



**THK Electrical Actuator Controller Series  
Stepper Driver Controller**

# TSC

## INSTRUCTION MANUAL

No.6120-2(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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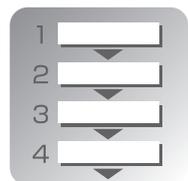
This section includes general precautions to follow when using the product. Be sure to read this section before use and observe the precautions.

<b>2. Safety precautions</b>	<b>1-4</b>
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This section includes introduction about peripheral devices to be used with this product.

<b>3. System configuration</b>	<b>1-6</b>
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This section describes installation and setting processes to make this product ready for use.

<b>4. Flow until using the product</b>	<b>1-7</b>
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# 1. Introduction

## 1-1 Acknowledgment

Thank you for purchasing our product.

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 Purpose

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 access our website or use the printed version of this manual, be sure to keep it in the place that the intended 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 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 our Customer Support (refer to back cover).
- Drawings show representative 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 can be applied to special types. However, the descriptions defined in the delivery specification drawings or the delivery specification documents of those special types should 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 functions, error, or damage of the product if not observed while using the product.

**Note**

- Supplementary information for the description.

**Reference**

- Reference information for the description.

# 1. Introduction

## 1-3 How to use this product

- This product cannot be used for the devices or systems that are used under the situations that can affect 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**

- For the driver controller TSC, select the electrical actuator to use when purchasing it. Use them in the prescribed combination. ( → P.2-3)

## 1-4 About product support

For the following information, please contact our Customer Support (refer to back cover).

- Technical support for this product

## 1-5 About related instruction manuals

- When you use the driver controller TSC, read the following instruction manuals as necessary.
  - Controller series                      Setup tool D-STEP
  - Controller series                      Digital operator TDO

## 1-6 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.

 <p><b>This mark indicates "prohibition" of the action.</b></p>	 <p>Prohibited</p>  <p>Do not disassemble</p>
 <p><b>This mark indicates "instruction" for the action.</b></p>	 <p>Obligatory</p>  <p>Provide grounding connection</p>
 <p><b>This mark indicates "caution" about the action.</b></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.

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 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.

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 - High  
temperature

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

Doing so may cause burns.

#### ⚠ CAUTION



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 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 actuator 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. (→ P.6-5)

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.

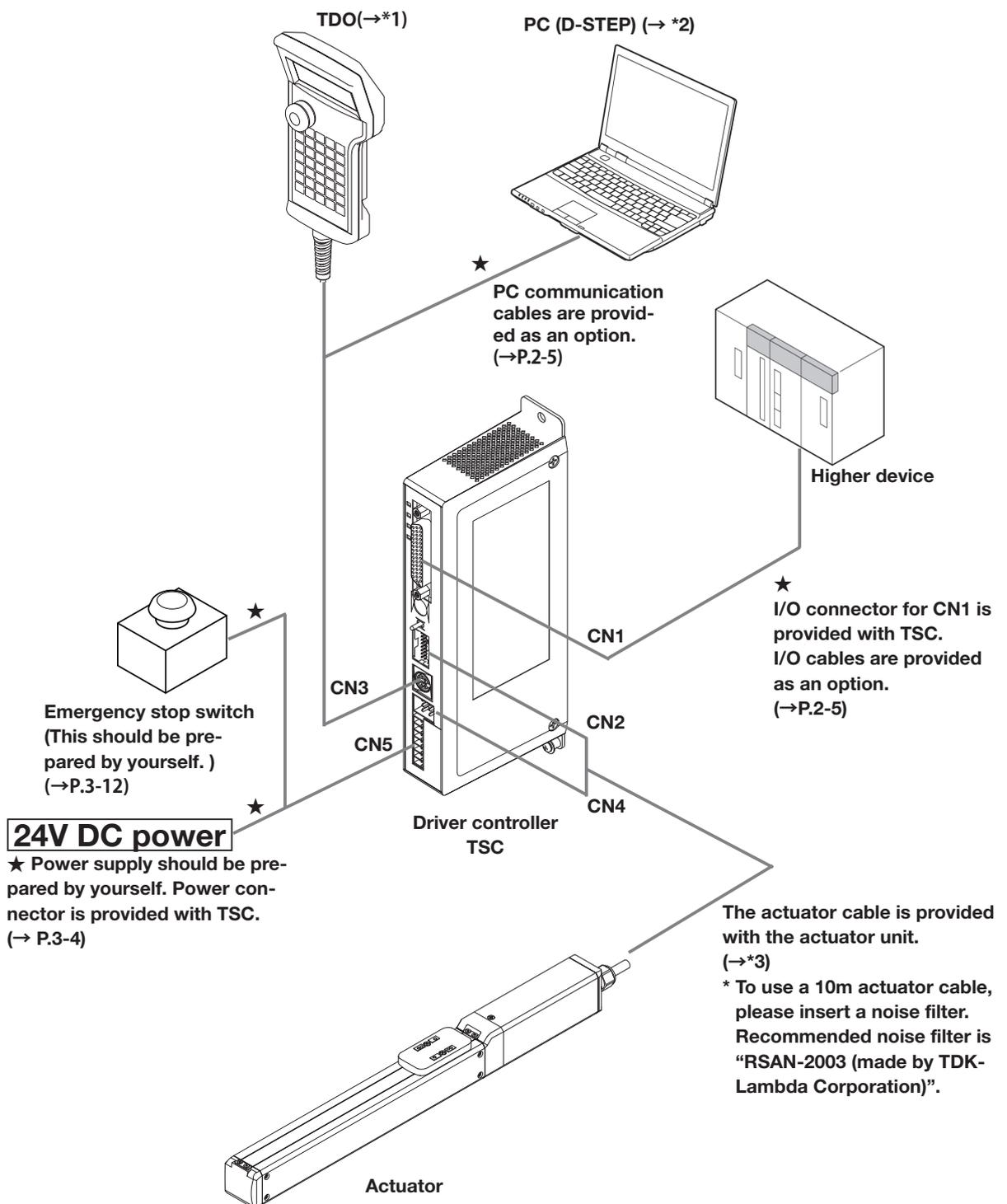
- Observe the specified input voltage.

Failure to do so may cause fire or fault.

## 3. System configuration

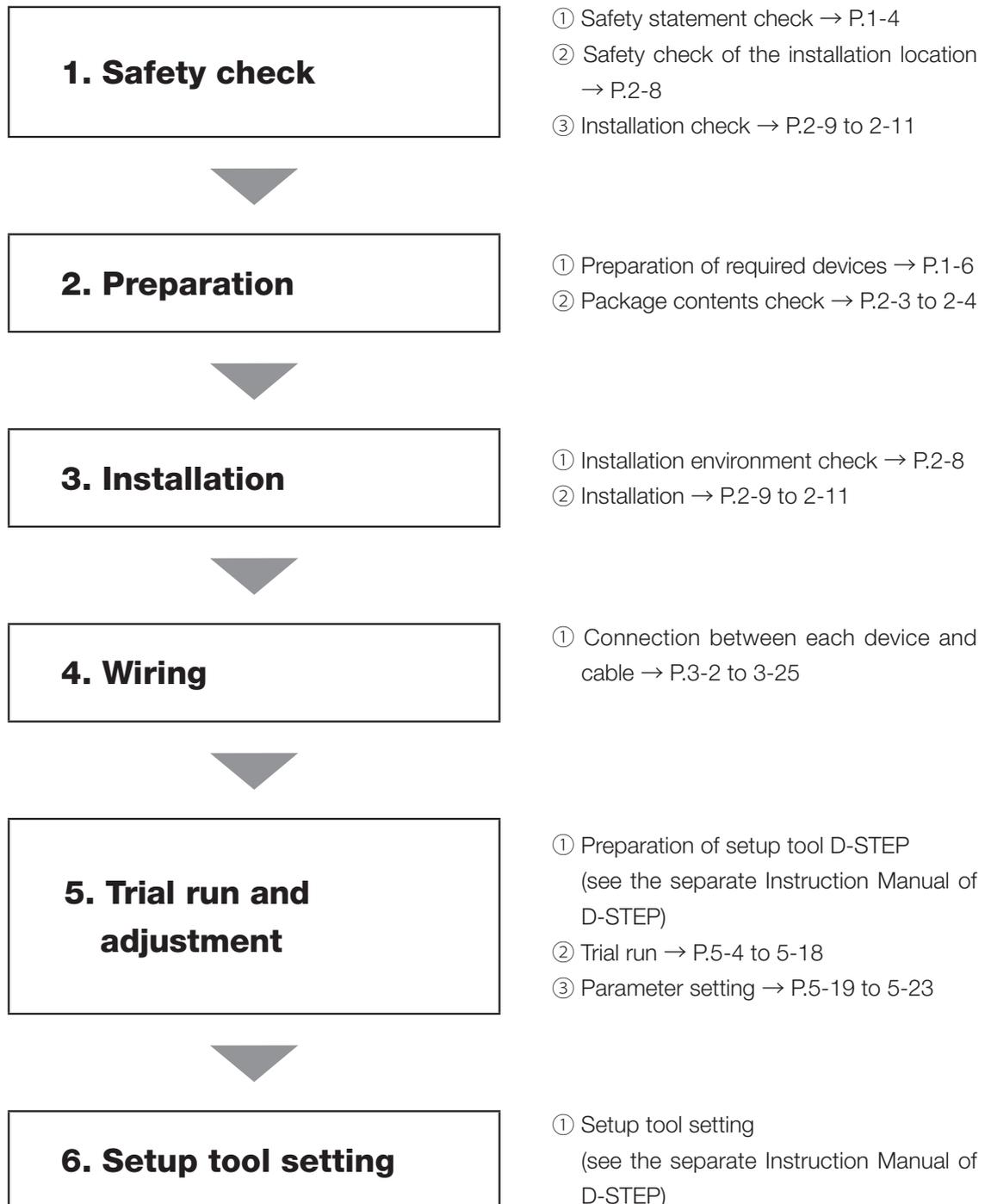
### 3-1 System configuration diagram

- The diagram below shows a representative example for using the economy series ES with the driver controller TSC.
- Cables used for connecting the devices shown with ★ should be prepared by yourself.



\*1: See the separate TDO Instruction Manual.  
 \*2: See the separate D-STEP instruction manual.  
 \*3: See the separate ES/EC 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 precautions on use of this product.

### 1. Check products ..... 2-2

1-1. Check the package contents of TSC ..... 2-3

1-2. Options ..... 2-5

1-3. Names of individual parts  
and functions ..... 2-6

1-4. Store and dispose of products..... 2-7



This section describes the installation procedures of this product.

### 2. How to install ..... 2-8

2-1. Installation environment ..... 2-8

2-2. Install TSC ..... 2-9

# 1. Check products

## WARNING



Prohibited

- **For the combination of the driver controller TSC and actuator, do not use actuators with models other than TSC.**

Doing so may cause unexpected motions, accidents or failures.

### Example of combination

Actuator model: **ES4-06-0300B-TS/35PL-D00-S3**

Driver 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.

- **When carrying the product, do not hold the cable.**

Doing so may cause damage of the cable that leads to injury.



Prohibited

- **When any abnormality is detected on the product, do not continue to use it.**

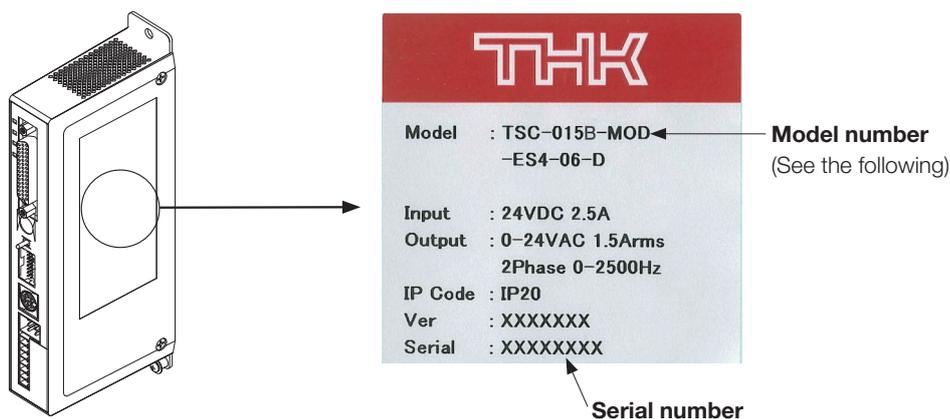
Using a fractured product may cause malfunction that leads to injury or fault. When you find any failures, please contact our Customer Support (⇒ refer to the back cover).

# 1. Check products

## 1-1 Check the package contents of TSC

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

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



**TSC** — **015** — **B** — **MOD** — **ES6** — **06** — **D** — **B**

①      ②      ③      ④      ⑤      ⑥      ⑦      ⑧

① Model	<b>TSC</b> : Driver controller TSC
② Current value	<b>015</b> : 1.5 A
③ Design symbol	<b>B</b>
④ Type	<b>MOD</b> : Mode switching type
⑤ Applicable actuator	<b>ES3, ES4, ES5, ES6</b> <b>ES3R, ES4R, ES5R, ES6R</b> <b>EC3, EC4</b> (Select "EC3" for EC3H, and "EC4" for EC4H. ) <b>EC3R, EC4R</b> <b>KRF4, KRF5, CKRF4, CKRF5</b>
⑥ Applicable value	<b>06</b> : 6 mm
Ball screw lead	<b>10</b> : 10 mm <b>12</b> : 12 mm
⑦ Zero point	<b>D</b> : Motor side <b>R</b> : Reverse motor side
⑧ Brake	<b>No symbol</b> : No brake <b>B</b> : With brake

Note) Refer to the respective actuator catalogs for the model configuration of driver controller TSC for ET and EG.

# 1. Check products

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

No cable is provided, so please separately prepare a cable.

Type of parts	Model number		Qty.
Driver controller	* See the product label		1
Power connector	Current product	Conventional product	1
	FK-MCP 1,5/7-ST-3,81 (PHOENIX CONTACT)	MPC300-38107 (DECA) 	
I/O connector	Current product	Conventional product	1
	Plug HD-44SP (MISUMI)	Plug DBH44MCA (NSXD) 	
	Cover RDA-25H-UNC (MISUMI)	Cover DT44PB (NSXD) 	1

## 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.

### Reference

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

# 1. Check products

## 1-2 Options

### 1-2-1 D-STEP

A setup tool. This can be downloaded from our website free of charge.

\* Registration with the technical support is required to download.

URL: <https://tech.thk.com/>

In addition, a PC communication cable is required to use D-STEP.

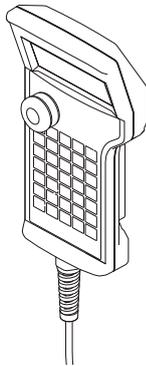
For details, see the separate D-STEP Instruction Manual.

### 1-2-2 TDO

The digital operator for driver controller TSC, TLC and THC.

Model: TDO-N

For details, see the separate TDO Instruction Manual.

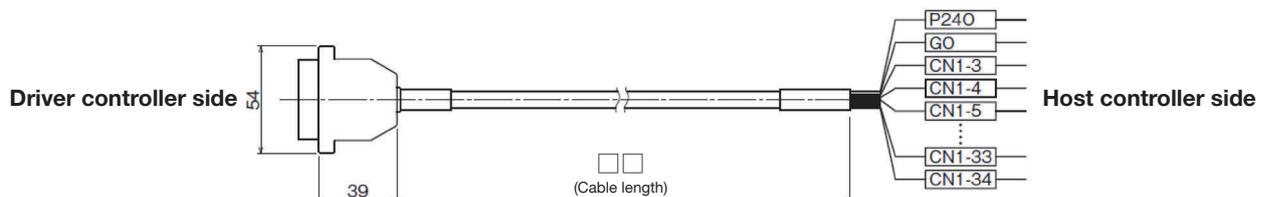


### 1-2-3 I/O cable

A cable with a soldered I/O connector for external input and output signals (CN1).

Model: CBL-TSC-IO-□□ (03: 3 m, 05: 5 m, 10: 10 m)

For details, see (→ P.3-14) (→ P.3-25)

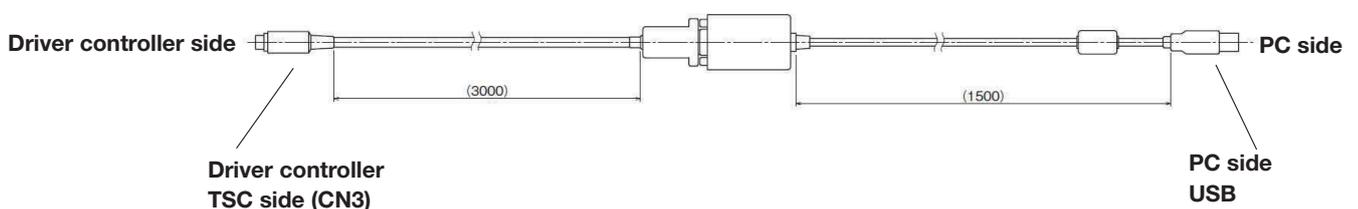


### 1-2-4 PC communication cable

A PC communication cable for use with D-STEP.

Model: CBL-COM-03

For details, see the separate D-STEP Instruction Manual.

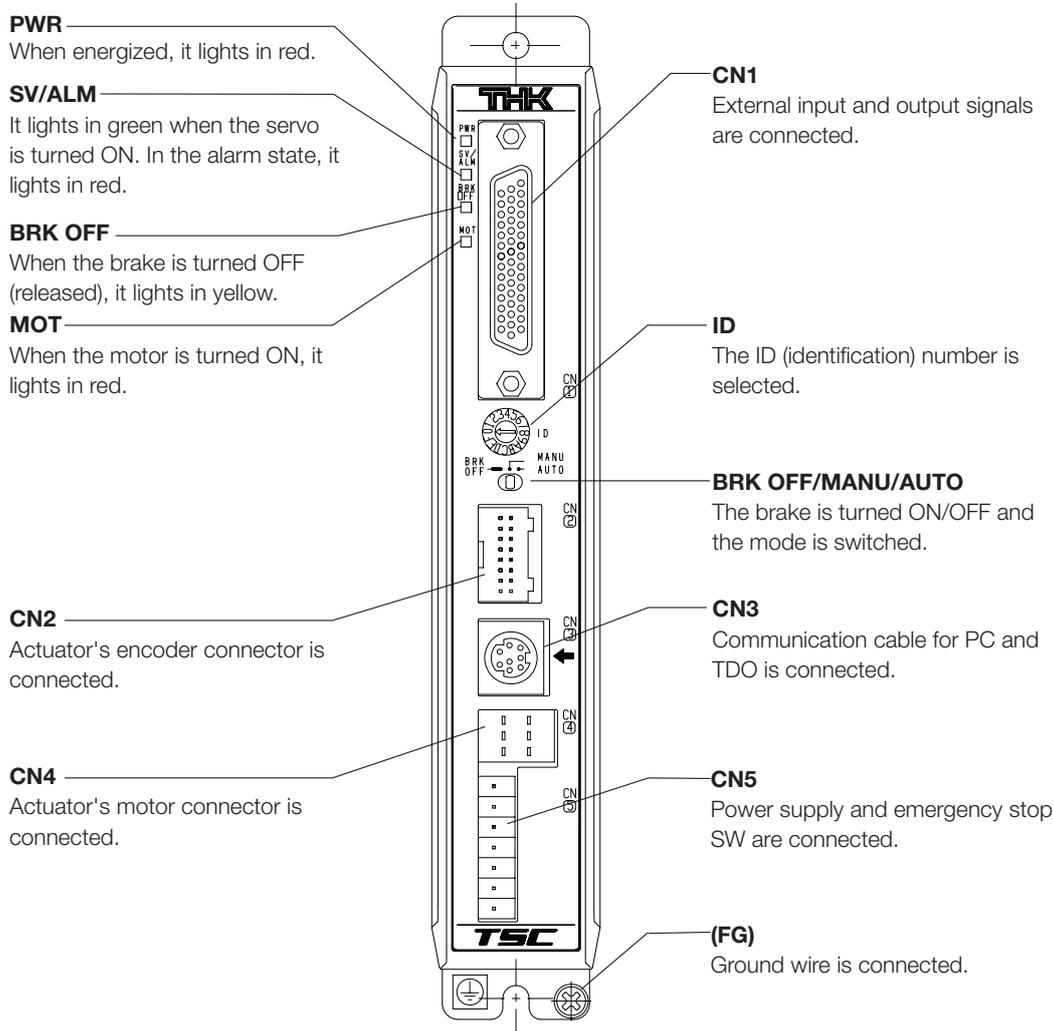
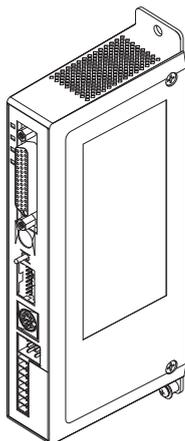


# 1. Check products

## 1-3 Names of individual parts and functions

### 1-3-1 Driver controller TSC

- Connectors for CN1 and CN5 are provided with this product. No cable is provided, so please separately prepare it. For CN1, an optional package with a cable is available. (→ P.2-5) (→ P.3-25)
- A cable to connect to CN3 and PC is available as an option. (→ P.2-5)



# 1. Check products

## 1-4

### Store and dispose of products

#### 1-4-1

##### 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 place:

- Indoor or outdoor at the driver controller TSC's ambient temperature of -20 to 85°C (no freezing)
- Indoor or outdoor at the driver controller TSC's ambient humidity of 90% RH or less (no condensation)
- Stored with the power disconnected
- 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

#### 1-4-2

##### 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. How to install

## 2. Installation

### 2-1 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.

### 2-1-1

#### Installation environment of the driver controller TSC

Place it within a control panel that meets the following conditions:

- Indoor or outdoor at the ambient temperature of 0 to 40 °C (no freezing)
- Indoor or outdoor at the ambient humidity of 90% RH or less (no condensation)
- Place at an altitude below 1000 m
- 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

### 2-1-2

#### 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.

## 2. How to install

### 2. Installation

#### 2-2

#### Install TSC

### ! WARNING



Caution -  
Electrical shock

- **The driver controller TSC must be installed within the control panel and operated with the door closed.**

Failure to do so may cause electric shocks.

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

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



Obligatory

- **Place to the upper equipment the emergency stop circuit that stops the operations of the product and disconnects the main circuit power supply in the event of emergency.**

Failure to do so may cause the damage of the product that leads to injury.



Obligatory

- **Install a safety device such as a breaker for wiring to prepare against short-circuit of the wiring connected to the driver controller TSC.**

Failure to do so may cause electric shocks or fault.



Caution -  
Flammable

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

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

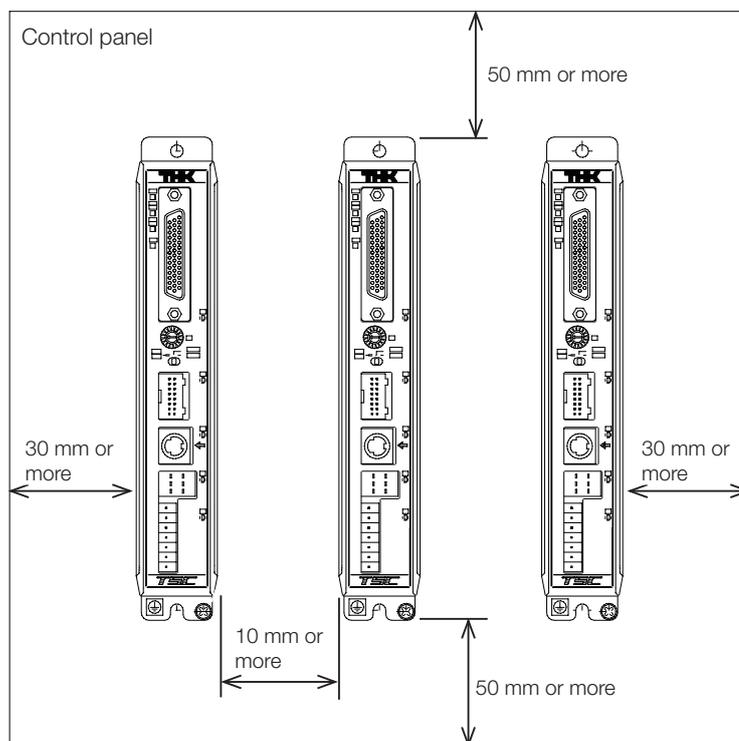
## 2. How to install

### 2. Installation

#### 2-2-1 Standards for installation

When installing the driver controller TSC to the control panel, observe the following installation standards.

