CKD

ESC4 Series
Controller for Electric Actuators

INSTRUCTION MANUAL

Read this Instruction Manual before using the product.

In particular, read the safety notes carefully.

Keep this Instruction Manual safe for use at any time.

2024-09-13 SM-A85796/2-A

PREFACE

Thank you for purchasing our controller "ESC4 Series" for electric actuators.

This Instruction Manual describes basic matters related to the operation of this product in order to fully demonstrate its performance. Please read this Instruction Manual thoroughly and use the product properly.
Keep this Instruction Manual in a safe place and be careful not to lose it.

Product specifications and appearances presented in this Instruction Manual are subject to change without notice.

SAFETY INFORMATION

When designing and manufacturing any device incorporating the product, the manufacturer has an obligation to ensure that the device is safe. To that end, make sure that the safety of the machine mechanism of the device and the electric system that controls such mechanism is ensured.
Ensure to observe organization’s standards, laws and regulations etc. for safety related to design and management of the equipment.
In order to use our products safely, it is important to select, use, handle, and maintain the products properly.
Observe the warnings and precautions described in this Instruction Manual to ensure device safety.
Various safety measures have been taken for the product, but handling that is not described in this Instruction Manual may cause an accident. Thoroughly read and understand this Instruction Manual before using the product.

To explicitly indicate the severity and likelihood of a potential harm or damage, precautions are classified into three categories: "DANGER", "WARNING", and "CAUTION".

 **DANGER**	Indicates an imminent hazard. Improper handling will cause death or serious injury to people.
 **WARNING**	Indicates a potential hazard. Improper handling may cause death or serious injury to people.
 **CAUTION**	Indicates a potential hazard. Improper handling may cause injury to people or damage to property.

Precautions classified as "CAUTION" may still lead to serious results depending on the situation.
All precautions are equally important and must be observed.

<Warning symbol type>

	A general purpose mark indicating prohibited (not allowed) actions.		A mark that prohibits touching equipment.
	A mark that prohibits the act of putting a finger.		A general purpose mark indicating the danger such as electric shock and burn.
	A mark indicating the danger that occurs when an automatic equipment is started.		A general purpose mark indicating what you must do.
	A mark instructing you to carefully read the Instruction Manual.		A mark instructing the connection of the ground wire.

In addition, the following icons indicate general precautions, usage tips, or technical information or glossary.

	● Contains useful information such as general precautions, supplementary information, and reference information.
	● Contains detailed information and tips on how to use it in a practical way.
	● Contains technical information and glossary that you should know when using the function.

Precautions on Product Use

DANGER

Do not use this product for the following applications.

- Medical equipment pertaining to sustainment and management of human life and body
- Mechanism and mechanical device for transferring and transporting people
- Critical parts for securing safety in a mechanical device

WARNING

Never modify or implement additional processing to the product.

- Modification or additional processing may not only pose a risk of fire or electric shock, but may not satisfy the specifications described in this Instruction Manual.

Never handle the product, install or remove the equipment until safety is confirmed.

- Check and maintain the machinery and equipment only after confirming that all systems related to the product are safe. In addition, be careful not to get an electric shock by turning off the power of the device or the power of the corresponding equipment.
- Even after the operation is stopped, as there may be high-temperature parts or charging parts, carefully handle the product, and install or remove the equipment.

The product must be handled by the person who has sufficient knowledge and experience.

- This product is designed and manufactured as general industrial machinery equipment and parts, so please handle with care.

Use the product within the specifications.

- It cannot be used outside of product-specific specifications.
- Since this product is intended to use in general industrial machinery equipment and parts, it is not applicable when used in the following conditions. It will be applicable if you consult with our company at the time of its adoption and understand the specifications of our company's product. However, even in such a case, take safety measures to avoid danger in case of failure.
  - ◎ Use under conditions and environments other than those specified, and outdoor use.
  - ◎ Use in equipment and applications that come into direct contact with nuclear power, railways, aviation, ships, vehicles, medical equipment, beverages and food.
  - ◎ Use in applications requiring safety, such as recreational equipment, emergency shut off circuits, press machines, brake circuits, and safety measures.
  - ◎ Use in applications that are expected to have a significant impact on people and property and require special safety.

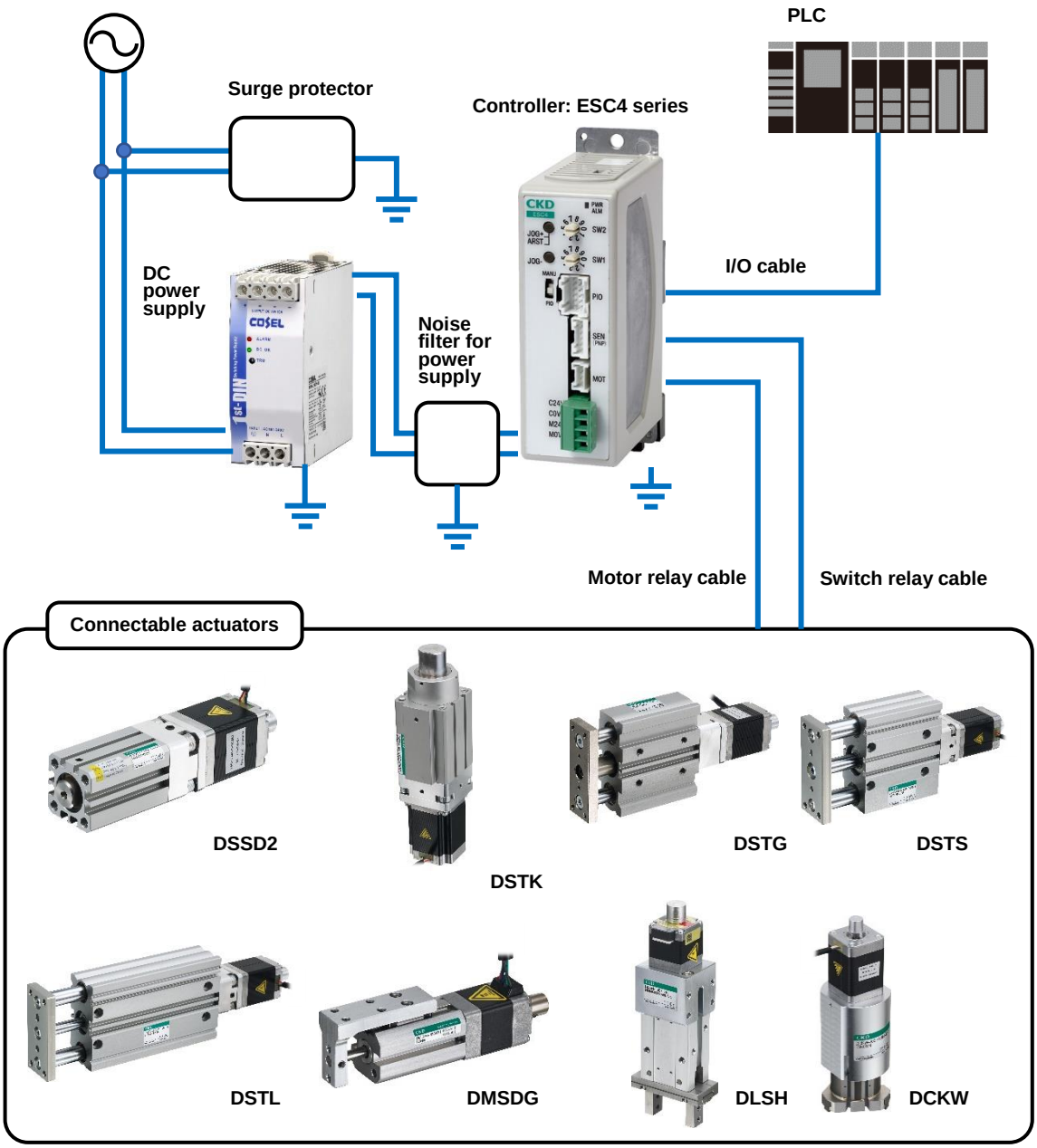
CONTENTS

1. PRODUCT OVERVIEW

1.1. System Structure

1.1.1. System structure

■ **ESC4 Series**



※ Refer to "1.4 Model Number Indication" for controller model numbers for the connectable actuators.

The following items can be purchased from us in the system configuration.

<table>
<tr><th></th><th>Component</th><th colspan="2">Product name/Model No.</th></tr>
<tr><td>This product</td><td>Controller</td><td colspan="2">ESC4 Series</td></tr>
<tr><td>Accessories</td><td>Power supply connector</td><td colspan="2">MC 1,5/ 4-ST-3,81
(PHOENIX CONTACT)</td></tr>
<tr><td rowspan="7">Sold separately</td><td rowspan="2">Actuator</td><td>Screw drive system</td><td>Spring drive system</td></tr>
<tr><td>DSSD2 series
DSTK series
DSTG series
DSTS series
DSTL series</td><td>DMSDG series
DLSH series
DCKW series</td></tr>
<tr><td>Motor relay cable</td><td colspan="2">ESC3-M2-□</td></tr>
<tr><td>Switch relay cable</td><td colspan="2">ESC3-S2-□</td></tr>
<tr><td>I/O cable</td><td colspan="2">ESC3-NP2-□</td></tr>
<tr><td>24 VDC power supply</td><td colspan="2">EA-PWR-KHNA240F-24</td></tr>
<tr><td>Noise filter</td><td colspan="2">AX-NSF-NF2015A-OD</td></tr>
</table>

To use this product as a product conforming to the European standards, refer to "6 STANDARD " and follow the instructions. Also for recommended surge protectors, refer to "6 STANDARD ".

