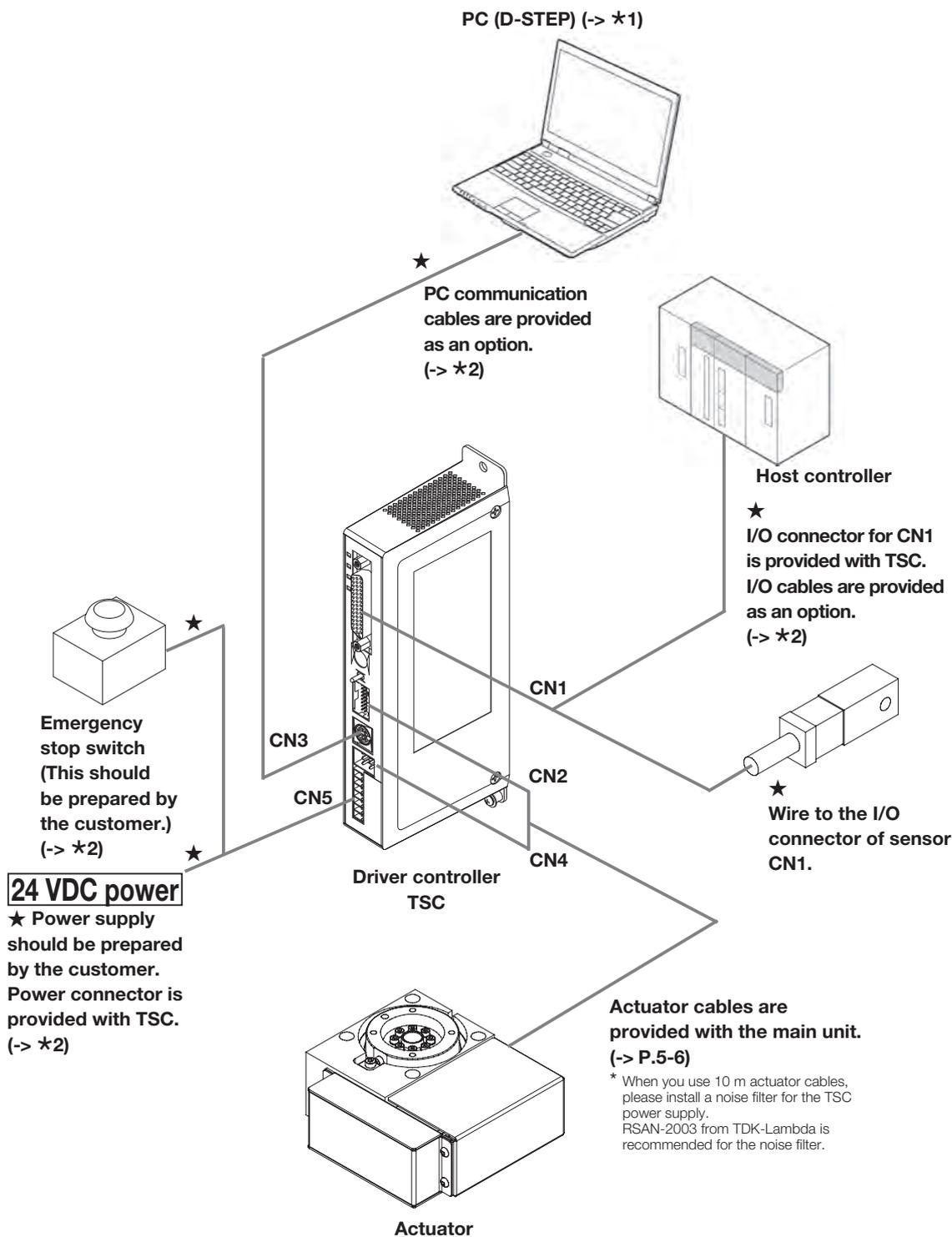
Otherwise, it may cause fire or failures.

3. System configuration

3-1

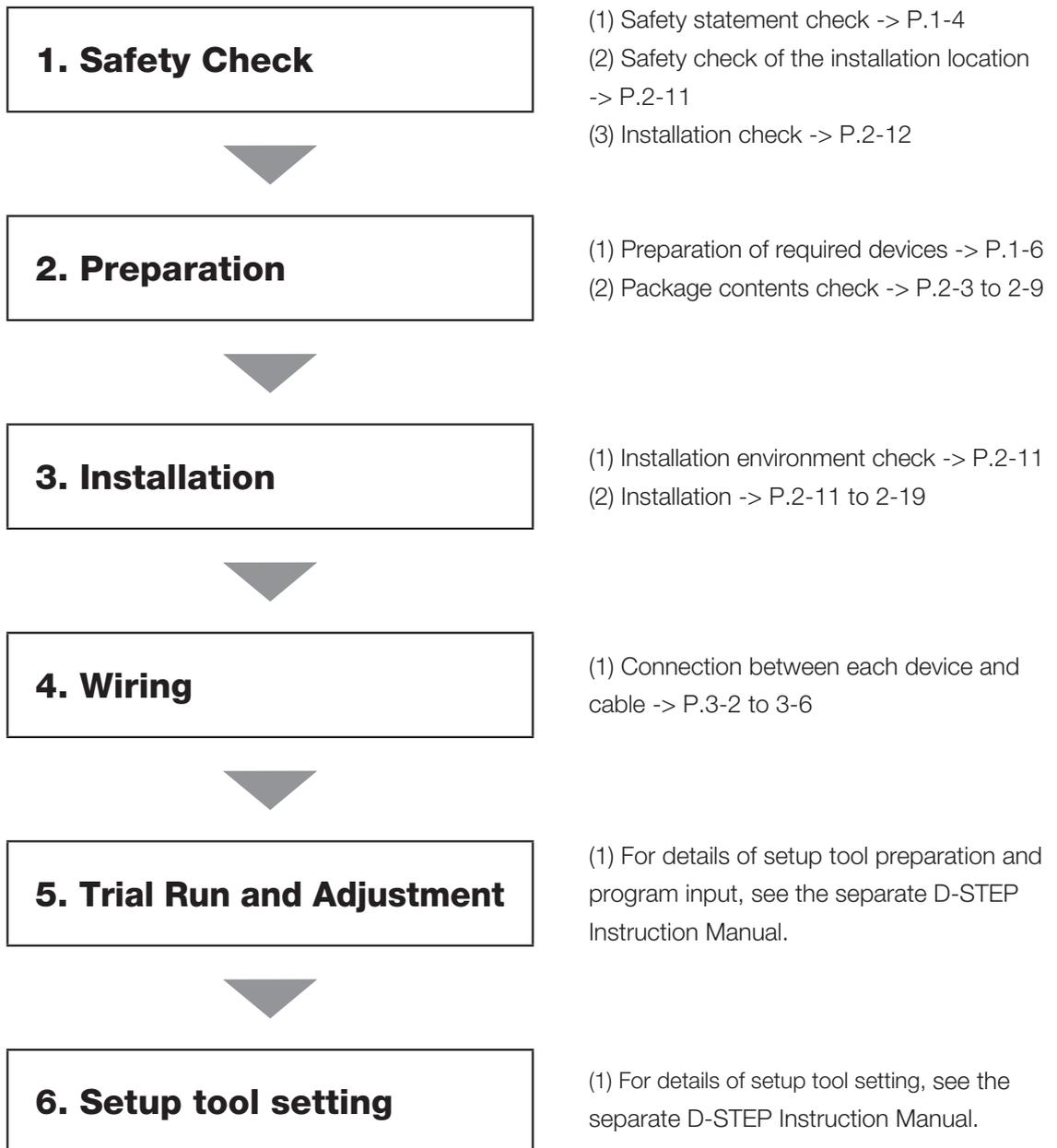
System configuration diagram

- 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 D-STEP Instruction Manual.
★2 See the separate TSC Instruction Manual.

4. Flow until using the product



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 products 2-2

1-1 Check the package contents of ET 2-3

1-2 Names of individual parts and functions 2-7

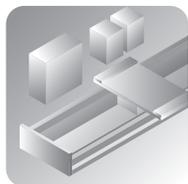
1-3 Store and dispose of products..... 2-9



This section describes the precautions on use of this product.

2. Precautions on use 2-10

2-1 Precautions on use of ET 2-10



This section describes the installation procedures of this product.

3. How to install 2-11

3-1 Installation environment 2-11

3-2 Setting of ET 2-12

1. Check products

Warning



Prohibited

- **For the combination of the actuator ET and the driver controller TSC, do not use actuators with models other than TSC.** Otherwise, it may cause unexpected motions, accidents or failures.

330° specification

Actuator model number: **ET20-45-330-TS/20P-D00-S3**

Controller model number: TSC-015B-MOD-**ET20-45-330-D**

360° specification

Actuator model number: **ET20-45-360-TS-U/20P-S3**

Controller model number: TSC-015B-MOD-**ET20-45-360**

Caution



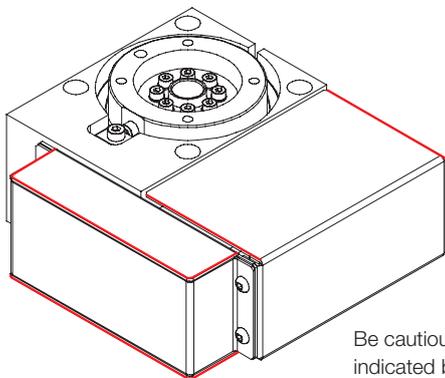
Prohibited

- **Do not stand on the packaging box or this product.**
Otherwise, it may cause the failures or damage that leads to injury.
- **Do not touch the rotating table.**
It may injure you.
Do not let finger or hands touch or become caught in rotating parts such as the table.
- **Do not grip the edges of this product's pulley cover and motor cover.**
It may injure you.
Take care not to cut your hands or fingers on the cover's edge.



Prohibited

- **When carrying the product, do not hold the cable.**
The cable bush or cable could break and possibly cause an injury.
- **Do not use the product if you find any abnormality.**
Using a fractured product may cause malfunction that could lead to injury or fault. If you find any defect, please contact THK.



Be cautious of the cover edge indicated by the red line.

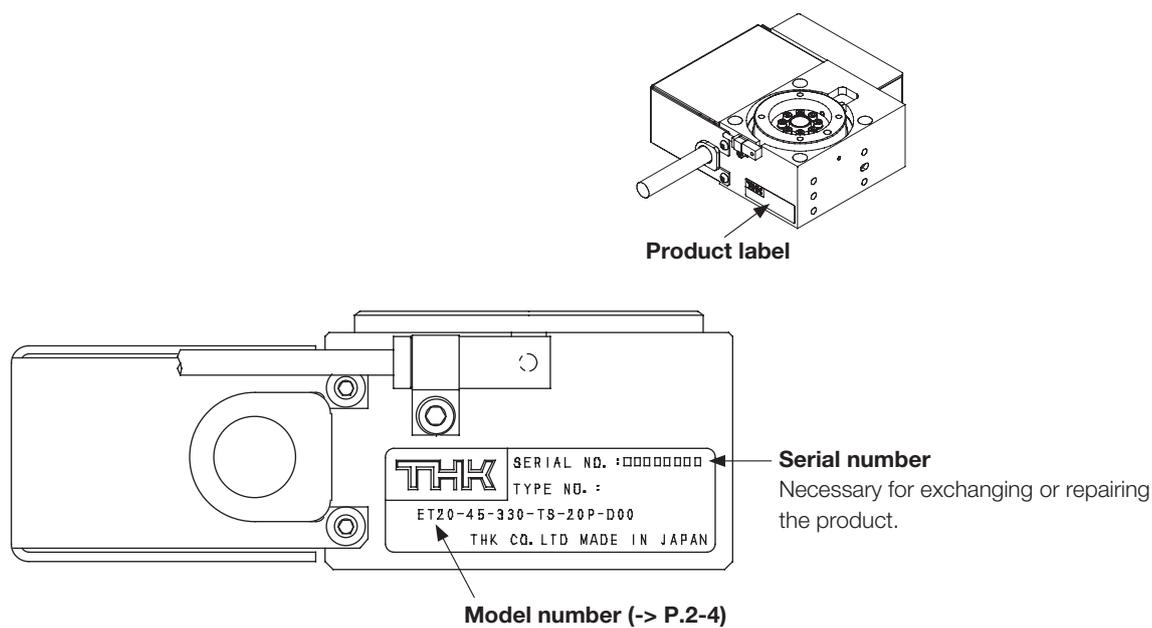
1. Check products

2. Installation

1-1 Check the package contents of ET

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

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



1. Check products

ET model configuration

TSC specifications

ET20-45-330-TS-_____ / 20P D00 S3

(1) (2) (3) (4) (5) (6) (7) (8)

(1) Model number	ET20, ET35
(2) Reduction ratio	20: 1/20 (ET35 only) 30: 1/30 (ET35 only) 45: 1/45 (ET20 only)
(3) Stroke	330: 330° 360: Multi-rotation (360° or more)
(4) Control device type	TS: Stepper driver controller TSC
(5) Sensor	U : Magnetic proximity switch (Asa Electronics Industry Co., Ltd. AH003) No symbol : None
(6) Motors used	20P: <input type="checkbox"/> 20 stepper motor (ET20) (Made by Oriental Motor Co., Ltd.) 35P: <input type="checkbox"/> 35 stepper motor (ET35) (Made by Oriental Motor Co., Ltd.)
(7) Origin	D00: CCW rotation during return to home position R00: CW rotation during return to home position No symbol: None (Multi-rotation specification has no symbol)
(8) Cable length	No symbol : None S3 : 3 m standard S5 : 5 m standard SA : 10 m standard

1. Check products

2. Installation

ET model configuration

Type without motor

ET35-30-360-0-B-U

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

(1) Model number	ET20, ET35
(2) Reduction ratio	20: 1/20 (ET35 only) 30: 1/30 (ET35 only) 45: 1/45 (ET20 only)
(3) Stroke	330: 330° 360: Multi-rotation (360° or more)
(4) With/without motor	0: Without motor 1: With motor (Customer specified motor purchased/mounted by THK)
(5) Motor plate	A: For stepper motor B: For servo motor
(6) Option	U : Magnetic proximity switch (Asa Electronics Industry Co., Ltd. AH003) No symbol : None

1. Check products

1-1-2 Checking the type and number of accessories

Actuator

TSC specification

Type of parts	Qty.
Actuator main unit	1

No motor specification
Motor plate symbol: A

Type of parts	Qty.
Actuator main unit	1
Pulley cover	1
Flat nut	1
Timing pulley	1
Timing belt	1
Hexagonal socket-head setscrew Half-point	2
Hexagonal-socket-head type button bolt	4