- Install it onto the wall perpendicularly so that the front of TSC directly faces to the operator.
- The space between TSC and TSC must be 10 mm or more.
- To allow for cooling by the fan or natural convection, the space between TSC and the right/left wall must be 30 mm or more.
- To allow for cooling by the fan or natural convection, the space the above/below TSC must be 50 mm or more.
- If the temperature in the control panel exceeds 40°C, install cooling fan(s).



## 2. How to install

### 2. Installation

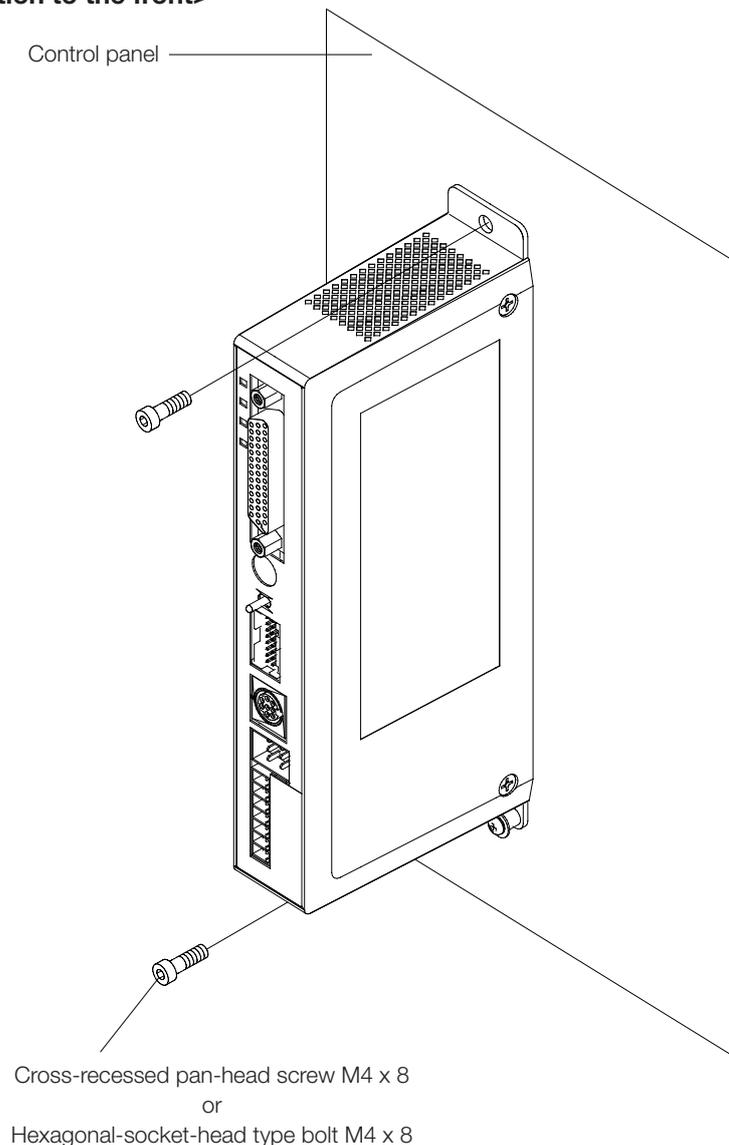
#### 2-2-2 How to install

- Use the 2 mounting holes on the fittings of the driver controller TSC and fixing bolts for installation. Installation direction is vertical only (panel display is upright). Do not perform tilt, horizontal, or up-side-down installation which disturbs heat discharge.
- To prevent effects of the PWM switching noise and external noise, be sure to perform single point D-type ground for the TSC frame ground (FG).

\* Prepare bolts and tools to be used separately.

- **Fixing bolt:** Cross-recessed pan-head screws or hexagonal-socket-head type bolts M4 x 8 (2 pcs.)
- **Tools to use:** According to bolt types

##### <Installation to the front>



# 3. Wiring

## About this chapter

This chapter describes how to connect to and wire TSC.



Connect to peripherals to operate the actuator.

### 1. How to wire..... 3-2

1-1. Entire wiring ..... 3-3

1-2. Connect peripheral devices to power supply..... 3-4

1-3. Connect to PC ..... 3-11

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Connect to the upper equipment to operate the actuator.

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# 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.



Provide grounding connection

- **Be sure to perform single-point D-type ground for the FG terminal of this product.**

**Connect the grounding electrode according to the laws, ordinances, and regulations applied in respective regions and countries.**

Fault or electric leakage may cause electric shocks.

- **Do not ground the earth to the following locations:**

- Gas pipe...Explosion or fire may occur.
- Conductor rod or telephone line... It poses a danger in the event of ground discharge.
- Water line...It causes electric shocks. In addition, the earth does not function if its middle section is made of plastic.



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.



Caution - Electrical shock

- **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.**

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.

- **The actuator cable is not a robot cable.**

Fix the cable before using it.

## ⚠ CAUTION



Obligatory

- **When connecting TSC to the network unit TNU, do not wire the CN5 pin number ① (S1).**

Doing so may cause fault.



# 1. How to wire

## 1-2 Connect peripheral devices to power supply

### 1-2-1 How to connect connectors for power supply

The power supply (CN5) connector to connect to the driver controller is provided with the driver controller TSC as standard. (→P. 2-4)

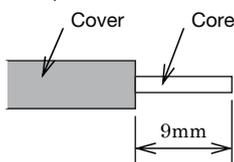
Input power supply	Power (CN5) connector type
24 VDC ± 10% (max. 2.5 A)	FK-MCP1.5/7-ST-3.81(PHOENIX CONTACT)

#### ► Prepare the power supply cable.

- Use the power supply cable with permissible current, making allowance for the usage conditions (the ambient temperature, number of the core, number of binding wires, and duct storage, etc.) at 1.25 mm<sup>2</sup> (AWG16) or below.

\* To supply the power to multiple units, be careful about the current capacity of the wire rod.

- Strip length of core: 9 mm



- Process for the terminal:

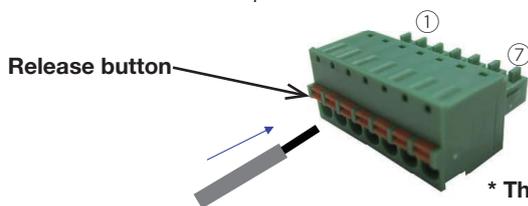
- Twist the wires appropriately to prevent them from not spreading.
- Do not apply solder plating to the core, doing so causes poor contact.
- Do not twist more than one wire together, doing so may cause a fall.

- Wiring and routing:

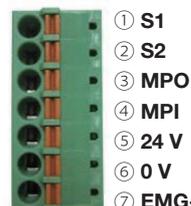
- Twist the electric wires of 24 V and 0 V (to exclude noise).
- Separate the electric wires from strong electric lines (do not bind them together or place them in the same duct).

- Connect to the connector:

- Insert the electric wires, pressing the release button of the connector by a tapering screwdriver.
- Insert the electric wires to the bottom, and release the release button.
- Lightly pull the electric wires to ensure that it would not fall off.
- Once the entire wiring is completed, check that there is no short-circuit caused by two adjacent wires.



\* The numbers represent the pin numbers.



\* The numbers represent the pin numbers.

#### Important

- When connecting to the network unit TNU, do not wire the CN5 pin number ① (S1). For more information, see the separate TNU instruction manual.
- Prepare materials used for the power supply cable (the wire rod, and crimping terminal, etc.).

#### Important

- Unless the connector is fully connected, the product will not operate properly.

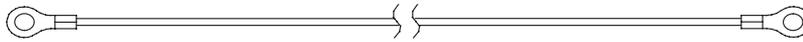


# 1. How to wire

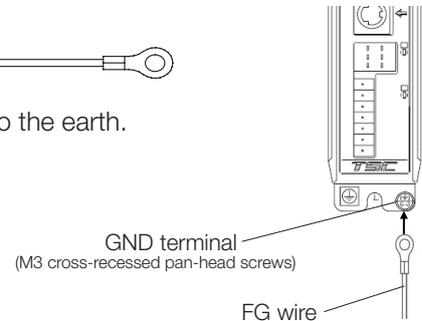
## 1-2-2 Connection of FG wire

### ► Production of FG cable example (prepare it by yourself)

- Recommended electric wire: 1.25 mm<sup>2</sup> (AWG16)



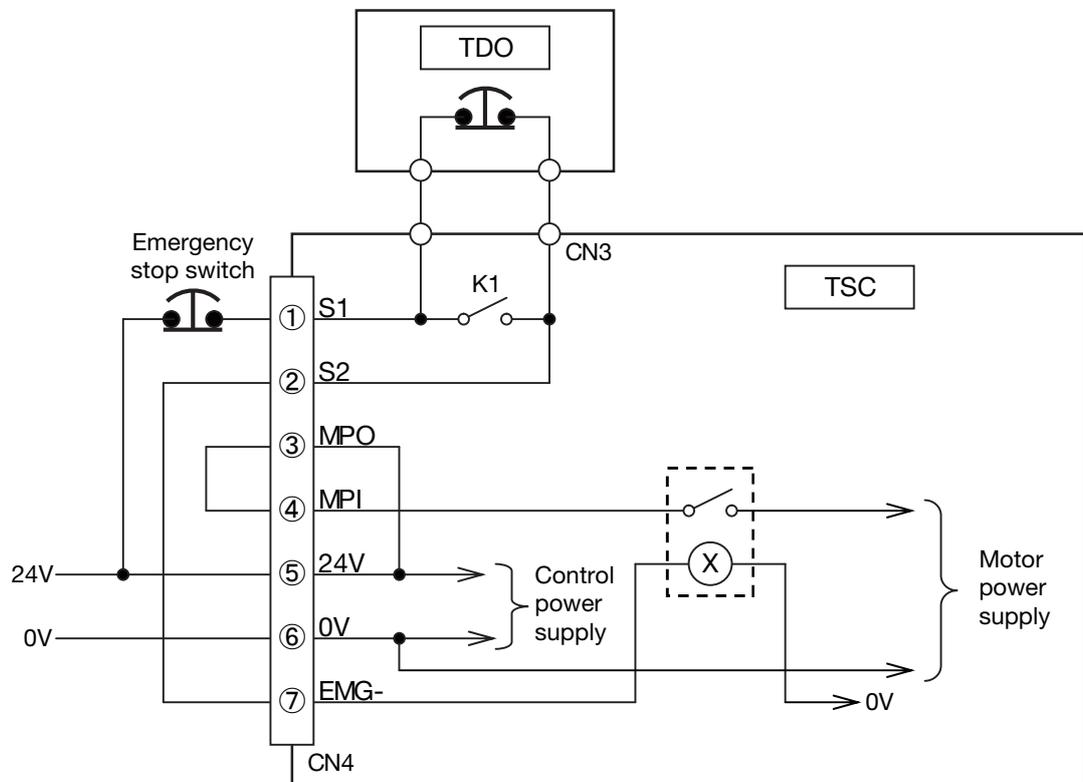
Connect the FG wire to the GND terminal, and ground it to the earth.



## 1-2-3 Wiring diagram

### ● Use one machine of TSC (no reset switch)

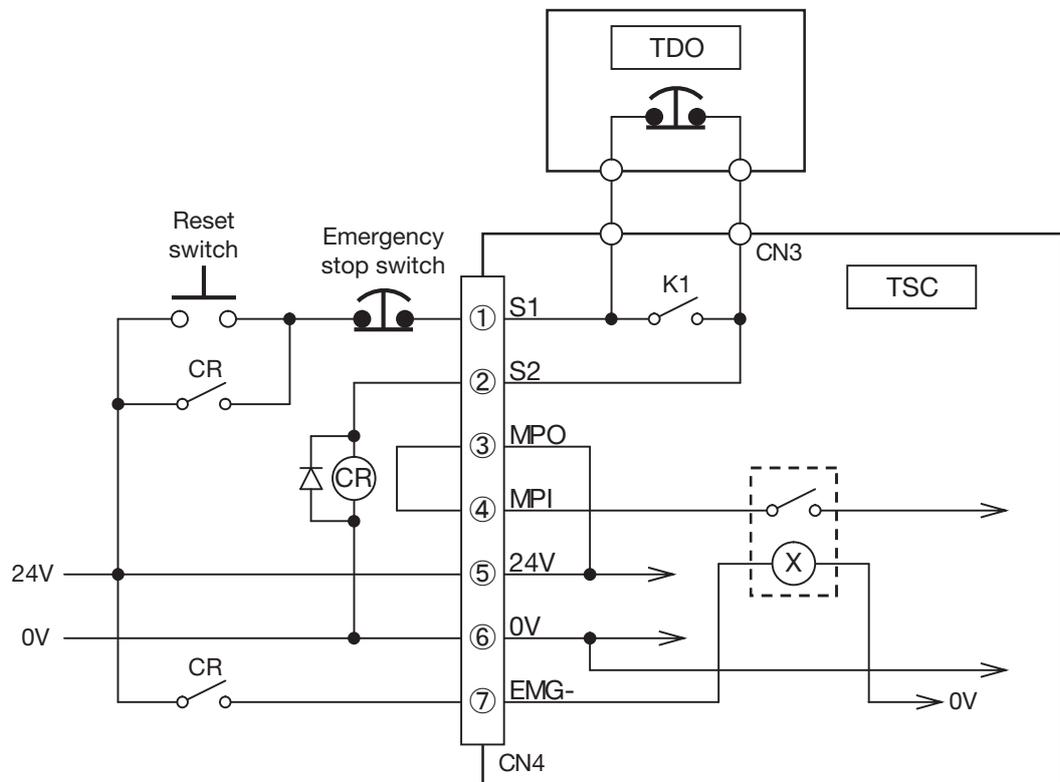
- The motor is energized as soon as the emergency stop switch is released.
- Connecting TDO will open the internal relay K1, and the TDO emergency stop switch is activated.
- While TDO is not connected, the internal relay K1 is closed.
- When connecting TSC to the network unit TNU, do not wire the CN5 pin number ① (S1). (Doing so may cause fault.)



# 1. How to wire

## ● Use one machine of TSC (with reset switch)

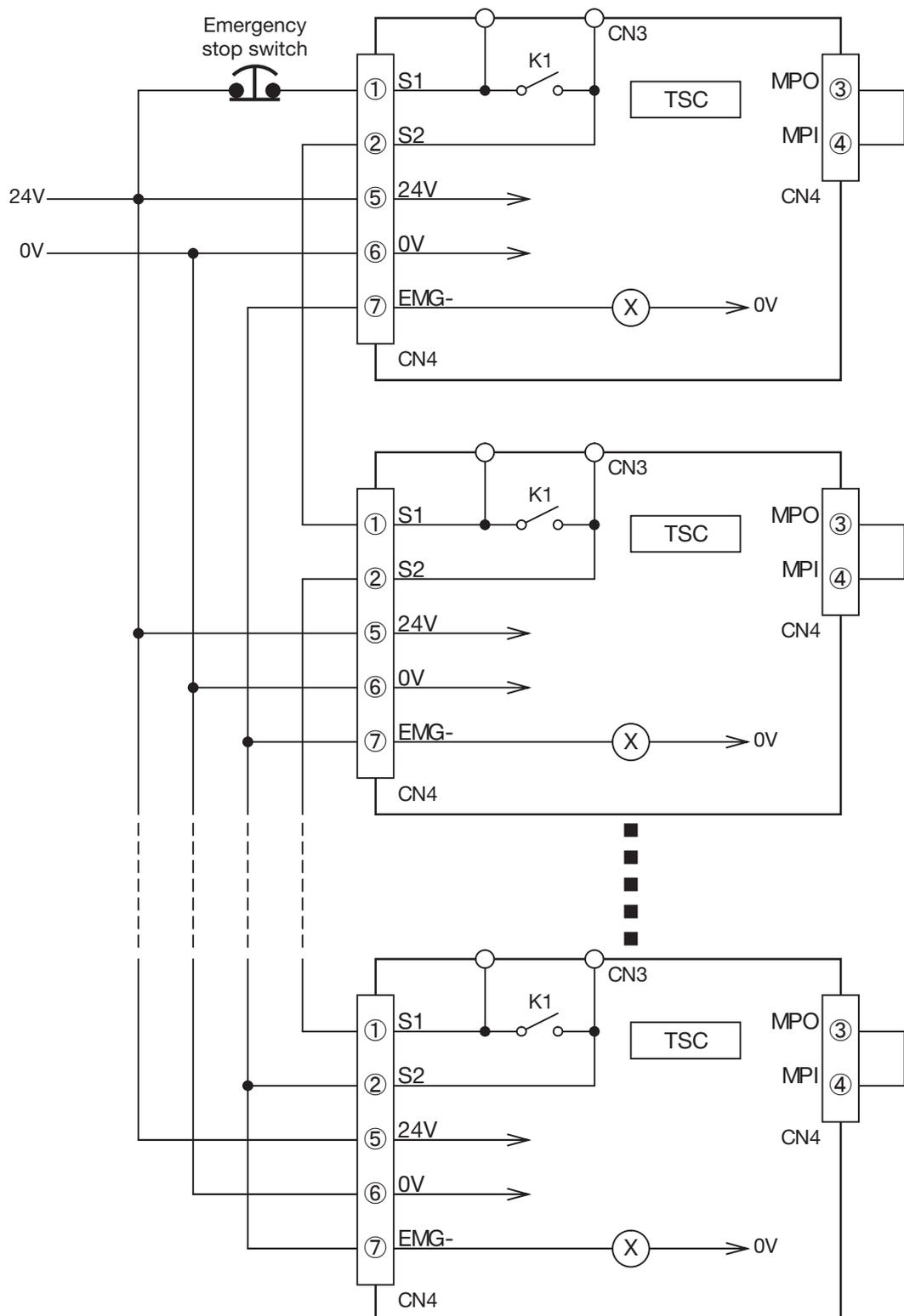
- Even if the emergency stop switch is released, the motor would not be energized until the reset switch is turned ON.
- The reset switch must be turned ON when the power is turned ON.
- Use the external relay CR with the surge absorption diode at 0.1 A or less coil current.
- Connecting TDO will open the internal relay K1, and the TDO emergency stop switch is activated.
- When TDO is not connected, the internal relay K1 will be closed.
- When connecting TSC to the network unit TNU, do not wire the CN5 pin number ① (S1). (Doing so may cause fault.)



# 1. How to wire

## ● Use more than one machine of TSC (the same power source)

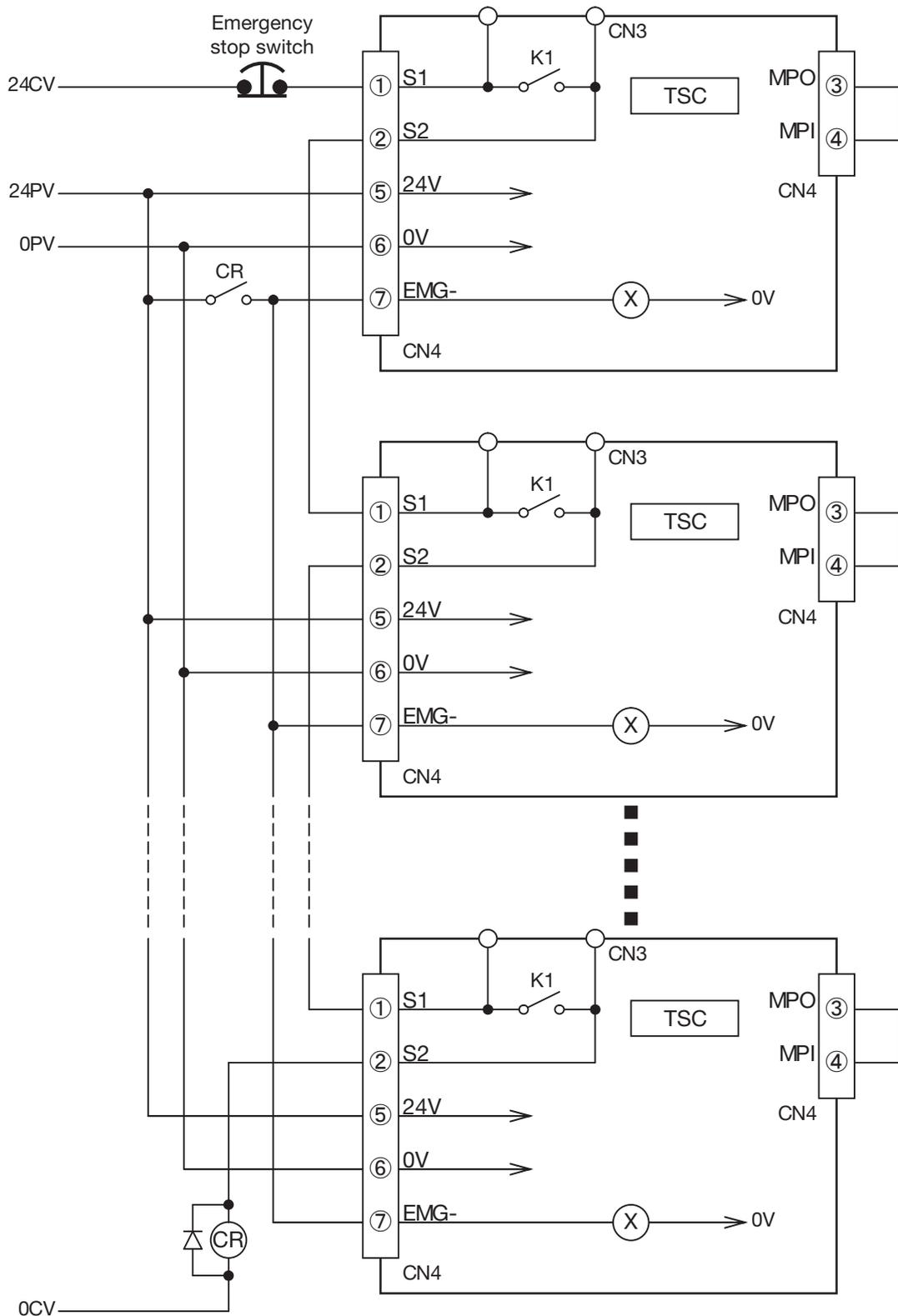
- One emergency stop switch can stop all the TSCs urgently.
- When TDO is connected to any TSC, the emergency stop by TDO also stops all the TSCs urgently.
- When connecting TSC to the network unit TNU, do not wire the CN5 pin number ① (S1). (Doing so may cause fault.)