- A "surge protector" is a device that protects equipment and communication equipment from transient abnormal high voltages such as lightning.
- A "noise filter" is an electric or electronic circuit for removing noise and a device that contains it.

- This product is not intended for use in residential areas. It may also not be able to provide sufficient protection for wireless receivers in the same environment.
- If this product is used in a residential environment, it may interfere with other equipment.
- Do not use this product in a residential environment unless you take measures to reduce electromagnetic interference so as not to interfere with radio and television reception status.
- Surge protector and noise filters should be installed near the input device and wired at the shortest possible distance.

1.1.2. Workflow

CAUTION

Connect the controller that supports the actuator.

- If operated with unsupported controller, the actuator may operate unexpectedly. It may cause injury to people around it or failure of the actuator.

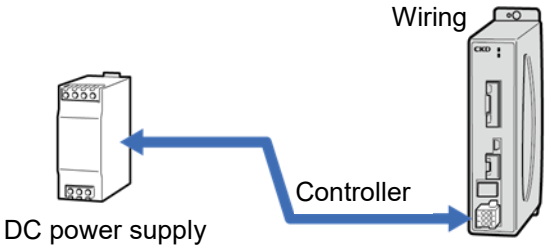
Follow the steps below to wire and set the controller so that it can be operated from the PLC.

1. Unpack

Take the product out of the box. Refer to "2.2 Unpacking" for details.

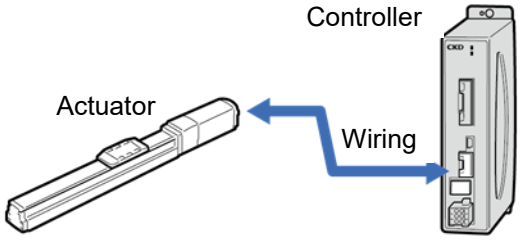
2. Connect the power supply

Connect the controller and the power supply. Refer to "2.3.1 Wiring with the power supply" for details.



3. Connect the actuator

Connect the controller and the actuator. Refer to "2.3.2 Wiring to the Actuator" for details.



4. Connect the PLC

Connect the controller and the PLC. Refer to "2.3.3 Wiring with the I/O cable" for details.

5. Set operating conditions

Set the speed, pressing force, and gripping force of the actuator connected to the controller using the rotary switch. Refer to "3.1 Setting" for details.

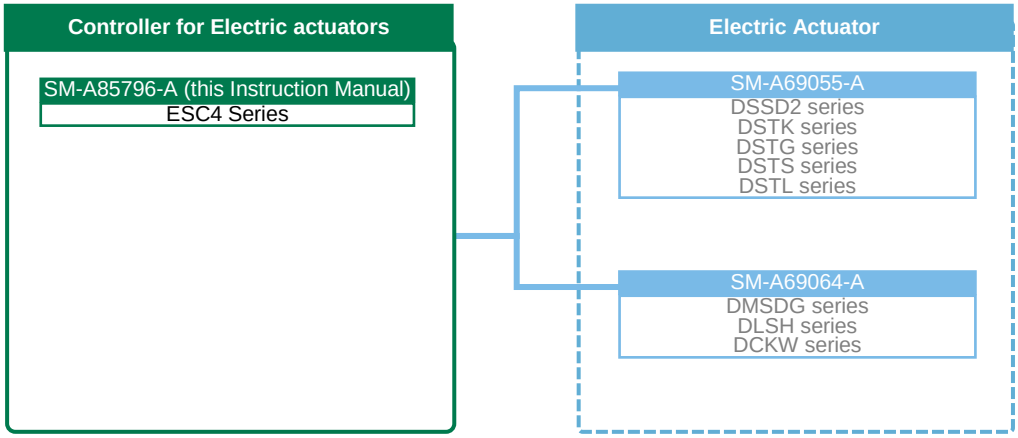
6. Start operation

Operate the actuator using the PLC. Refer to "3.2 Operation and Time Chart" for details.

- The steps of step 3 to 5 are in no particular order. Carry out in the order according to the customer's situation.

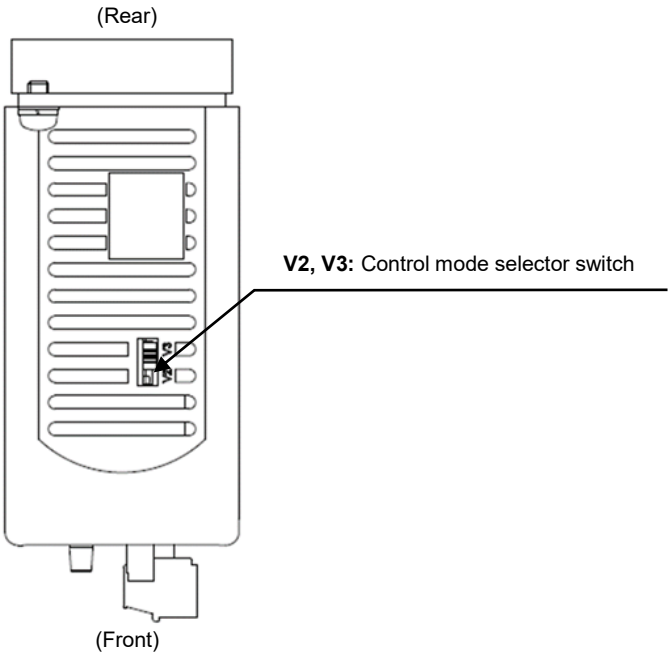
1.2. Instruction Manuals Related to This Product

This Instruction Manual is "SM-A85796-A".
The instruction manuals related to this product are as follows.

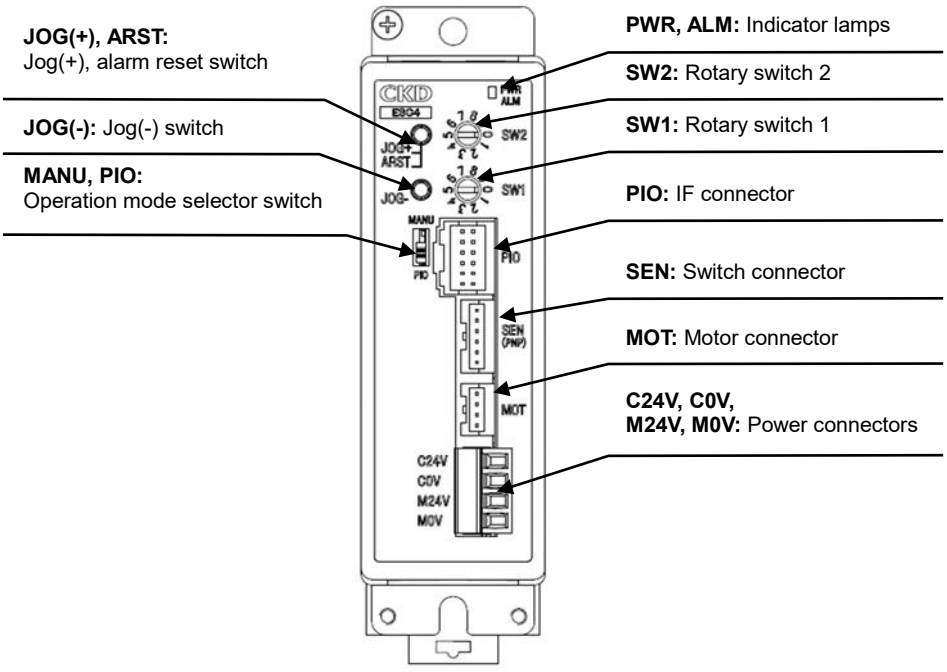


1.3. Part Name

<Top>



<Front>



Code	Part Name	Description		
V2, V3	Control mode selector switch	A switch to select the control mode. V2 represents the solenoid valve mode double 2-position type, and V3 represents the solenoid valve mode double 3-position type. Refer to "3.1.2 Setting the control mode" for the control mode.		
PWR, ALM	Indicator lamps	PWR represents the servo lamp and ALM represents the alarm lamp. For LED indications, see "1.3.1 LED indication".		
JOG(+), ARST	Jog(+) switch, alarm reset switch	A switch that has both the function of moving the actuator moving part and the function of resetting the alarm. For more information on JOG operation, see "JOG operation" in "3.2.1Basic Operation".		
JOG(-)	JOG(-) switch	A switch that moves the actuator moving part. For more information on JOG operation, see "JOG operation" in "3.2.1Basic Operation".		
MANU, PIO	Operation mode selector switch	A switch that selects whether to enable operation with the JOG switch or to enable signals from the PLC.		
C24V, C0V, M24V, M0V	Power supply connector	A connector for connecting power to the controller. Refer to "2.3.1 Wiring with the power supply" for information on wiring method.		
MOT	Motor connector	A connector for connecting the motor relay cable. Connection cable model number: ESC3-M2-□ Refer to "2.3.2 Wiring to the Actuator" for the connection cables.		
SEN	Switch connector	A connector for connecting the switch relay cable. Connection cable model number: ESC3-S2-□ Refer to "2.3.2 Wiring to the Actuator" for the connection cables.		
PIO	IF connector	Connector used to connect the upper device Connection cable model number: ESC3-NP2-□ Refer to "2.3.3 Wiring with the I/O cable" for the connection cables.		
SW1	Rotary switch 1 Note 1	Model group: DSSD2, DSTK, DSTG, DSTS, DSTL	Model group: DMSDG	Model group: DLSH, DCKW
		A switch for setting the PULL speed.	A switch for setting the PUSH speed and PULL speed.	A switch for setting the opening/closing speed.
SW2	Rotary switch 2 Note 1	Model group: DSSD2, DSTK, DSTG, DSTS, DSTL	Model group: DMSDG	Model group: DLSH, DCKW
		A switch for setting the PUSH speed.	A switch for setting the pressing force.	A switch for setting the gripping force.