ET20 No motor specification
Motor plate symbol: B

Type of parts	Qty.
Actuator main unit	1
Pulley cover	1
Intermediate plate	1
Timing pulley	1
Timing belt	1
Hexagonal socket-head setscrew Half-point	2
Hexagonal-socket-head type button bolt	4
Hexagon socket head cap screw (M2.5)	2
Hexagon socket head cap screw (M3)	2
Flat washer Small washer	2

ET35 No motor specification
Motor plate symbol: B

Type of parts	Qty.
Actuator main unit	1
Pulley cover	1
Intermediate plate	1
Timing pulley	1
Timing belt	1
Hexagonal socket-head setscrew Half-point	2
Hexagonal-socket-head type button bolt	4
Hexagon socket low head cap screw	4
Hexagonal-socket-head type bolt	2
Flat washer Small washer (3 x 6 x 0.5)	4
Flat washer Small washer (4 x 8 x 0.8)	2

Model numbers of parts supplied with no motor specification (motor plate symbol: A)

Model	ET20-45	ET35-20	ET35-30
Timing pulley	P26-1.5GT-3-33F	P30-2GT-6-33F (P26-2GT-6-33F)	
	Made by Gates Unitta Asia Company		
Timing belt	100.5-1.5GT-3	142-2GT-6 (134-2GT-6)	158-2GT-6 (148-2GT-6)
	Made by Gates Unitta Asia Company		
Hexagonal socket-head setscrew half-point	M2.6 x 3L	M3 x 4L	
Hexagonal-socket-head type button set bolt	M2.5 x 5L	M3 x 5L	

Model numbers of parts supplied with no motor specification (motor plate symbol: B)

Model	ET20-45	ET35-20	ET35-30
Timing pulley	P28-1.5GT-3-33F	P30-2GT-6-33F	
	Made by Gates Unitta Asia Company		
Timing belt	103.5-1.5GT-3	142-2GT-6	158-2GT-6
	Made by Gates Unitta Asia Company		
Hexagonal socket-head setscrew half-point	M2.6 x 3L	M3 x 4L	
Hexagonal-socket-head type button bolt	M2.5 x 5L	M3 x 5L	
Hexagonal-socket-head type bolt	M2.5 x 6L M3 x 8L	M4 x 12L	
Hexagon socket low head cap screw	-	M3 x 6L (head height: 2 mm)	
Flat washer Small washer	2.5 x 5 x 0.5	3 x 6 x 0.5	
		4 x 8 x 0.8	

Note) The model numbers for ET35 timing pulleys and timing belts differ according to shipment period. The conventional model number is in parentheses.

Cable list

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

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

Reference

- For any custom product, check against the delivery specification drawings.

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 products

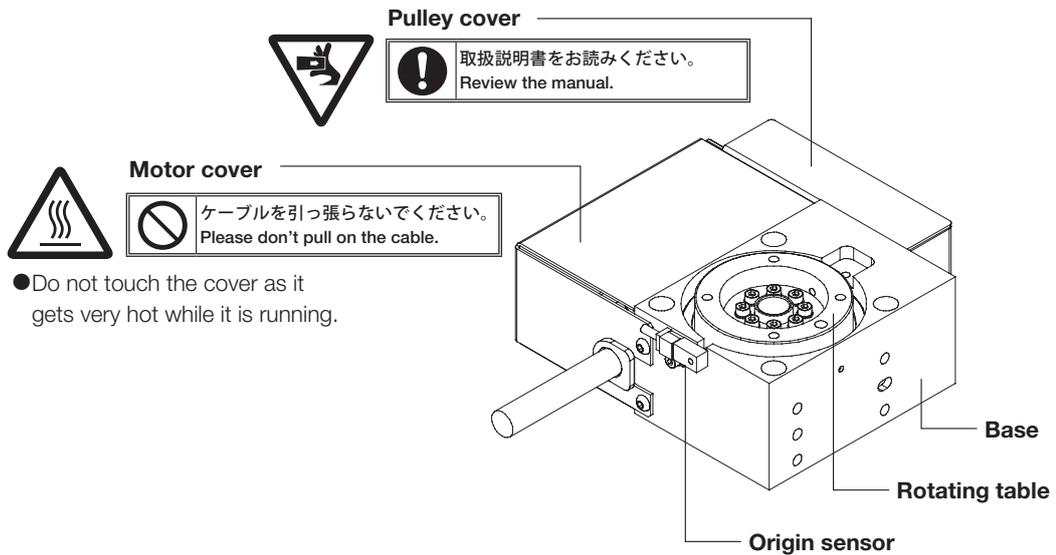
1-2

Names of individual parts and functions

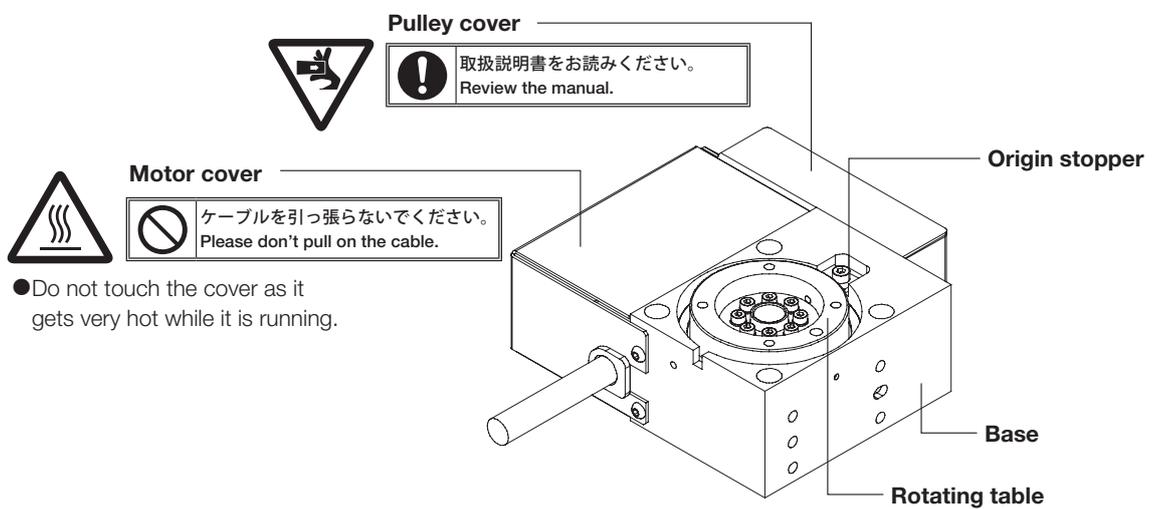
1-2-1

Thin lightweight turntable ET

- Direct motor coupled TSC specification Sensor origin mode



- Direct motor coupled TSC specification Pressing origin mode



1. Check products

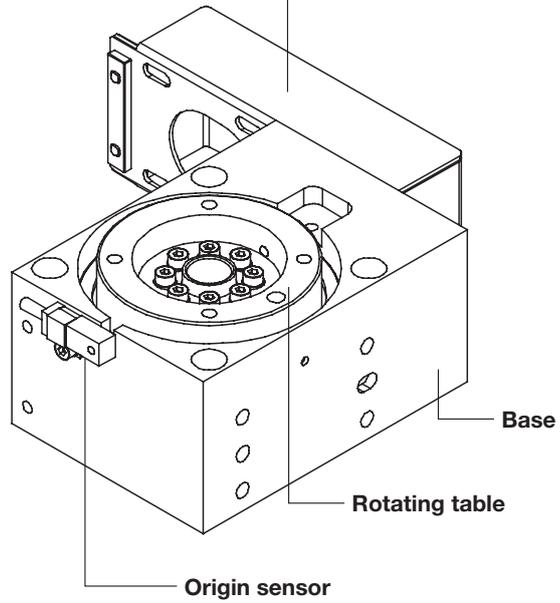
- No motor specification

- Sensor origin mode



Pulley cover

取扱説明書をお読みください。
Review the manual.

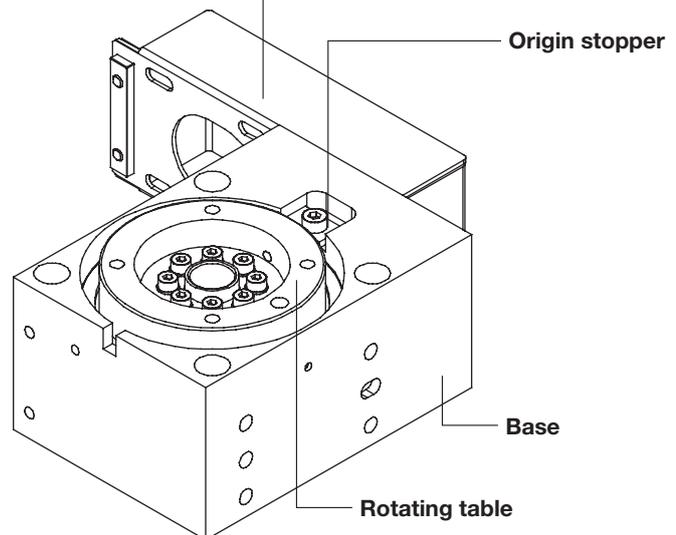


- Pressing origin mode



Pulley cover

取扱説明書をお読みください。
Review the manual.



1. Check products

1-3 Store and dispose of 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:

- Indoors at the ambient temperature between -10°C and 50°C
- The ambient humidity must be 20 to 80% RH or less
- Location where no direct sunlight nor radiation heat reaches
- Location where the product is not exposed to water
- Location where no flammable substance exists in the vicinity
- Location where no strong electric field nor powerful magnetic field generates
- Location where vibration or shock does not transmit to the product
- Location 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.4-8) 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.**

Otherwise, it may lead to bursting of the product, generation of noxious gas, or 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. Precautions on use

2-1 Precautions on use of ET

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.
- **Do not let finger or hands become caught in movable parts such as the table.**
It may injure you.



Obligatory

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

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

- **For 330° specifications, when returning to origin, be careful not to interfere with the surroundings because it strokes to the stopper position on the origin return side.**

Otherwise, it may cause failures or damage.



Prohibited

- **For 330° specifications, do not perform positioning by pressing the mecha stopper.**

Since it becomes a mecha stopper for origin detection, impact from positioning or overrun may cause malfunction or damage.

(It does not include the pressing operation with a combination motor at origin return when using TSC.)

3. How to install

3-1 Installation environment

Warning



Caution -
Flammable

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

Otherwise, it may lead to bursting of the product, generation of noxious gas, or injury due to bursting.

3-1-1 Installation environment of ET

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

- Indoors at the ambient temperature between 0 and 40°C (no freezing)
- Indoors at the ambient humidity from 20 to 80% RH or less (no condensation)
- Location where the product is not exposed to water
- Location where no flammable substance exists in the vicinity
- Location where vibration or shock does not transmit to the product
- Location 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
- Location where no direct sunlight nor radiation heat reaches
- Location where no strong electric field nor powerful magnetic field generates
- Location where inspections and cleanings can be easily performed

The option sensor is a magnet sensor.

Do not use in locations where a powerful magnetic field is generated in order to prevent false positives when returning to the origin.

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.

We do not take any responsibility for damage derived from not taking appropriate measures.

3. How to install

3-2

Setting of ET

Warning



Obligatory

- For 330° specifications, to prevent a collision accident caused by coasting of the rotating table, we recommend you install it on the outside so that it will hit the shock absorber before reaching to the mecha 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.

Otherwise, it may cause electric shock or injury caused by malfunction.



Caution -
Flammable

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

Otherwise, it may cause electric shock, fire or injury caused by malfunction.

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

- Do not let finger or hands become caught in movable parts such as the table.

It may injure you.

3. How to install

3-2-1 Stand and installation criteria for installing ET

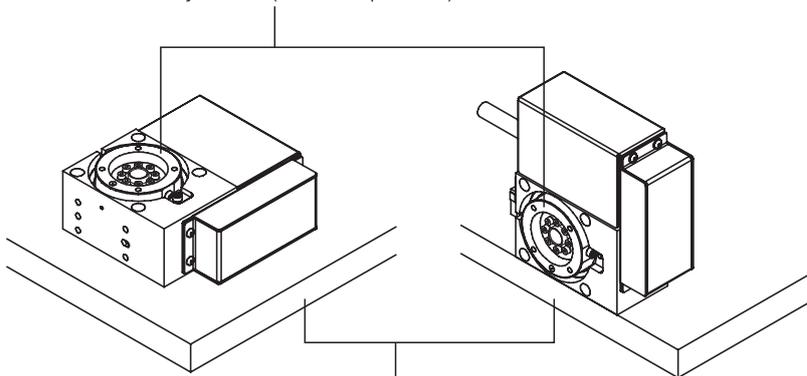
Install ET on a sufficiently rigid and stable stand to prepare a space for maintenance.

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

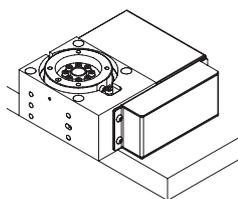
- Object mounting surface (table surface) material: Aluminum alloy or iron (SS400 equivalent)



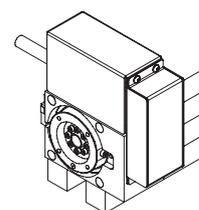
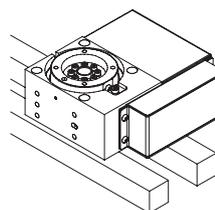
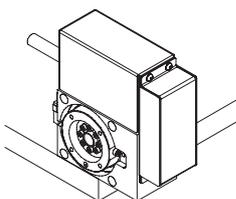
- Base mounting surface material: Aluminum alloy or steel (SS400 equivalent)



The entire base is not completely contacted to the ground.



The entire base is not completely contacted to the ground.