# 1. How to wire

## ● Use two or more machines of TSC (another power source)

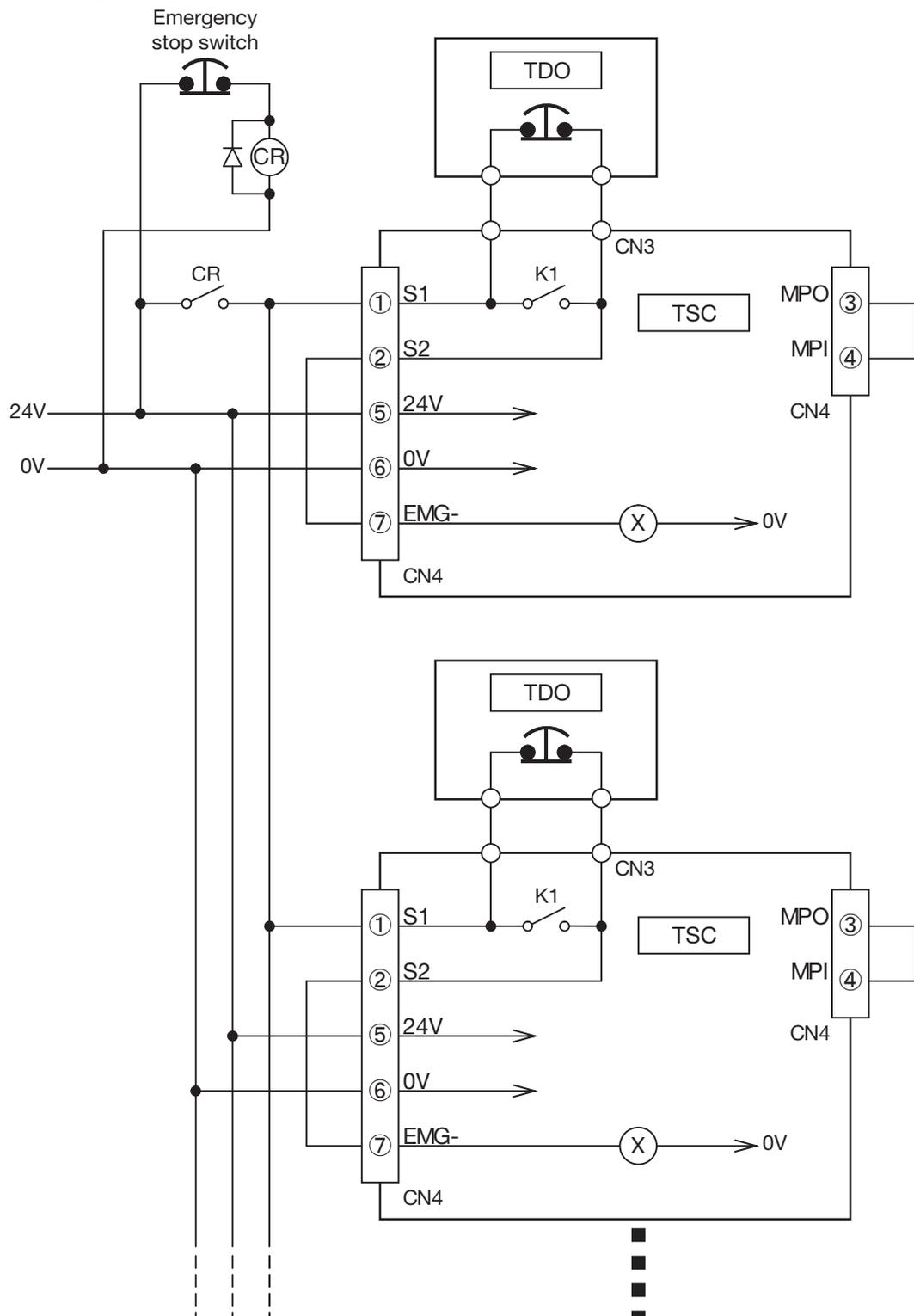
- One emergency stop switch can stop all the TSCs urgently.
- When TDO is connected to any TSC, the emergency stop by TDO also stops all the TSCs urgently.
- Use the external relay CR with the surge absorption diode at 0.1 A or less coil current.
- When connecting TSC to the network unit TNU, do not wire the CN5 pin number ① (S1). (Doing so may cause fault.)



# 1. How to wire

## ● Solo emergency stop of TSC (TDO uses)

- One emergency stop switch can stop all the TSCs urgently.
- When TDO is connected to any TSC, the emergency stop by TDO stops only the TSC urgently.
- Use the external relay CR with the surge absorption diode at 0.1 A or less coil current.
- When connecting TSC to the network unit TNU, do not wire the CN5 pin number ① (S1). (Doing so may cause fault.)



# 1. How to wire

## 1-2-4 Connect to driver controller TSC

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

**2. Connect the motor connector (black) to the CN4 of TSC.**

If it is connected properly, it should be locked and cannot be fallen off even by pulling it lightly.

\* Do not pull it strongly.



**3. Connect the encoder connector (white) to the CN2 of TSC.**

If it is connected properly, it should be locked and cannot be fallen off even by pulling it lightly.

\* Do not pull it strongly.



# 1. How to wire

## 1-3 Connect to PC

### 1-3-1 How to connect

- Connect with the separately-sold communication cable (CBL-COM-03.) (→P. 2-5)
- If the PC has only the USB port instead of the RS-485 port, use the provided conversion cable. Operations with other than this conversion cable cannot be guaranteed. (→P. 2-5)

**1. Insert the cable to the CN3 of TSC, aligning the arrow of the plug with the one of TSC.**

If you insert the plug while rotating it, the connection pins may be damaged.



## 1-4 Connect to TDO

### 1-4-1 How to connect

**1. Insert the cable to the CN3 of TSC, aligning the arrow of the plug with the one of TSC.**

If you insert the plug while rotating it, the connection pins may be damaged.



# 1. How to wire

## 1-5 Peripheral devices

### 1-5-1 Breaker for wiring

- For your safety, attach an electric leakage breaker appropriate for the DC power supply onto the primary side (the AC input side) of the DC power supply to supply the power for the TSC.

### 1-5-2 Electromagnetic contractor, surge suppressor

- **1-2-3 Wiring diagram (→ P. 3-5)** describes a wiring example that the motor power supply is disconnected due to an emergency stop, which is the result that all the contacts within the TSC internal relay have been released.
- To directly disconnect the motor power supply in an external contact, insert a contact of the electromagnetic contractor or the like between MPO<sup>③</sup> and MPI<sup>④</sup>.
- Be sure to connect the surge suppressor to the excitation coil of the electromagnetic contractor.
- Take appropriate measures such as contact duplexing according to the requirements on the safety category.  
(All the wiring examples in this document do not guarantee the achievement of the safety categories in particular.)

### 1-5-3 Emergency stop switch

- Be sure to install an emergency stop switch to forcibly terminate the device in case of emergency.
- Select an emergency stop switch with the contact closed at normal times (b contact, N.C. contact).
- The EMGS output (pin.33) turns OFF when the emergency stop is activated.
- When the emergency stop is activated, in case of an actuator with a brake, its brake can be activated.  
However, note that by releasing the brake manually, it is released at the same time that the emergency stop is released.

### 1-5-4 External control device

- To the CN1 of this product, connect the positive-common type or positive-negative-common type external input signal circuit.
- To the CN1 of this product, connect the **sink type (NPN type)** external output signal circuit.
- Power supply voltage of both input and output is DC 24 V.

## 2. External input and output (CN1)

### ⚠ WARNING



Caution -  
Electrical shock

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

Doing so will cause electric shocks.



Caution -  
Electrical shock

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

Doing so causes disconnection of the cable, short circuits, or electric shocks.

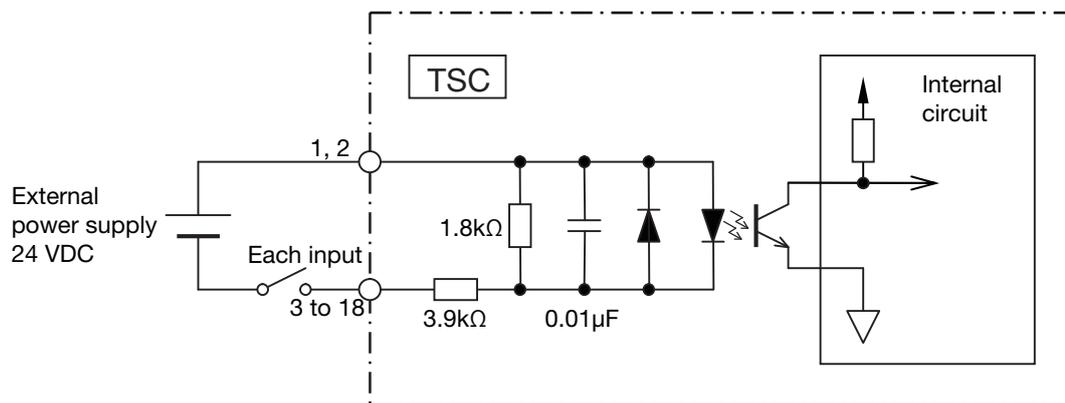
### 2-1

### Electrical specification

#### 2-1-1

#### Specifications of external input parts

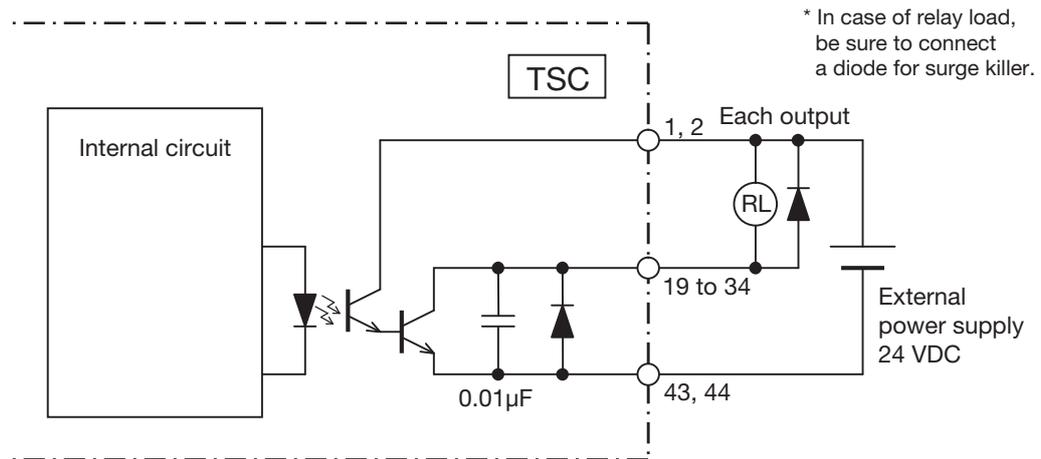
Items	Specifications
Input voltage	24 VDC ± 10%
Input current	6 mA/1 circuit
Insulation method	Photo coupler



## 2. External input and output (CN1)

### 2-1-2 External output specifications

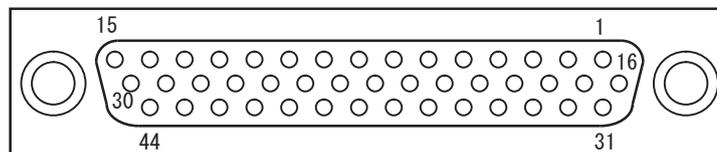
Items	Specifications
Rated load voltage	24 VDC $\pm$ 10%
Maximum current	50 mA/1 circuit
Residual voltage	0.3 V or less
Insulation method	Photo coupler



### 2-1-3 Filter for noise reduction

- An input-time constant is set in order to prevent malfunctions due to chattering and noises of the input signals, etc.
- The input signal is switched when the same state continues for 6 ms or longer (ON  $\rightarrow$  OFF and OFF  $\rightarrow$  ON).

### 2-1-4 Connector pin number



\* This figure shows the view from the fit surface with the plug.

## 2. External input and output (CN1)

### 2-2 Signal name

#### 2-2-1 List of function modes

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		---	JOG P	---	PI 8	---	---	
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		

## 2. External input and output (CN1)

### 2-2-2 Details of signals

- In the following descriptions, "ON" means short circuit to 0 V.
- Valid for function modes with "○". Invalid for function modes with "—". The function modes with "△" functions only in case of alarm.

#### ● Power supply, etc.

Signal name	Pin Number	Function mode						Functions and use application	Reference Page
		0	1	2	3	4	5		
P240	1,2	○	○	○	○	○	○	Connect an external power supply DC 24 V. Connect a power source other than the CN5 in order to prevent noise.	---
FG	41,42	○	○	○	○	○	○	Connected to the frame ground.	---
GO	43,44	○	○	○	○	○	○	Connect an external power supply 0 V. Connect a power source other than the CN5 in order to prevent noise.	---
FG	case	○	○	○	○	○	○	Connected to the frame ground.	---

#### ● Input

Signal name	Pin Number	Function mode						Functions and use application	Reference Page
		0	1	2	3	4	5		
PI 0	3	○	○	○	○	—	—	Specify the STEP No. to be executed by binary. The specification must be completed before the STRT turns ON (prior to 10 ms).	(→ P.4-5) (→ P.4-6) (→ P.4-8) (→ P.4-9)
PI 1	4	○	○	○	○	—	—		
PI 2	5	○	○	○	○	—	—		
PI 3	6	○	○	○	○	—	—		
PI 4	7	○	○	○	○	—	—		
PI 5	8	○	○	○	○	—	—		
PI 6	9	—	—	○	○	—	—		
PI 7	10	—	—	○	○	—	—		
PI 8	11	—	—	—	○	—	—	2 <sup>8</sup> 256	
ST 0	3	—	—	—	—	○	○	Directly specify the STEP No. Execute the STEP No. right after it is turned ON. STRT does not require turning ON/OFF. The two or more contracts are turned ON at the same time, resulting in malfunction.	(→ P.4-10) (→ P.4-12)
ST 1	4	—	—	—	—	○	○		
ST 2	5	—	—	—	—	○	○		
ST 3	6	—	—	—	—	○	—		
ST 4	7	—	—	—	—	○	—		
ST 5	8	—	—	—	—	○	—		
ST 6	9	—	—	—	—	○	—		
MODE	9	—	○	—	—	—	—	ON: Migrate to the instruction mode, OFF: Normal position mode	(→ P.4-8)
JOG/ INCHING	10	—	○	—	—	—	—	In manual operation, JOG P and JOG N are: ON : INCHING operation    OFF : JOG operation	(→ P.4-7)
JOG P	11	—	○	—	—	—	—	Move in the positive (+) direction.	(→ P.4-7)

## 2. External input and output (CN1)

Signal name	Pin Number	Function mode						Functions and use application	Reference Page
		0	1	2	3	4	5		
JOG N	12	—	○	—	—	—	—	Move in the negative (-) direction.	( → P.4-7)
BKRL	12	○	—	○	○	○	○	With ON, the brake is <u>released</u> forcibly. Usually, it interlocks with the servo ON/OFF.	( → P.5-17)
STRT	13	○	—	○	○	—	—	Execute the program by turning STEP No. ON after specifying it.	( → P.4-6)
STRT/PWRT	13	—	○	—	—	—	—	MODE is ON: Current position write OFF: Normal program execution	( → P.4-9)
MANU	14	○	○	○	○	○	○	Switch the operation modes. ON: MANUAL mode OFF: AUTO mode However, it does not switch when the parameter No.38 is "Valid".	( → P.5-5)
HOME	15	○	○	○	○	○	○	Execute the zero return operation.	( → P.5-9)
PAUSE	16	○	○	○	○	○	○	With OFF, pause.	( → P.5-10)
REST	17	○	○	○	○	○	○	Reset the alarm. During pause, the remaining movement distance is canceled.	( → P.5-10)
SV-ON	18	○	○	○	○	○	○	Turn the servo ON. This can be changed to "Always ON" by the parameter No.35.	( → P.5-8)

### ● Output

Signal name	Pin Number	Function mode						Functions and use application	Reference Page
		0	1	2	3	4	5		
PO 0	19	○	○	○	○	—	—	Output the STEP No. whose operation has been completed by binary.	( → P.4-5)
PO 1	20	○	○	○	○	—	—		
PO 2	21	○	○	○	○	—	—		
PO 3	22	○	○	○	○	—	—		
PO 4	23	○	○	○	○	—	—		
PO 5	24	○	○	○	○	—	—		
PO 6	25	—	—	○	○	—	—		
PO 7	26	—	—	○	○	—	—		
PO 8	27	—	—	—	○	—	—		
PE 0	19	—	—	—	—	○	—	Directly output the STEP No. whose operation has been completed.	( → P.4-11)
PE 1	20	—	—	—	—	○	—		
PE 2	21	—	—	—	—	○	—		
PE 3	22	—	—	—	—	○	—		
PE 4	23	—	—	—	—	○	—		
PE 5	24	—	—	—	—	○	—		
PE 6	25	—	—	—	—	○	—		

## 2. External input and output (CN1)

Signal name	Pin Number	Function mode						Functions and use application	Reference Page	
		0	1	2	3	4	5			
LS 0	19	—	—	—	—	—	○	When it enters into the positioning range set in each STEP No., it turns ON. Not related to the selected ST.	(→ P.4-13)	
LS 1	20	—	—	—	—	—	○			
LS 2	21	—	—	—	—	—	○			
(AC 0)	19	△	△	△	△	△	△	2 <sup>0</sup> 1	Output the alarm code by binary, using (AC 0) to (AC 5) only when an alarm occurs.	(→ P.6-4)
(AC 1)	20	△	△	△	△	△	△	2 <sup>1</sup> 2		
(AC 2)	21	△	△	△	△	△	△	2 <sup>2</sup> 4		
(AC 3)	22	△	△	△	△	△	△	2 <sup>3</sup> 8		
(AC 4)	23	△	△	△	△	△	△	2 <sup>4</sup> 16		
(AC 5)	24	△	△	△	△	△	△	2 <sup>5</sup> 32		
MOVE	25	○	○	—	—	—	—	Turns ON while moving the actuator.	(→ P.5-18)	
AREA	26	○	—	—	—	○	○	Turns ON when it is within the range set by the parameters No.1 and 2.	(→ P.5-15)	
MODE S	26	—	○	—	—	—	—	ON: Instruction mode, OFF: Normal mode	(→ P.4-8)	
P AREA	27	○	○	○	—	○	○	Turns ON when it is within the P area A/B set by the running STEP No.	(→ P.5-15)	
MANU S	28	○	○	○	○	○	○	ON: MANUAL mode OFF: AUTO mode Interlocks with not only the MANU input but also the mode change switches of the panel.	(→ P.5-5)	
HEND	29	○	○	○	○	○	○	Turns ON when the zero return is completed.	(→ P.5-9)	
INPS	30	○	○	○	○	○	—	Turns ON when the current position enters into the pos range set by the running STEP No.	(→ P.5-12)	
LOAD/TRQS	31	○	—	○	○	○	—	Outputs the results of the torque determination.	(→ P.5-14)	
WEND	31	—	○	—	—	—	—	When writing is completed in instruction mode, it turns ON for 30 ms.	(→ P.4-9)	
SVRDY	32	○	○	○	○	○	○	Turns ON when the servo is normally turned ON.	(→ P.5-8)	
EMGS	33	○	○	○	○	○	○	In an emergency stop status, it turns OFF.	(→ P.3-12)	
ALM	34	○	○	○	○	○	○	In an alarm state, it turns OFF.	(→ P.6-4)	

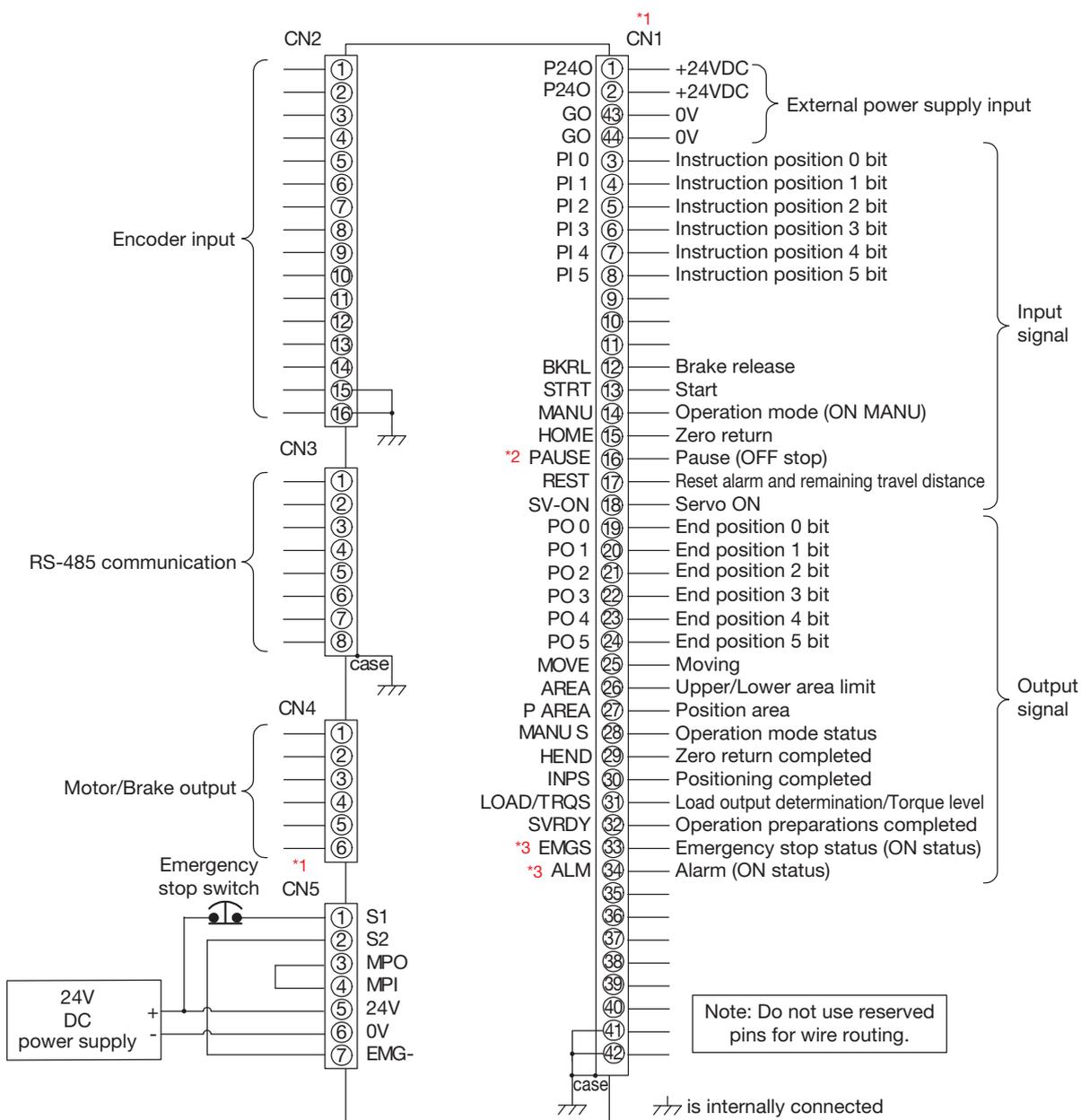
\* For details of parameter setting and program input, see the separate instruction manual on setup tool D-STEP.