Note 1: Refer to "3.1.4 Setting the speed" and "3.1.5 Setting the pressing and gripping forces" for details.

1.3.1. LED indication

■ Servo lamp and alarm lamp

Controller status			Servo lamp (green)	Alarm lamp (red)
Control power OFF			Off	Off
Normal	When operation mode PIO is selected	Motor energized state	ON	Off
		Motor de-energized state	Blinking (Lit once per second)	
	When operation mode MANU is selected		Blinking (Lit once every 0.5 seconds)	Off
At alarm occurrence	When an operation alarm occurs		Off	Blinking (Lit once per second)
	When a system alarm occurs			ON
At the time of the occurrence of warning	When operation mode PIO is selected	Motor energized state	ON	Blinking (lit once per 2 seconds)
		Motor de-energized state	Blinking (Lit once per second)	
	When operation mode MANU is selected		Blinking (Lit once every 0.5 seconds)	

※ Refer to "5.2 Alarm Indications and Countermeasures" for the details on responding alarms.

1.4. Model Number Indication

ESC4- [D] P- [01] [20] - [06] [100]

Controller mounting method	
D	DIN rail mounting
P	Panel mounting

Model group	
01	DSSD2
02	DSTK
03	DSTG
04	DSTS
05	DSTL
06	DMSDG
07	DLSH
08	DCKW

Actuator size	
08	8
16	16
20	20
32	32
50	50

Actuator lead note 1	
NN	Not included
06	6 mm
09	9 mm
12	12 mm

Actuator stroke note 2	
NNN	Not included
010	10 mm
020	20 mm
025	25 mm
030	30 mm
050	50 mm
075	75 mm
100	100 mm
150	150 mm
200	200 mm

Note 1: When selecting 06 (DMSDG), 07 (DLSH) or 08 (DCKW) of the model group, select "None".
Note 2: When selecting 07 (DLSH) or 08 (DCKW) of the model group, select "None".

1.4.1. Combination of actuator and controller model numbers

■ Screw drive system

Actuator			Actuator model number	Controller model number
Model group	Size	Lead		
DSSD2	20	06	DSSD2-20SE-06***-T3PHN0AN	ESC4-DP-0120-06***
		09	DSSD2-20SE-09***-T3PHN0AN	ESC4-DP-0120-09***
	32	06	DSSD2-32SE-06***-T3PHN0AN	ESC4-DP-0132-06***
		12	DSSD2-32SE-12***-T3PHN0AN	ESC4-DP-0132-12***
	50	06	DSSD2-50SE-06***-T3PHN0AN	ESC4-DP-0150-06***
		12	DSSD2-50SE-12***-T3PHN0AN	ESC4-DP-0150-12***
DSTK	20	06	DSTK-M-20SE-06***-T3PHN0AN	ESC4-DP-0220-06***
		09	DSTK-M-20SE-09***-T3PHN0AN	ESC4-DP-0220-09***
	32	06	DSTK-M-32SE-06***-T3PHN0AN	ESC4-DP-0232-06***
		12	DSTK-M-32SE-12***-T3PHN0AN	ESC4-DP-0232-12***
	50	06	DSTK-M-50SE-06***-T3PHN0AN	ESC4-DP-0250-06***
		12	DSTK-M-50SE-12***-T3PHN0AN	ESC4-DP-0250-12***
DSTG	20	06	DSTG-M-20SE-06***-T3PHN0AN	ESC4-DP-0320-06***
		09	DSTG-M-20SE-09***-T3PHN0AN	ESC4-DP-0320-09***
	32	06	DSTG-M-32SE-06***-T3PHN0AN	ESC4-DP-0332-06***
		12	DSTG-M-32SE-12***-T3PHN0AN	ESC4-DP-0332-12***
	50	06	DSTG-M-50SE-06***-T3PHN0AN	ESC4-DP-0350-06***
		12	DSTG-M-50SE-12***-T3PHN0AN	ESC4-DP-0350-12***

※ The actuator model number is for a straight type switch, without cable, and without option.

※ The controller model number is for DIN rail mounting.

Actuator			Actuator model number	Controller model number
Model group	Size	Lead		
DSTS	20	06	DSTS-M-20SE-06***-T3PHN0AN	ESC4-DP-0420-06***
		09	DSTS-M-20SE-09***-T3PHN0AN	ESC4-DP-0420-09***
	32	06	DSTS-M-32SE-06***-T3PHN0AN	ESC4-DP-0432-06***
		12	DSTS-M-32SE-12***-T3PHN0AN	ESC4-DP-0432-12***
	50	06	DSTS-M-50SE-06***-T3PHN0AN	ESC4-DP-0450-06***
		12	DSTS-M-50SE-12***-T3PHN0AN	ESC4-DP-0450-12***
DSTL	20	06	DSTL-M-20SE-06***-T3PHN0AN	ESC4-DP-0520-06***
		09	DSTL-M-20SE-09***-T3PHN0AN	ESC4-DP-0520-09***
	32	06	DSTL-M-32SE-06***-T3PHN0AN	ESC4-DP-0532-06***
		12	DSTL-M-32SE-12***-T3PHN0AN	ESC4-DP-0532-12***
	50	06	DSTL-M-50SE-06***-T3PHN0AN	ESC4-DP-0550-06***
		12	DSTL-M-50SE-12***-T3PHN0AN	ESC4-DP-0550-12***

※ The actuator model number is for a straight type switch, without cable, and without option.

※ The controller model number is for DIN rail mounting.

■ Spring drive system

Actuator			Actuator model number	Controller model number
Model group	Size	Lead		
DMSDG	08	3.3	DMSDG-08SH3** F3PH-TN0AN	ESC4-DP-0608-NN***
	16	5.1	DMSDG-16SH5** F3PH-TN0AN	ESC4-DP-0616-NN***
DLSH	20	4.2	DLSH-20SH410NN F3PH-FN0AN	ESC4-DP-0720-NNNNN
	32	6	DLSH-32SH622NN F3PH-FN0AN	ESC4-DP-0732-NNNNN
DCKW	20	4.2	DCKW-20SH410NN F3PH-FN0AN	ESC4-DP-0820-NNNNN
	32	6	DCKW-32SH608NN F3PH-FN0AN	ESC4-DP-0832-NNNNN

※ The actuator model number is for a straight type switch, connector take-out direction: top or front, and without cable.

※ The controller model number is for DIN rail mounting.

2. INSTALLATION

DANGER

Do not use the product in a place where dangerous substances such as ignitable, inflammable, or explosive materials are present.
- A fire, ignition, or explosion may occur.

Do not work with wet hands.
- Doing so may cause electric shock.

Prevent water and oil from splashing onto the product.
- A fire, electric leakage, or failure may occur. Even oil drops and oil mists are prohibited.

Make sure to hold and secure a workpiece to install the product.
- An injury may occur if the product falls down, falls off, or operates abnormally.

For the controller power supplies (control power supply and motive power supply) and the input/output circuit power supply, use a DC stabilized power supply (24 VDC ± 10%) with sufficient capacity.
- If the product is directly connected to an AC power supply, a fire, burst or damage may occur.

Install overcurrent protective equipment (such as a breaker for wiring and a circuit protector) on the power supply on the primary side when wiring in accordance with "JIS B 9960-1:2019 (IEC 60204-1:2016) Safety of machinery - Electrical equipment of machines - Part 1: General requirements".

Reference: Excerpt from "7.2.1 General matters" of JIS B 9960-1:2019.
Overcurrent protection shall be provided where the current in a circuit can exceed either the rating of any component or the allowable current of the conductors, whichever is the lesser value. The ratings or settings to be selected are detailed in 7.2.10.

WARNING

Do not install the product to a combustible material.
- If the product is installed near a combustible material, a fire may result.

Do not place heavy objects on cables or pinch them.
- Otherwise, the cover of the cable may tear or excessive stress is applied, causing poor continuity and insulation degradation.

Do not connect the communication connector used for this product to other devices.
- A malfunction or damage may occur.

Do not use or store the product in an environment where there is strong electromagnetic waves or radiation.
- A malfunction or failure may occur.

Because precision instruments are integrated, do not lay the product sideways or subject the product to vibration or impact during transportation.
- Component damage may occur.

Do not perform disassembly or modification of products that are not specified in this manual.
- An injury, accident, malfunction, or failure may occur; in addition, the specifications described in this manual may not be satisfied.

Install a safety fence to prevent entry into the actuator operation range.

Insulate unused wires.
- A malfunction, failure, or electric shock may occur.

When restarting after emergency stop or abnormal stop, check that it is safe for the actuator to operate.

WARNING

Design a safety circuit or safety device so that if the machine stops due to a system abnormality such as an emergency stop or a power failure, the equipment will not be damaged or personal injury will not occur.

When wiring the product, refer to this Instruction Manual or any other relevant instruction manuals to make sure that the wiring is correct and connectors are firmly connected.

- Otherwise, abnormal operation or the flow of an overcurrent may result. Overcurrent may cause abnormal operation, damage, or fire.

Make sure that the wiring is insulated.