3. How to install

3-2-2 Mounting orientation

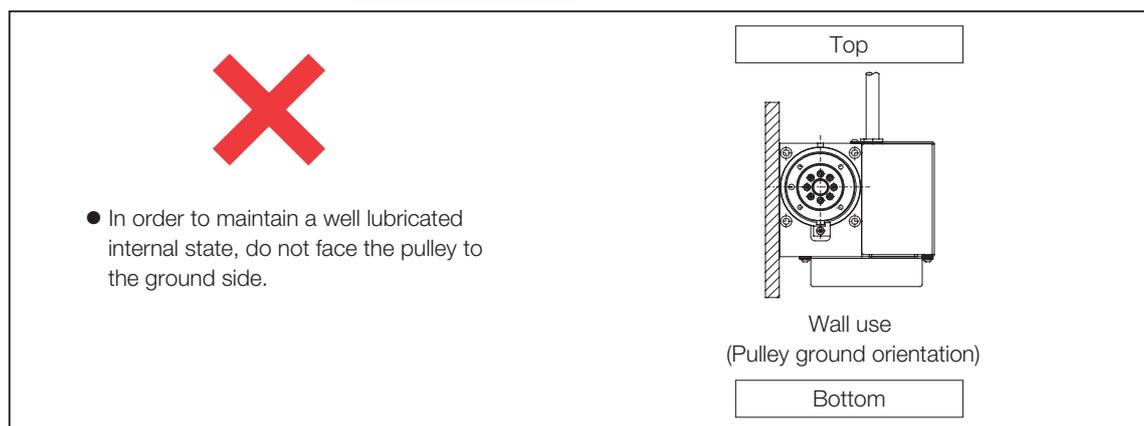
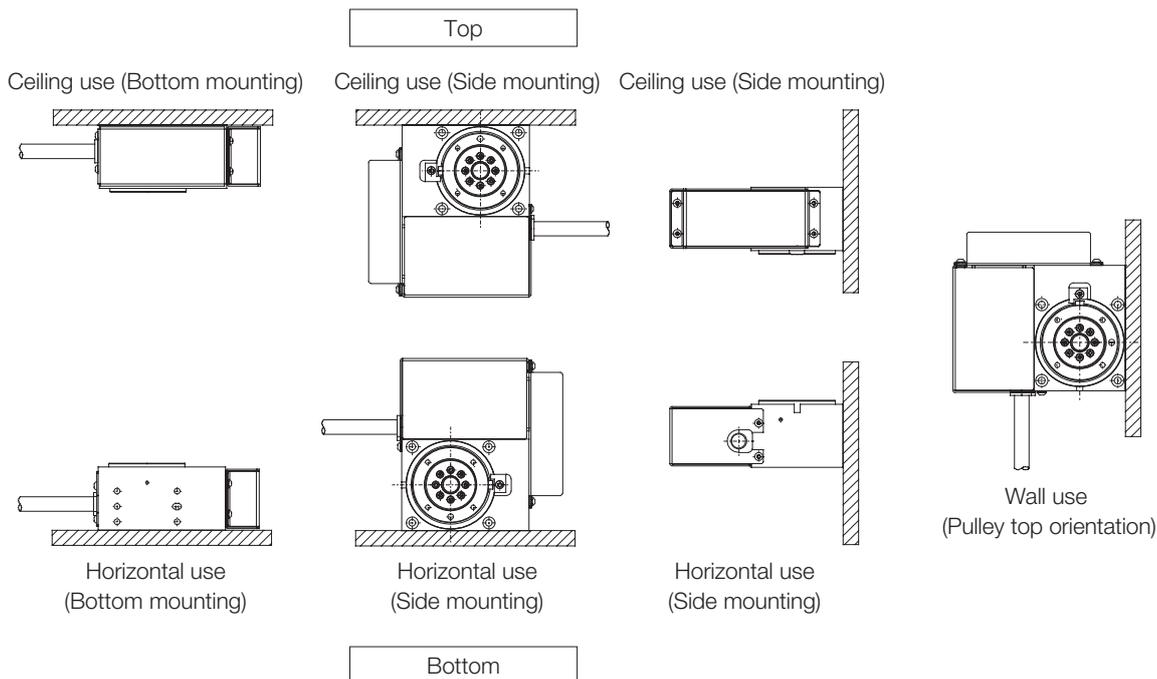
Important

● Depending on the mounting orientation, it may be difficult to maintain a well lubricated state internally.

Supplement

● If used over a long period with mounting orientation for ceiling use, horizontal use (“side mounting” only), or wall use (as shown below), oil may separate from the interior grease and leak externally, but function will be unaffected.

Mounting orientation



3-2-3 Tools used

Please prepare the tools on your side.

Model	At use	Tools used
ET20	Bottom mounting (-> P.2-15)	Opposite side distance 2.5 mm
	Side mounting (-> P.2-16)	Opposite side distance 2.5 mm
	Installation of object to be mounted (-> P.2-18)	Opposite side distance 2.0 mm
ET35	Bottom mounting (-> P.2-15)	Opposite side distance 3.0 mm
	Side mounting (-> P.2-16)	Opposite side distance 3.0 mm
	Installation of object to be mounted (-> P.2-18)	Opposite side distance 3.0 mm

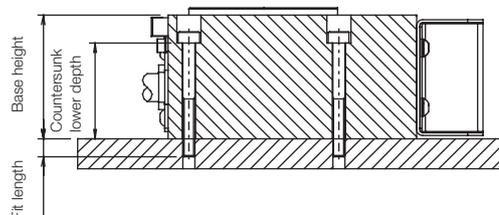
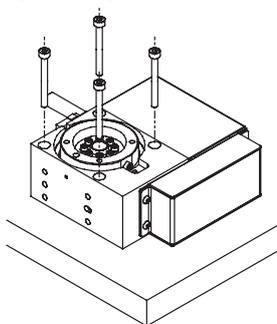
Hexagonal wrench

3. How to install

3-2-4 ET installation

Attach ET on the mounting surface and secure it by bolts. Refer to the following table for the bolts and tightening torques to use. * Prepare bolts and tools to be used separately.

Bottom mounting (Using countersunk holes)



Model			ET20		ET35	
Screw type			Hexagonal-socket-head type bolt		Hexagonal-socket-head type bolt	
Size			M3 × 30L		M4 × 40L	
Material of screw			Steel	SUS	Steel	SUS
			10.9	A2-70	10.9	A2-70
Fit length of screw [mm]			6		8	
Countersunk lower depth [mm]			24		32	
Tightening torque [N·cm]	Material of mounting surface	Iron	131.1	100.3	265.5	228.7
		Aluminum	131.1	100.3	265.5	228.7

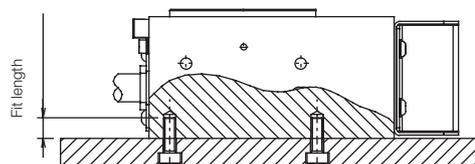
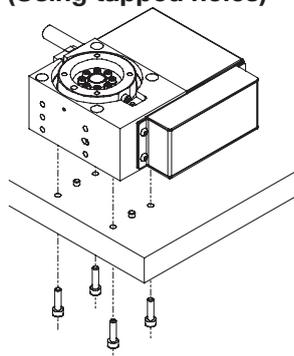
Important

● Be sure to use all the securing taps or mounting holes, 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 in the order of the opposite angle after temporarily tightening using the designated tightening torque.

Bottom mounting (Using tapped holes)



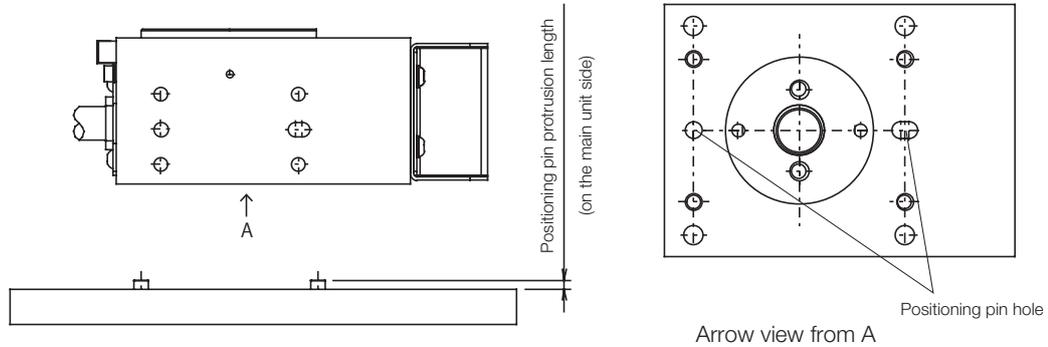
Model			ET20		ET35	
Screw type			Hexagonal-socket-head type bolt		Hexagonal-socket-head type bolt	
Size			M3		M4	
Material of screw			Steel	SUS	Steel	SUS
			10.9	A2-70	10.9	A2-70
Fit length of screw [mm]			4		7	
Tightening torque [N·cm]	Material of mounting surface	Iron	120.9	100.3	265.5	228.7
		Aluminum	120.9	100.3	265.5	228.7

3. How to install

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.

Bottom positioning pin usage

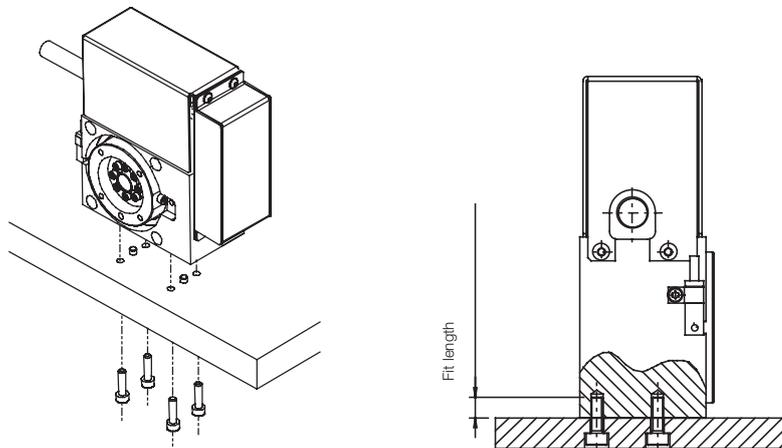


Model	ET20	ET35
Main unit hole depth [mm]	2.5	3
Positioning pin protrusion length [mm]	2	2.5

Side mounting (Using tapped holes)

Supplement

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



Model		ET20		ET35		
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		7		
Tightening torque [N·cm]	Material of mounting surface	Iron	120.9	100.3	265.5	228.7
		Aluminum	120.9	100.3	265.5	228.7

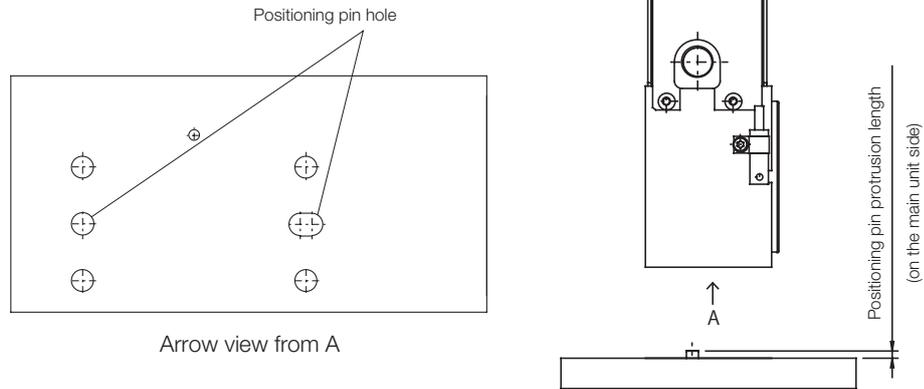
3. How to install

2. Installation

Side positioning pin usage

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	ET20	ET35
Positioning pin hole [mm]	$\phi 3^{+0.02}_0$	$\phi 4^{+0.02}_0$
Main unit hole depth [mm]	2.5	3
Positioning pin protrusion length [mm]	2	2.5

3. How to install

3-2-5 Mounting of equipment to ET

Caution



Caution

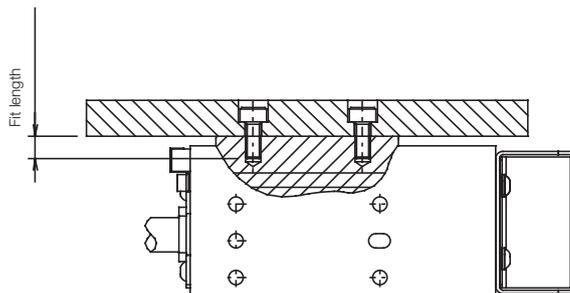
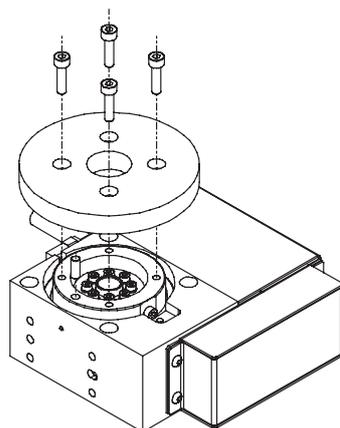
- Be sure to use the designated screws and all the securing taps, and securely fasten it by the designated tightening torque. If you use screws other than those specified or there are unused securing taps or the tightening torque is insufficient, it will cause a vibration or misalignment to prevent the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

Mount the object on the table as shown in the figure.

* Prepare bolts and tools to be used separately.

Supplement

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

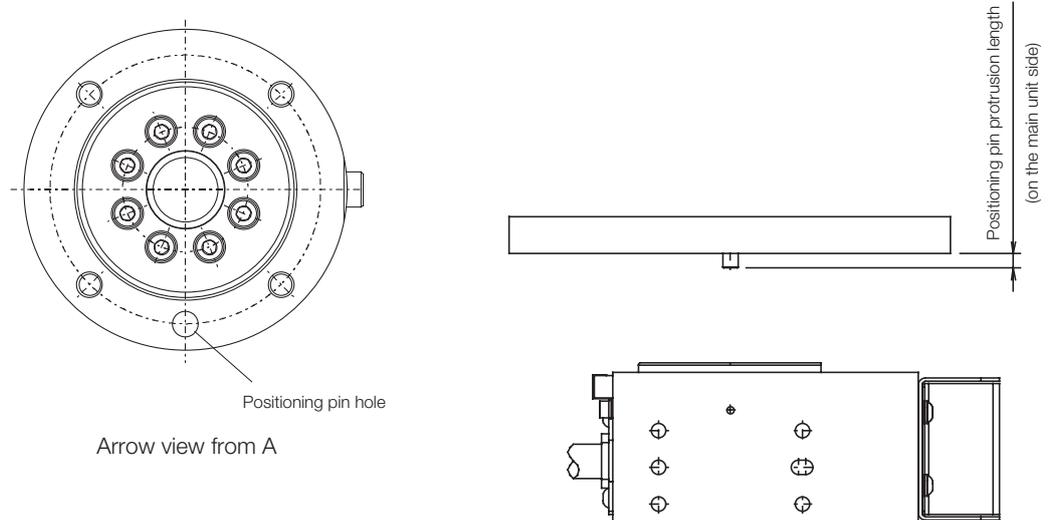


Model		ET20		ET35		
Screw type		Hexagonal-socket-head type bolt		Hexagonal-socket-head type bolt		
Size		M2.5		M4		
The number of bolts		6		4		
Material of screw		Steel	SUS	Steel	SUS	
		10.9	A2-70	10.9	A2-70	
Fit length of screw [mm]		4		7		
Tightening torque [N·cm]	Material of mounting surface	Iron	116.2	55.6	477.7	228.7
		Aluminum	72.5	55.6	265.5	228.7

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	ET20	ET35
Positioning pin hole [mm]	$\phi 2.5H8^{+0.014}_0$	$\phi 4H8^{+0.018}_0$
Main unit hole depth [mm]	2.5	4
Positioning pin protrusion length [mm]	2	3.5

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.**
Otherwise, it 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.**
Otherwise, it may cause abnormal operation, failure, or electric shock.
- **Do not damage, tuck, place a heavy object on or apply excessive stress on the cable.**
Otherwise, it may cause electric shock.
- **Do not touch the energized parts within TSC or TLC.**
Otherwise, it may cause electric shock.
- **The wiring works must be performed by electric work experts.**
Otherwise, it may cause electric shock.