## 2. External input and output (CN1)

### 2-3 Pin assignment

#### 2-3-1 Function mode 0

- The position 64 type pin assignment



\*1 For details of CN1 and CN5 wiring, see ( → P.3-4 to 3-9 and P.3-13 to 3-14)

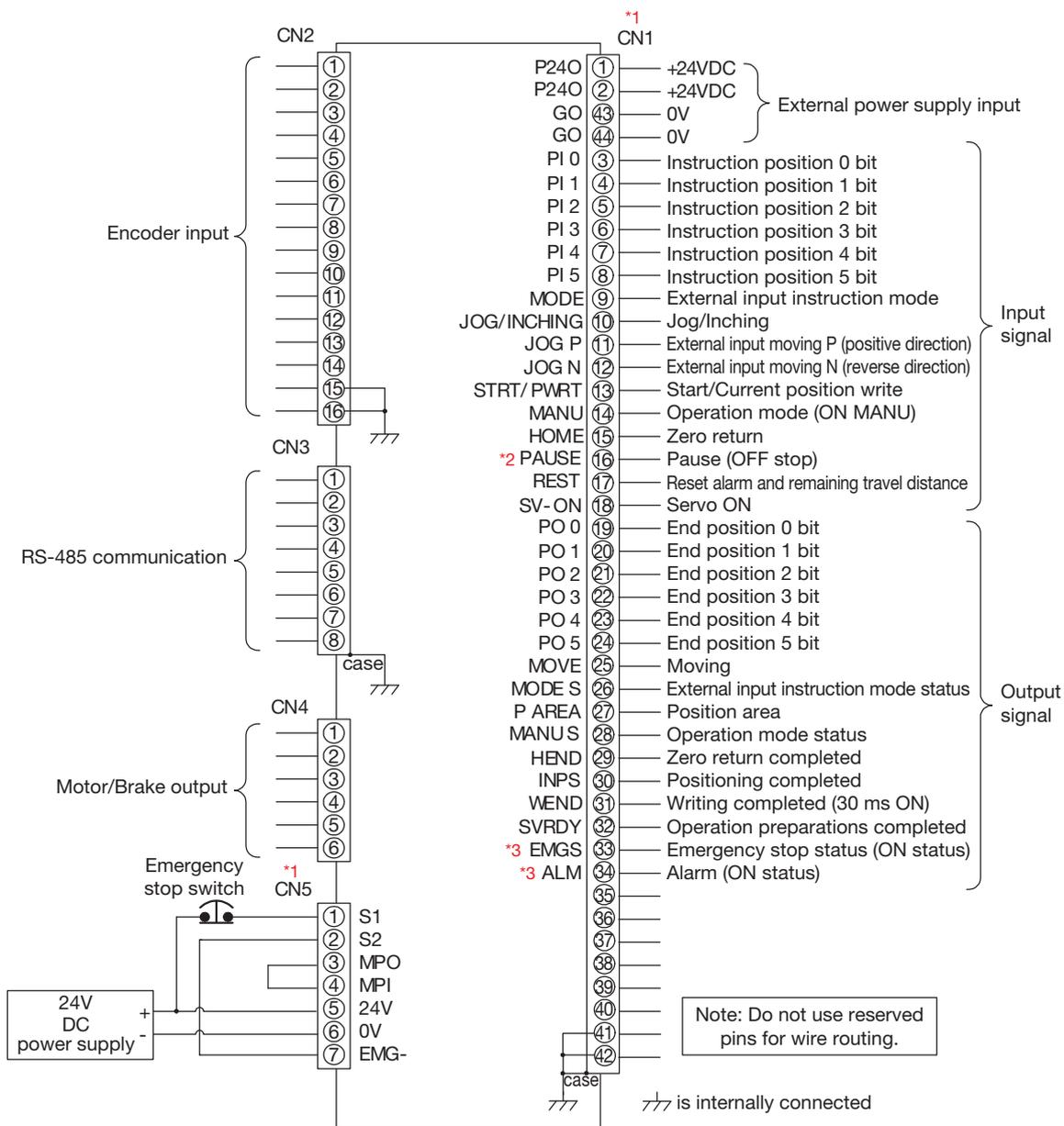
\*2 The pause (PAUSE) signal pauses with OFF.

\*3 The emergency stop and alarm status are generated by turning OFF the emergency stop status (EMGS) and alarm (ALM) signals.

## 2. External input and output (CN1)

### 2-3-2 Function mode 1

- The external input instruction-type pin assignment



\*1 For details of CN1 and CN5 wiring, see (→ P.3-4 to 3-9 and P.3-13 to 3-14)

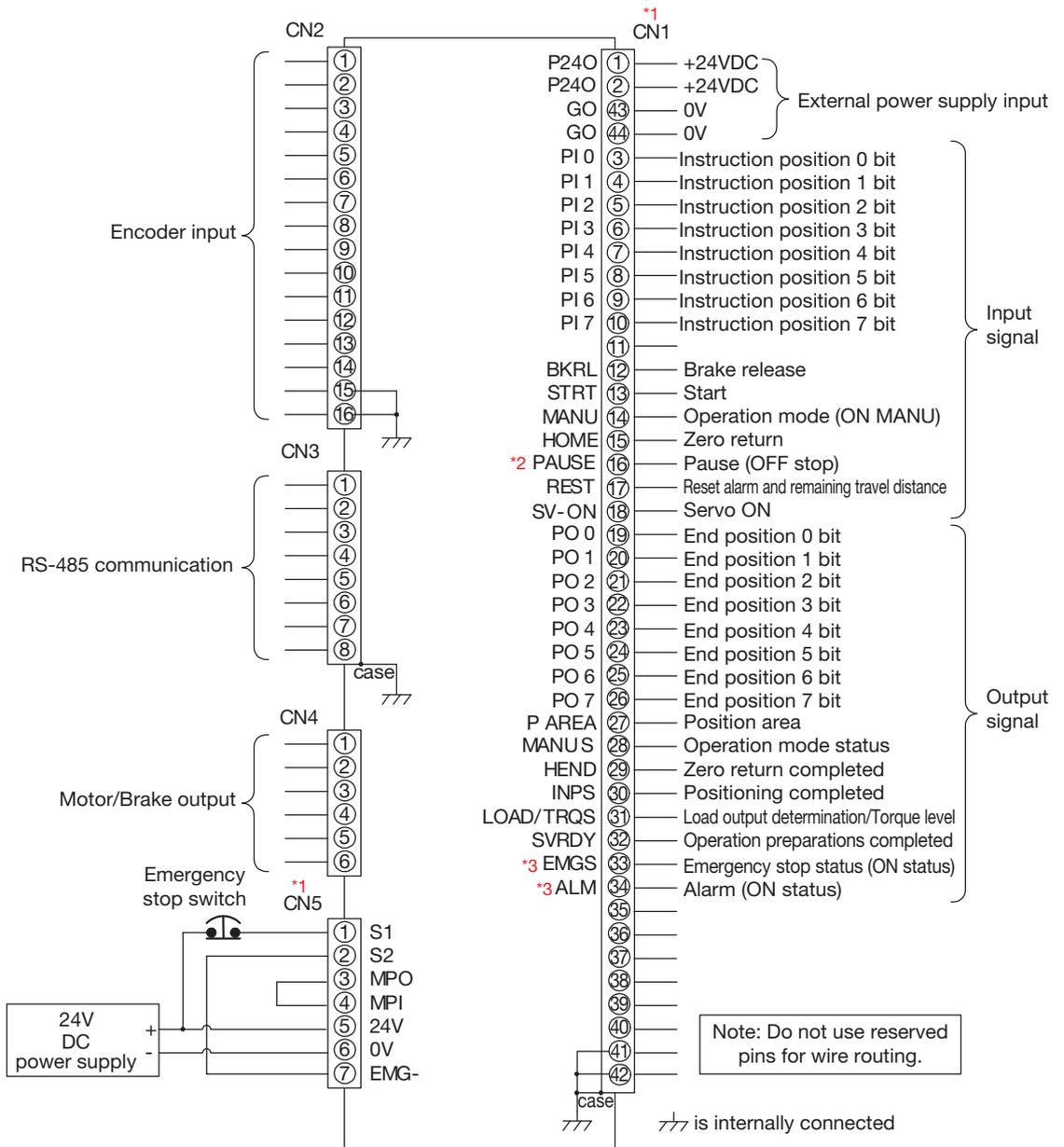
\*2 The pause (PAUSE) signal pauses with OFF.

\*3 The emergency stop and alarm status are generated by turning OFF the emergency stop status (EMGS) and alarm (ALM) signals.

## 2. External input and output (CN1)

### 2-3-3 Function mode 2

- The position 256 type pin assignment



\*1 For details of CN1 and CN5 wiring, see ( → P.3-4 to 3-9 and P.3-13 to 3-14)

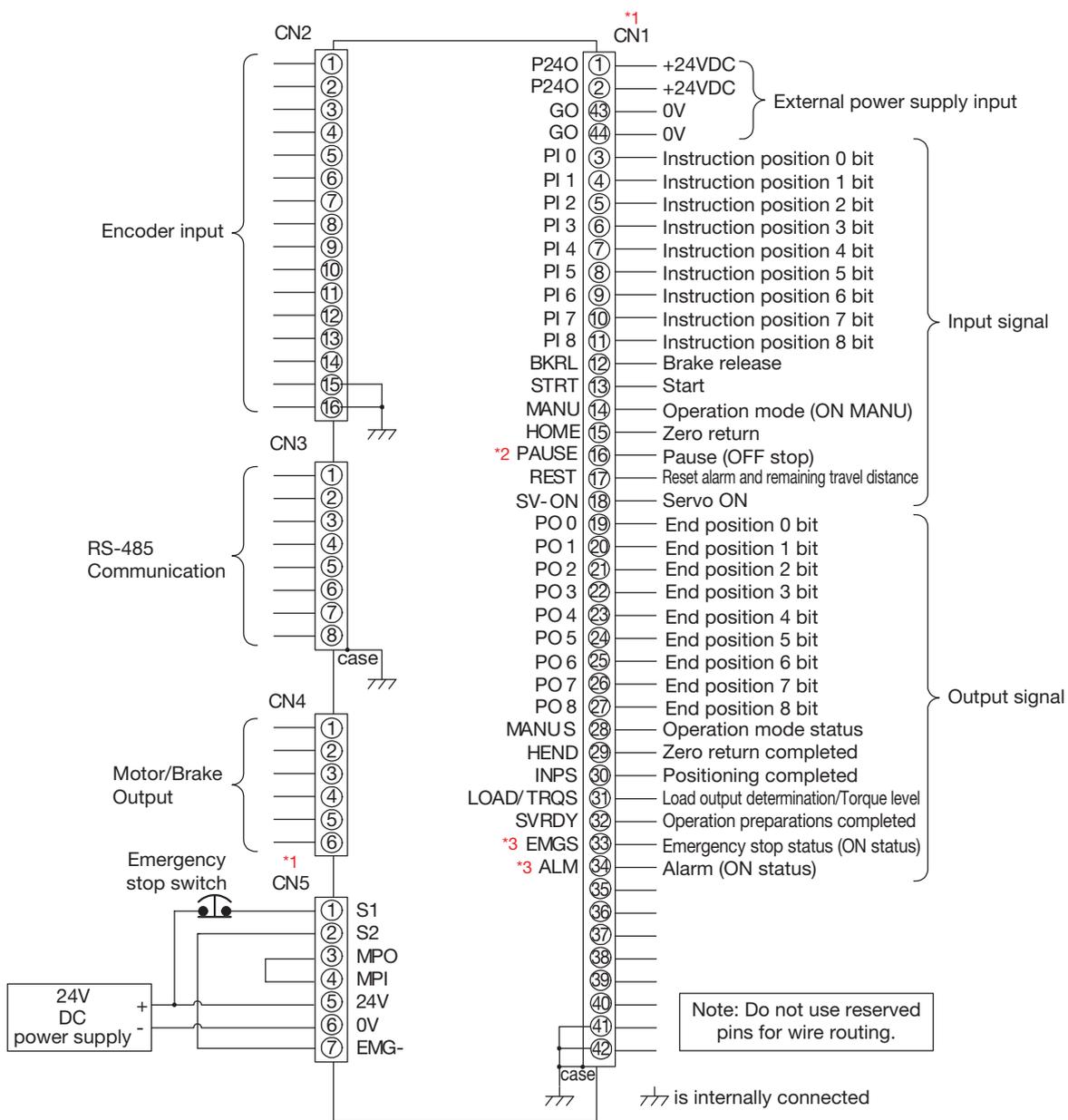
\*2 The pause (PAUSE) signal pauses with OFF.

\*3 The emergency stop and alarm status are generated by turning OFF the emergency stop status (EMGS) and alarm (ALM) signals.

## 2. External input and output (CN1)

### 2-3-4 Function mode 3

- The position 512 type pin assignment



\*1 For details of CN1 and CN5 wiring, see ( → P.3-4 to 3-9 and P.3-13 to 3-14)

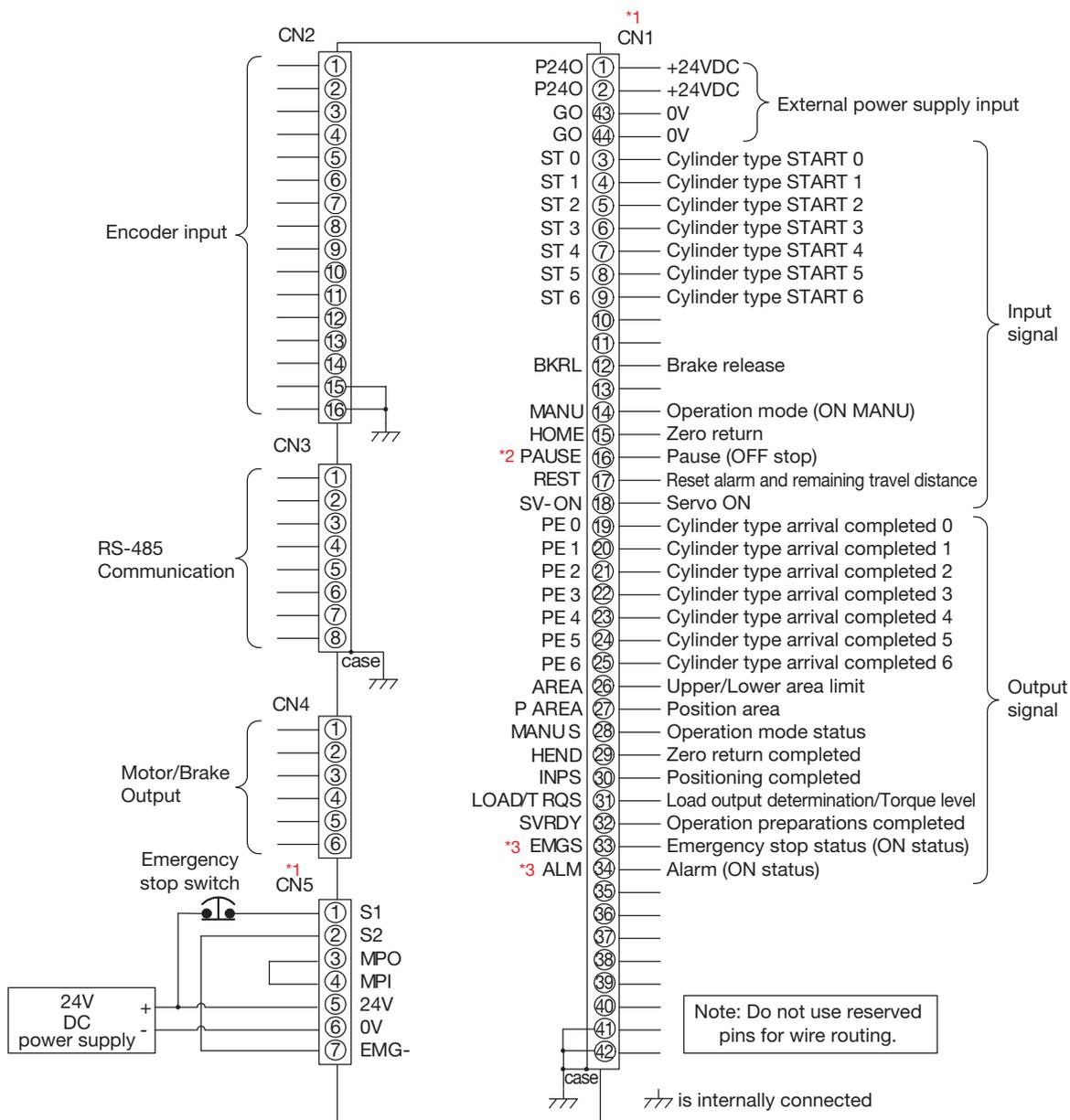
\*2 The pause (PAUSE) signal pauses with OFF.

\*3 The emergency stop and alarm status are generated by turning OFF the emergency stop status (EMGS) and alarm (ALM) signals.

## 2. External input and output (CN1)

### 2-3-5 Function mode 4

- The solenoid mode 1 type pin assignment.



\*1 For details of CN1 and CN5 wiring, see ( → P.3-4 to 3-9 and P.3-13 to 3-14)

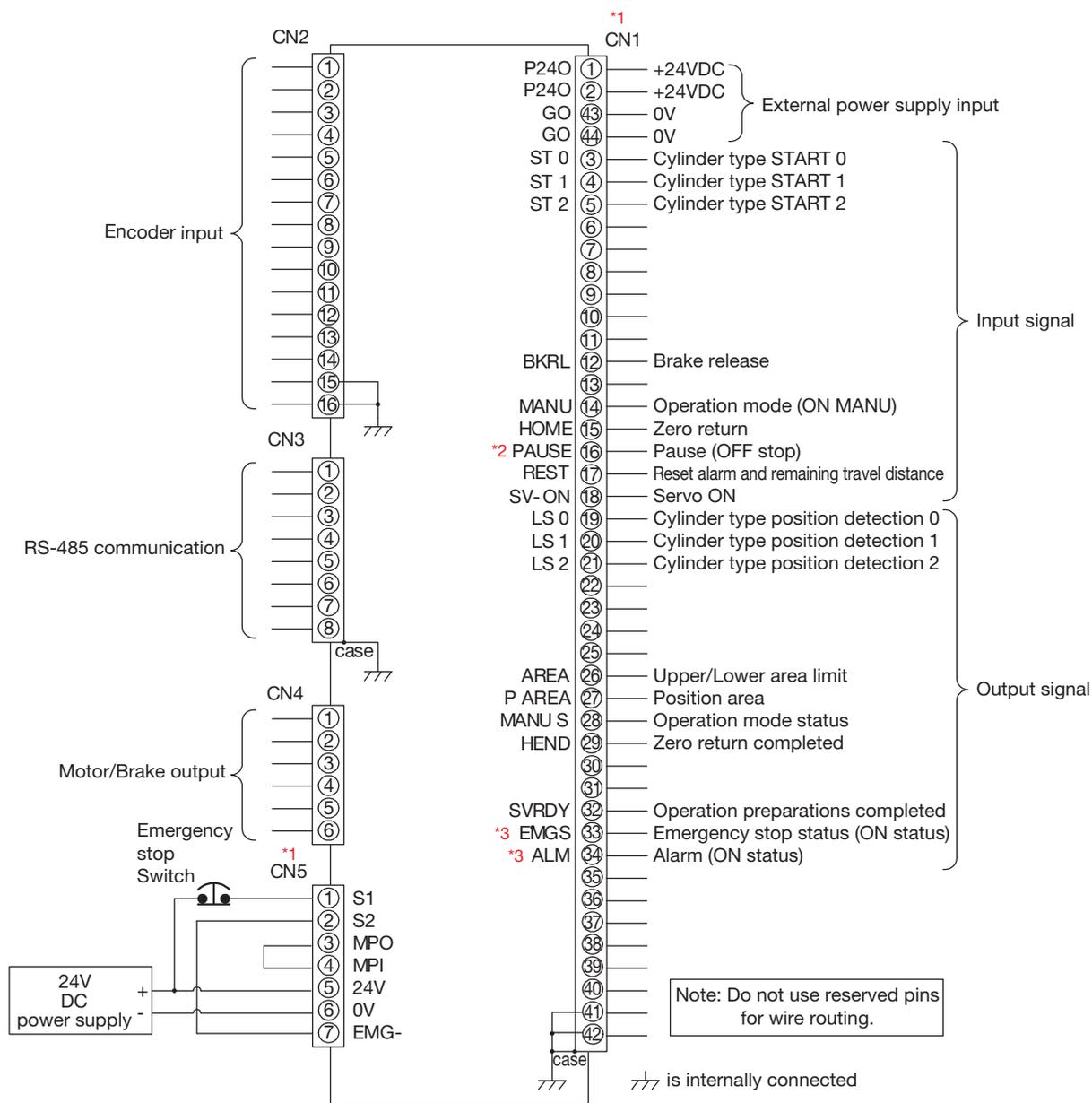
\*2 The pause (PAUSE) signal pauses with OFF.

\*3 The emergency stop and alarm status are generated by turning OFF the emergency stop status (EMGS) and alarm (ALM) signals.

## 2. External input and output (CN1)

### 2-3-6 Function mode 5

- The solenoid mode 2 type pin assignment.



\*1 For details of CN1 and CN5 wiring, see ( → P.3-4 to 3-9 and P.3-13 to 3-14)

\*2 The pause (PAUSE) signal pauses with OFF.

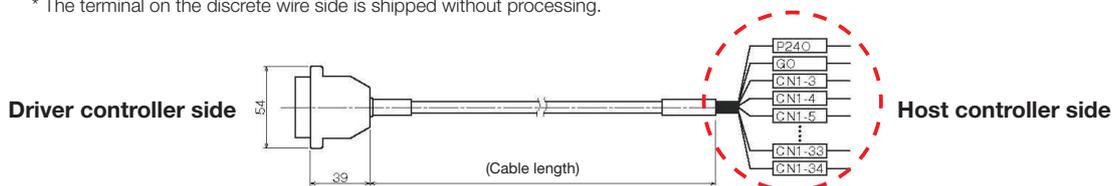
\*3 The emergency stop and alarm status are generated by turning OFF the emergency stop status (EMGS) and alarm (ALM) signals.

## 2. External input and output (CN1)

### 2-4

### Optional I/O cable

- The wire color and pin number of the optional I/O cable  
(Separately-sold)  
\* The terminal on the discrete wire side is shipped without processing.



Current product

I/O cable: CBL-CON-IO-□□ (Cable length of □□ : 03: 3 m, 05: 5 m, 10: 10 m)

Pin number	Wire color	Wire type	Pin number	Wire color	Wire type
P240	Black	0.08mm <sup>2</sup> (AWG28)	CN1-17	White	0.08mm <sup>2</sup> (AWG28)
P240	Black + White dot		CN1-18	Yellow-green + White dot	
G0	Brown		CN1-19	Pink	
G0	Brown + White dot		CN1-20	Pink + Black dot	
CN1-3	Red		CN1-21	Yellow-green	
CN1-4	Red + White dot		CN1-22	Yellow-green + Black dot	
CN1-5	Orange		CN1-23	Sky blue	
CN1-6	Orange + White dot		CN1-24	Sky blue + Black dot	
CN1-7	Yellow		CN1-25	Light gray	
CN1-8	Yellow + White dot		CN1-26	Light gray + Black dot	
CN1-9	Green		CN1-27	Red + Black dot	
CN1-10	Green + White dot		CN1-28	Red + Blue dot	
CN1-11	Blue		CN1-29	Orange + Black dot	
CN1-12	Blue + White dot		CN1-30	Orange + Green dot	
CN1-13	Purple		CN1-31	Yellow + Black dot	
CN1-14	Purple + White dot		CN1-32	Yellow + Green dot	
CN1-15	Gray	CN1-33	Green + Black dot		
CN1-16	Gray + White dot	CN1-34	Light gray + Green dot		

Conventional product

I/O cable: CBL-TSC-IO-□□ (Cable length of □□ : 03: 3 m, 05: 5 m, 07: 7 m and 10: 10 m)

Pin number	Wire color	Wire type	Pin number	Wire color	Wire type
P240	Gray + Black 1	0.3mm <sup>2</sup> (AWG22)	CN1-17	Yellow + Black 4	0.3mm <sup>2</sup> (AWG22)
P240	Gray + Red 1		CN1-18	Yellow + Red 4	
G0	White + Black wire		CN1-19	Yellow + Black wire	
G0	White + Red wire		CN1-20	Yellow + Red wire	
CN1-3	Gray + Black 2		CN1-21	Pink + Black 1	
CN1-4	Gray + Red 2		CN1-22	Pink + Red 1	
CN1-5	Gray + Black 3		CN1-23	Pink + Black 2	
CN1-6	Gray + Red 3		CN1-24	Pink + Red 2	
CN1-7	Gray + Black 4		CN1-25	Pink + Black wire	
CN1-8	Gray + Red 4		CN1-26	Pink + Red wire	
CN1-9	Gray + Black wire		CN1-27	White + Black 1	
CN1-10	Gray + Red wire		CN1-28	White + Red 1	
CN1-11	Yellow + Black 1		CN1-29	White + Black 2	
CN1-12	Yellow + Red 1		CN1-30	White + Red 2	
CN1-13	Yellow + Black 2		CN1-31	White + Black 3	
CN1-14	Yellow + Red 2		CN1-32	White + Red 3	
CN1-15	Yellow + Black 3	CN1-33	White + Black 4		
CN1-16	Yellow + Red 3	CN1-34	White + Red 4		

# 4. TSC Functions

## About this chapter

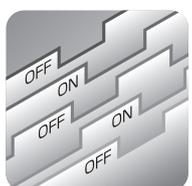
This chapter describes the driver controller TSC's functions.