- Otherwise, abnormal operation or the flow of an overcurrent may result. Overcurrent may cause abnormal operation, damage, or fire.

Make sure that the wires do not contact other circuits and there is no ground fault and insulation failure between terminals.

- Otherwise, abnormal operation or the flow of an overcurrent may result. Overcurrent may cause abnormal operation, damage, or fire.

Make sure to install the emergency stop button in a location where operation is easy.

- Make sure that the emergency stop button has a structure that cannot be automatically reset, and that no one can reset it inadvertently.
- It may take several seconds from the emergency stop to the actuator stop, depending on the speed and loading load when the actuator moves.

Consider the possibility of motor or motive power source failure.

- Even if motor or motive power source failure occurs, take measures to prevent personal injury or equipment failure.

When there is a need for resetting the actuator to the starting position, design a safe control unit.

Install the product indoors and in a dry place.

- It may cause an electric leakage or a fire accident in a place exposed to water or a place with high humidity (place with humidity of 80% or more, or with condensation).

When using the actuator for other than horizontal installation, use an external stopper, a holding mechanism (e.g. a brake), etc.

- The moving part may drop at the time of servo OFF (including an emergency stop and alarm), power OFF, or motor step-out, resulting in injury or damage to a workpiece.

Perform class D grounding (ground resistance: 100 Ω or less) for the product.

- Electric leakage may cause a fire, electric shock or malfunction.

CAUTION

Do not use the product in an environment where a strong magnetic field occurs.
- A malfunction may occur.

Do not perform a withstand voltage test or an insulation resistance test on a device with the product installed.
- Due to the circuit design, the product may be damaged if a withstand voltage test or an insulation resistance test is performed on the device with the product installed. If a withstand voltage test or an insulation resistance test is required as a device, remove the product before performing it.

Do not store or use the product in a place exposed to ultraviolet rays or in an atmosphere where corrosive gas or salt are present.
- It may cause performance deterioration and strength deterioration due to rust.

Do not install the product in a place subjected to strong vibrations or shocks.
- If the product is subjected to strong vibrations or shocks, a malfunction may occur.

Do not use the product in a place where condensation occurs due to a sudden change in the ambient temperature.
- It may cause a malfunction of the product or deteriorate of strength.

Connect only cables designed for the product.
- A failure of the product or unexpected accident may occur.

When transporting or mounting, do not have the moving part or cable part of the product.
- An injury or cable disconnection may occur.

Do not move the lead cable from the actuator.
- Secure the connector using a cable clamper, etc. so as to prevent it from moving. Use the lead cable with a bending radius of 40 mm or more.

Do not bend the relay cable up to 200 mm from the end of the connector.
- Poor continuity may occur.

Do not hold the controller case tightly.

Do not use the cylinder switch lead wire to carry the cylinder.
- It may cause the lead wire to break or the internal elements of the switch to be damaged.

Do not use the cylinder switch in locations with surge sources.
If there is equipment (electromagnetic lifters, high frequency guideways, motors, etc.) that generates a large surge around the actuator with a non-contact switch, it may cause deterioration or damage of the internal circuit elements of the switch. Therefore, take into consideration measures against the surge for the source.

CAUTION

Install the wiring so that no induction noise is applied.
- Avoid a place where a large current or strong magnetic field occurs.
- Do not use the same piping or wiring (with multi-core cables) as the power line of a large motor other than the product.
- Do not use the same piping or wiring as the power supplies and wires for inverters used for robots. Apply frame ground to the power supply and insert a filter into the output section.

Use a stabilized power supply (24 VDC ± 10%) as the power supply, and select one with sufficient capacity for the number of installed products.
- If the capacity is not sufficient, a malfunction may occur.

Use cables with a bending radius of 46 mm or more.
- Since the bending radius cannot be applied to the bending of the connector part, it is recommended to fix near the connector.

Secure sufficient space for maintenance and inspection.
- Otherwise, maintenance and inspection cannot be performed, which may cause equipment stop or damage, or injuries.

The customer is responsible for checking the compatibility of the product with the customer's system, machinery, and device.

When holding the product, hold its bottom surface.

When transporting and installing the product, ensure the safety of the workers by securely supporting the product using a lift or supporting gear and by assigning more than one worker.

Install the product in a way that it is not subjected to twisting or bending force.

Before adjusting the gain, firmly fix the actuator body to the rigid equipment.

Separate the power for the output section of the product from the power for inductive loads such as solenoid valves and relays that generate surges.
- If the power supply is shared, surge current may be applied to the output part, causing damage.
  If the power cannot be separated, connect the surge absorption elements in parallel directly to all the inductive loads.

⚠ CAUTION

Observe the tightening torque when installing the cylinder switch.

- If the maximum tightening torque is exceeded, setscrews, brackets, switches, etc. may be damaged. In addition, if the switch is tightened with less than the minimum tightening torque, the switch mounting position may be shifted.

Pay attention to the bending stress and tensile force of the lead wire.

- The minimum bending radius of the lead wire must be 9 mm or more (fixed), and care must be taken not to apply repeated bending stress or tensile force to the lead wire.

Make sure that no external force is applied to the cylinder switch.

- When handling, do not apply external force such as dropping, bending, impact (more than 980 m/s^2 for non-contact switch), pressure, or pulling. This may result in internal damage to the switch or malfunction of the body.

Fix the cylinder switch at a position that provides sufficient margin for the stroke.

- There is a risk of colliding with the mechanical end, causing the motor to step out.

Since the operating position of the cylinder switch changes due to temperature, the stop position of the actuator may change slightly.

- If the amount of the change is a problem, readjust the position of the cylinder switch.
- Select a model with ample margin for the stroke range.

Slide the switch from outside the operating range and set it at the rising position of the operating range.

- The actuator detects the rising edge of the switch and decelerates to a stop. If it is set to the center of the operating range, it may stop further than the desired position and collide with the mechanical stopper, etc.

Avoid using the product in an environment where it is constantly exposed to water.

- Insulation failure may occur, resulting in malfunction.

Avoid using the product in oily or chemical environments.

- Cylinder switches may be adversely affected (poor insulation, malfunction, hardening of lead wire coating, etc.) when used in environments with various oils, coolant fluids, cleaning fluids, or chemicals, so please consult with our company.

Be careful not to deposit iron powder or come close to magnetic materials.

- The magnetic force in the actuator may be taken away and the cylinder switch may not work.

Be careful not to bring actuators close together.

The switch may malfunction due to magnetic interference on both sides.

CAUTION

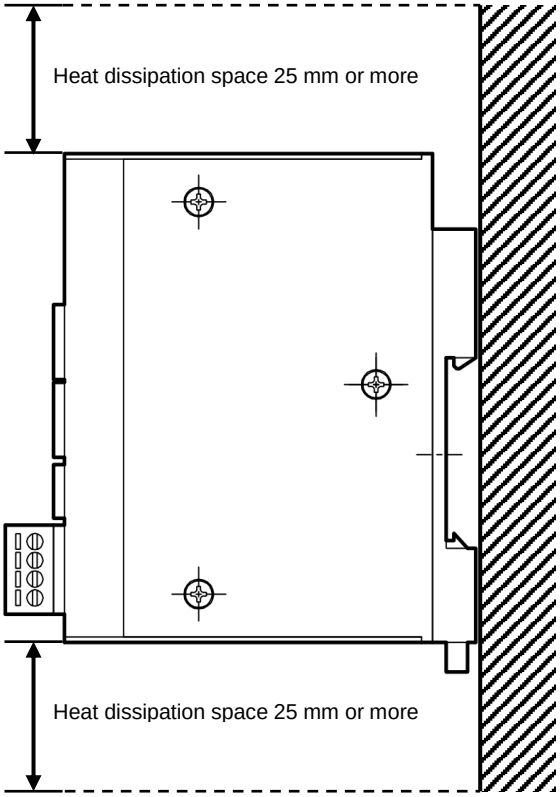
If the switch is set to the center of the operating range, gripping force may be reduced during PUSH/closing operation.

When performing electric welding to the equipment to which the product is installed, remove all the frame ground connections of the product.

If electric welding is performed with the frame ground connected, the product may be damaged due to welding current, excessive high voltage during welding, or surge voltage.

2.1. Environment

- Before storing or using the product, check the ambient temperature and atmosphere specified in the product specifications.
- Use the product at an ambient temperature between 0°C and 40°C. Ventilate if heat can become trapped.
- Use the product at an ambient humidity between 35% and 85% RH. Do not use the product in a place where condensation occurs.
- Store in a place with an ambient temperature of -10 to 50°C and an ambient humidity of 35 to 85% RH, and avoid condensation and freezing.
- Avoiding places exposed to direct sunlight or near heating elements, install in a place free from dust, corrosive gas, explosive gas, flammable gas, and flammable materials. Chemical resistance has not been considered for the product.
- Install the actuator on a smooth and flat surface.
- Installing the actuator on a smooth surface with dents may cause the actuator to malfunction or be damaged.
- Install the controller so that the exhaust port faces up and down and the power supply connector on the front panel faces down. Secure a space of 25 mm or more on both the top and bottom surfaces in consideration of natural convection as a heat dissipation space.
- Do not route cables together, and ensure sufficient distance between cables for heat dissipation and noise countermeasures.



2.2. Unpacking

CAUTION

Do not carry heavy products alone.

Do not stand on the package.

In order to prevent deforming the package, do not place heavy objects and objects of which their load concentrates.

Do not apply unnecessary force to any part of the product.