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.

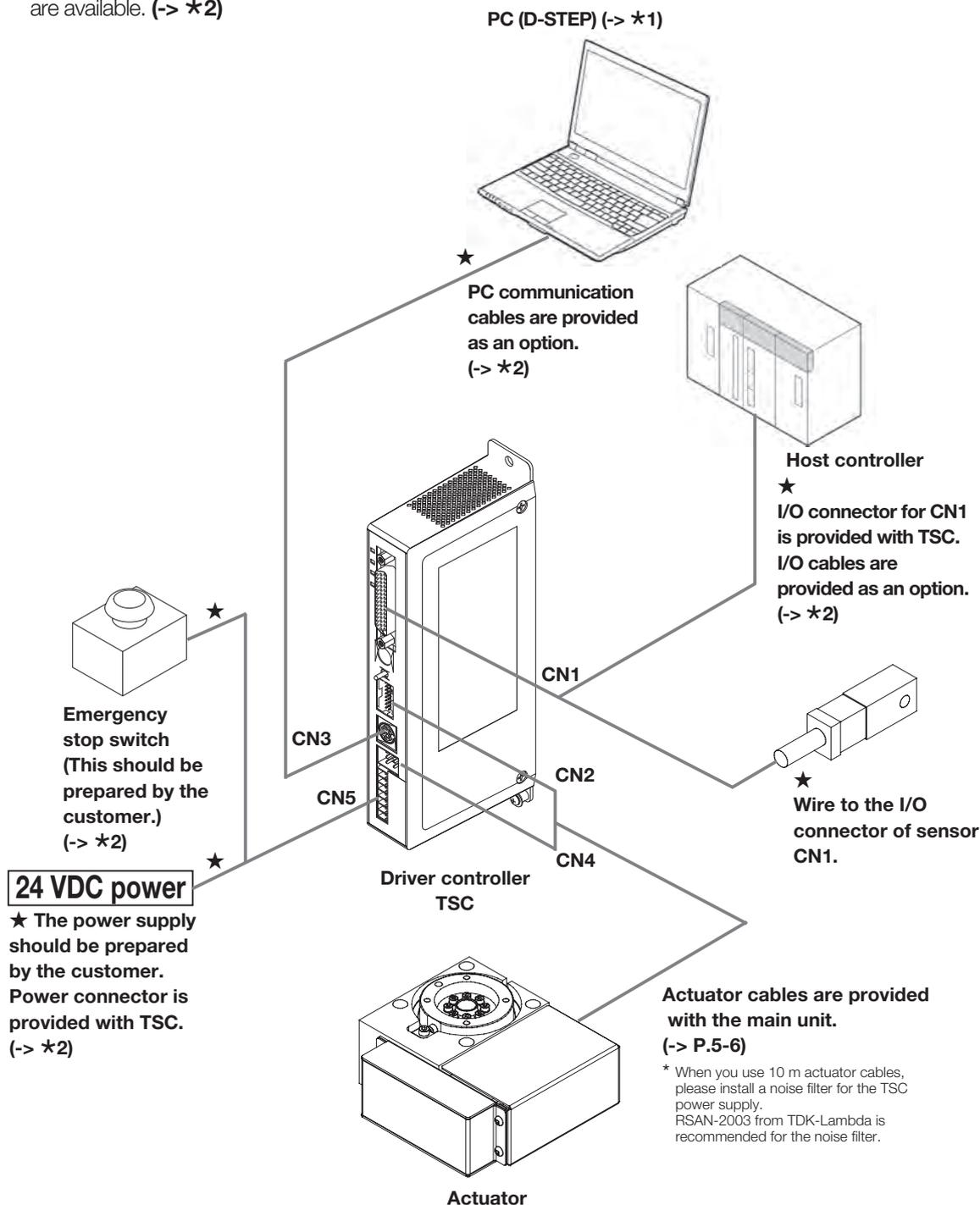
1. How to wire

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. (-> ★2)



★1 See the separate D-STEP Instruction Manual.

★2 See the separate TSC Instruction Manual.

1. How to wire

1-2 Connect actuator cable

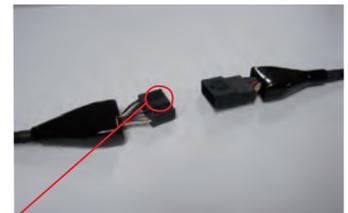
1-2-1 Connect to actuator (for driver controller TSC)

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

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

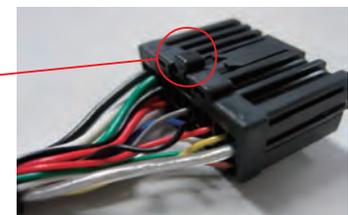


3. Insert the connector until you hear a click sound. When removing, release the lock in the convex part and pull it out holding the connector.



(1) Actuator cable for TSC
Model No.: CBL-TSC-AC-**-B (standard)
** indicates the cable length (03: 3 m, 05: 5 m, 10: 10 m).

Convex part

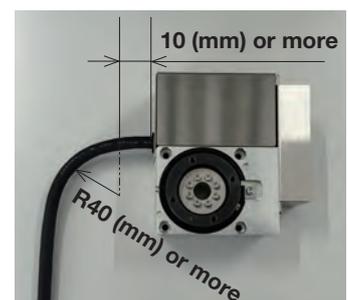


4. Engage the connector cover firmly to prevent dust or other foreign material from entering.

Connector cover



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



1. How to wire

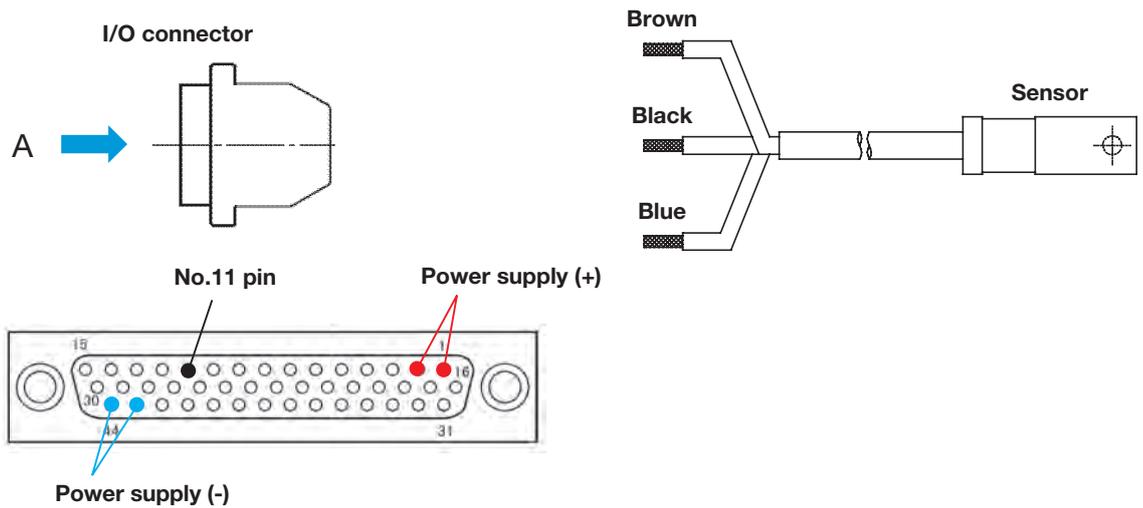
Important

- 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. See the photo on P.3-4.

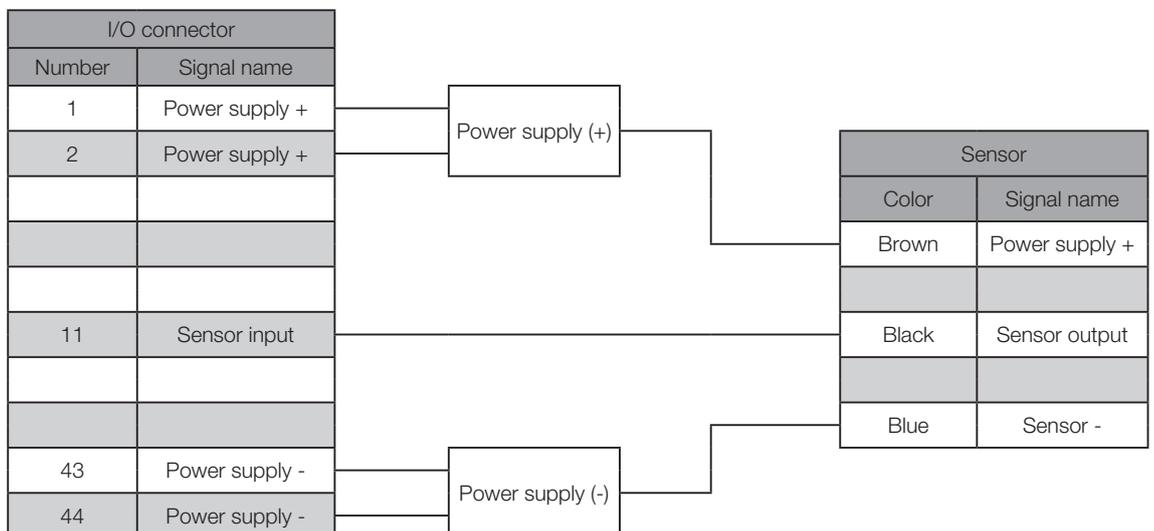
1-2-2 Sensor wiring

In the case of sensor specifications, wire the sensor signal line to the I/O connector of TSC controller CN1 .

The pin number to be connected is pin 11.



* Seen from the A side



1. How to wire

- In the case of sensor specifications, compared to other actuator TSC controllers, the pin assignment will be changed as follows depending on function mode.

Pin number	Input/output	Signal name					
		Function mode 0	Function mode 1	Function mode 2	Function mode 3	Function mode 4	Function mode 5
		Position 64	External input instruction	Position 256	Position 512	Solenoid 1	Solenoid 2
1,2	-	P24O	P24O	P24O	P24O	P24O	P24O
3	Input	PI 0	PI 0	PI 0	PI 0	ST 0	ST 0
4		PI 1	PI 1	PI 1	PI 1	ST 1	ST 1
5		PI 2	PI 2	PI 2	PI 2	ST 2	ST 2
6		PI 3	PI 3	PI 3	PI 3	ST 3	-
7		PI 4	PI 4	PI 4	PI 4	ST 4	-
8		PI 5	PI 5	PI 5	PI 5	ST 5	-
9		-	MODE	PI 6	PI 6	ST 6	-
10		-	JOG/INCHING	PI 7	PI 7	-	-
11		SENSOR	SENSOR	SENSOR	SENSOR	SENSOR	SENSOR
12		BKRL	JOG N	BKRL	BKRL	BKRL	BKRL
13		STRT	STRT/PWRT	STRT	STRT	-	-
14		MANU	MANU	MANU	MANU	MANU	MANU
15		HOME	HOME	HOME	HOME	HOME	HOME
16		PAUSE	PAUSE	PAUSE	PAUSE	PAUSE	PAUSE
17	REST	REST	REST	REST	REST	REST	
18	SV-ON	SV-ON	SV-ON	SV-ON	SV-ON	SV-ON	
19	Output	PO 0	PO 0	PO 0	PO 0	PE 0	LS 0
20		PO 1	PO 1	PO 1	PO 1	PE 1	LS 1
21		PO 2	PO 2	PO 2	PO 2	PE 2	LS 2
22		PO 3	PO 3	PO 3	PO 3	PE 3	-
23		PO 4	PO 4	PO 4	PO 4	PE 4	-
24		PO 5	PO 5	PO 5	PO 5	PE 5	-
25		MOVE	MOVE	PO 6	PO 6	PE 6	-
26		AREA	MODE S	PO 7	PO 7	AREA	AREA
27		P AREA	P AREA	P AREA	PO 8	P AREA	P AREA
28		MANU S	MANU S	MANU S	MANU S	MANU S	MANU S
29		HEND	HEND	HEND	HEND	HEND	HEND
30		INPS	INPS	INPS	INPS	INPS	-
31		LOAD/TRQS	WEND	LOAD/TRQS	LOAD/TRQS	LOAD/TRQS	-
32		SVRDY	SVRDY	SVRDY	SVRDY	SVRDY	SVRDY
33		EMGS	EMGS	EMGS	EMGS	EMGS	EMGS
34		ALM	ALM	ALM	ALM	ALM	ALM
35	-	-	-	-	-	-	
36	-	-	-	-	-	-	
37	-	-	-	-	-	-	
38	-	-	-	-	-	-	
39	-	-	-	-	-	-	
40	-	-	-	-	-	-	
41,42	-	FG	FG	FG	FG	FG	
43,44	-	GO	GO	GO	GO	GO	
case		FG	FG	FG	FG	FG	

4. Maintenance and Warranty

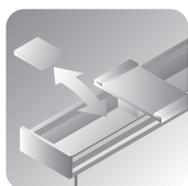
About this chapter

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



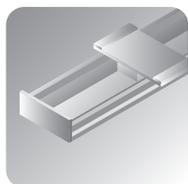
Perform correct maintenance works regularly as it could minimize the incidence of troubles.

1. Maintenance	4-2
1-1 Daily inspection	4-2
1-2 Periodical inspection	4-3
1-3 How to apply grease	4-4
1-4 Check points when restoring from the long-term suspension	4-8



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

2. Repair/Replacement	4-9
2-1 How to replace the timing belt	4-9



This chapter describes the warranty of this product.