This section describes the overview of the TSC functions.

### 1. Overview ..... 4-3

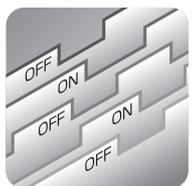
- 1-1. Type of function mode ..... 4-3
- 1-2. Selection by intended use ..... 4-3
- 1-3. Timing chart (Common to position move) ... 4-4



This section describes function modes 0, 2 and 3.

### 2. Function modes 0, 2 and 3 ... 4-5

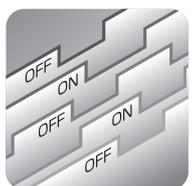
- 2-1. Specify and execute STEP No..... 4-5
- 2-2. How to specify STEP No. .... 4-5
- 2-3. How to obtain STEP No. whose operation has been completed ..... 4-5
- 2-4. Timing chart ..... 4-6



This section describes the function mode 1.

### 3. Function mode 1 ..... 4-7

- 3-1. Manual operation..... 4-7
- 3-2. Position instruction ..... 4-7
- 3-3. Methods of position instruction ..... 4-8
- 3-4. Specify and execute STEP No..... 4-8
- 3-5. How to obtain STEP No. whose operation has been completed ..... 4-8
- 3-6. Timing chart (Normal mode)..... 4-8
- 3-7. Timing chart (Instruction mode) ..... 4-9



This section describes the function mode 4.

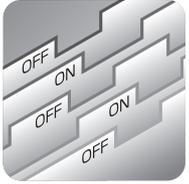
### 4. Function mode 4 ..... 4-10

- 4-1. Specify and execute STEP No..... 4-10
- 4-2. Move command method ..... 4-10
- 4-3. How to obtain STEP No. whose operation has been completed ..... 4-11
- 4-4. Timing chart ..... 4-11

# 4. TSC Functions

## About this chapter

This chapter describes the driver controller TSC's functions.



This section describes the function mode 5.

## 5. Function mode 5 ..... 4-12

5-1. Specify and execute STEP No..... 4-12

5-2. Move command method ..... 4-12

5-3. Position detection signal ..... 4-12

5-4. Timing chart ..... 4-13

# 1. Overview

TSC have 6 modes for different purposes and objectives.

- The 6 modes have different number of positions, implemented functions, and operation methods.
- You can change the mode in the parameter No.36 (Function mode).
- While program of each STEP in each mode is configured by the setup tool D-STEP (the execution from outside will be performed by input/output signals). For more information, see the separate setup tool D-STEP Instruction Manual.

## 1-1

### Type of function mode

Function mode		Overview	Number of steps	Pressing operation
Multi-point positioning type	0: Position 64 type	Multi-point positioning operation with 64 points With area output, with P area output	64	○
	1: External unit input instruction type	Multi-point positioning operation with 64 points External instruction mode by I/O Without area output, with P area output	64	—
	2: Position 256 type	Multi-point positioning operation with 256 points Without area output, with P area output	256	○
	3: Position 512 type	Multi-point positioning operation with 512 points Without area output, without P area output	512	○
Electromagnetic valve type	4: Solenoid mode 1 type	Multi-point positioning operation with 7 points Direct move command input With area output, with P area output	7	○
	5: Solenoid mode 2 type	Multi-point positioning operation with 3 points Direct move command input Position sensor auto-switch output With area output, with P area output	3	—

## 1-2

### Selection by intended use

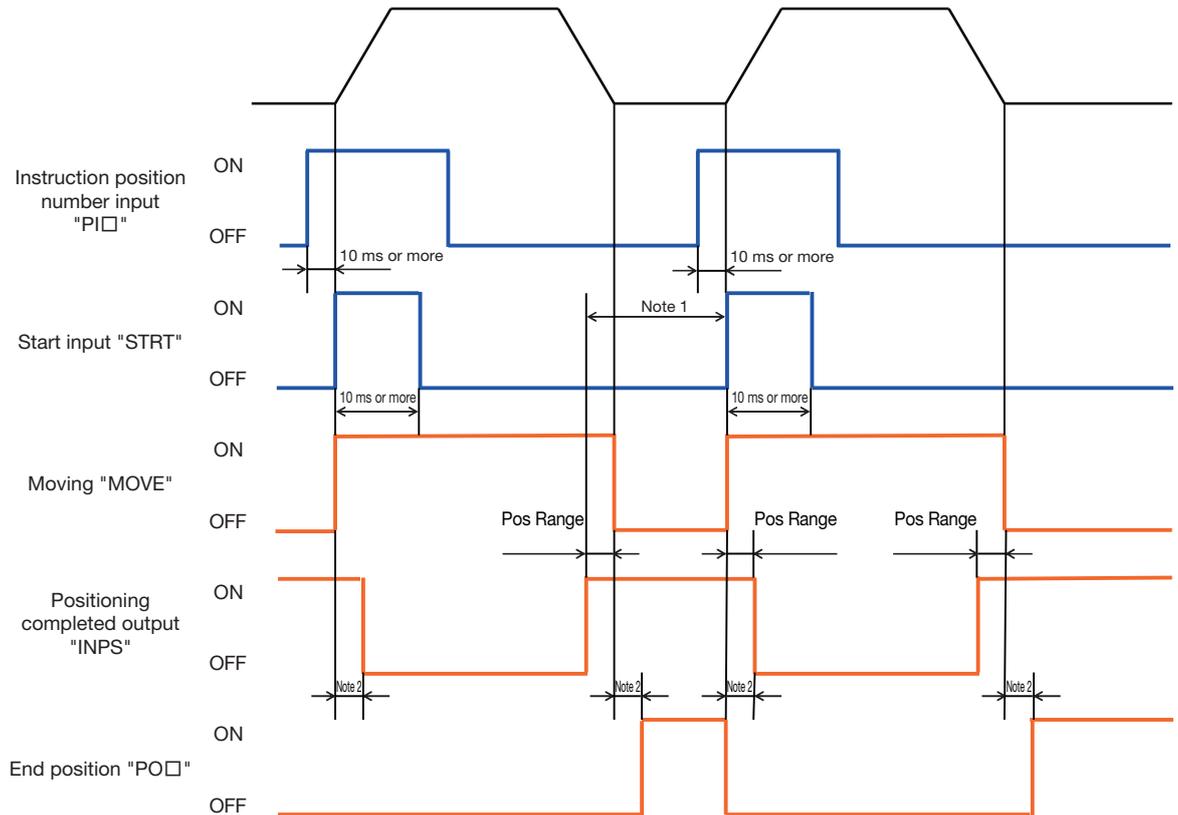
Intended use	Mode: 0 Position 64 type	Mode: 1 External input instruction type	Mode: 2 Position 256 type	Mode: 3 Position 512 type	Mode: 4 Solenoid mode 1	Mode: 5 Solenoid mode 2
Move and instruction from I/O	—	○	—	—	—	—
Brake release from I/O	○	—	○	○	○	○
Pressing operation	○	—	○	○	○	—
Torque determination	○	—	○	○	○	—
Area output	○	—	—	—	○	○
P area output	○	○	○	—	○	○
Signal output during operation	○	○	—	—	—	—

# 1. Overview

## 1-3

### Timing chart (Common to position move)

- The timing chart of each signal during general position movement for mode 0 to 3 is described below. For details of the chart for each mode, see the respective timing chart.



Note 1: If input is made before "INPS" turns ON,  
multi step transmission operation is activated after "INPS" turns ON

Note 2: The delay time is up to several milliseconds

## 2. Function modes 0, 2 and 3

### 2-1 Specify and execute STEP No.

- To specify STEP No. in the function mode 0, 2 and 3, convert STEP No. into a binary number and turn ON/OFF the inputs of PI 1 to PI 8.
  - ① Function mode 0: STEP No.0 to 63 → PI 0 to PI 5 are used.
  - ② Function mode 2: STEP No.0 to 255 → PI 0 to PI 7 are used.
  - ③ Function mode 3: STEP No.0 to 511 → PI 0 to PI 8 are used.
- Turning the STRT ON after specifying it (after 10 ms) will execute the specified STEP No. program.

### 2-2 How to specify STEP No.

- Break down STEP No. into a binary number to obtain the PI to be turned ON.

PI	0	1	2	3	4	5	6	7	8
Binary number digits	20	21	22	23	24	25	26	27	28
Decimal number	1	2	4	8	16	32	64	128	256

- Break down STEP No. into the sum of the decimal numbers in the above table and then turn the corresponding PI(s) ON.

Example) To specify STEP No. = 22

22 = 16 + 4 + 2, so turn PI 4 (= 16), PI 2 (= 4), and PI 1 (= 2) ON.

Example) To specify STEP No. = 101

101 = 64 + 32 + 4 + 1, so turn PI 6 (= 64), PI 5 (= 32), PI 2 (= 4) and PI 0 (= 1) ON.

### 2-3 How to obtain STEP No. whose operation has been completed

- Assuming the PO is equivalent to each binary number digit, convert them into decimal numbers to obtain STEP No.

PI	0	1	2	3	4	5	6	7	8
Binary number digits	2 <sup>0</sup>	2 <sup>1</sup>	2 <sup>2</sup>	2 <sup>3</sup>	2 <sup>4</sup>	2 <sup>5</sup>	2 <sup>6</sup>	2 <sup>7</sup>	2 <sup>8</sup>
Decimal number	1	2	4	8	16	32	64	128	256

- Obtain the decimal numbers of the PO being ON from the above table, and add all the numbers up to determine the STEP No. whose operation has been completed.

Example) When PO 5 (= 32), PO 3 (= 8), PO 1 (= 2) and PO 0 (= 1) are ON

32 + 8 + 2 + 1 = 43, so STEP No. = 43.

Example) When PO 8 (= 256), PO 5 (= 32) and PO 0 (= 1) are ON

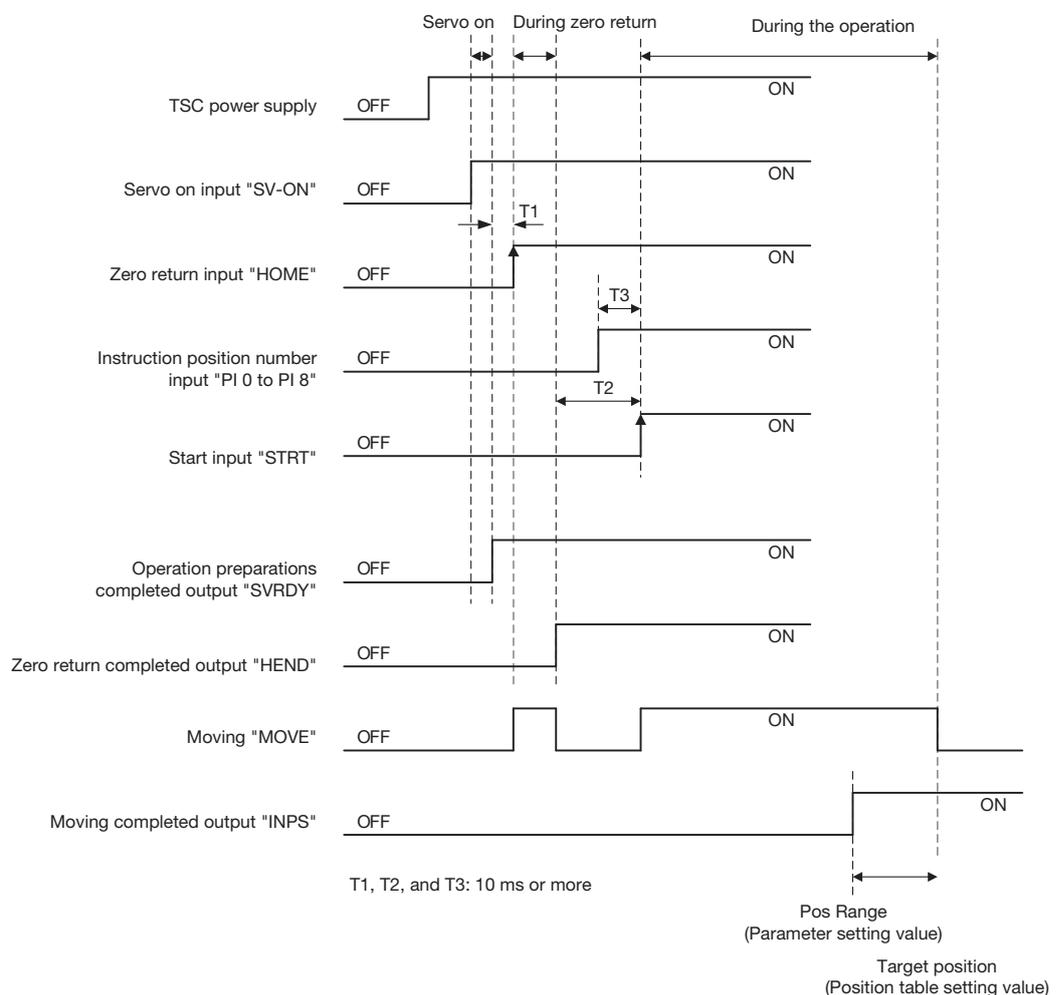
256 + 32 + 1 = 289, so STEP No. = 289.

## 2. Function modes 0, 2 and 3

### 2-4

### Timing chart

- In the STRT signal move command, it reads the signals of PI 0 to PI 8 as STEP No. and operates according to the program set to each STEP No.
- Function mode 0: 6 bits between PI 0 and PI 5 (64 position)  
Function mode 2: 8 bits between PI 0 and PI 7 (256 position)  
Function mode 3: 9 bits between PI 0 and PI 8 (512 position)
- The zero return input HOME and start input STRT detect the rising edge from signal OFF to ON.
- The moving signal MOVE is output only in function mode 0.



## 3. Function mode 1

### 3-1 Manual operation

- In function mode 1, the actuator can be operated discretionarily by external input and output, in addition to normal positioning operation.
  - \* Operations are allowed even before zero return, but the servo must be ON.
- There are the jog operation in which the actuator operates during the input is ON, and inching operation in which the actuator moves for a certain distance and then stops per each turning ON.
- Turning the JOG/INCHING input (pin.10) ON will activate the inching operation, and OFF will activate the jog operation.
  - ① Jog operation: Only while being ON, the actuator in operates in positive (+) direction with JOG P (pin.11), or in negative (-) direction with JOG N (pin.12).  
For definitions of positive and negative directions, see "**4-2 Positive/negative of moving direction (→ P.5-9)**".  
The moving speed is set by the parameter No.21 (I/O jog speed).  
This moving speed is common to that of the inching operation described below.
  - ② Inching operation: Once turned ON, the actuator in moves for certain distance in positive (+) direction with JOG P (pin.11), or in negative (-) direction with JOG N (pin.12).  
For definitions of positive and negative directions, see "**4-2 Positive/negative of moving direction (→ P.5-9)**".  
The moving speed is set by the parameter No.21 (I/O jog speed) (**→ P.5-20**).  
This moving speed is common to that of the jog operation described above.  
The moving distance is set by the parameter No.22 (I/O inching distance) (**→P.5-20**).  
To repeat the operation, turn it OFF and then ON.

### 3-2 Position instruction

- Position after manual operation (jog operation or inching operation) can be written by specifying arbitrary STEP No.
- Zero return is required to write the position.
- For how to specify STEP No., see "**2-2 How to specify STEP No.(→P.4-5)**."
- For speed and acceleration, etc., the initial value set in a parameter will be entered.

Items	Speed	ACC/DCC	Pos Range	Stop mode
Parameters	No.8	No.9	No.10	No.25

**Important**

- Writing without zero return cannot guarantee the reproducibility of the position.

## 3. Function mode 1

### 3-3 Methods of position instruction

- ① Turn the servo ON.
  - ② Perform zero return.
  - ③ Turn the MODE (pin.9) ON. Check that the MODE S (pin.26) is ON.
  - ④ Move to the position you want to instruct by manual operation. See "**3-1 Manual operation(→P.4-7)**".
  - ⑤ Specify the STEP No. you want to instruct. See "**2-2 How to specify STEP No.(→P.4-5)**".
  - ⑥ Turn the STRT/PWRT (pin.13) ON to instruct (for over 20 ms).
  - ⑦ When instruction is completed, WEND (pin.31) is turned ON for 30 ms. If the STRT/PWRT (pin.13) is still ON, turn it OFF.
  - ⑧ Repeat the steps ④ through ⑦ as necessary.
  - ⑨ When all instructions are completed, be sure to turn the MODE (pin.9) OFF.
- \* Turning the STRT/PWRT (pin.13) ON to execute the program with the MODE (pin.9) still ON, the program is overwritten.

### 3-4 Specify and execute STEP No.

- When MODE (pin.9) is OFF, the specified STEP No. is executed instead of instruction (normal position mode). (Check that the MODE S (pin.26) is OFF)
- Execution in the function mode 1 follows the function mode 0. See "**2-1 Specify and execute STEP No.(→P.4-5)**".  
However, STRT/PWRT (pin.13) is used instead of STRT (pin.13), which is used in the function mode 0 (pin number is the same)

### 3-5 How to obtain STEP No. whose operation has been completed

- The method to obtain in the Function mode 1 follows the Function mode 0. See "**2-3 How to obtain STEP No. whose operation has been completed(→P.4-5)**".

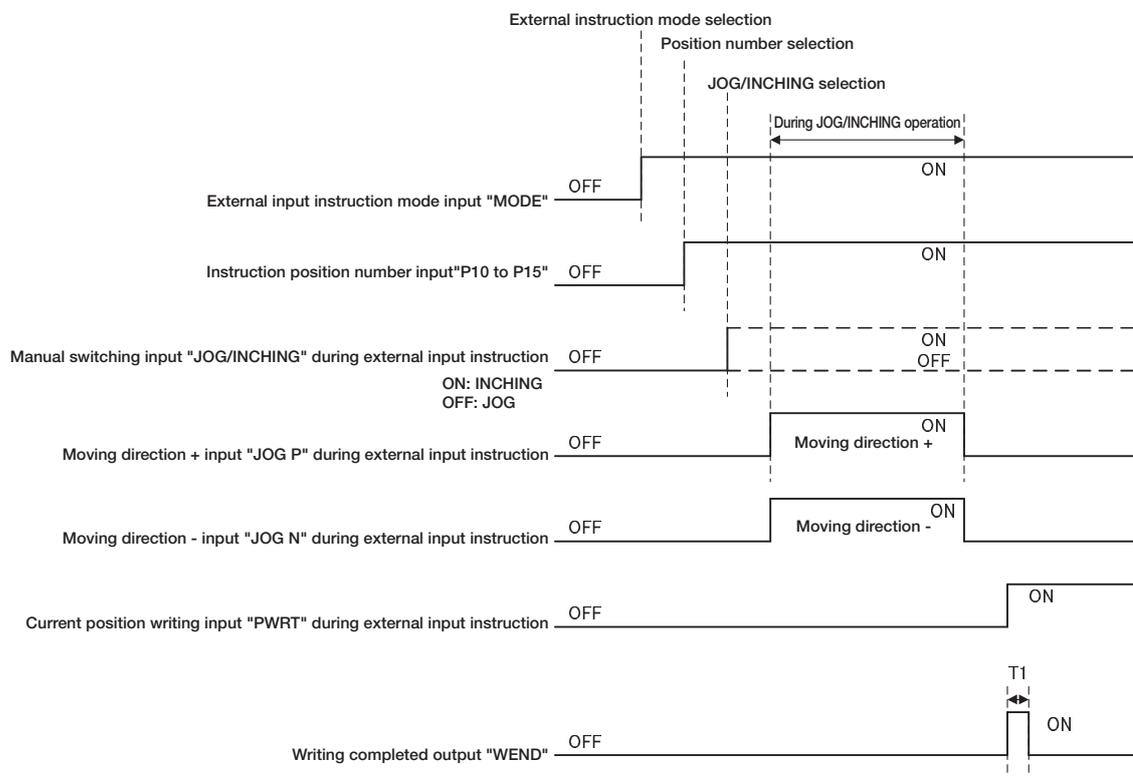
### 3-6 Timing chart (Normal mode)

- In the normal mode (MODE (pin.9) is OFF), STRT/PWRT (pin.13) is equivalent to STRT (pin.13).
- In the STRT/PWRT (pin.13) signal move command, it reads the signals of PI 0 to PI 5 as STEP NO. and operates according to the program set to each STEP No.
- Function mode 1: 6 bits between PI 0 and PI 5 (64 position)
- The zero return input HOME (pin.15) and start input STRT/PWRT (pin.13) detect the rising edge from signal OFF to ON.
- Moving output MOVE (pin.25) is valid.
- For actual timing chart, see "**2-4 Timing chart(→P.4-6)**".

## 3. Function mode 1

### 3-7 Timing chart (Instruction mode)

- In the instruction mode (MODE (pin.9) is ON), STRT/PWRT (pin.13) serves as PWRT.
- Write the current position data into the "Position (mm)" field of the program table.
- Writing is executed by turning ON the current position writing signal STRT/PWRT (pin.13) for 20 ms or more in the instruction mode (MODE (pin.9) input is ON).
- Once writing is completed, the writing completion signal WEND (pin.31) turns ON for 30 ms.



## 4. Function mode 4

### 4-1

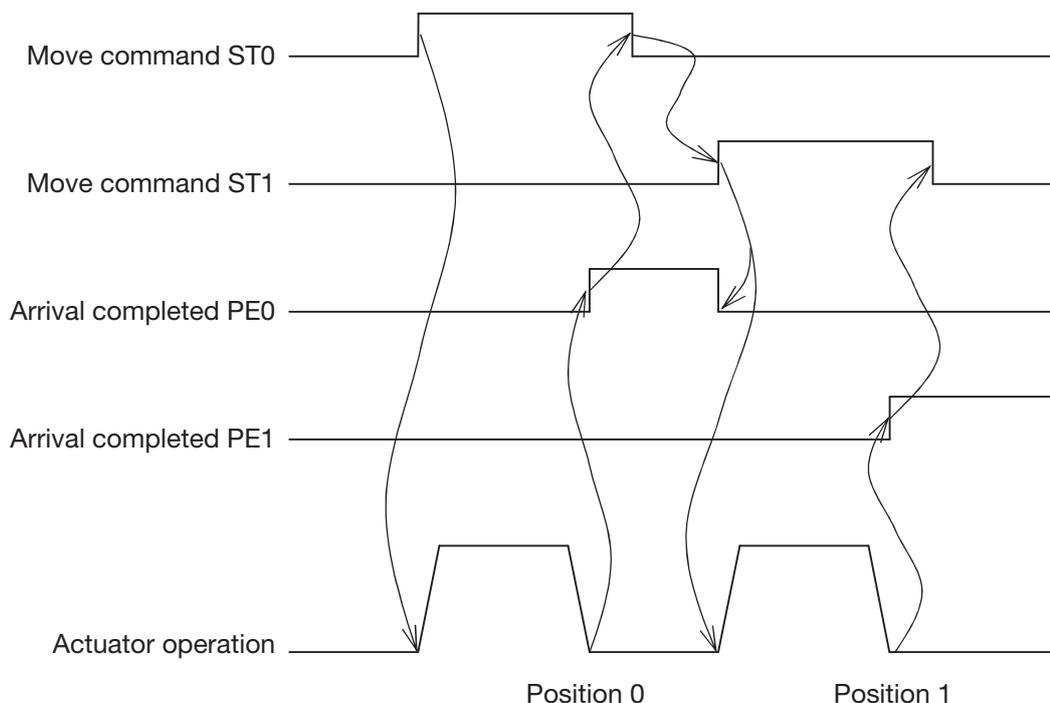
### Specify and execute STEP No.