When carrying or handling the product, use extreme care not to apply impact to the product (for example, do not drop the product).

When taking the product out of the package, hold the product body.

Place the product horizontally when not in use.

Check that the model number ordered and the model number indicated on the product are the same.
Check the exterior of the product for any damage.

2.3. Wiring Method

WARNING

Do not touch the charging part with bare hands.
- Doing so may cause electric shock.

Perform the wiring with the power supply turned OFF.
- Touching the electrical wiring connections may result in electric shock.

Read and fully understand this instruction manual before performing the electrical wiring.

CAUTION

Secure a sufficient bending radius for the network cable and do not bend it forcibly.

Take countermeasures against lightning surges in the equipment side.
- The product is not resistant to lightning surges.
- Use AC voltage in installation category 2.

To prevent the wiring connection from loosening or coming off, retighten the screws of the terminal block with a specified torque, and insert the connectors correctly.
- This may cause fire, electric shock or malfunction of the equipment.

Check the working voltage and polarity before wiring.
- A wrong wiring may cause failure.

Secure distance from the communication cable to the power line and the high voltage line so that it is not affected by noise.

- The "installation category" is a concept that describes how well an electrical device can withstand the application of a transient voltage from an AC power source. The installation category 2 corresponds to "primary side circuit for equipment using a power cord connected to an outlet".

2.3.1. Wiring with the power supply

■ Power supply connector specifications

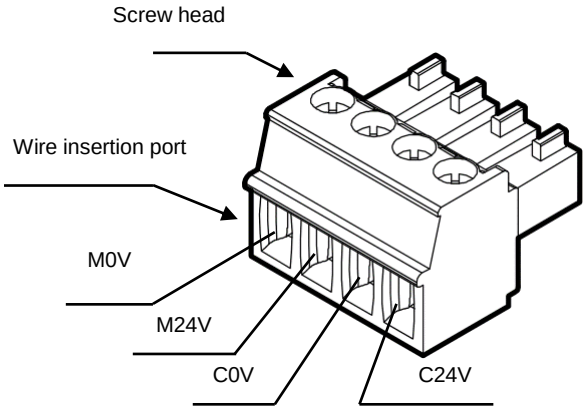
<List of power supply connector terminals (MC 1,5/4-ST-3,81 (PHOENIX CONTACT))>

Terminal name	Function name	Description of function
M0V	**Motive power supply (-)**	Applies 0 VDC of the power supply. Note 1
M24V	**Power supply (+)**	Applies 24 VDC of the power supply.
C0V	**Control power supply (-)**	Applies 0 VDC of the control power supply. Note 1
C24V	**Control power (+)**	Applies 24 VDC of the control power supply.

Note 1: The motive power supply (-) and control power supply (-) are connected internally. Connecting the (+) and (-) terminals of the motive power supply or control power supply in reverse may cause the controller to malfunction.

Power supply connector (power supply connector is an accessory)

Turn the screw head counterclockwise with a precision screwdriver or the like to open the wire insertion port and insert the wire. Turn the screw head clockwise to close the wire insertion port.



For the wires connected to the power connector, use wires that can accept a current of "Specifications of power supply circuit" according to the following specifications.

Item	Explanation
Core wire	0.14 to 1.5 mm^2 (AWG28 to 16) single wire, stranded wire, stranded wire with bar terminal without insulating sleeve
Lead wire stripping area	7 mm from the tip of the lead wire
Screw tightening torque	0.22 to 0.25 N·m

■ Specifications of power supply circuit

Item			Specifications
Motive power supply voltage			24 VDC ± 10%
Power unit consumption current	**Screw drive system**	**□35(DSSD2-20,DSTK-20, DSTG-20,DSTS-20,DSTL-20)**	3.0 A or less
		□42(DSSD2-32,DSTK-32, DSTG-32,DSTS-32,DSTL-32)	3.0 A or less
		□56(DSSD2-50,DSTK-50, DSTG-50,DSTS-50,DSTL-32)	3.0 A or less
	Spring drive system	**□20(DMSDG-08)**	0.8 A or less
		□28(DMSDG-16,DLSH-20, DCKW-20)	2.0 A or less
		□42(DLSH-32,DCKW-32)	2.0 A or less
Control power supply voltage			24 VDC ± 10%
Control unit consumption current			100 mA or less

■ Electrical circuit and basic composition of power supply

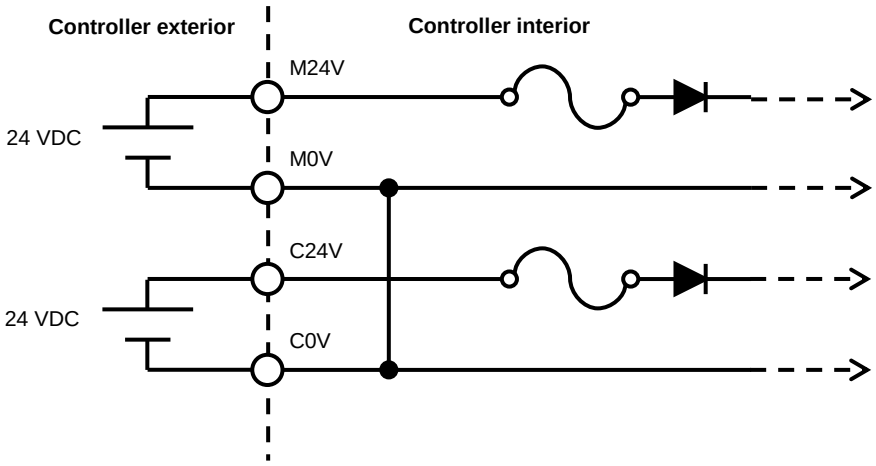
CAUTION

Reconfirm wiring prior to energizing to prevent wiring mistakes.

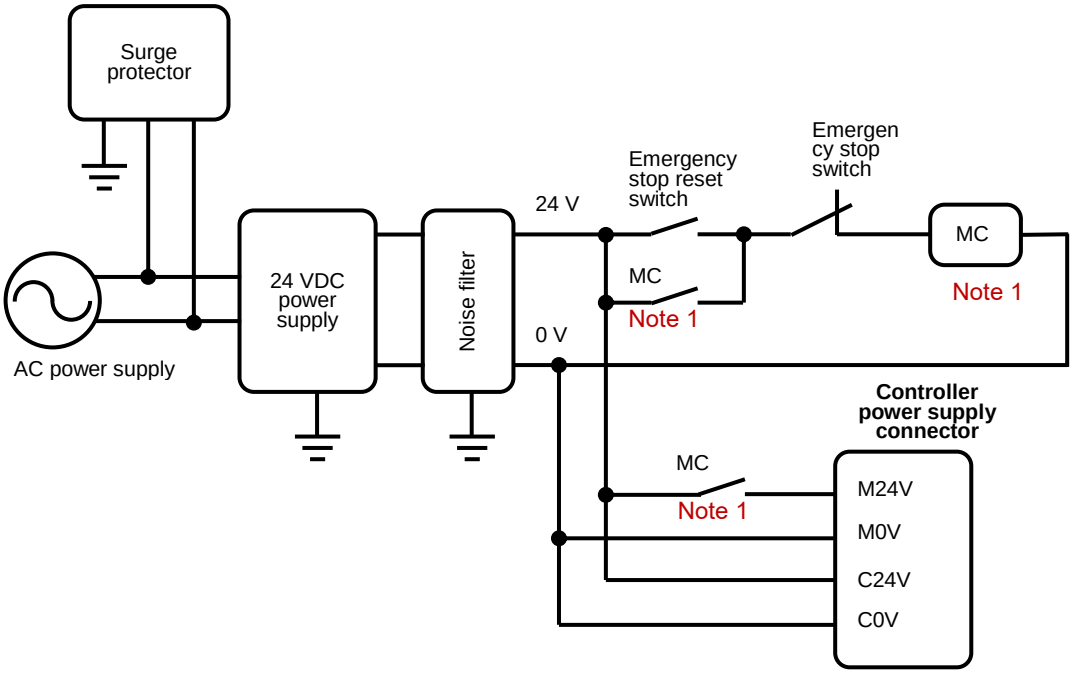
To prevent the wiring connection from loosening or coming off, retighten the screws of the terminal block with a specified torque, and insert the connectors correctly.

- This may cause fire, electric shock or malfunction of the equipment.

<Electrical schematic of power supply>



<Basic configuration of power supply>



Note 1: To externally shut off the motive power supply for supporting safety categories, connect a contact from an electromagnetic switch or other device to the M24V terminal.

2.3.2. Wiring to the Actuator

Use the dedicated relay cable to wire the controller and actuator. The combinations of controller and relay cable are as follows.

Controller	Relay cable	
ESC4 Series	Motor relay cable	ESC3-M2-R□
	Switch relay cable	ESC3-S2-R□

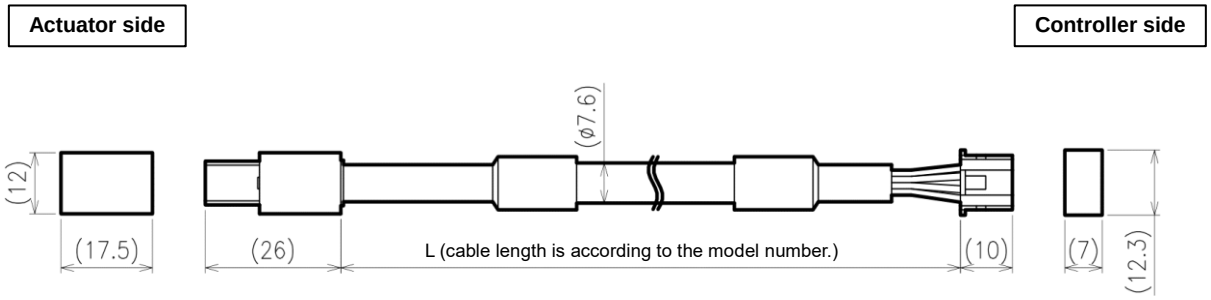
■ Motor relay cable model number system

ESC3-M2-R **1**

Cable length	
1	1 m
3	3 m
5	5 m
X	10 m

※ The cable type is movable cable.