3. Product warranty	4-13
3-1 Free warranty period	4-13
3-2 Usage conditions (range)	4-13
3-3 Warranty scope	4-13
3-4 Exclusion of warranty liability	4-14
3-5 Delivery conditions	4-14

1. Maintenance

Warning



Obligatory

- **Before conducting maintenance and inspection works, be sure to stop the machine and turn the power supply OFF. 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 ET

- **Visually inspect the actuator main unit and cable for any exterior damages or stains*.**
- **Adhesives, paints or other viscous items or solids sticking to the strip seal or other parts might cause the table to malfunction or cause damage. If it becomes dirty, wipe off the dirt using a clean waste cloth soaked with alcohol-based detergent.**
- **Make sure there is no abnormal sound or vibration while it is running. If abnormal noise or vibration occurs, immediately stop the machine and inspect the state of the product. 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. Maintenance

1-2 Periodical inspection

1-2-1 Periodic inspection of ET

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.**
- **Supply grease to the table.**
- **Check for any looseness of the connector.**
- **Check the timing belt state (wear, scratch, crack, noise, etc.). If you find any abnormal symptoms (i.e. wear, scratch, crack, noise) of the belt, replace the timing belt.**

The ET rotating table (cross-roller ring) can be used as is since the grease is sealed, but because the rolling structure is harsh on the rollers regarding lubricant, it will require regular greasing.

Usually, the specified grease should be applied to the entire interior every 3 to 6 months, even if the rotational frequency is low.

The reference amount of grease to use is described in 1-3-1 "How to apply grease for ET" (P.4-4).

Finally, lubrication intervals should be set with the actual device.

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.**

Otherwise, it may ignite the grease, which could cause fire.

1. Maintenance

1-3 How to apply grease

► Regarding grease for ET

This product is filled with grease specialized for cross-roller rings to achieve high performance. Make sure to use the dedicated grease (THK AFF grease) when you apply grease. Do not mix different types of grease. Otherwise, it may affect the performance.

1-3-1 How to apply grease for ET

⚠ Caution



Caution

- **Do not grasp the pulley cover of this product.**

It may injure you.

Some parts of the pulley cover may be sharp. Take care not to cut your hands or fingers.

- **Be careful not to apply too much grease.**

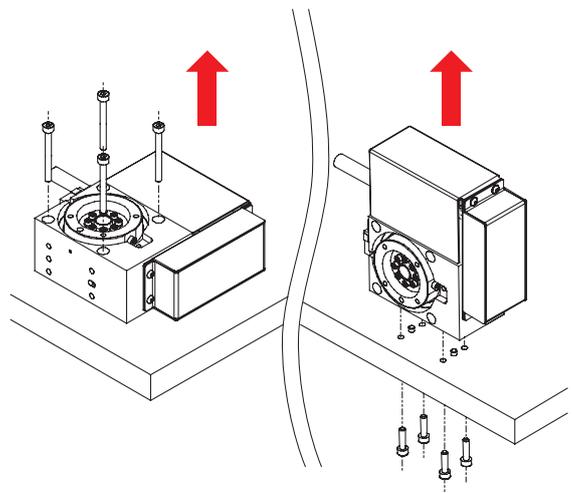
Take care as too much grease will cause grease to leak from the upper surface of the cross roller (from the top of the rotating table).

► How to apply grease

1. Turn the power off.

2. If using the mounting holes or bottom tapped holes, remove the screws.

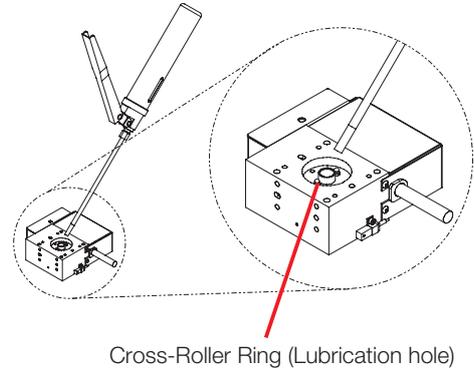
Check the table on P. 2-15 to 2-16 for hexagon socket head cap screws.



1. Maintenance

3. Supply grease to the cross-roller ring from the lubrication hole.

- * Wipe off the old grease or stains using a clean waste cloth. Please use the grease gun MG70 (N type attachment). You can spread the grease in every corner while moving the table.
- * Supply grease from the lubrication holes on both sides. Please use the grease gun MG70 (N type).

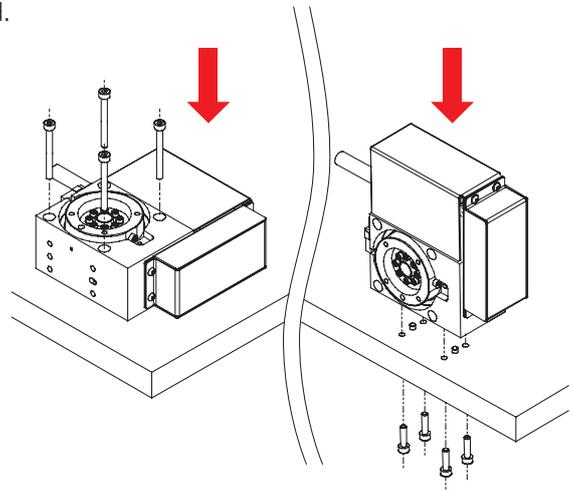


Type	Grease amount	
	One location (cm ³)	Total (cm ³)
ET20	0.2	0.4
ET35	0.3	0.6

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

5. Restore the removed ET.

- * Refer to P. 2-15 for the mounting method.



1. Maintenance

1-3-2 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. Otherwise, it may affect the performance.

Model	Location
THK AFF grease	Cross-Roller Ring
Kingstar SG-0LF	Hypoid gear

- 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

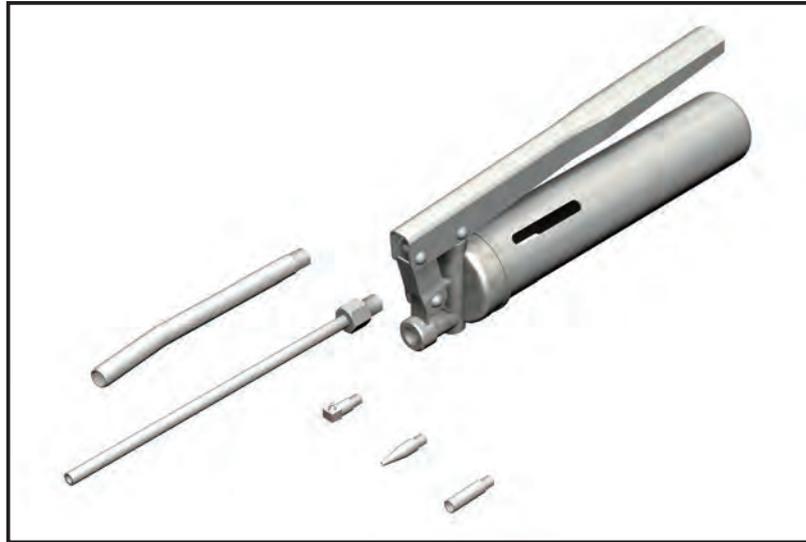
Item	Representative property values	Test method
Consistency enhancer	Lithium-based grease	
Base oil	High-class synthetic oil	
Base oil kinetic viscosity: mm ² /s (40°C)	100	ISO 2137 ISO 2176 ISO 6743 ISO 11009 ISO 12924
Worked penetration (25°C, 60 W)	315	
Mixing stability (100,000 W)	345	
Dropping point: °C	220	
Evaporation: mass% (99°C, 22 h)	0.7	
Oil separation rate: mass% (100°C, 24 h)	2.6	
Copper plate corrosion (B method, 100°C, 24 h)	Accepted	
Low temperature torque: mN·m (-20°C)	Startup	
	Rotation	60
4-ball test (fusion load): N	1236	ASTM D2596
Operating temperature range: °C	-40 to 120	
Appearance color	Reddish brown	



Appearances of the grease tube and product box

1. Maintenance

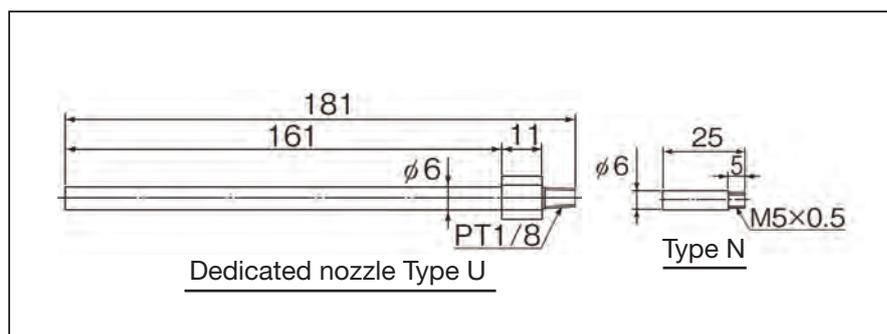
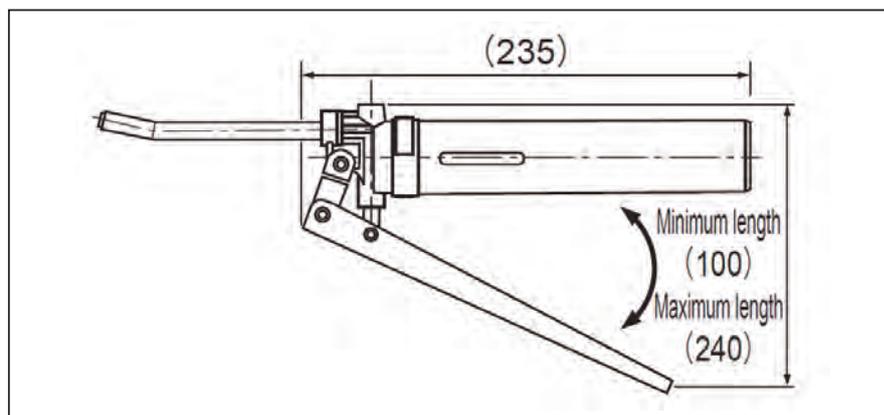
► Grease Gun Unit MG70



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	19.6 MPa max
Discharge rate	0.6 cc/stroke
Grease	70 g bellows cartridge
Overall length	235 mm (excluding nozzle)
Weight	480 g (with nozzle, excluding grease)



Shapes of the nozzle and attachment for the grease gun

1. Maintenance

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 details	Actions
ET	Cross-Roller Ring	<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>(-> P.4-4)</p>

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 origin 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.

2-1

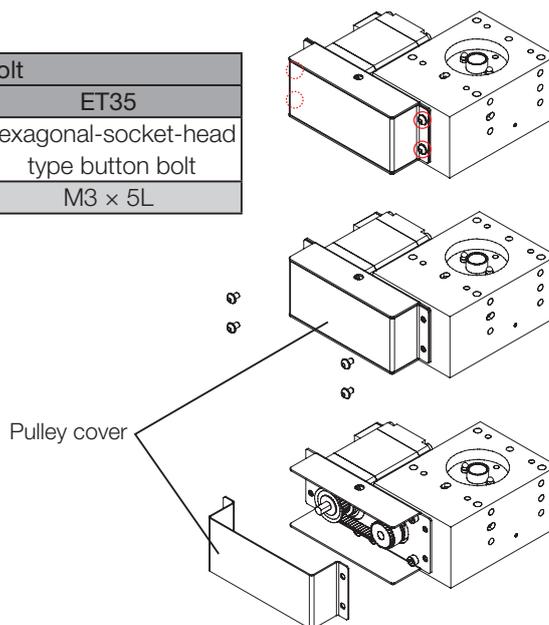
How to replace the timing belt

- The figure shown are those with ET35 as the representative example.

1. Turn the power off.

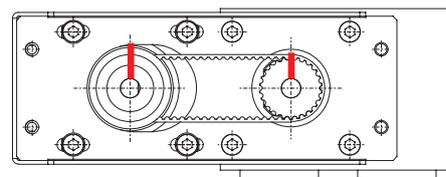
2. Remove the pulley cover.

Pulley cover mounting bolt		
Model	ET20	ET35
Screw type	Hexagonal-socket-head type button bolt	Hexagonal-socket-head type button bolt
Size	M2.5 × 5L	M3 × 5L



3. Place a mark on the timing pulley.

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

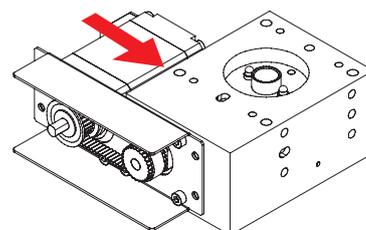
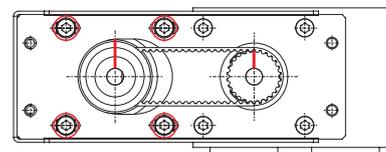


2. Repair/Replacement

4. Loosen the timing belt.

* Loosen the red-circular bolt and slide it in the direction of the arrow.

Motor (motor plate) mounting bolt		
ET20		
Model	· TSC specifications · No motor specification (Motor plate symbol: A)	· No motor specification (Motor plate symbol: B)
Screw type	Hexagonal-socket-head type bolt	Hexagonal-socket-head type bolt
Size	M2 × 3L	M2.5 × 6L
Washer type	Flat washer Large washer	Flat washer Small washer
Size	2 × 5 × 0.3	2.5 × 5 × 0.5



Motor (motor plate) mounting bolt		
ET35		
Model	· TSC specifications · No motor specification (Motor plate symbol: A)	· No motor specification (Motor plate symbol: B)
Screw type	· Hexagon socket low head cap screw Head height: 2 mm · Hexagonal-socket-head type bolt ^{*1}	Hexagon socket low head cap screw Head height: 2 mm
Size	M3 × 6L	M3 × 6L
Washer type	Flat washer Small washer	Flat washer Small washer
Size	3 × 6 × 0.5	3 × 6 × 0.5

*1 Screw types for ET35 TSC specification and no motor specification (motor plate symbol: A) differ according to shipment period. The conventional screw type is the hexagonal-socket-head type bolt.

5. Replace the timing belt.

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

Model	ET20-45	
Type	· TSC specifications · No motor specification (Motor plate symbol: A)	· No motor specification (Motor plate symbol: B)
Timing belt	100.5-1.5GT-3	103.5-1.5GT-3
Made by Gates Unitta Asia Company		

Model	ET35-20	
Type	· TSC specifications · No motor specification (Motor plate symbol: A)	· No motor specification (Motor plate symbol: B)
Timing belt	142-2GT-6 ^{*2} (134-2GT-6) ^{*2}	142-2GT-6
Made by Gates Unitta Asia Company		

Model	ET35-30	
Type	· TSC specifications · No motor specification (Motor plate symbol: A)	· No motor specification (Motor plate symbol: B)
Timing belt	158-2GT-6 ^{*2} (148-2GT-6) ^{*2}	158-2GT-6
Made by Gates Unitta Asia Company		

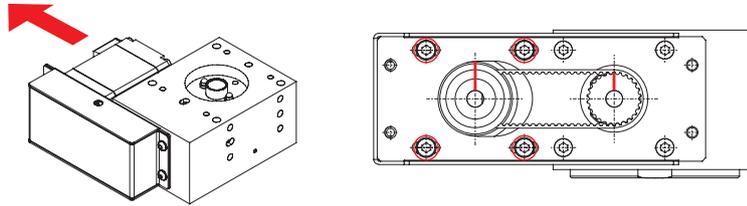
*2 When replacing the timing belt, check the model number on the belt. The model numbers for ET35 timing belts differ according to shipment period. The conventional model number is in parentheses.