- To specify and execute STEP No. in the function mode 4, turn ON the ST of the same number (pin.3 to 9).
- There is no need to turn the STRT (pin.13) ON. Note that turning the ST (pin.3 to 9) ON starts execution immediately.
- STEP No.0 to 6 → ST 0 (pin.3) to ST 6 (pin.9) are used.

### 4-2

### Move command method

- Select the move command method from level and edge.
- Select the method in the parameter No.13 (Move command system) (→ P.5-20).
  - Level : The movement is started when turning the input signal ON and is stopped when turning it OFF on the way.
  - Edge : The movement is started at the rising edge of the input signal and is not stopped even when turning it OFF on the way.
- If PAUSE is valid (parameter No.33 is valid), turn it OFF to pause it.
- The following illustrates the case where the command input is level. In case of edge, it may be turned OFF after starting the operation.



## 4. Function mode 4

### 4-3

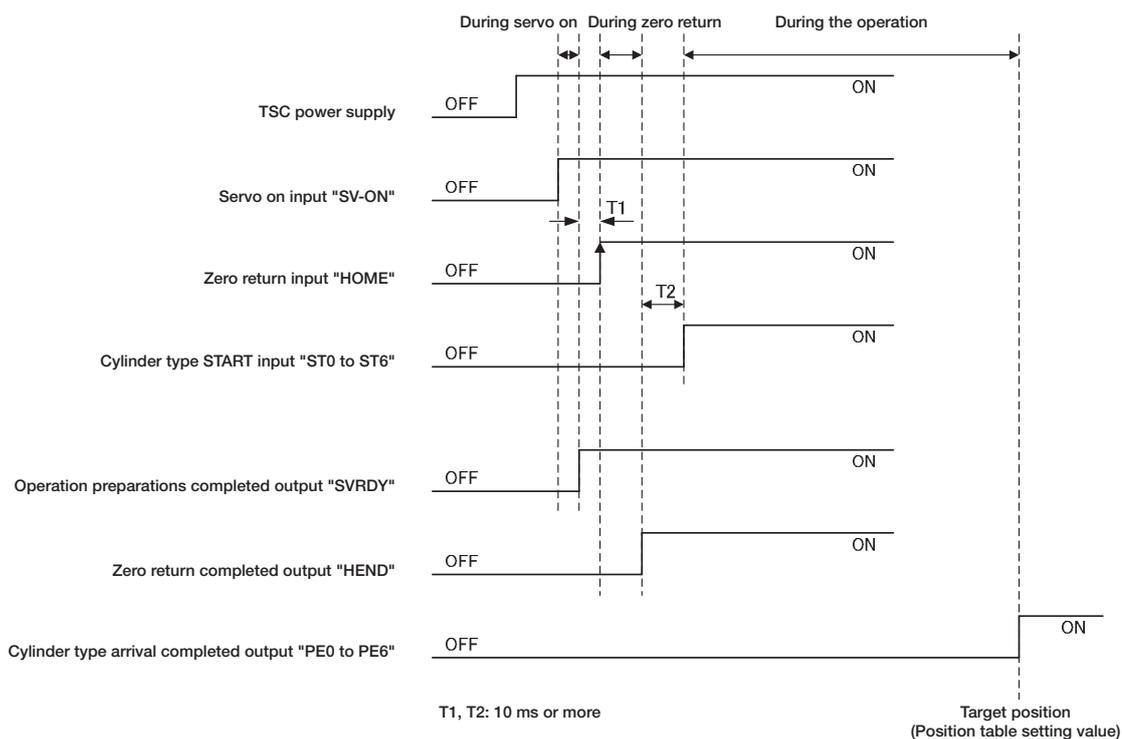
### How to obtain STEP No. whose operation has been completed

- PE (pin.19 to 25) output equivalent to the operation-completed STEP No. is directly turned ON (ST corresponds PE one-to-one). See the figure in "4-2 Move command method (→ P.4-10)".
- Note that this is not a binary expression unlike the function modes 0 to 3.

### 4-4

### Timing chart

- A start signal (ST 0 to ST 6) is available for each STEP No., and turning ON the corresponding start signal will operate the actuator according to the program set to each STEP No.
- The zero return input HOME (pin.15) detects the rising edge from signal OFF to ON. Move command input for ST 0 to ST 6 is either level or edge. For details, see "4-2 Move command method (→ P.4-10)".



## 5. Function mode 5

### 5-1

### Specify and execute STEP No.

- To specify and execute STEP No. in the function mode 5, turn ON the ST (pin.3 to 5) of the same number.
- There is no need to turn the STRT (pin.13) ON. Note that turning the ST (pin.3 to 5) ON starts execution immediately.
- STEP No.0 to 2 → ST 0 (pin.3) to ST 2 (pin.5) are used.

### 5-2

### Move command method

- Move command method is edge only.  
Edge : The movement is started at the rising edge of the input signal and is not stopped even when turning it OFF on the way.  
If PAUSE is valid (parameter No.33 is valid), turn it OFF to pause it.

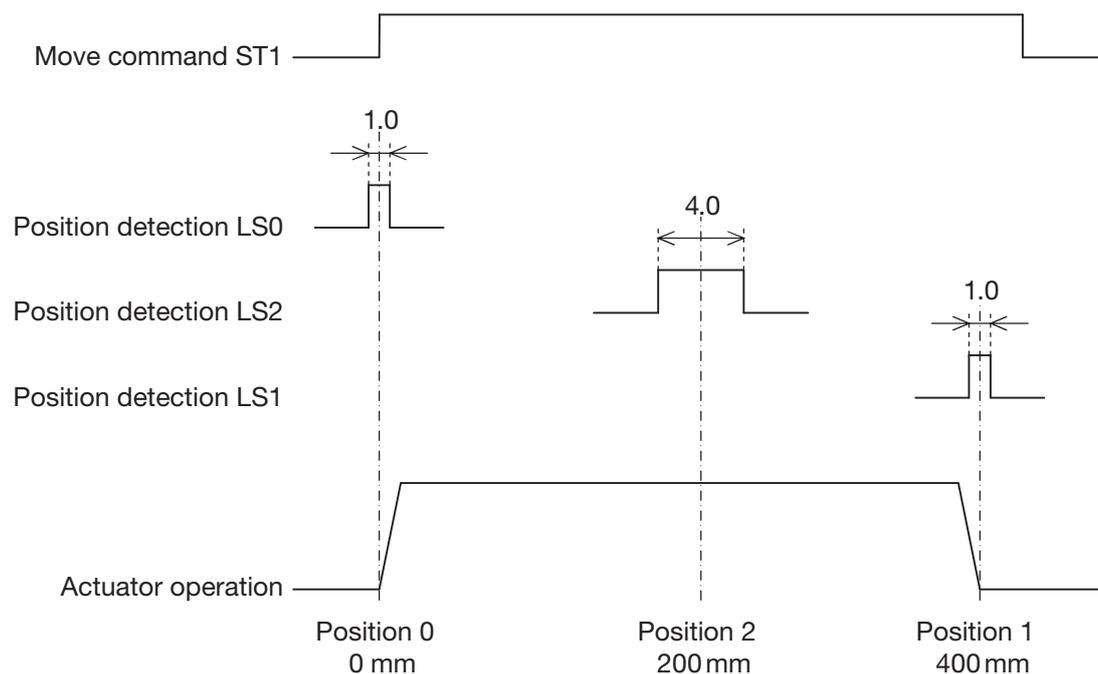
### 5-3

### Position detection signal

- Regardless of the selected and executed STEP No., entering the positioning range set to each STEP No. will turn the relevant LS (pin.19 to 21) ON.

Example

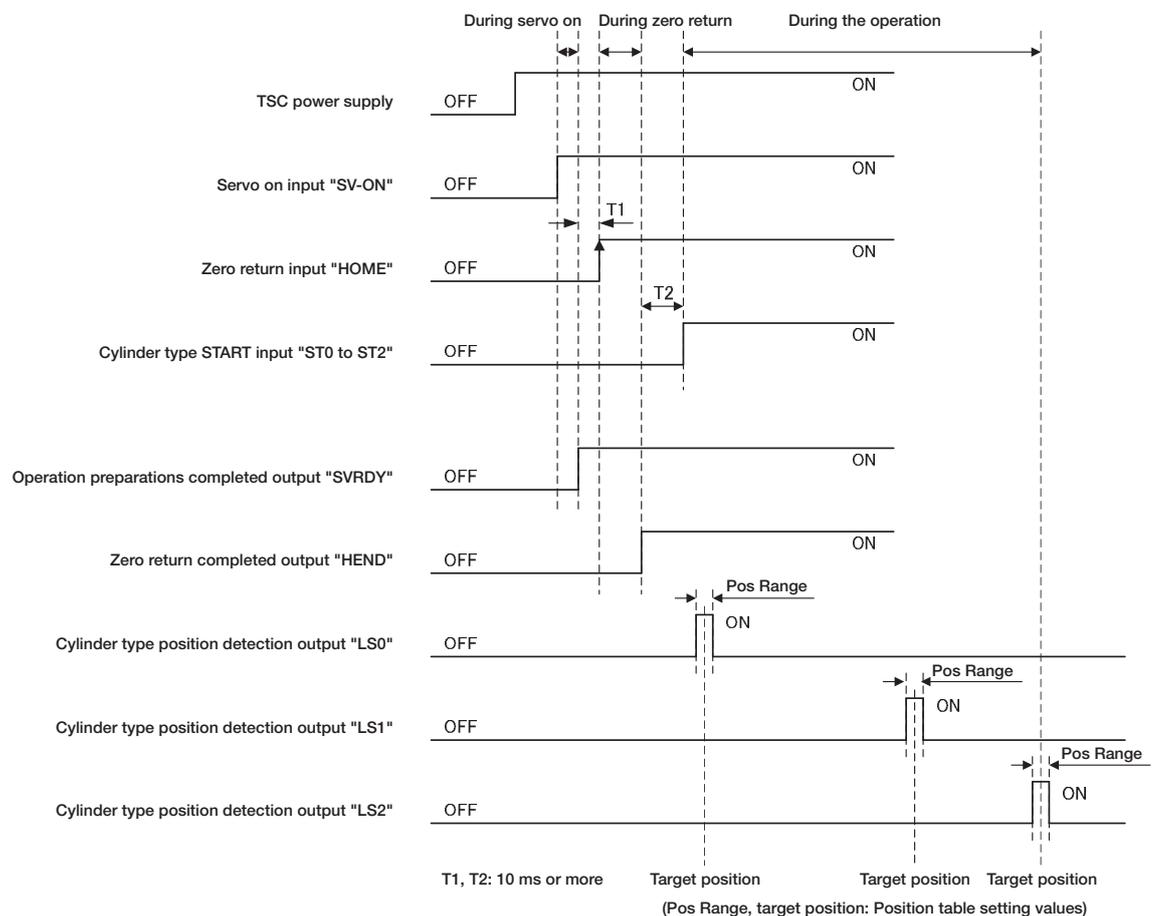
STEP No.	Position (mm)	Speed (mm/s)	ACC (m/s <sup>2</sup> )	DCC (m/s <sup>2</sup> )	Push (%)	Pos Range (mm)
0	0	100	1	1	0	0.5
1	400	100	1	1	0	0.5
2	200	100	1	1	0	2



## 5. Function mode 5

### 5-4 Timing chart

- A start signal (ST 0 to ST 2) is available for each STEP No., and turning ON the corresponding start signal will operate the actuator according to the program set to each STEP No.
- The position detection output (LS 0 to LS 2) turns ON according to the "Position (mm)" set to each STEP No.  
ON range depends on the "Pos range (mm)".
- The zero return input HOME and ST 0 to ST 2 detect the rising edge from signal OFF to ON.



# 5. Operations and adjustment

## About this chapter

This chapter describes the operations and adjustment.



This section describes the operation mode details.

<b>1. Operation mode.....</b>	<b>5-4</b>
1-1. <b>MANUAL mode.....</b>	<b>5-5</b>
1-2. <b>AUTO mode .....</b>	<b>5-5</b>
1-3. <b>MANUAL mode switching .....</b>	<b>5-5</b>



This section describes the standstill mode details.

<b>2. Stop mode .....</b>	<b>5-6</b>
2-1. <b>Invalid .....</b>	<b>5-6</b>
2-2. <b>Auto servo OFF 1 (ASO 1) .....</b>	<b>5-6</b>
2-3. <b>Auto servo OFF 2 (ASO 2) .....</b>	<b>5-6</b>
2-4. <b>Auto servo OFF 3 (ASO 3) .....</b>	<b>5-6</b>
2-5. <b>Full servo control (SERVO) .....</b>	<b>5-7</b>

This section describes the servo ON details.

<b>3. Servo ON .....</b>	<b>5-8</b>
3-1. <b>Servo ON .....</b>	<b>5-8</b>

This section describes the zero return details.

<b>4. Zero return .....</b>	<b>5-9</b>
4-1. <b>Zero return method.....</b>	<b>5-9</b>
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# 5. Operations and adjustment

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# 5. Operations and adjustment

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# 1. Operation mode

## ! WARNING



Obligatory

- **To prevent unexpected accidents, make sure to install the emergency stop switch and have the machine ready to be shut down at any time before performing operation.**

Failure to do so may cause damage or injury.

- **If any abnormal heating, odor, smoke or fire is observed in TSC and the actuator, shut the power off immediately since there is a risk of fire etc.**

Failure to do so may cause burns due to high temperature, damage or injury. Please contact us after confirming that the abnormal condition is stopped.



Caution –  
High temperature

- **When the power supply is ON, do not touch the motor/brake housing of the actuator.**

Doing so may cause burns due to high temperature.



Prohibited

- **Do not touch the actuator's moving part during operations.**

Doing so may cause injury.

- **Do not remove/insert the connector while energizing.**

Doing so may cause the malfunction or failures.

- **There are right combinations of driver controller TSC and actuator depending on differences of strokes and leads. Do not use them in a different combination than default one.**

Doing so may cause the malfunction or failures.

## ! CAUTION



Obligatory

- **Configure and check appropriate settings of TSC parameter before trial run.**

Otherwise, unexpected operation may occur.

- **If an alarm of TSC is generated, remove the cause, ensure the safety, and reset the alarm.**

Failure to do so may cause damage or injury. When a part generates heat, restart the operation after taking sufficient cooling time.

- **In case of any failure, do not continue operations without eliminating the cause.**

Doing so may cause malfunction, resulting in damage and injury.



Prohibited

- **If the alarm is reset when operation signals are input to TSC, it may suddenly restart. So do not enter into the moving range of the unit.**

Doing so may cause damage or injury.

- **In the event of instantaneous power failure during actuator operation, the unit may be restarted after restoration. So do not enter into the moving range of the unit for personnel's safety.**

# 1. Operation mode

- There are 2 types of TSC operation mode: the **MANUAL** mode connects the PC to CN3 to operate the mode change switch with MANU, and the **AUTO** mode connects the external input and output signals to CN1 to operate the mode change switch with AUTO.
- In description of operations in this chapter, ① **AUTO** mode, and ② **external input and output** are used unless otherwise stated.

## Reference

When first energizing or adjusting unit start-up, setting a small value to the parameter No.20 (Speed override) (→ P.5-20) limits the speed temporarily and you can ensure the safety.

## 1-1

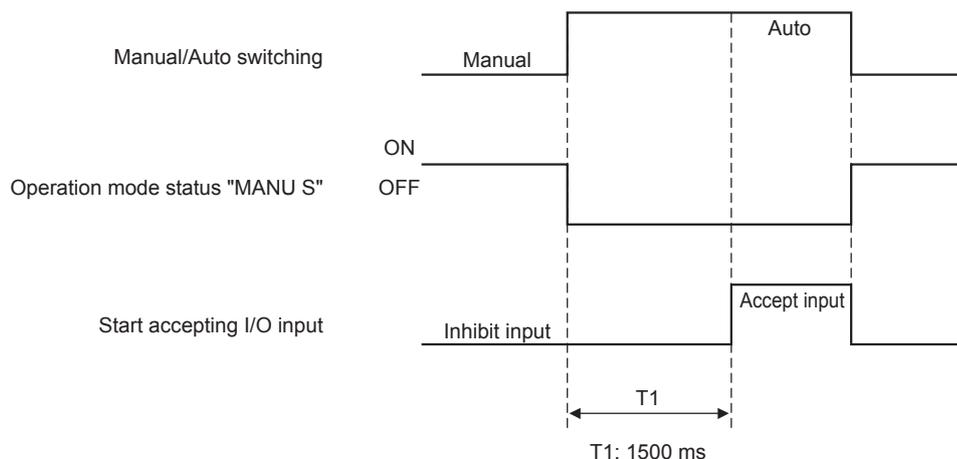
### MANUAL mode

- Operations are performed with the mode change switch set to MANU in this mode. MANU S output (pin.28) is turned ON.
- In this mode, you can use the setup tool D-STEP on the connected PC to perform input and execution of the operation programming, parameter setting, manual jog and inching operations, etc. For more information, see the separate D-STEP or TDO Instruction Manual.

## 1-2

### AUTO mode

- Operations are performed with the mode change switch set to AUTO in this mode. MANU S output (pin.28) is turned OFF.
- This manual primarily describes the operation method and operations using the external input and output signals in AUTO mode. Operations must be programmed beforehand. See the separate setup tool D-STEP Instruction Manual.
- In the descriptions, "on" and "ON" means the external input and output terminal is shorted to 0 V.



## 1-3

### MANUAL mode switching

- In the AUTO mode, turning MANU (pin.14) ON will also switch to the MANUAL mode. When switching is done, MANU S output (pin.28) is turned ON.
- When the parameter No.38 (Inhibit MANU input) (→ P.5-22) ( is set to "Valid," MANU input is rejected.

## 2. Stop mode

- You can select a stop status after reaching the target point in "Standstill mode". You can set the initial value when inputting programs in the parameter No.25 (Default standstill mode).
- Selecting an appropriate mode reduces heat generation and power usage.
- You can check the current passing through the motor on the "Monitor" screen of the setup tool D-STEP.

### Reference

You can change the signal for positioning completion (pin.30), signal for positioning completion, in the parameter No.37 (IN-POSI signal type) (→ P.5-22).

### 2-1

#### Invalid

- The servo will be turned OFF immediately after reaching and the current set in the parameter No.11 (Cur. limit at stop) (→P.5-20) continues to flow.
- Although the actuator maintains the current position with the torque generated by this current, the position will not be re-adjusted in the event of misalignment since the servo is OFF.

### 2-2

#### Auto servo OFF 1 (ASO 1)

- Once reached, the servo will be turned OFF after the elapse of the time set in the parameter No.17 (Auto servo OFF time 1) (→P.5-20).
- The present position cannot be retained because the current becomes 0 after the servo is turned OFF.
- If the position deviation caused by external force (difference between the command value and the current value) exceeds the parameter No.30 (Position deviation) (→P.5-21) the alarm of the alarm code No.32 (Excessive position error (deviation)) will be generated. (→P.6-5)  
Note that the alarm will be generated only when the next move command is executed.
- If the position deviation is within the permissible position deviation, the operation can be continued by specifying and starting the next STEP No. You also can continue to use the current STEP No. to start an operation (returning to the "Position" of this STEP No.).

### 2-3

#### Auto servo OFF 2 (ASO 2)

- Once reached, the servo will be turned OFF after the elapse of the time set in the parameter No.18 (Auto servo OFF time 2) (→P.5-20).
- Other operations are same as 2-2 Auto servo OFF 1 (ASO 1) (→P.5-6).

### 2-4

#### Auto servo OFF 3 (ASO 3)

- Once reached, the servo will be turned OFF after the elapse of the time set in the parameter No.19 (Auto servo OFF time 3) (→P.5-20).
- Other operations are same as 2-2 Auto servo OFF 1 (ASO 1) (→P.5-6).

## 2. Stop mode

---

### 2-5

### Full servo control (SERVO)

- The servo continues to control the actuator.
- If the external force is small, the current decreases in proportion to the position deviation.
- If position deviation is caused due to external force, a torque to correct it will be generated (the current will increase).
- If the external force exceeds the torque generated at the maximum current, the position deviation occurs.  
Otherwise, position deviation never occurs.
- Vibration or abnormal noise may occur depending on the status at stop.  
Do not use the controller if vibration or abnormal noise affects the performance.

## 3. Servo ON

### ! WARNING



Caution

- For vertical application, note that the moving part may fall if the torque is not sufficient. It may cause damage or injury.

### 3-1

### Servo ON

- When the SV-ON input (pin.18) is turned ON, the motor is energized to make the product operational and the SV/ALM LED on the front face of the unit lights in green.
- When servo is normally turned ON, the SVRDY output (pin.32) is turned ON to indicate the operational status.
- Zero return cannot be performed without turning the servo ON. Therefore, program operations requiring zero return cannot be performed. However, jog and inching operations of the Function mode 1 can be performed.
- For an actuator with a brake, the brake will be released at the same time as the servo ON. Note that the actuator may fall in using it in the vertical direction if the torque is insufficient.
- When you turn the servo OFF while the actuator is running, the motor current will be interrupted, and the actuator will stop. Leave it ON unless you need to turn it OFF. For more information on current limit during the actuator stop, see **2. Standstill mode 2. (→P.5-6)**.

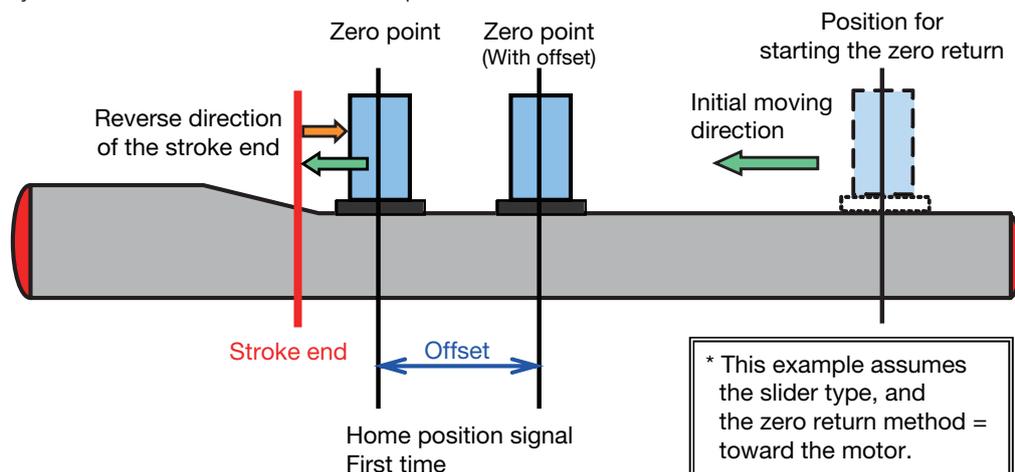
## 4. Zero return

- To define the zero-point before execution of programmed operations, it must be performed. However, it is not necessary for jog and inching operations in the Function mode 1 (necessary for instruction though).
- You cannot change the returning direction and speed.

### 4-1

### Zero return method

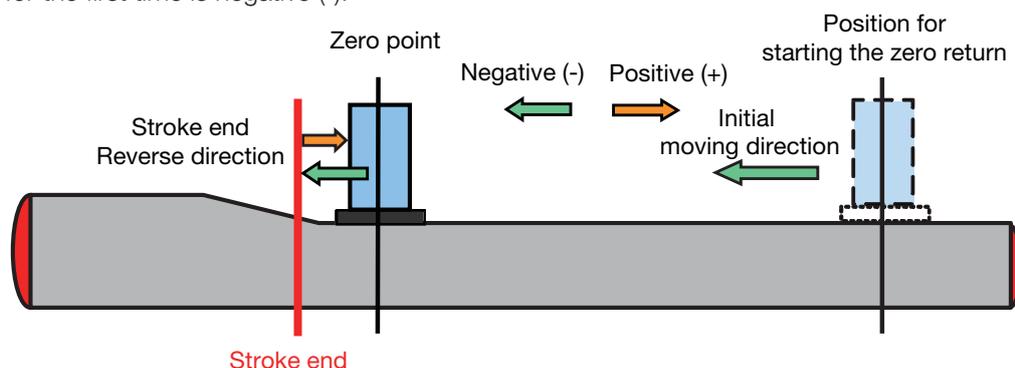
- ① Turn the SV-ON input (pin.18) ON. Check that the SVRDY output (pin.32) is ON.
- ② When the HOME input (pin.15) is turned ON, the zero return operation will be started.  
The actuator starts moving toward the predefined zero point and turns around at the stroke end.  
\* In some cases, the PAUSE input (pin.16) must be ON.  
For details, see 5-1. Pause (→P.5-10).
- ③ After turning around, it stops. When it completes returning to the zero point, the HEND output (pin.29) will be turned ON. Turn the HOME input (pin.15) OFF.
- ④ If you have configured the parameter No.6 (ORG offset) (→P.5-19) the position which is moved by the set value becomes the zero point.