■ Motor relay cable external dimensions



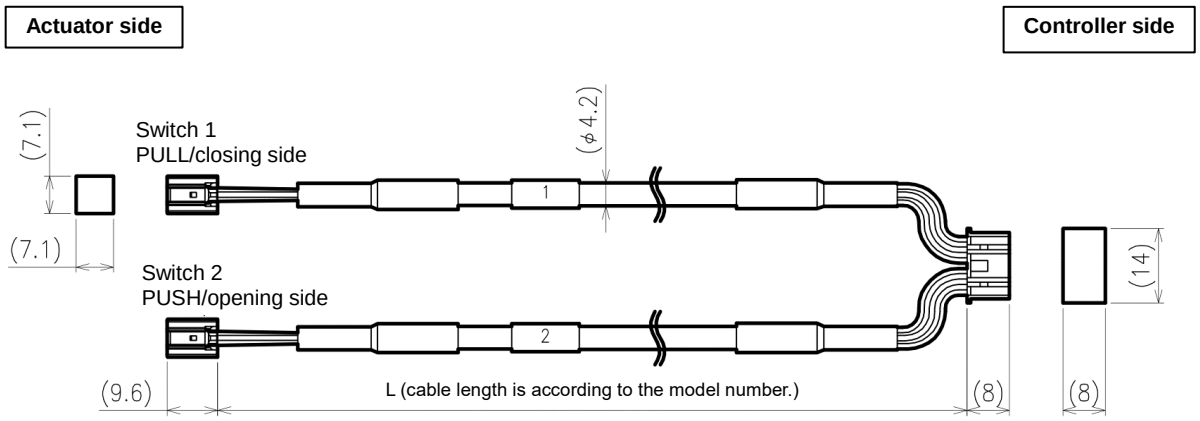
■ Switch relay cable model number system

ESC3-S2-R **1**

Cable length	
1	1 m
3	3 m
5	5 m
X	10 m

※ The cable type is movable cable.

■ Switch relay cable external dimensions



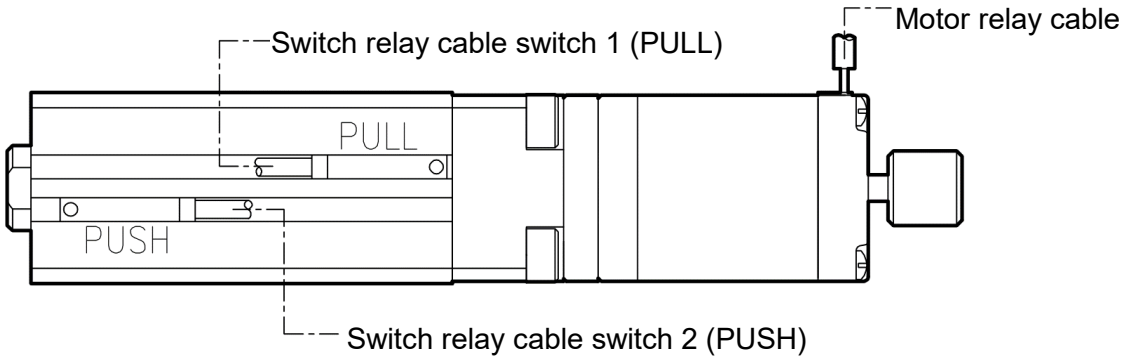
■ Wiring diagram of motor relay cable and switch relay cable

CAUTION

Reconfirm wiring prior to energizing to prevent wiring mistakes.

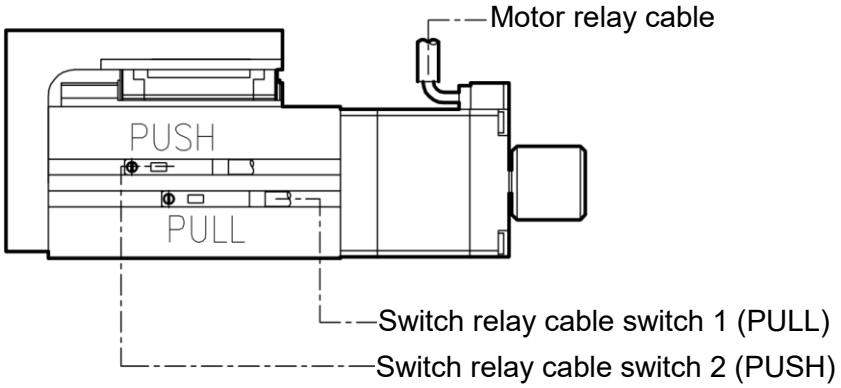
<For DSSD2, DSTK, DSTG, DSTS, and DSTL series>

Connect the lead wire of the motor to the motor relay cable.
Connect the cylinder switch on the PUSH side to switch 2 of the switch relay cable.
Connect the cylinder switch on the PULL side to switch 1 of the switch relay cable.



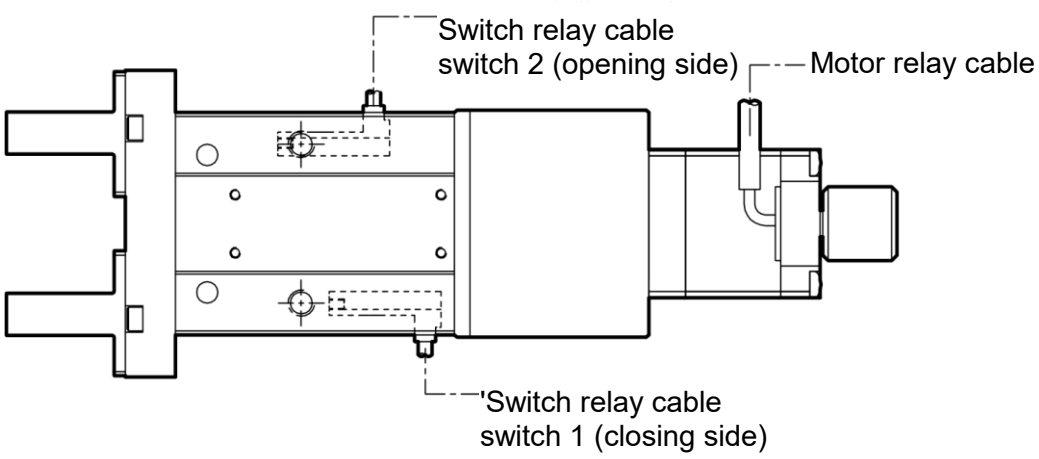
<For DMSDG series>

Connect the lead wire of the motor to the motor relay cable.
Connect the cylinder switch on the PUSH side to switch 2 of the switch relay cable.
Connect the cylinder switch on the PULL side to switch 1 of the switch relay cable.



<For DLSH and DCKW series>

Connect the lead wire of the motor to the motor relay cable.
Connect the cylinder switch on the opening side to switch 2 of the switch relay cable.
Connect the cylinder switch on the closing side to switch 1 of the switch relay cable.



2.3.3. Wiring with the I/O cable

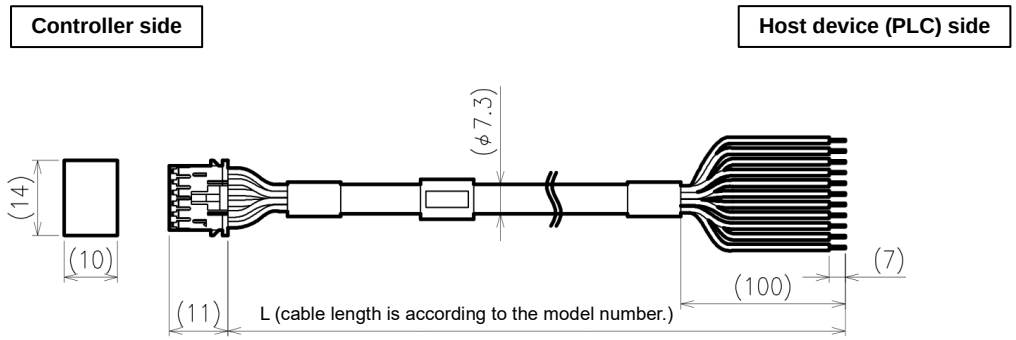
Use the dedicated I/O cable to wire the controller and the host device (PLC).