2. Repair/Replacement

6. Adjust the tension of the timing belt.

- (1) Match the timing pulley marking positions and assemble the timing belt.
- (2) With the motor in the arrow direction, tighten the bolt circled in red and fix the motor while pulling with roughly double the belt tension force.



- (3) As in the figure, put the rotating table side downward and bring the sonic tensimeter (U-507) (made by Gates Unitta Asia Company) microphone near the timing belt. Pluck the timing belt with a metal rod dropped into the belt tension measurement hole ($\phi 5$) to measure the timing belt tension.

* Frequency range of sonic tensimeter (U-507)

ET20, ET35-30: High (500-5000 Hz)

ET35-20: Standard (10-600 Hz)

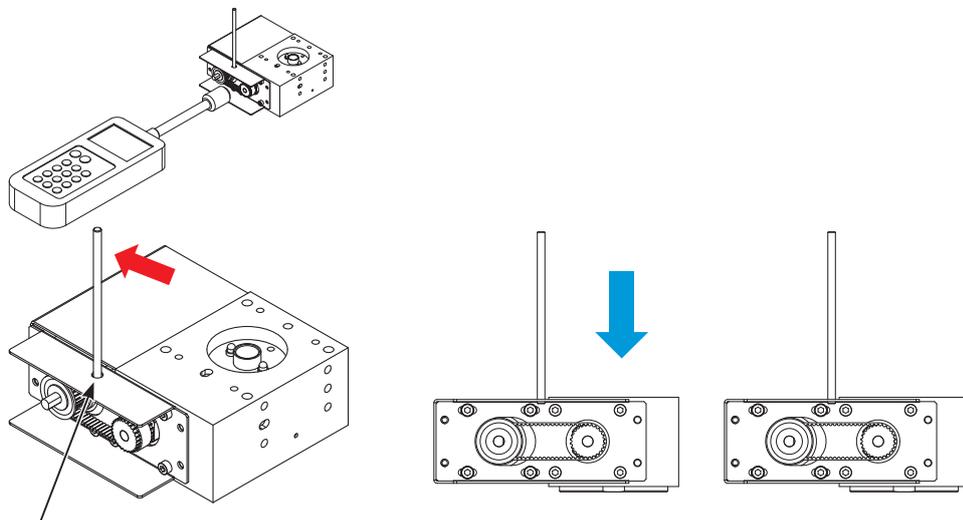
* After plucking the timing belt by dropping the metal rod, be careful not to pluck it again immediately when grasping the rod.

* Metal rod size and weight (reference)

ET20, ET35-30: $\phi 3$, weight 5-10 g or so

ET35-20: $\phi 3$, weight 35-40 g or so

- (4) When the tension measurement value is outside the range in the table, loosen the motor mounting bolts and repeat steps (2) and (3).



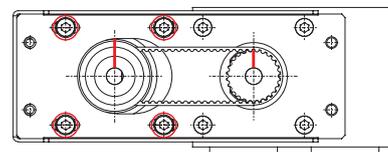
Belt tension measurement hole ($\phi 5$)

Model	ET20	ET35
Belt tension range	6.3 - 8.4N	17.0 - 20.2N

2. Repair/Replacement

7. Fasten the bolt.

- * Fasten the red-circular bolt using the designated tightening torque.
Please measure it by the tensiometer once again after fastening the bolt.



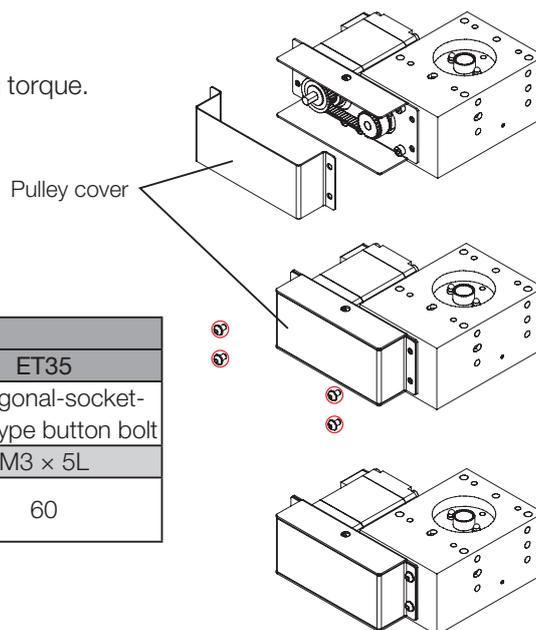
Motor (motor plate) mounting bolt		
Model	ET20	
	· TSC specifications · No motor specification (Motor plate symbol: A)	· No motor specification (Motor plate symbol: B)
Screw type	Hexagonal-socket-head type bolt	Hexagonal-socket-head type bolt
Size	M2 × 3L	M2.5 × 6L
Washer type	Flat washer Large washer	Flat washer Small washer
Size	2 × 5 × 0.3	2.5 × 5 × 0.5
Tightening torque [N·cm]	30	70

Motor (motor plate) mounting bolt		
Model	ET35	
	· TSC specifications · No motor specification (Motor plate symbol: A)	· No motor specification (Motor plate symbol: B)
Screw type	(1) Hexagon socket low head cap screw Head height: 2 mm ^{*1} (2) Hexagonal-socket-head type bolt	Hexagon socket low head cap screw Head height: 2 mm
Size	M3 × 6L	M3 × 6L
Washer type	Flat washer Small washer	Flat washer Small washer
Size	3 × 6 × 0.5	3 × 6 × 0.5
Tightening torque [N·cm]	(1) 60 (2) 110 ^{*1}	60

*1 Screw types for ET35 TSC specification and no motor specification (motor plate symbol: A) differ according to shipment period. The conventional screw type is the hexagonal-socket-head type bolt.

8. Mount the pulley cover A/B.

- * Fasten the bolt by the designated tightening torque.



Pulley cover mounting bolt		
Model	ET20	ET35
Screw type	Hexagonal-socket-head type button bolt	Hexagonal-socket-head type button bolt
Size	M2.5 × 5L	M3 × 5L
Tightening torque [N·cm]	36	60

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: **Checking the package contents of 1-1 ET (-> P.2-3)**

3-3-2 Consumables and spare parts

- Cables and timing belts are 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 and timing belts.
- 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 ET 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 trial run 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. Motor mounting method 5-2

1-1 Motor mounting example 5-2



This section describes cables.

2. Cables 5-6

2-1 Connection cable..... 5-6



This section describes necessary materials for selection.

3. Materials Required for Selecting ... 5-7

1. Motor mounting method

1-1

Motor mounting example

Note) Please use the D cut type for the motor output shaft.

* In the figure, a TSC specification motor is mounted as an example.

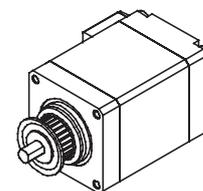
1. Check that the motor is powered off.

2. Mount the pulley to the motor.

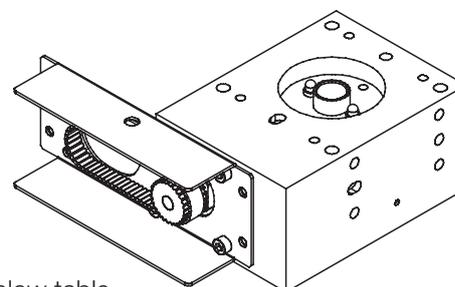
Check that the mounting bolt is not sticking out from the pulley.

* Fasten the bolt by the designated tightening torque.

Pulley mounting bolt		
Model	ET20	ET35
Screw type	Hexagonal socket-head setscrew Half-point	Hexagonal socket-head setscrew Half-point
Size	M2.6 x 3L	M3 x 4L
Tightening torque [N·cm]	35	50



3. Mount the timing belt.



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

Model	ET20-45	ET35-20	ET35-30
Timing belt	100.5-1.5GT-3	142-2GT-6	158-2GT-6
	103.5-1.5GT-3	(134-2GT-6)	(148-2GT-6)
Made by Gates Unitta Asia Company			

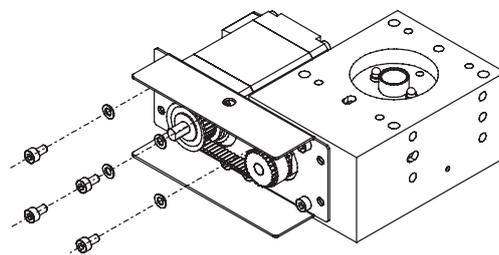
Note) The model numbers for ET35 timing pulleys and timing belts differ according to shipment period. The conventional model number is in parentheses.

1. How to Mount the Motor

4. Temporarily tighten the mounting bolt.

For ET35-30 in particular, confirm that the belt does not interfere with the bolt head, and if there is interference adjust the motor side pulley position to resolve the issue.

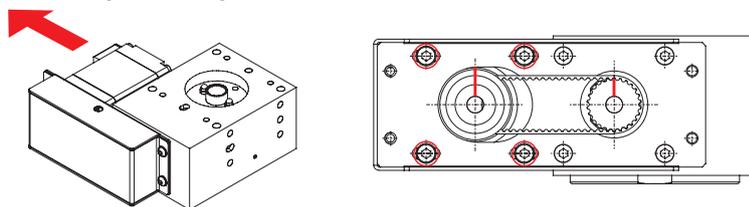
* Make sure that the belt and mounting bolts do not interfere.



Motor (motor plate) mounting bolt			
Model	ET20		ET35
	· TSC specifications with motor · No motor specification [Motor plate symbol: A]	· No motor specification [Motor plate symbol: B]	
Screw type	Hexagonal-socket-head type bolt	Hexagonal-socket-head type bolt	Hexagon socket low head cap screw Head height: 2 mm
Size	M2 × 3L	M2.5 × 6L	M3 × 6L
Washer type	Flat washer Large washer	Flat washer Small washer	Flat washer Small washer
Size	2 × 5 × 0.3	2.5 × 5 × 0.5	3 × 6 × 0.5

5. Adjust the tension of the timing belt.

- (1) Match the timing pulley marking positions and assemble the timing belt.
- (2) With the motor in the arrow direction, tighten the bolt circled in red and fix the motor while pulling with roughly double the belt tension force.



- (3) As in the figure, put the rotating table side downward and bring the sonic tensimeter (U-507) (made by Gates Unitta Asia Company) microphone near the timing belt. Pluck the timing belt with a metal rod dropped into the belt tension measurement hole ($\phi 5$) to measure the timing belt tension.

* Frequency range of sonic tensimeter (U-507)

ET20, ET35-30: High (500-5000 Hz)

ET35-20: Standard (10-600 Hz)

* After plucking the timing belt by dropping the metal rod, be careful not to pluck it again immediately when grasping the rod.

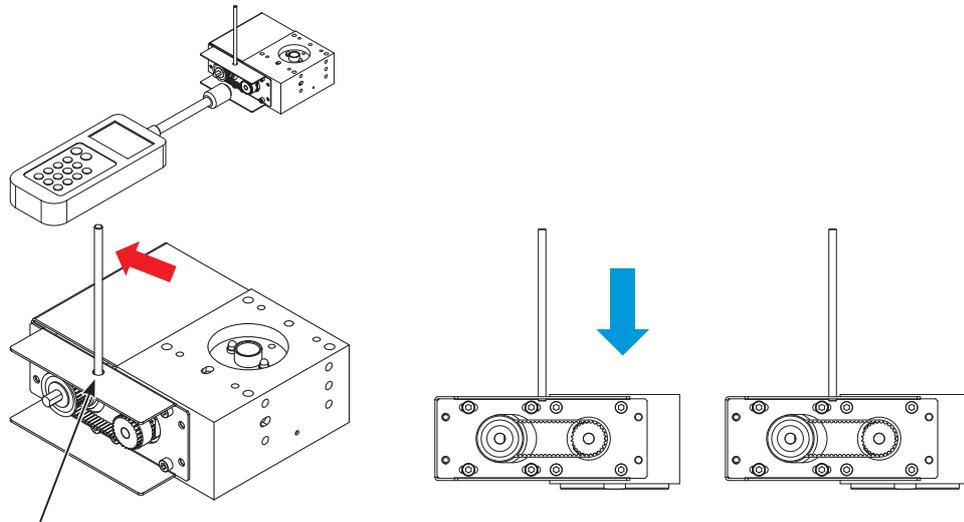
* Metal rod size and weight (reference)

ET20, ET35-30: $\phi 3$, weight 5-10 g or so

ET35-20: $\phi 3$, weight 35-40 g or so

1. How to Mount the Motor

(4) When the tension measurement value is outside the range in the table, loosen the motor mounting bolts and repeat steps (2) and (3).

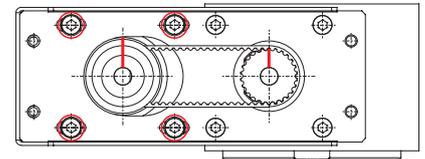


Belt tension measurement hole ($\phi 5$)

Model	ET20	ET35
Belt tension range	6.3 - 8.4N	17.0 - 20.2N

6. Fasten the bolt.

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



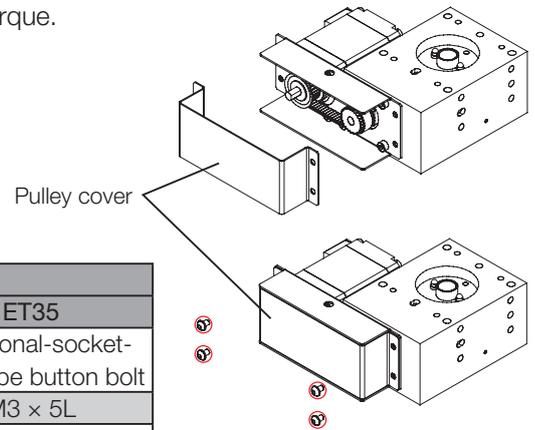
Motor (motor plate) mounting bolt			
Model	ET20		ET35
	· TSC specifications with motor · No motor specification [Motor plate symbol: A]	· No motor specification [Motor plate symbol: B]	
Screw type	Hexagonal-socket-head type bolt	Hexagonal-socket-head type bolt	Hexagon socket low head cap screw Head height: 2 mm
Size	M2 x 3L	M2.5 x 6L	M3 x 6L
Washer type	Flat washer Large washer	Flat washer Small washer	Flat washer Small washer
Size	2 x 5 x 0.3	2.5 x 5 x 0.5	3 x 6 x 0.5
Tightening torque [N·cm]	30	70	60

1. How to Mount the Motor

7. Mount the pulley cover A/B.

* Fasten the bolt by the designated tightening torque.