### 4-2

### Positive/negative of moving direction

- For definitions of positive (+) and negative (-) of moving direction, the direction in which the actuator returns after turning around at the stroke end for the zero return operation is regarded as positive (+).
- The direction in which it moves toward the stroke end from the middle point of the stroke range for the first time is negative (-).



Note) If the zero return direction is reverse motor side, the positive (+) and negative (-) will be opposite of the figure above.

## 5. Pause

### 5-1 Pause

- Turning the PAUSE input (pin.16) OFF during operations will decelerate the speed and then pause it. Turning ON will resume the operations for the remaining move amount for the STEP No. that was active before turning the PAUSE input (pin.16) OFF.
- During pause, turning ON the REST input (pin.17) will cancel the remaining move amount for the STEP No. that was active before turning the PAUSE input (pin.16) OFF. In this case, turning ON the PAUSE again will not resume the operations and the unit remains in the position, so enter the operation command for the next STEP No.
  - \* The operation command of the next STEP No. should be the STEP No. other than the one that was active before turning the PAUSE input (pin.16) OFF.  
The same STEP No. was canceled with the REST input, so its operation command cannot be accepted.
- When "Invalid" is selected for the parameter No.33 (Selection of invalid for pause input) (→ P.5-24), pause is invalid regardless of ON/OFF status of the PAUSE input (pin.16). (it does not pause.)

## 6. Manual operation

### 6-1

### Manual operation

- In function mode 1, the actuator can be operated discretionarily by external input and output, in addition to normal positioning operation.
  - \* Operations are allowed even before zero return, but the servo must be ON.
- There are the jog operation in which the actuator operates during the input is ON, and inching operation in which the actuator moves for a certain distance and then stops per each turning ON.
- Turning the JOG/INCHING input (pin.10) ON will activate the inching operation, and OFF will activate the jog operation.
  - ① Jog operation: Only while being ON, the actuator in operates in positive (+) direction with JOG P (pin.11), or in negative (-) direction with JOG N (pin.12).

For definitions of positive and negative directions, see "**4-2 Positive/negative of moving direction(→P.5-9)**".

The moving speed is set by the parameter No.21 (I/O jog speed).  
This moving speed is common to that of the inching operation described below.
  - ② Inching operation: Once turned ON, the actuator in moves for certain distance in positive (+) direction with JOG P (pin.11), or in negative (-) direction with JOG N (pin.12).

For definitions of positive and negative directions, see "**4-2 Positive/negative of moving direction(→P.5-9)**".

The moving speed is set by the parameter No.21 (I/O jog speed).  
This moving speed is common to that of the jog operation described above.  
The moving distance is set by the parameter No.22 (I/O inching distance).  
To repeat the operation, turn it OFF and then ON.

# 7. Positioning operation

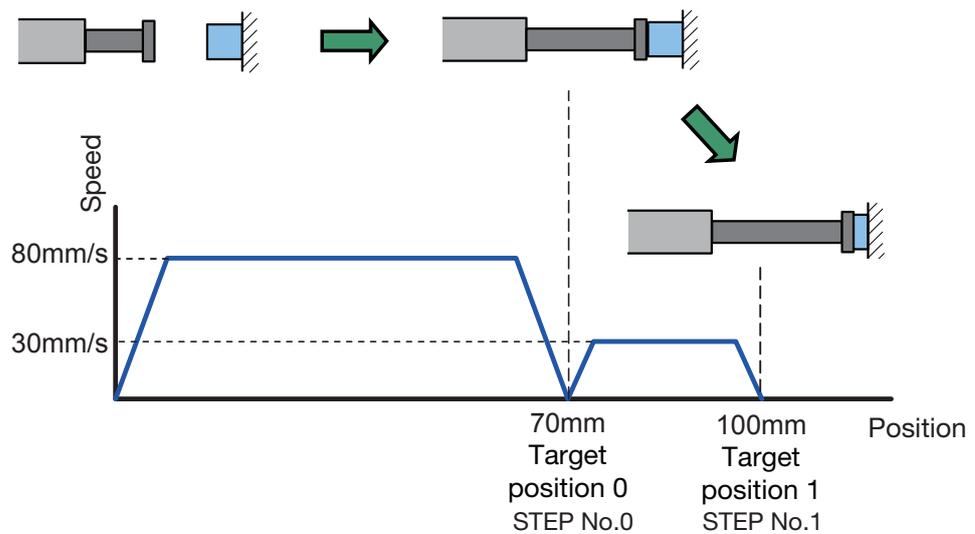
## 7-1 Positioning operation

- You can perform this in all operation modes.
- When "Push (%)" in the program table is "0," positioning operation will be performed to move the actuator to the target "Position."
- The INPS output (pin.30) is turned ON when the current position enters into the "IN-POSI" of the target "POSI."
- For more information on settings, see the separate D-STEP or TDO Instruction Manual.

Example

STEP No.	ABS / INC	Position [mm]	Speed [mm/s]	ACC [mm/s <sup>2</sup> ]	DCC [mm/s <sup>2</sup> ]	JUMP [No.]	Comment
0	ABS	70.00	80	3	3	1	Positioning operation 1
1	ABS	100.00	30	3	3	E	Positioning operation 2

\* Some of the setting fields are omitted.



## 8. Pressing operation

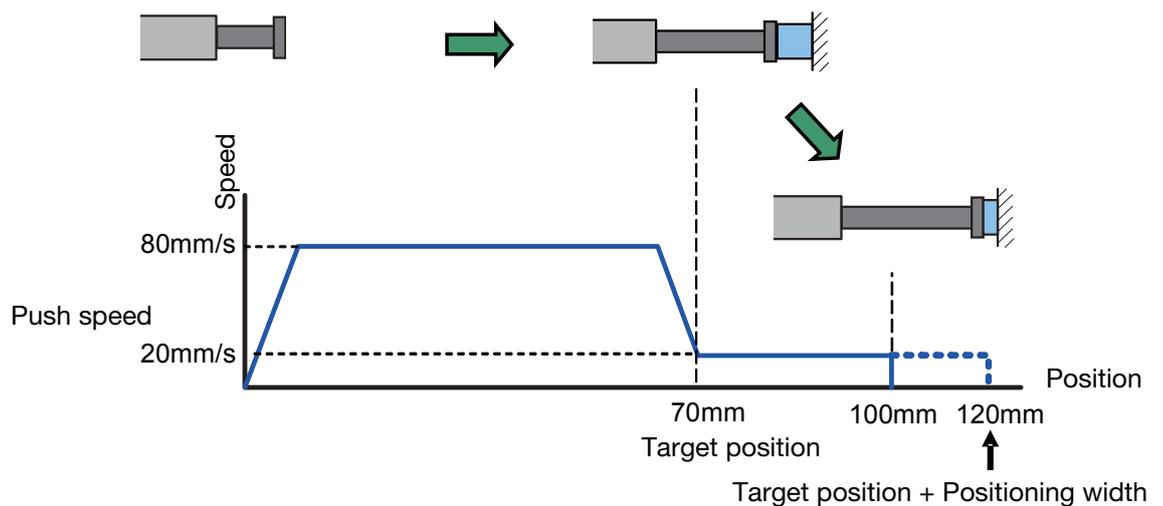
### 8-1 Pressing operation

- You can perform this in the operation mode 0, 2, 3, and 4.
- When "Push (%)" is other than "0," pressing operation will be performed to press the object with torque limit (current limit).
- Even when the amount of impressing is not constant, you can perform pressing by controlling the torque.
- For more information on settings, see the separate D-STEP or TDO Instruction Manual.

Example

STEP No.	ABS / INC	Position [mm]	Speed [mm/s]	Push [%]	Pos Range [mm]	JUMP [No.]	Comment
0	ABS	70.00	80	70	50.00	E	Pressing operation

\* Some of the setting fields are omitted.

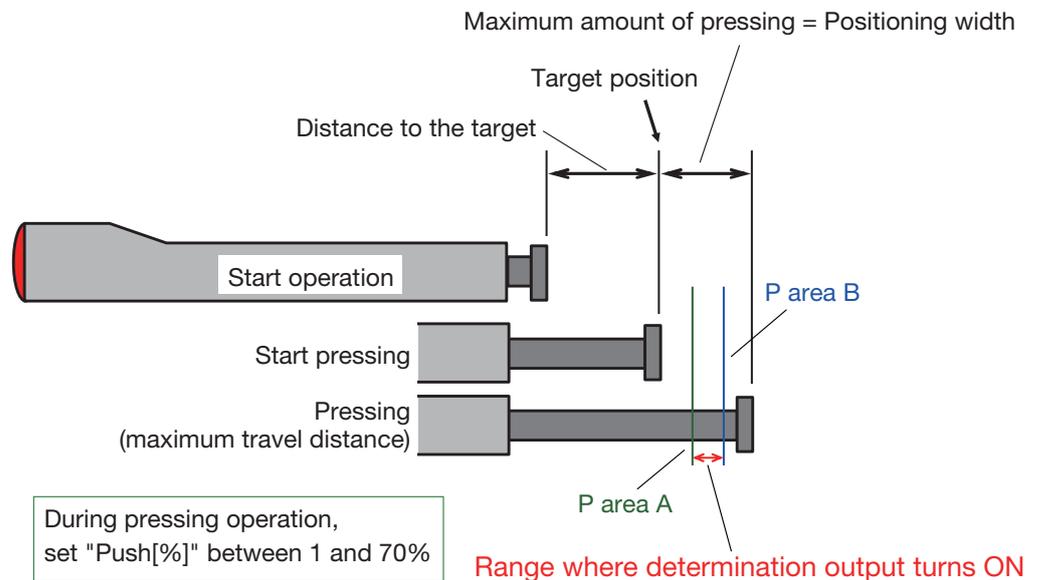


## 9. Torque determination

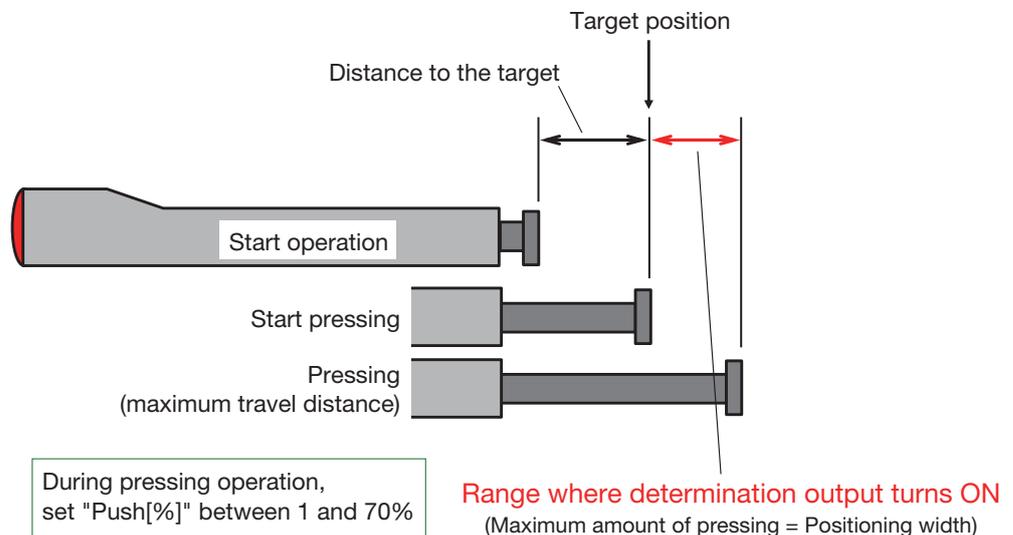
### 9-1 Torque determination

- You can perform this in the operation mode 0, 2, 3, and 4.
- You can set the current during "Pressing operation" as "Push (%)," and moreover you can set "Threshold" as a guide for torque determination.
- If the output current above the rate (%) set for the "Threshold (%)" of the "program table" continues for the time set by the parameter No.23 (Judgment time) (→P.5-21) then the LOAD / TRQS output (pin.31) is turned ON.
- With the parameter No.24 (Threshold judgment range) (→P.5-21) the "Valid" or "Invalid" of the torque determination range setting can be selected.
- For more information on settings, see the separate D-STEP or TDO Instruction Manual.

#### • When the range setting is valid



#### • When the range setting is invalid



# 10. Area determination

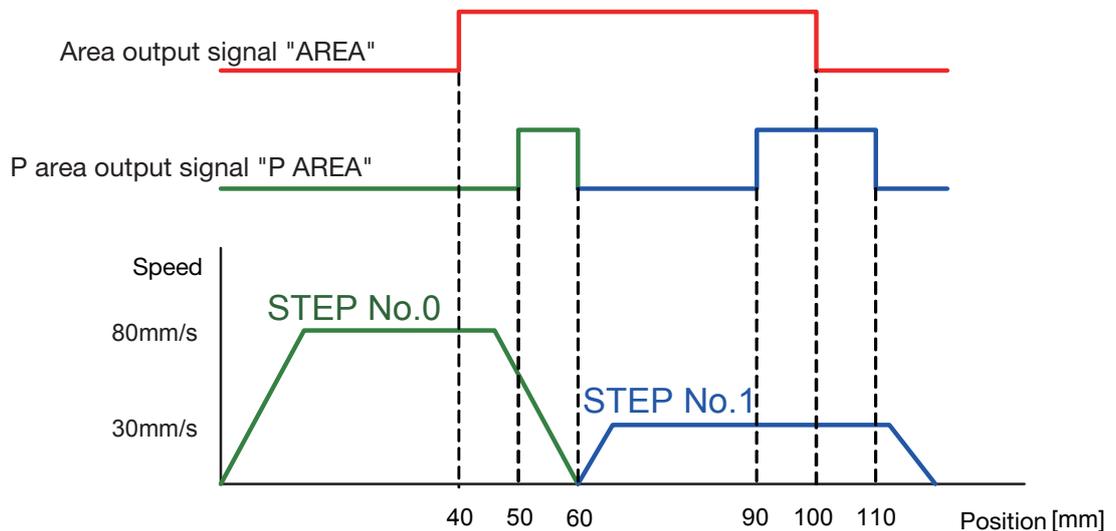
## 10-1 Area determination

- There are 2 types: "area determination" that sets the determination range by parameters and "P area determination" that sets for STEP No. of the program table.
  - When the actuator enters into the range set by the parameter No.1 (Max. area) (→ **P.5-19**) and No.2 (Min. area) (→ **P.5-19**), AREA output (pin.26) is turned ON (, which is executable in function modes 0, 4 and 5).
  - AREA output (pin.26) will also be output during job and inching operations.
  - When the actuator enters into the range configured in the "P area A (mm)" and "P area B (mm)" of the "program table", the P AREA output (pin.27) turns ON (, which is executable in operation modes 0, 1, 2, 4 and 5).
- \* The P area set for the running STEP No. is valid. The P area for other STEP No. is invalid.
- For more information on settings, see the separate D-STEP or TDO Instruction Manual.

No.	Parameter name	Set value
1	Max. area	100.00
2	Min. area	40.00

STEP No.	ABS / INC	Position [mm]	Speed [mm/s]	P area A [mm]	P area B [mm]	JUMP [No.]	Comment
0	ABS	60.00	80	50.00	70.00	1	STEP No.0 operation (green)
1	ABS	120.00	30	90.00	110.00	E	STEP No.1 operation (blue)

\* Some of the setting fields are omitted.



# 11. Speed switching

## 11-1 Speed switching

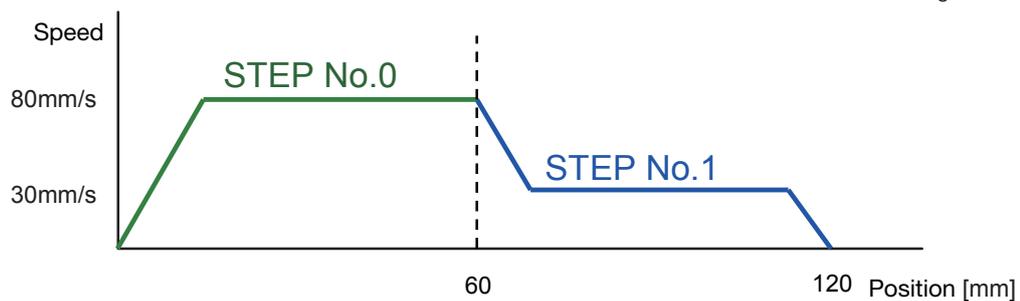
- While moving, you can change the speed and continue the operation without pausing by issuing the execution command for the next program STEP No. (specify STEP No. → STRT ON).
- If the execution command for the next program STEP No. is delayed, the operation continues after a pause.
- The acceleration and deceleration rate from the speed changing point to the next speed will be "ACC (m/s<sup>2</sup>)" for the next STEP.

Note that the rate will always be "ACC (m/s<sup>2</sup>)" even for deceleration operation.

- For STEP No. in which you will perform speed switching, set "E" to "JUMP (NO.)."
- You can switch speed only in the operation mode 0, 2, and 3.
- This function is not available for operations from D-STEP. (The machine always pauses.)

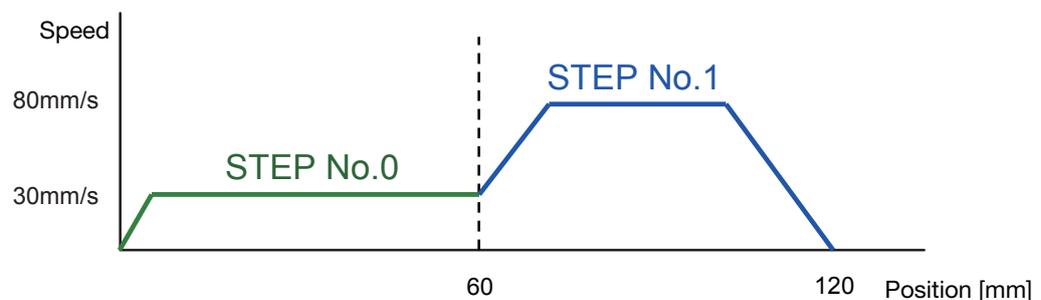
STEP No.	ABS / INC	Position [mm]	Speed [mm/s]	P area A [mm]	P area B [mm]	JUMP [No.]	Comment
0	ABS	60.00	80	50.00	70.00	E	STEP No.0 operation (green)
1	ABS	120.00	30	90.00	110.00	E	STEP No.1 operation (blue)

\* Some of the setting fields are omitted.



STEP No.	ABS / INC	Position [mm]	Speed [mm/s]	P area A [mm]	P area B [mm]	JUMP [No.]	Comment
0	ABS	60.00	30	50.00	70.00	E	STEP No.0 operation (green)
1	ABS	120.00	80	90.00	110.00	E	STEP No.1 operation (blue)

\* Some of the setting fields are omitted.



## 12. Brake release

- The brake of the actuator with brake can be released manually.
- Normally it is interlocked with servo ON for brake release.

However, if it will not interlock if deactivated manually (by using switches or external input and output), and it remains deactivated even if the servo is turned OFF. In this case, it must be manually returned to the valid status.

### WARNING



Obligatory

- Note that if the brake is released when using it in the vertical direction, the moving part may fall freely. So be sure to do this after securing the moving part.

Failure to do so may cause damage or injury.

- Note that if the mode change switch is turned AUTO with BKRL input (pin.12) of external input and output ON, the moving part may fall freely. So be sure to turn the BKRL input (pin.12) OFF and then set the mode change switch to AUTO.

Failure to do so may cause damage or injury.



Caution

- If it is manually released, return it to the valid status manually. The brake remains released until it is returned to the valid status, and it does not interlock with the servo ON/OFF. Also, note that if the brake is stopped with the emergency stop switch, it is released when the switch is back.

### 12-1 Release with switch

- Press and hold the mode change switch on the front panel toward the "BRK OFF" side (for more than 2 seconds), the brake will be released and the "BRK OFF" LED will light.
- While releasing the brake, press and hold the mode change switch on the front panel toward the "BRK OFF" side (for less than 0.5 seconds), the brake will be enabled and the "BRK OFF" LED will be turned off.

### 12-2 Release with external input and output

- In the AUTO mode, the brake can be released/enabled by using the external input and output.
- Turning the BKRL input (pin.12) ON for the external input and output will release the brake and then "BRK OFF" LED will light.
- Turning the BKRL input (pin.12) OFF for the external input and output will enable the brake and then "BRK OFF" LED will be turned off.

## 13. General precautions

---

### 13-1 General precautions

- (1) To receive the next STRT signal or ST 0 to 6 signals after the completion of movement, INPS (pin.30) and LS (pin.19 to 21) signals ON, the intervals of more than 10 ms are necessary.
- (2) In the function modes 0 and 1, the MOVE output (pin.25) turns ON until the movement completion program. Especially, when the MOVE output (pin.25) turns OFF without the INPS output (pin.30) ON for the pressing operation, please determine that pressing failed (missed).

# 14. Parameters

You can set and save the following items for the parameters:

- ① Basic operations/constants of the driver controller/actuator.
- ② Initial values entered into program table.
- ③ Constants related to servo operations.
- For actual setup operations, use the setup tool **D-STEP** or the digital operator **TDO**. For more information, see the separate instruction manual.
- Depending on the function mode, some parameters do not function.  
Example) "Max. area" and "Min. area" of the function mode 1 ← Due to the lack of area output.
- There are some missing numbers or non-disclosed parameters due to circumstances.

## 14-1

### Parameter: Actuator information

No.	Parameter name	Unit	Setting range	Default value
1	Max. area	mm	-9999.99 to 9999.99	9999.99
	Description	Sets the + side (MAX side) of the area where the AREA signal (pin.26) turns ON.		
2	Min. area	mm	-9999.99 to 9999.99	-9999.99
	Description	Sets the - side (MIN side) of the area where the AREA signal (pin.26) turns ON.		
3	Soft limit +	mm	0.00 to 9999.99	9999.99
	Description	Sets the + side (MAX side) of the actuator-movable area.		
4	Soft limit -	mm	-9999.99 to 0.00	-9999.99
	Description	Sets the - side (MIN side) of the actuator-movable area.		
6	ORG offset	mm	-9999.99 to 9999.99	0.00
	Description	Enables the zero point of absolute coordinate system to be set in an arbitrary position.		

## 14-2

### Parameter: Actuator operation settings

No.	Parameter name	Unit	Setting range	Default value
7	Push judgment time	ms	1 to 99999	100
	Description	Sets the time from when the actuator hits a work in the pressing operation until when the operation is judged to be completed.		
8	Default speed	mm/s	1 to 1000	100
	Description	Inputs the default value of "Speed" entered when double-clicking an arbitrary row of the program table.		
9	Default ACCEL/DECEL	m/s <sup>2</sup>	1 to 100	3
	Description	Inputs the default value of "ACC" and "DCC" entered when double-clicking an arbitrary row of the program table.		
10	IN-POSI range	mm	0.00 to 999.99	0.02
	Description	Inputs the default value of "Positioning width" entered when double-clicking an arbitrary row of the program table.		