■ I/O cable model number system

ESC3-NP2- **1**

Cable length	
1	1 m
3	3 m
5	5 m
X	10 m

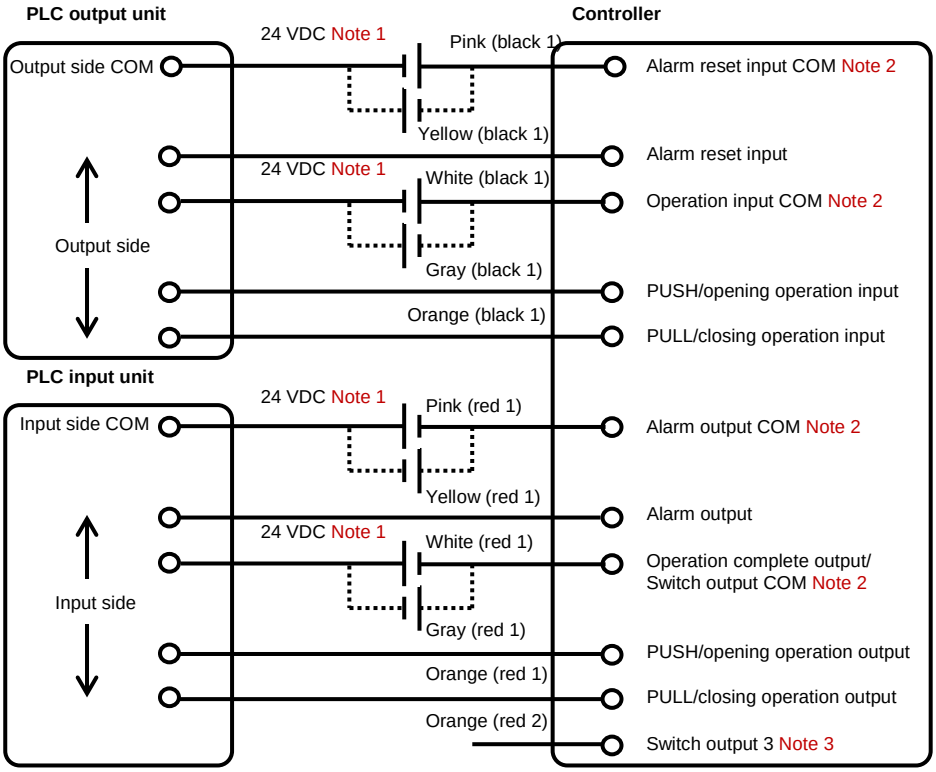
■ I/O cable dimensions



■ I/O cable wiring diagram

CAUTION

Reconfirm wiring prior to energizing to prevent wiring mistakes.



Note 1: External power supply (24 VDC) is required for both input and output. Input and output COM can be used for either + side or - side. Solid lines indicate NPN connections and dotted lines indicate PNP connections.
Note 2: Each input/output COM is not connected inside the controller.
Note 3: Switch output 3 is not used, so do not connect anything. Also, apply insulation.

※ See "Input/output signal assignment" for more information.

※ The part before the parentheses shows the color of the insulator, and the part inside the parentheses shows the color and number of dot marks.

- "NPN" indicates that NPN transistors are generally used in the output unit of a PLC in the connection of parallel I/O specification. Even if the NPN transistor is not used, if the − side of the external power supply is connected to the output COM (output common) and the + side of the external power supply is connected to the input COM (input common), the term NPN is used. Also referred to as negative common type or sink type.
- "PNP" indicates that PNP transistors are generally used in the output unit of a PLC in the connection of parallel I/O specification. Even if the PNP transistor is not used, if the + side of the external power supply is connected to the output COM (output common) and the - side of the external power supply is connected to the input COM (input common), the term PNP is used. Also referred to as positive common type or source type.

■ Input/output signal assignment

<Signal name list>

The table below lists the input and output signals.

For details on the control mode, see "3.1.2 Setting the control mode".

For details on the operation, see "3.2.1 Basic Operation".

<Input signal> (PLC -> controller)

Alarm reset input	Explanation
ON edge	Perform an alarm reset.

Control mode: Solenoid valve mode double 2-position type

PUSH/opening operation input	PULL/closing operation input	Explanation
ON edge	**OFF**	Starts moving in the PUSH/opening direction.
OFF	**ON edge**	Starts moving in the PULL/closing direction.

Control mode: Solenoid valve mode double 3-position type

PUSH/opening operation input	PULL/closing operation input	Explanation
ON	**OFF**	Starts moving in the PUSH/opening direction.
OFF	**ON**	Starts moving in the PULL/closing direction.
OFF	**OFF**	Suspends travel and stops at that point.

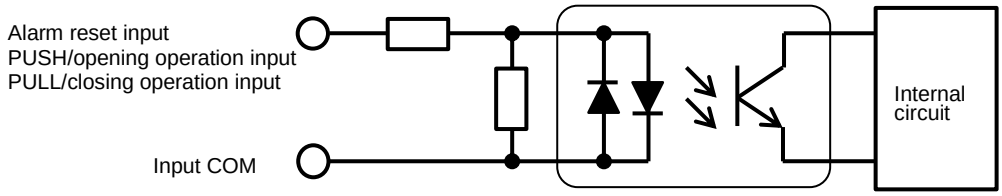
<Output signal> (Controller -> PLC)

Signal name	Explanation
Alarm output	Turns OFF when an alarm occurs, and turns ON when no alarm occurs.
PUSH/opening operation complete output	Turns ON when the operation decelerates to a stop after detection of the PUSH/opening side cylinder switch. Turns ON if it is within the detection range of the cylinder switch on the PUSH side, after a movement command input at the time of power ON or by the JOG switch until a movement command by an operation input.
PULL/closing operation complete output	Turns ON when the operation decelerates to a stop after detection of the PULL/closing side cylinder switch. Turns ON if it is within the detection range of the cylinder switch on the PULL side, after a movement command input at the time of power ON or by the JOG switch until a movement command by an operation input.
Switch output 3	Not used. Do not connect anything.

■ Input/output circuit

<Input circuit>

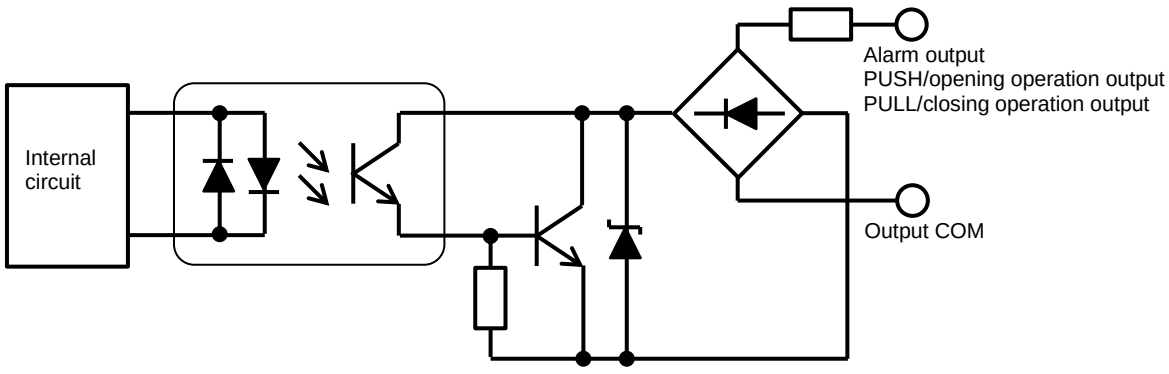
Item	Specifications
Number of inputs	3 points
Input voltage	24 VDC ± 10%
Input current	4 mA/point
Minimum input current when ON	3 mA or more
Maximum input current when OFF	0.5 mA or less



※ Input has no polarity, so input COM can be used for either + or -.
※ Each input COM is not connected inside the controller.

<Output Circuit>

Item	Specifications
Number of outputs	3 points
Load voltage	24 VDC ± 10%
Load current	9 mA/point
Internal voltage drop when ON	6 V or less
Leakage current when OFF	10 μA or less
Output short-circuit protection circuit	Yes
Connecting load	PLC



※ Output has no polarity, so output COM can be used for either + or -.
※ Each output COM is not connected inside the controller.

3. USAGE

DANGER

Do not enter the operating range while the actuator can operate.
- An injury may occur.

Do not work with wet hands.
- Doing so may cause electric shock.

WARNING

Do not climb on the product or put things on it.
- A fall accident, injury due to the product falling down or off, etc., or malfunction and runaway due to the product damage may occur.

Do not apply a load greater than the allowable value to the product.
- Details of the allowable value are provided on the model selection page of the catalog.

Do not touch the main unit with hands or body during operation or immediately after stopping.
- There is a risk of contact with hot areas and burns.

Confirm the wiring with peripheral devices and that equipment is safe to operate before supplying electricity to the product.
- If electricity is supplied inadvertently, an electric shock or injury may occur.

If the controller LED does not light or blink when the power is turned on, turn off the power immediately.

Before controlling the actuator from a position where it cannot be seen, check that it is safe for the actuator to operate.

When a power failure occurs, turn off the power to the controller.
- The product can suddenly start moving when the power is restored and it can lead to an accident.

Before moving the moving part of the actuator manually, perform after confirming the servo OFF.
- When setting the servo OFF, operate with sufficient safety so that there is no danger of the moving part falling.

Take measures to prevent damage to the human body and the device in case of power failures.
- An unexpected accident may occur.

CAUTION

When the controller and actuator are connected with a cable, do not move the actuator moving part by external force except for manual operation.

- A malfunction or damage may occur due to regenerative currents.

Do not dent or scratch the moving part of the actuator.

- An operation fault may occur.

Do not set the servo OFF while gravity or force of inertia is applied.

- The moving part may continue to move or fall off if the servo OFF is set. For safety reasons, perform the servo OFF operation in a balanced state, or be careful not to drop the workpiece by its own weight in the case of vertical installation.

Do not issue the stop command during acceleration or deceleration.

- There is a risk of danger due to speed change.

Do not turn the power on and off frequently.

- Elements in the controller may become damaged.

Do not hit the table or finger against the mechanical stopper, etc., except when used as clamping.