Pulley cover mounting bolt		
Model	ET20	ET35
Screw type	Hexagonal-socket-head type button bolt	Hexagonal-socket-head type button bolt
Size	M2.5 × 5L	M3 × 5L
Tightening torque [N·cm]	36	60



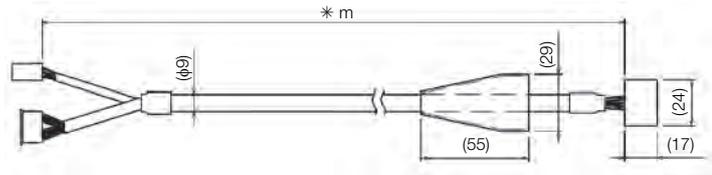
2. Cables

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).



3. Materials Required for Selecting

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

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

Actuator		Permissible moment *1 [N·m]	Permissible axial load *1 [N]	Permissible radial load *1 [N]	Permissible input torque [N·m]
Model	Reduction ratio				
ET20	45	3.6	30	13.2	0.039
ET35	20	17.7	200	88	0.248
ET35	30	17.7	200	88	0.248

*1 For the permissible axial load, permissible radial load, and permissible moment, provide a safety ratio: 1.5 or more (2 or more in the case of an impact load).

Actuator		Maximum angular velocity [deg/s]	Maximum angular acceleration [deg/s ²]
Model	Reduction ratio		
ET20	45	270	2000
ET35	20	600	3000
ET35	30	400	3000

Actuator		Backlash [deg]	Repeated positioning accuracy [mm]
Model	Reduction ratio		
ET20	45	0.2*2 or less	±0.04 or less
ET35	20	0.2*2 or less	±0.04 or less
ET35	30	0.2*2 or less	±0.04 or less

*2 Backlash is determined using a predetermined measurement method in our company, and is the value of the stroke position when shipped. Backlash may increase due to slight wear of the hypoid gear caused by usage conditions.

Actuator		Main unit weight (with motor) [kg]	Main unit weight (without motor) [kg]	Moving part weight [kg]	Inertial moment of body *3 [kg·cm ²]	Efficiency
Model	Reduction ratio					
ET20	45	0.52	0.35	0.07	0.004	0.47
ET35	20	1.2	0.8	0.17	0.012	0.72
ET35	30	1.2	0.8	0.17	0.015	0.71

*3 Body inertial moment is a converted value from the input shaft (motor shaft).

Actuator		Internal resistance torque [N·m]	Maximum output torque [N·m]	Permissible moment of inertia [kg·m ²]
Model	Reduction ratio			
ET20	45	P.5-13 Motor shaft rotational speed and internal resistance torque Characteristic Diagram	P.5-13 Motor shaft rotational speed and output torque Characteristic Diagram	P.5-13 Motor shaft rotational speed and permissible moment of inertia Characteristic Diagram
ET35	20	P.5-13 Motor shaft rotational speed and internal resistance torque Characteristic Diagram	P.5-13 Motor shaft rotational speed and output torque Characteristic Diagram	P.5-13 Motor shaft rotational speed and permissible moment of inertia Characteristic Diagram
ET35	30	P.5-13 Motor shaft rotational speed and internal resistance torque Characteristic Diagram	P.5-13 Motor shaft rotational speed and output torque Characteristic Diagram	P.5-13 Motor shaft rotational speed and permissible moment of inertia Characteristic Diagram

Actuator		Timing pulley	Timing belt
Model	Reduction ratio		
ET20	45	(1) P26-1.5GT-3-33F (2) P28-1.5GT-3-33F	(1) 100.5-1.5GT-3 (2) 103.5-1.5GT-3
		Made by Gates Unitta Asia Company	
ET35	20	P30-2GT-6-33F (P26-2GT-6-33F)	142-2GT-6 (134-2GT-6)
		Made by Gates Unitta Asia Company	
ET35	30	P30-2GT-6-33F (P26-2GT-6-33F)	158-2GT-6 (148-2GT-6)
		Made by Gates Unitta Asia Company	

Note) ET20 (1) is the model number used with motor plate symbol: A and (2) with motor plate symbol: B.

Note) The model numbers for ET35 timing pulleys and timing belts differ according to shipment period. The conventional model number is in parentheses.

3. Materials Required for Selecting

When selecting the rotation axis, calculate the moment of inertia and load torque for the conditions to be used, and select so that permissible inertia moment and maximum output torque are not exceeded. In the formula for calculating a reference/typical moment of inertia below, calculate the moment of inertia for the work used and mounting fixture.

Selection procedure

● Calculating moment of inertia

Check that the calculated moment of inertia meets the permissible moment of inertia for the model.

Calculated moment of inertia < Permissible moment of inertiaCan be used.

Calculated moment of inertia ≥ Permissible moment of inertiaCannot be used.

Please change the model or make the weight or radius of gyration smaller.

Check the “Angular Velocity and Permissible Moment of Inertia Characteristic Diagram” for the permissible moment of inertia for each model.

Check that the calculated torque meets the maximum output torque criteria for that model.

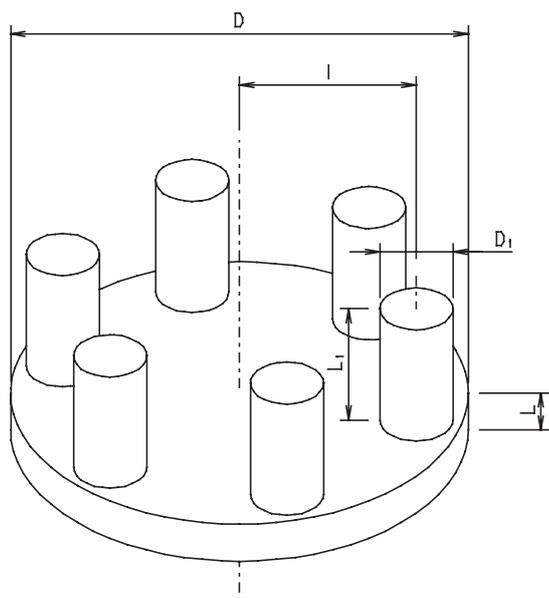
Calculated torque < Maximum output torque..... Can be used.

Calculated torque ≥ Maximum output torque..... Cannot be used.

Please change the model or make the weight or radius of gyration smaller.

Refer to “Angular velocity and output torque Characteristic Diagram” for the maximum torque of each model.

(Reference) Moment of inertia combining multiple cylinders



$$I_x = \frac{1}{8} m \cdot D^2 + \frac{1}{8} n \cdot m \cdot (D_1^2 + 8l^2) \text{ [kg} \cdot \text{m}^2\text{]}$$

$$m : \frac{\pi}{4} \rho \cdot L \cdot D^2$$

$$m_1 : \frac{\pi}{4} \rho \cdot L_1 \cdot D_1^2$$

Table

Diameter : D [m] Height : L [m]
 Mass : m [kg]

Workpiece

Diameter : D₁ [m] Height : L₁ [m]
 Mass : m₁ [kg] Number : n [items]

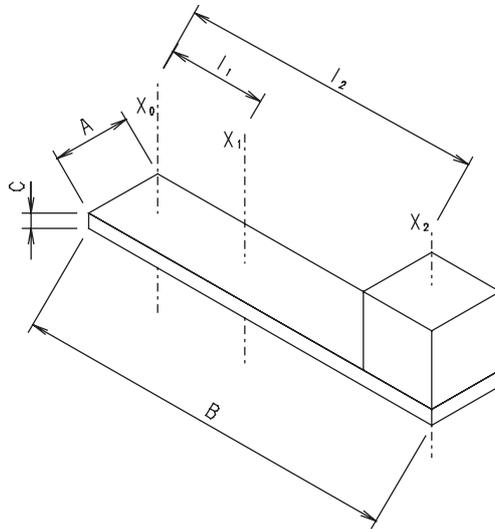
Density: ρ[kg/m³]

(Caution)

- Set the work shape and mass to all be the same.
- Set work positions all equal intervals from the center.

3. Materials Required for Selecting

(Reference) Moment of inertia combining multiple cuboids



$$I_x = \frac{1}{12} m_1 (A^2 + B^2 + 12 \cdot l_1^2) + \frac{1}{12} m_2 (2 \cdot A^2 + 12 \cdot l_2^2) [\text{kg} \cdot \text{m}^2]$$

$$m_1 : \rho \cdot A \cdot B \cdot C$$

$$m_2 : \rho \cdot A^3$$

L_1 : Distance between X_0 and X_1 (rotational center X_0) [m]

L_2 : Distance between X_0 and X_2 (rotational center X_0) [m]

Cuboid:

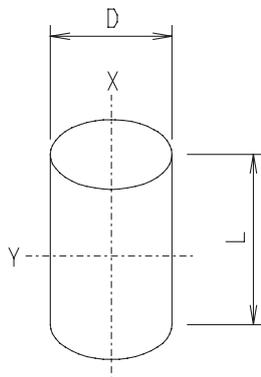
Depth A [m], Height B [m], Width C [m], Mass m_1 [kg]

Cube:

Depth A [m], Height A [m], Width A [m], Mass m_2 [kg]

Density: ρ [kg/m³]

Cylinder moment of inertia



$$I_x = \frac{1}{8} m \cdot D^2 = \frac{\pi}{32} \rho \cdot L \cdot D^4 [\text{kg} \cdot \text{m}^2]$$

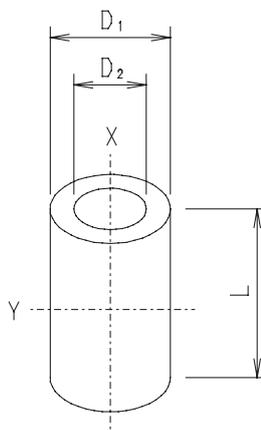
$$I_y = \frac{1}{4} m \left(\frac{D^2}{4} + \frac{L^2}{3} \right) [\text{kg} \cdot \text{m}^2]$$

Outer diameter : D [m] Length : L [m]

Mass : m [kg]

Density: ρ [kg/m³]

Hollow cylinder moment of inertia



$$I_x = \frac{1}{8} m (D_1^2 + D_2^2) = \frac{\pi}{32} \rho \cdot L \cdot (D_1^4 - D_2^4) [\text{kg} \cdot \text{m}^2]$$

$$I_y = \frac{1}{4} m \left(\frac{D_1^2 + D_2^2}{4} + \frac{L^2}{3} \right) [\text{kg} \cdot \text{m}^2]$$

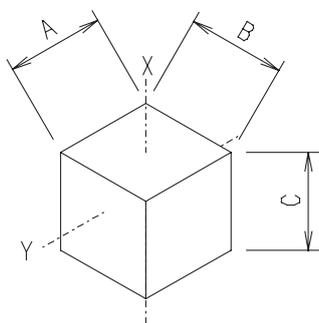
Outer diameter : D_1 [m] Inner diameter : D_2 [m]

Length : L [m] Mass : m [kg]

Density: ρ [kg/m³]

3. Materials Required for Selecting

Cuboid moment of inertia



$$I_x = \frac{1}{12} m(A^2 + B^2)$$

$$= \frac{1}{12} \rho \cdot A \cdot B \cdot C \cdot (A^2 + B^2) [\text{kg} \cdot \text{m}^2]$$

$$I_y = \frac{1}{12} m(B^2 + C^2)$$

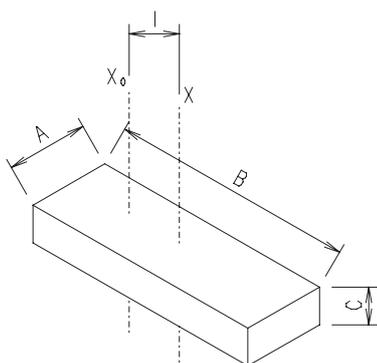
$$= \frac{1}{12} \rho \cdot A \cdot B \cdot C \cdot (B^2 + C^2) [\text{kg} \cdot \text{m}^2]$$

Depth : A [m] Width : B [m]

Height : C [m] Mass : m [kg]

Density: ρ [kg/m³]

Moment of inertia for an object with a shifting rotational center and center of gravity



$$I_x = \frac{1}{12} m(A^2 + B^2 + 12 \cdot l^2) [\text{kg} \cdot \text{m}^2]$$

$$m : \rho \cdot A \cdot B \cdot C$$

l: Distance between X and Xo (rotational center Xo)[m]

Cuboid:

Depth A [m], Height B [m], Width C [m], Mass m [kg]

Cube:

Depth A [m], Height A [m], Width A [m], Mass m [kg]

Density: ρ [kg/m³]

$I <$ Permissible moment of inertia..... Can be used.

$I \geq$ Permissible moment of inertia..... Cannot be used.

Please change the model or make the weight or radius of gyration smaller.

Check the "Angular velocity and permissible moment of inertia Characteristic Diagram" for the permissible inertia for each model.

3. Materials Required for Selecting

Torque calculation when using horizontally (Bottom mounting)

$$T_1 = (I \times \omega' + \text{external torque}) \times \text{safety factor}$$

I : Moment of inertia [$kg \cdot m^2$]

ω' : Angular acceleration [rad/s^2]

Ensure a safety factor of 1.5

or more

Example) External torque (Friction torque)

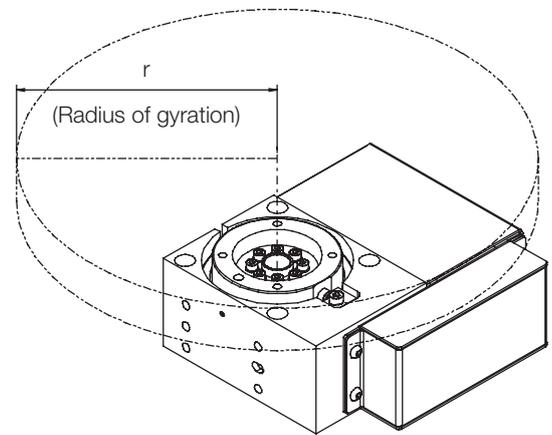
$$\text{External torque} = \mu \cdot m \cdot g \cdot r$$

m : Work mass [kg]

g : Gravity acceleration [m/s^2]

μ : Friction coefficient

r : Radius of gyration



Check that the calculated torque meets the maximum output torque criteria for that model.

$T_1 < \text{Maximum output torque}$Can be used.

$T_1 \geq \text{Maximum output torque}$Cannot be used.

Please change the model or make the weight or radius of gyration smaller.

Refer to "Angular velocity and output torque Characteristic Diagram" for the maximum torque of each model.