# 14. Parameters

No.	Parameter name	Unit	Setting range	Default value
11	Cur. limit at stop	%	1 to 70	70
	Description	Sets the current applied to the motor when the actuator is in stop status. Increasing the value increases the stoppage holding torque (settable to the linear), but also increases the heat generation and the electric power usage. The current value tailored to the standard specification of the actuator is set before shipment.		
12	Cur. limit at origin	%	1 to 100	80
	Description	Sets the current applied to the motor when the actuator returns to zero point. Increasing the value increases the zero return torque (settable to the linear), but also increases the heat generation and the electric power usage. The current value tailored to the standard specification of the actuator is set before shipment.		
13	Move command type	[Select]	Level/Edge	Level
	Description	Selects the method of inputting move command (ST 0 to 6) (pin. 3 to 9) for function mode 4. Level: The movement is started when turning the input signal ON and is stopped when turning it OFF on the way. Edge: The movement is started at the rising edge of the input signal and is not stopped even when turning it OFF on the way.		
15	Push speed	mm/s	1 to 20	10
	Description	Defines the pressing speed after reaching the target position during pressing operation. A default value tailored to the actuator characteristics is set before shipment.		
*16	Jog speed	mm/s	1 to 250	10
	Description	D-STEP: Sets the jog speed on the PROGRAM screen. For the speed setting by I/O input, see No. 21.		
17	Auto servo OFF 1	s	0 to 9999	9999
	Description	Sets the time after completing the positioning until the servo turns OFF when "Stop mode" of the program table is "ASO1".		
18	Auto servo OFF 2	s	0 to 9999	9999
	Description	Sets the time after completing the positioning until the servo turns OFF when "Stop mode" of the program table is "ASO2".		
19	Auto servo OFF 3	s	0 to 9999	9999
	Description	Sets the time after completing the positioning until the servo turns OFF when "Stop mode" of the program table is "ASO3".		
*20	Speed override	%	1 to 100	100
	Description	For protection against the danger in trial operation, this is used when you want to operate the actuator at a low speed. In the operation, it is possible to multiply the movement speed in the "Speed" field of the "Program table" by the ratio of the value set here.		
*21	I/O jog speed	mm/s	1 to 250	10
	Description	Sets the speed in jog operation when external input instruction by I/O (Function mode 1) is selected. For the speed setting by D-STEP, see No. 16.		
*22	I/O inching distance	mm	1 to 5000	10
	Description	Sets the movement distance by inching operation when external input instruction by I/O (Function mode 1) is selected. For the speed setting by D-STEP, see No. 31.		

Note: The parameter with "\*" attached to "No." can be changed while keeping the servo ON.

Note: [Select] in the "Unit" field is selected from the items displayed in "Setting range."

# 14. Parameters

No.	Parameter name	Unit	Setting range	Default value
23	Judgment time	ms	1 to 99999	10
	Description	When performing the torque determination in pressing operation, this sets the time until the condition is judged to be met after reaching the threshold.		
24	Threshold judgment range	[Select]	Invalid/Valid	Invalid
	Description	When performing the torque determination in pressing operation, Valid: Sets the judgment range. Invalid: Does not set the judgment range.		
25	Default standstill mode	[Select]	Invalid/Automatic turn off 1 to 3/ Full servo	Invalid
	Description	Sets the default value of "Standstill mode" after reaching the target position of each STEP. Selecting an appropriate mode reduces heat generation and power usage. Invalid : The servo turns OFF but No. 11 current continues to flow. Automatic turn OFF 1: After the elapse of the time in No. 17, the servo turns OFF and the flowing current becomes 0. Automatic turn OFF 2: After the elapse of the time in No. 18, the servo turns OFF and the flowing current becomes 0. Automatic turn OFF 3: After the elapse of the time in No. 19, the servo turns OFF and the flowing current becomes 0. Full servo: The servo is always turned ON even in stop status.(The current increases or decreases depending on the external force)		
26	Ball screw lead	mm	0.0 to 99.9	Depends on models
	Description	Sets the length of ball screw lead. A value tailored to the actuator is set before shipment.		
28	Cur. select at miss	[Select]	Current limit on stop status/Limit for pressing	Current limit on stop status
	Description	Sets the current limit after the pressing operation being in vain. Current limit on stop status: Current set in No. 11 Limit for pressing: Current set in "Push (%)"		
29	Max. speed	mm/s	1 to 1000	Depends on models
	Description	Sets the maximum speed settable in the "Program table."		
30	Position deviation	mm	0.00 to 999.99	Depends on models
	Description	Sets the value to output alarm code No. 32 (Excessive position error (deviation)).		
*31	Inching distance	mm	0.1 to 200.0	10.0
	Description	D-STEP: Sets the inching distance on the PROGRAM screen. For the distance setting by I/O input, see No. 22.		

Note: The parameter with "\*" attached to "No." can be changed while keeping the servo ON.

Note: [Select] in the "Unit" field is selected from the items displayed in "Setting range."

# 14. Parameters

## 14-3

### Parameter: External interface

No.	Parameter name	Unit	Setting range	Default value
33	Selection of invalid for pause input	[Select]	Invalid/Valid	Valid
	Description	The "PAUSE" input (pin.16) of TSC is configured to be N.C. contact from the viewpoint of fail safe. Therefore, this should be turned ON (shorted to 0 V) during the operation. However, if it is not used, setting "Invalid" does not require the contact to turn ON. Valid: "PAUSE" input (pin. 16) will be valid. Invalid: "PAUSE" input (pin. 16) will be invalid.		
*34	Communication speed	[Select]	38400/57600/115200	115200
	Description	Sets the communication speed between PC and TDO via RS-485. The change will be valid by turning on the power again.		
35	Selection of servo ON input method	[Select]	External input/Always ON	External input
	Description	Selects the method to turn the servo ON. External input: Turning ON the "SV-ON" (pin. 18) input turns the servo ON. Always ON: Turning ON the power turns the servo ON.		
36	Function mode	[Select]	Type 0/1/2/3/4/5	Type 0
	Description	Selects the function mode of the driver controller.		
37	IN-POSI signal type	[Select]	PEND/INP	INP
	Description	Selects the output method of signal for positioning completion "INPS" (pin.30). When the servo is OFF, this is unconditionally turned OFF regardless of the current position. PEND: Servo ON → Once "INPS" is turned ON, this remains ON even when the position is out of "IN-POSI"(No.10). INP: Servo ON → Turns ON only when the position is within "IN-POSI."		
38	Inhibit MANU input	[Select]	Invalid/Valid	Invalid
	Description	Selects the operation when TSC is in AUTO mode and the "MANU" (pin.14) input turns ON. Invalid: TSC will be in MANUAL mode. Valid: TSC remains AUTO mode.		
*39	Comment	--	16 one-byte alphanumeric characters	-----
	Description	Enter any comment on the axis displayed on the Connect Start and PROGRAM screens.		
48	TDO enable function	[Select]	Invalid/Valid	Valid
	Description	When TDO is connected to the driver controller, this selects the TDO enable switch operation. Valid: The enable switch will be valid. (Turning it OFF stops the operation) Invalid: The enable switch will be invalid. (Even when turning it OFF, the operation does not stop)		

Note: The parameter with "\*" attached to "No." can be changed while keeping the servo ON.

Note: [Select] in the "Unit" field is selected from the items displayed in "Setting range."

# 14. Parameters

## 14-4 Parameter: Servo gain

No.	Parameter name	Unit	Setting range	Default value
*40	Position gain	1/s	1 to 100	Depends on models
	Description	This is a parameter to determine the responsiveness of position control loop. Increasing the setting value improves the follow-up performance to the position command but is likely to cause the overshoot.		
*41	Speed loop P gain	Hz	1 to 65536	Depends on models
	Description	This is a parameter to determine the responsiveness of speed control loop. As the load inertia increases, the setting value should be increased. Increasing the value improves the follow-up performance to the speed command (the servo rigidity is enhanced), but is likely to cause the overshoot and oscillation, resulting in mechanical vibration.		
*42	Speed loop I gain	0.01ms	1 to 65536	Depends on models
	Description	This is a parameter to determine the responsiveness of speed control loop. Increasing the value reduces the responsiveness to the speed command and repulsion force against the load change. Decreasing the value increases the responsiveness and repulsion force, but excessive decreasing is likely to cause the overshoot and oscillation, resulting in mechanical vibration.		

Note: The parameter with "\*" attached to "No." can be changed while keeping the servo ON.

Note: [Select] in the "Unit" field is selected from the items displayed in "Setting range."

# 6. Troubleshooting

## About this chapter

This chapter describes the causes and counter measures when an alarm is displayed or other failure occurs on the driver controller TSC.



This section describes the alarm list.

### 1. Alarm lists ..... 6-2

1-1. Alarm lists ..... 6-2

1-2. About the status of the servo when an alarm sounds ..... 6-3



This section describes the alarm code and its output procedures.

### 2. Alarm code ..... 6-4

2-1. Alarm code ..... 6-4



This section describes causes and handling of alarms.

### 3. Causes and counter measures of alarms ..... 6-5

3-1. Causes and counter measures of alarms ..... 6-5

# 1. Alarm lists

## 1-1

## Alarm lists

Code	Alarm name	Content
1	Motor overvoltage	Overvoltage is applied to the motor power supply
2	Control overvoltage	Overvoltage is applied to the input power supply
3	Control low-voltage	The input power supply is being reduced
11	Parameter error	The value set in the parameter exceeds the effective range
21	Move comm. at SV OFF	Move command has been entered with the servo OFF
22	Move comm. before ORG	① Position move command had been entered when zero return was not completed ② Move command has been entered while returning to zero point
23	ORG time out	After starting the zero return operation, it has not been completed even after the elapse of preset time
24	Writing error on move	During manual movement in Function mode 1, writing signal (PWRT signal) has been entered
25	Position data anomaly	① There is no data in the specified program table ② In Function mode 5, the target position in the "POSI" field is specified using a relative coordinate ③ "IN-POSI" sign for pressing operation has incorrectly been set
31	Position comm. error	Actual speed has exceeded the preset maximum value
32	Excessive position error (deviation)	The deviation between commanded position and current position has exceeded the parameter No. 30 Note: When the Standstill mode is ASO1 to 3, alarm generates when the following move command is executed (usually generates immediately after exceeding the parameter)
33	Soft limit over	The current position has exceeded the parameter No. 3 or 4
34	Push range over	During the pressing operation, the unit has been pushed back to the target position due to the too strong push-back force
51	EEPROM error	Abnormal data was detected in non-volatile memory checking during the start-up operation
52	Detection error	① There is no encoder feedback when performing the excitation detection ② Since there is an obstacle during the initial servo on behavior after turning on the power, the servo cannot be successfully turned on
53	Encoder error	The encoder was disconnected.
54	Servo error	After receiving the move command, the motor operation cannot be performed for 2 seconds or more before reaching the target position
55	Driver controller Overheat	The surrounding temperature of the power transistor within the driver controller is too high
63	Emergency stop	Emergency stop has been entered

# 1. Alarm lists

## 1-2

## About the status of the servo when an alarm sounds

Code	Alarm name	Servo status
1	Motor overvoltage	The servo changes to OFF status
2	Control overvoltage	The servo changes to OFF status
3	Control low-voltage	The servo changes to OFF status
11	Parameter error	The servo changes to OFF status
21	Move comm. at SV OFF	The servo changes to OFF status
22	Move comm. before ORG	The servo keeps ON status
23	ORG time out	The servo changes to OFF status
24	Writing error on move	The servo keeps ON status
25	Position data anomaly	The servo keeps ON status
31	Position comm. error	The servo keeps ON status
32	Excessive position error (deviation)	The servo changes to OFF status
33	Soft limit over	The servo keeps ON status
34	Push & hold operation range over-error	The servo changes to OFF status
51	EEPROM error	The servo changes to OFF status
52	Detection error	The servo changes to OFF status
54	Servo error	The servo changes to OFF status
55	Overheat	The servo changes to OFF status
63	Emergency stop	The servo changes to OFF status

## 2. Alarm code

### 2-1

### Alarm code

- Upon alarm generation, the ALM output (pin.34) is turned OFF. (ON is the normal status)
- In the event of any alarm, the binary alarm code is output to (AC 0 to 5) as the STEP No. is output in binary to PO 0-8, whose operation has been completed in Function modes 0 through 3. (See **"2-3 How to obtain STEP No. whose operation has been completed (→ P.4-5)"**.)
- Assuming the (AC) is equivalent to each binary number digit, convert them into decimal numbers to obtain an alarm code.

(AC)	0	1	2	3	4	5
Binary number digits	$2^0$	$2^1$	$2^2$	$2^3$	$2^4$	$2^5$
Decimal number	1	2	4	8	16	32

- Obtain the decimal numbers of the (AC) being ON from the table above, and add all the numbers up to determine the current alarm code.
- Example) When (AO 5) (=32), (AO 4) (=16), (AO 1) (=2), and (AO 0) (=1) are ON  
 $32 + 16 + 2 + 1 = 51$ , so alarm code = 51.

## 3. Causes and counter measures of alarms

### 3-1

### Causes and counter measures of alarms

No.	Alarm name	Generation status	Causes	Counter measures
1	Motor overvoltage	When 24 V power is activated (Short-circuiting of CN4 and MPI to MPO is used)	Driver controller board has a fault	Replace the driver controller with new one
		When MPO power is activated (Opening of CN4 and MPI to MPO is used)	The input voltage is high	Set the input voltage within the product specification range
			Driver controller board has a fault	Replace the driver controller with new one
		During normal operation	The input voltage is high (depending on excessive voltage variation)	Set the input voltage within the product specification range
			Driver controller board has a fault	Replace the driver controller with new one
When the motor decelerates in speed	The motor speed is high and load mass is too large	Reconsider the load condition and driving condition		
2	Control overvoltage	During 24 V power energizing	The input voltage is high	Set the input voltage within the product specification range
3	Control low-voltage	During 24 V power energizing	The input voltage is low	Set the input voltage within the product specification range
11	Parameter error	When 24 V power is activated	Driver controller board has a fault	Replace the driver controller with new one
		When reading out or writing in the parameter file	An inappropriate parameter file has been selected	Select an appropriate parameter file
21	Move comm. at SV OFF	When starting the normal operation	Operation starting procedures are not appropriate	Issue directive to move after servo ON and zero return
22	Move comm. before ORG	When starting the normal operation	Operation starting procedures are not appropriate	Issue directive to move after zero return
23	ORG time out	When in zero return	Actuator has a fault	Replace the actuator with new one
			Motor has a fault	Replace the actuator with new one
			Encoder has a fault	Replace the actuator with new one
			Actuator connection cable has a fault	Replace the cable with new one
			Driver controller board has a fault	Replace the driver controller with new one
24	Writing error on move	When entering external input instruction mode writing signal PWRT	Zero return was not completed	Execute the zero return
			The movement is going on by manual operation	Enter the signal after the operation completely stops
25	Position data anomaly	The program is being executed	There is some fault (omission, non-conformity, unreason, etc.) in the data to be executed	Correct the fault
			Specify the target position with function mode 5 in the relative coordinate	Specify the target position in the absolute coordinate
31	Position comm. error	During normal operation	Driver controller board has a fault	Replace the driver controller with new one
32	Excessive position error (deviation)	Positioning operation is going on	Inhibition of operation by external force	Remove the inhibitor
			Actuator has a fault	Replace the actuator with new one
			Motor has a fault	Replace the actuator with new one
			Encoder has a fault	Replace the actuator with new one
			Actuator connection cable has a fault	Replace the cable with new one
			Gain shortage	Readjust the gain
33	Soft limit over	Positioning operation is going on	Position setting is out of limit	Set the position within the limit
34	Push & hold operation range over-error	During the pressing operation	The amount of pressing is not enough	Increase the Push[%]

### 3. Causes and counter measures of alarms

No.	Alarm name	Generation status	Causes	Counter measures
51	EEPROM error	When 24 V power is activated	Driver controller board has a fault	Replace the driver controller with new one
52	Detection error	When the servo is turned ON	Encoder has a fault	Replace the actuator with new one
			Actuator connection cable has a fault	Replace the cable with new one
			Driver controller board has a fault	Replace the driver controller with new one
			The unit hits an obstacle.	Remove the obstacle
53	Encoder error	At 24 V power ON	Actuator connection cable fault	Replace the cable with new one
54	Servo error	When in positioning operation	Inhibition of operation by external force	Remove the inhibitor
			Actuator has a fault	Replace the actuator with new one
			Motor has a fault	Replace the actuator with new one
			Brake has a fault (when a brake is provided)	Replace the actuator with new one
			Actuator connection cable has a fault	Replace the cable with new one
			Driver controller board has a fault	Replace the driver controller with new one
55	Overheat	While energizing	Ambient temperature is high	Set the ambient temperature within the product specification range
			Bad ventilation is likely to cause the heat to be stayed inside the unit	Set the surrounding space according to the product specifications
			Driver controller board has a fault	Replace the driver controller with new one
63	EMG stop	While energizing	External emergency stop switch has operated	Restore the external emergency stop to the normal status
			Voltage reduction in motor power supply	Set the input voltage within the product specification range
			Driver controller board has a fault	Replace the driver controller with new one

- After removing the alarm cause and then implementing the counter measure, turning the REST input (pin.17) ON allows the alarm to be reset. If the alarm cannot be reset, the alarm cause is not removed.

# 7. Maintenance and Warranty

## About this chapter

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



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

### 1. Maintenance and inspection ..... 7-2

- 1-1. Standard of durability of consumables in the driver controller TSC ..... 7-2



This chapter describes the warranty of this product.

### 2. Product warranty ..... 7-3

- 2-1. Free warranty period ..... 7-3
- 2-2. Usage conditions (range) ..... 7-3
- 2-3. Warranty scope ..... 7-3
- 2-4. Exclusion of warranty liability ..... 7-4
- 2-5. Delivery conditions ..... 7-4

# 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

## Standard of durability of consumables in the driver controller TSC

### 1-1-1

## Standard of durability of consumables

- Parts listed in the table below are also subject to aged deterioration, so use the following only for reference.

Consumables	Location	Durability
Contact relay	Power supply circuit (power ON/OFF)	100,000 cycles
Contact relay	TDO connection circuit (with TDO connected)	100,000 cycles

#### Important

- We do not provide repair service for the driver controller TSC out of the warranty period. Please prepare a spare driver controller TSC in advance or purchase new one.

## 2. Product warranty

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

### 2-1 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.

### 2-2 Usage conditions (range)

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

### 2-3 Warranty scope

#### 2-3-1 Failure diagnosis

Please inform our Customer Support (refer to back cover) 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: **1-2 Package contents check of driver controller TSC (→ P.2-3)**

#### 2-3-2 Consumables and spare parts

- It is recommended to prepare spare parts for cables, driver controller TSC and other peripherals.

## 2. Product warranty

### 2-3-3 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 2-2 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.
- Failure arising out of any convulsion of nature such as earthquake, lightening, 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 2-1, 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 6 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.

### 2-3-4 Repair period

For driver controller TSC, we do not support repair services out of the warranty coverage. Please prepare a spare TSC in advance or purchase new one.

### 2-4 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 the 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.

### 2-5 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.

# 8. 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.

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This section describes the driver controller TSC.

<b>1. Driver controller TSC .....</b>	<b>8-2</b>
1-1. Specifications and dimensional drawing .....	8-2

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This section describes cables.

<b>2. Cables .....</b>	<b>8-3</b>
2-1. Connection cable.....	8-3

# 1. Driver controller TSC

## 8. Technical Materials

### 1-1

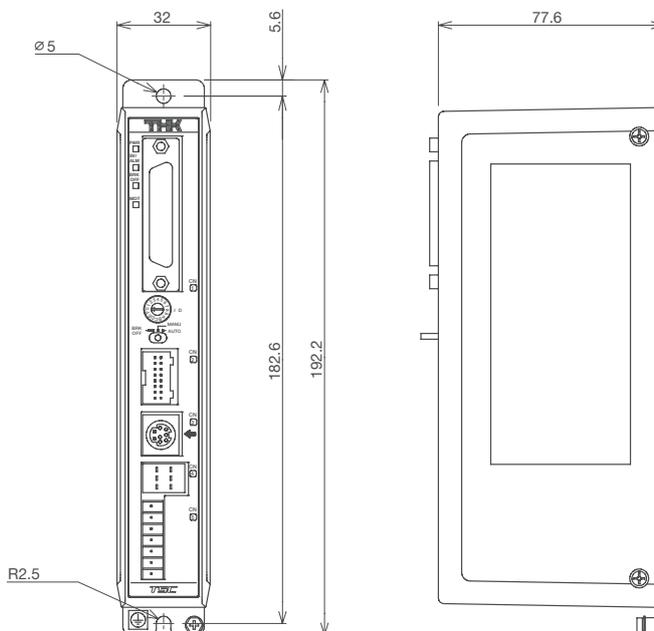
## Specifications and dimensional drawing

### Specifications

Basic specification	Input power supply	24 VDC ± 10% (max. 2.5 A)					
Control	Control shaft count	1 shaft					
	Motor type	Stepper motor (□ 28 mm, □ 35 mm, and □ 42 mm)					
	Control method	Feedback control (semi-closed loop)					
	Position detection method	Incremental					
	Acceleration/Deceleration method	Trapezoid acceleration					
Program	Function mode	Position 64 type	External unit input instruction type	Position 256 type	Position 512 type	Solenoid mode 1	Solenoid mode 2
	Step data count	64 points	64 points	256 points	512 points	7 points	3 points
	Program edit tool	PC setup tool D-STEP or digital operator TDO					
Input/output	Dedicated input/output	16 points (Start, Zero return, Pause, Reset, Servo ON, Step No. specification, etc.)					
	Output point count	16 points (Zero return completed, In position, Servo ready, Alarm, Emergency stop status, etc.)					
Communication	External power supply for input/output	24 VDC±10% (This should be prepared by yourself)					
	Serial communication	Connected device	PC setup tool D-STEP or digital operator TDO				
		Communication method	RS-485				
	Port count	Mini DIN x 1					
Usage conditions	Operating temperature /Storage temperature	0 to 40°C (no freezing)/-20 to 85°C (no freezing)					
	Service and Storage humidity	90% RH or less (no condensation)					
	Ambient condition	Indoor (without exposure to direct sunlight) with no corrosive gas, flammable gas, oil mist or dust particles					
General specifications	Protective function	Overload, Overvoltage, Position deviation too large, and Software limit over error, etc.					
	Accessories	Power connector x 1 I/O connector x 1					
	Options (Separately-sold)	Digital operator TDO (Cable length 5 m) I/O cables 3m, 5m, 7m and 10m PC communication cable (Mini DIN ↔ USB)					
	External dimensions	32 mm (W) × 192.2 mm (H) × 77.6 mm (D)					
	Mass	300 g or less					

\* Depending on function modes.

### Dimensions



## 2. Cables

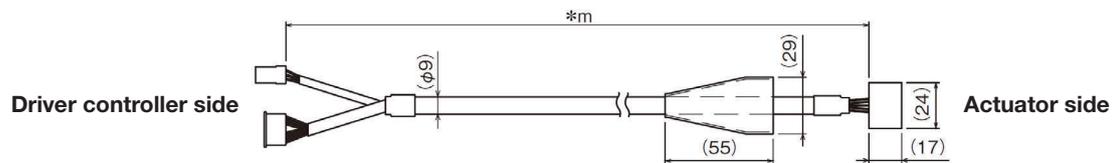
## 8. Technical Materials

### 2-1 Connection cable

#### 2-1-1 Actuator cable for TSC

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

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



# MEMO

# Appendix

## Revision history

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

Date of issue	Instruction manual No.	Details
December 2013	No.6120-1(0)E	First edition
February 2014	No.6120-1(1)E	Correction of erroneous description
June 2014	No.6120-1(2)E	Correction of erroneous description
November 2016	No.6120-1(3)E	Added compatible model numbers Changed accessories and optional parts
April 2018	No.6120-2(0)E	Errors corrected, notes added



**THK Electric Actuator Controller Series  
Stepper Driver Controller**

**TSC**

**INSTRUCTION MANUAL**