3. Materials Required for Selecting

Torque calculation when using horizontally (Side mounting)

$$T_2 = (m \cdot g \cdot r + I\omega' + \text{external torque}) \times \text{safety factor}$$

m : Work mass [kg]

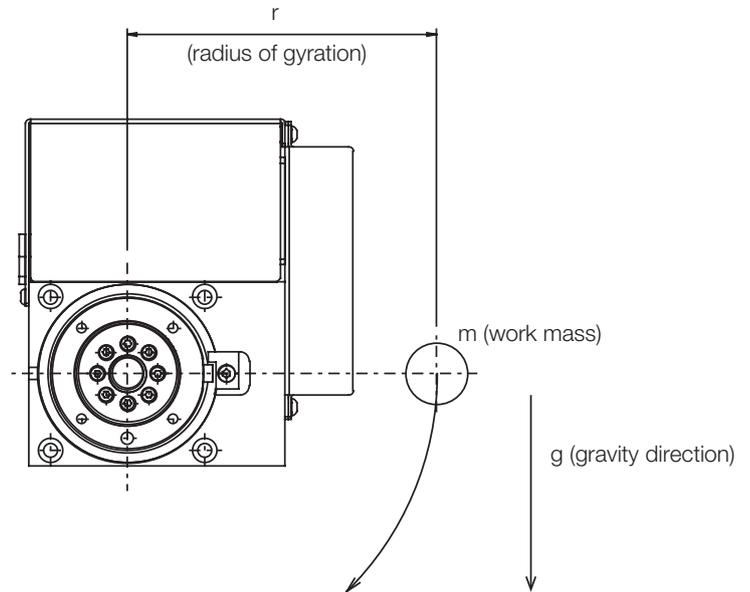
g : Gravity acceleration [m/s^2]

r : Radius [m]

I : Moment of inertia [$kg \cdot m^2$]

ω' : Angular acceleration [rad/s^2]

Ensure a safety
factor of 1.5 or more



Check that the calculated torque meets the maximum output torque criteria for that model.

$T_2 < \text{Maximum output torque}$ Can be used.

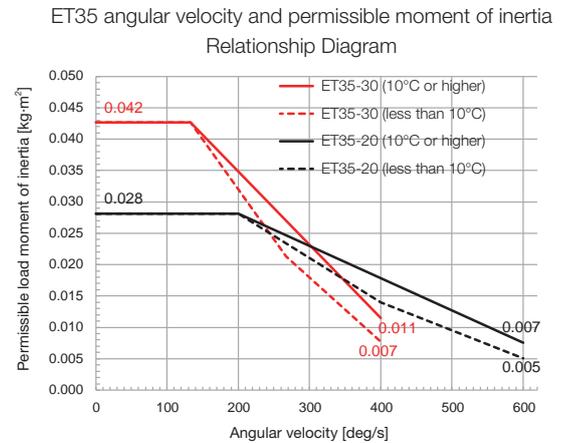
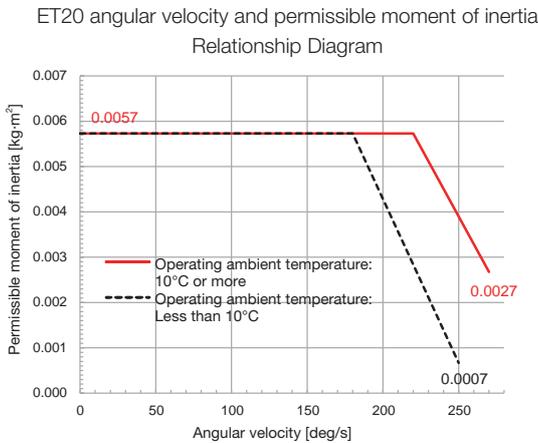
$T_2 \geq \text{Maximum output torque}$ Cannot be used.

Please change the model or make the weight or radius of gyration smaller.

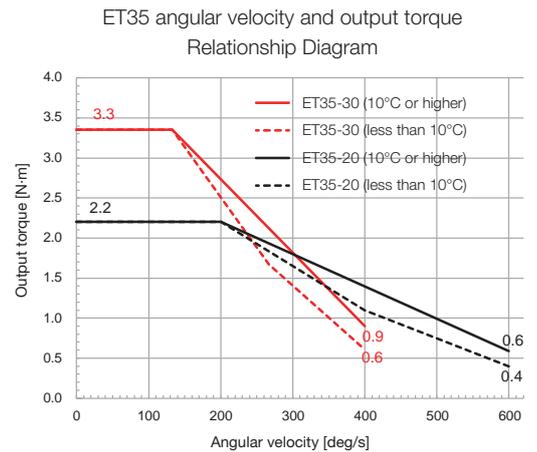
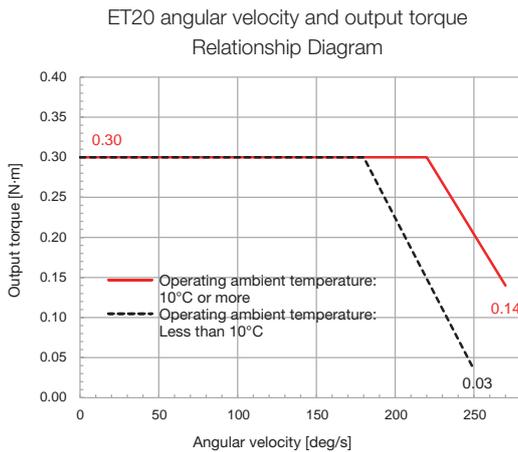
Refer to “Angular velocity and output torque Characteristic Diagram” for the maximum torque of each model.

3. Materials Required for Selecting

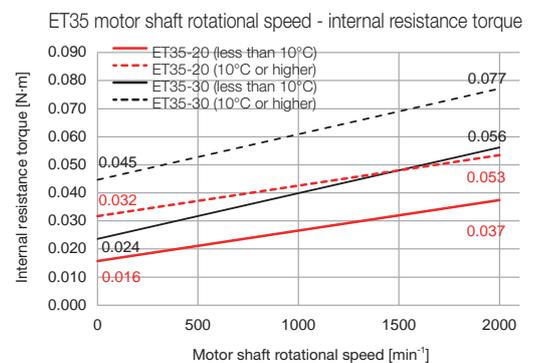
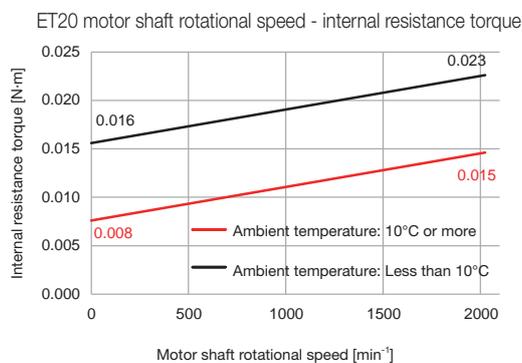
ET angular velocity and permissible moment of inertia Characteristic Diagram



ET angular velocity and output torque Characteristic Diagram



ET Motor shaft rotational speed and internal resistance torque Characteristic Diagram



(Note) The internal resistance increases in low-temperature environments (10°C or less). Therefore, a high safety ratio is recommended when selecting.

3. Materials Required for Selecting

Pressing origin return with TSC specification

Pressing origin return method

- (1) Turn the SV-ON input (pin.18) ON. Check that the SVRDY output (pin.32) is ON.
- (2) When the HOME input (pin.15) is turned ON, the origin return operation will be started.
- (3) The actuator starts moving in the predefined direction (CW direction or CCW direction).
 - * You cannot change the moving direction or speed.
 - * In some cases, the PAUSE input (pin.16) must be ON.
 - * You can set the current during movement in the parameter No.12 (Cur. limit at origin).
 For more information, see the instruction manual of the TSC controller.
- (4) When the actuator has reached the stopper, it turns around and starts rotating in the reverse direction.
- (5) The point, where the first origin signal is input after inversion (included in the encoder/one output per rotation), is the origin.
- (6) When it completes returning to the origin, the HEND output (pin.29) will be turned ON. Turn the HOME input (pin.15) OFF.
- (7) If you have configured the parameter No.6 (Origin offset), the position which is offset by the set value becomes the origin.
For more information, see the instruction manual of the TSC controller.

Caution

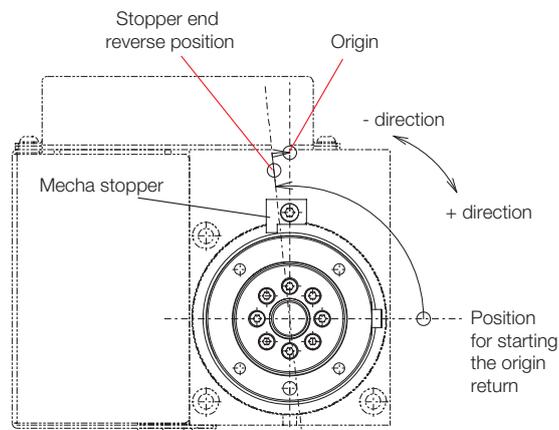


Prohibited

The mecha stopper for this actuator is a stopper for detecting the origin position, and should not be impacted. Therefore, be careful that the mecha stopper is not impacted by the rotating table during overrun, etc.

Positive/negative movement

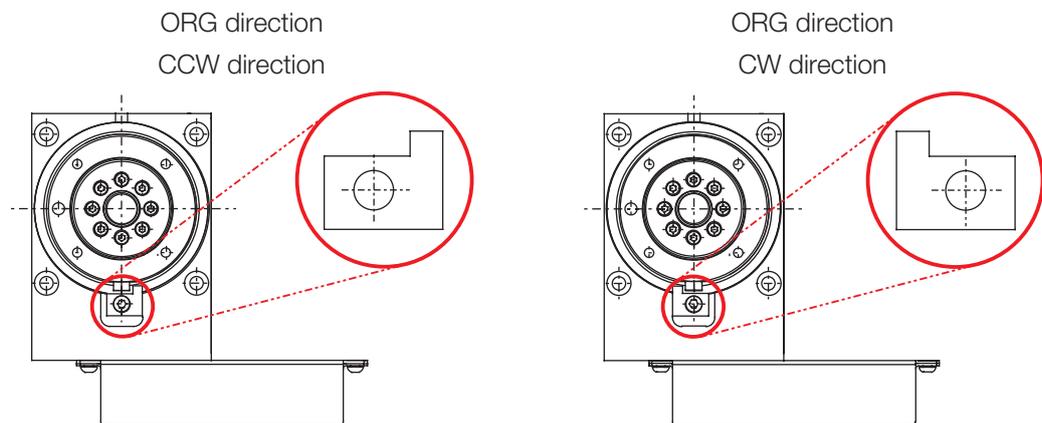
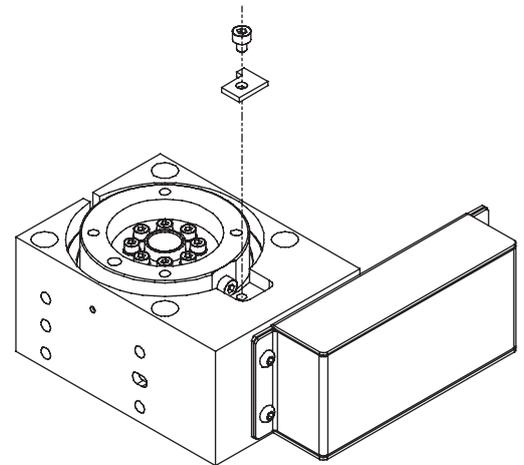
- As the definition of the positive/negative of the position and travel distance, when the origin return is performed, the direction turned to at the stopper end is considered the positive (+) direction.



3. Materials Required for Selecting

Pressed origin return direction when there is no motor

- When the no motor specification for the stroke 330° specification is selected, pressing the origin return button will send the stopper in the direction corresponding to the CCW direction. If the origin return direction is performed in the CW direction, remove the stopper, and after adjusting the orientation, attach once more.



Model	ET20	ET35
Screw type	Hexagon socket low head cap screw	Hexagonal-socket-head type button bolt
Size	M2.5 × 6L	M3 × 6L
Tightening torque [N-cm]	36	110

Caution



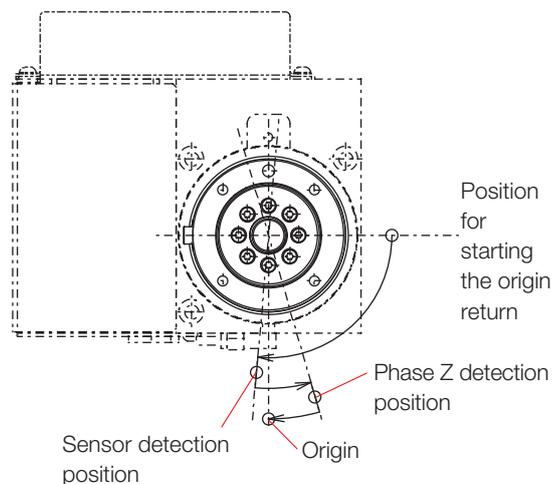
Prohibited

If pressed in the opposite direction with respect to the mecha stopper, the mecha stopper may be damaged. Secure the mecha stopper in an orientation matching that of the origin return direction before use.

3. Materials Required for Selecting

Sensor origin return

- (1) Turn the SV-ON input (pin.18) ON. Check that the SVRDY output (pin.32) is ON.
- (2) When the HOME input (pin.15) is turned ON, the origin return operation will be started.
- (3) The actuator starts moving in the predefined direction (CW direction or CCW direction).
 - * You cannot change the moving direction or speed.
 - * In some cases, the PAUSE input (pin.16) must be ON.
 For more information, see the instruction manual of the TSC controller.



- (4) When the origin sensor of the actuator turns ON, the actuator turns around and starts moving in the reverse direction.
 - * Type of the origin sensor depends on each actuator.
- (5) The position, where the first origin signal (included in the encoder/one output per rotation) is input after the move direction was inverted and the origin sensor was turned OFF, is the origin.
- (6) When it completes returning to the origin, the HEND output (pin.29) will be turned ON. Turn the HOME input (pin.15) OFF.
- (7) If you have configured the parameter No.6 (Origin offset), the position which is offset by the set value becomes the origin.

For more information, see the instruction manual of the TSC controller.

Appendix

Revision history

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

Date of issue	Instruction manual No.	Details
9/2016	No.1050-1(0)E	First edition
6/2017	No.1050-1(1)E	Added a supplementary description of mounting orientation
9/2017	No.1050-2(0)E	Servo motor specification added Errors corrected
3/2018	No.1050-3(0)E	Errors corrected



THK Electric Actuator Economy Series

ET

INSTRUCTION MANUAL