- The feed screw may become damaged due to impacts and failure may occur.

Do not insert fingers or objects into the opening of the product.

- An injury or product damage may occur.

If it operates with vibration, adjust the speed or mounted load to prevent vibration.

- Depending on the conditions of use, it may operate with vibration even within the operation speed range.

CAUTION

When changing the combination of the actuator and controller, be sure to check the model numbers and settings before operating them.
- An accident may occur.

Use the actuator so that no impact is applied to the moving part.

Since the product life varies depending on the transfer load, etc., set it with sufficient margin.
- The gripping force and the operating current consumption values described in the catalog and the instruction manual of each actuator are guidelines. Variation in the motor torque may cause errors even when the setting values are the same.

Do not use a load that does not fall within the specified range.
- If the specified range is exceeded, the unbalanced load applied to the guide section becomes excessive. This may cause play in the guide section, make the accuracy worse, and adversely affect the service life.

When operating the product without power supplied, use the manual operation shaft.

The small guide type DMSDG is not suitable for positioning operation.
- Use it by pressing it against the external stopper at the stop position.

When gripping with a pressing operation, make sure that the cylinder switch detects (lit) before the gripping or contacting position of the workpiece.

If the cylinder switch does not detect (lit) even when the workpiece is gripped or contacted, the motor will not stop and an error will occur.
- For more information, see Section 5. Troubleshooting.

Grip the workpiece with PUSH/closing operation.

Do not allow to hit the fingers or attachments against the work. An operation fault may occur.
- If force of inertia is applied due to movement or rotation, the steel ball becomes offset, increasing sliding resistance and reducing accuracy. In this case, perform full stroke operation by operating the manual operation shaft or opening/closing the attachment by hand.

Do not apply excessive torque to the manual operation shaft.
- It may cause damage or malfunction.

- "Regenerative current" is the current that is generated by the motor operating like a generator when the moving part of the actuator is moved by an external force. Reverse current flows from the motor to the controller, causing malfunction or damage.

3.1. Setting

3.1.1. Setting the operation mode

The operation mode can be set to MANU or PIO by the operation mode selector switch on the front of the controller.

Code	Operation mode	Explanation
MANU	**Manual**	This mode operates the actuator using the JOG(+) and JOG(-) switches on the front of the controller. It is used for maintenance, position adjustment of cylinder switch, etc. In this operation mode, input signals from the PLC are not accepted. When an alarm occurs, the JOG(+) switch can be used as an alarm reset switch.
PIO	**PIO**	This mode operates the actuator using input signals from the PLC. In this operation mode, JOG operation or alarm reset by the switch on the front of the controller is not accepted.

3.1.2. Setting the control mode

The control mode can be set to the solenoid valve mode double 2-position type or solenoid valve mode double 3-position type by the control mode selector switch on the top of the controller. For details on each control mode, see "3.2.1 Basic Operation". The factory default setting is "V2 (solenoid valve mode double 2-position type)".

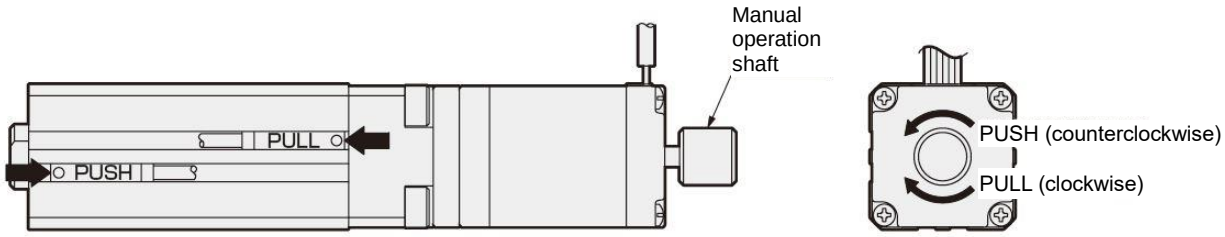
Code	Control mode
V2	Solenoid valve mode, double 2-position type
V3	Solenoid valve mode, double 3-position type

3.1.3. Setting the stop position

The stop position of the actuator can be set by adjusting the position of the cylinder switch.

■ DSSD2, DSTK, DSTG, DSTS, DSTL series

Rotate the manual operation shaft to move the moving part of the actuator to the desired position. Slide the cylinder switch from outside the operating range and fix it in the position where the LED is lit. Perform it for PUSH and PULL respectively.



※ The actuator detects the rising edge of the cylinder switch and decelerates to a stop. Set the position of the cylinder switch in consideration of the deceleration stop distance.

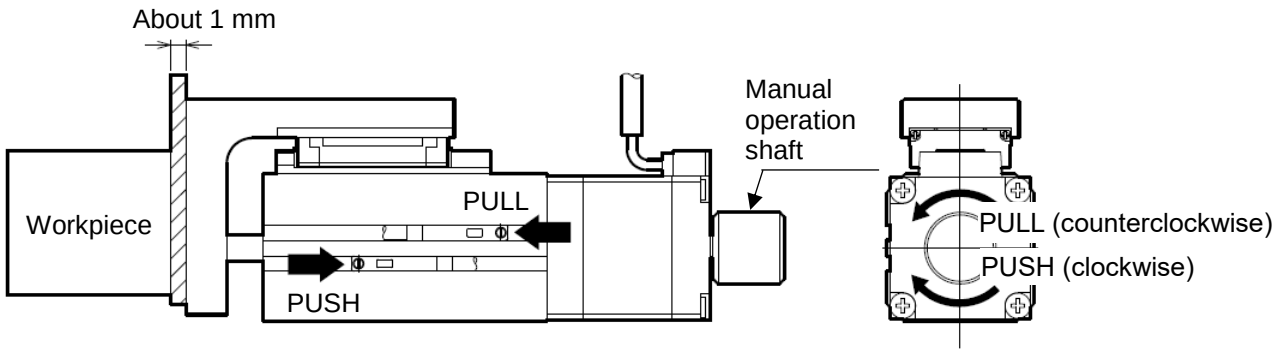
※ Set the PUSH and PULL positions of the cylinder switch correctly. If the mounting position is reversed, it may cause malfunction.

※ Make sure that both cylinder switches are lit. Operation without the light on may cause malfunction.

※ The lighting range of the cylinder switch slightly changes due to the influence of temperature. Fix the cylinder switch at a position that provides enough margin for the stroke.

■ DMSDG series

Install the actuator so that it presses the workpiece within the effective pressing range. Insert a spacer of about 1 mm between the table and the workpiece. Rotate the manual operation shaft and gently press the table against the workpiece and spacer. Slide the cylinder switch of the PUSH side from outside the operating range and fix it in the position where the LED is lit. Rotate the manual operation shaft to move it to any position on the PULL side. Slide the cylinder switch of the PULL side from outside the operating range and fix it in the position where the LED is lit.



※ The actuator detects the rising edge of the cylinder switch and decelerates to a stop. Set the position of the cylinder switch in consideration of the deceleration stop distance.

※ Set the PUSH and PULL positions of the cylinder switch correctly. If the mounting position is reversed, it may cause malfunction.

※ Do not rotate the manual rotation shaft with excessive force after pressing the workpiece. It may cause malfunction.

※ Make sure that both cylinder switches are lit. Operation without the light on may cause malfunction.

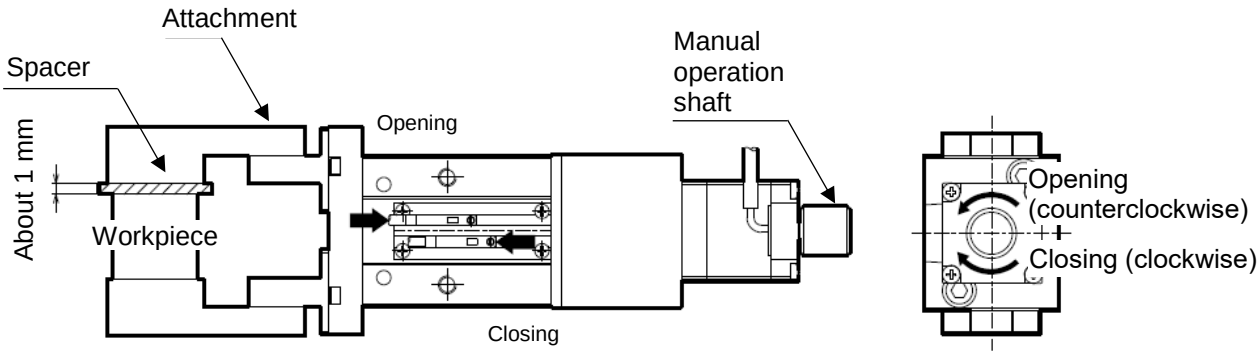
※ The lighting range of the cylinder switch slightly changes due to the influence of temperature. Fix the cylinder switch at a position that provides enough margin for the stroke.

※ When adjusting the position of the cylinder switch, pay attention to the sliding direction. If the cylinder switch is adjusted from the oposite sliding direction, a mulfunction may occur.

※ For the effective pressing range, see the instruction manual of electric actuators in “1.2. Instruction Manuals Related to This Product“.

■ DLSH series

Fabricate and install an attachment so that the position to grip the workpiece is within the effective pressing range. Insert a spacer of about 1 mm between the finger and the workpiece. Rotate the manual operation shaft and gently grip the workpiece and spacer. Slide the cylinder switch of the closing side from outside the operating range and fix it in the position where the LED is lit. Rotate the manual operation shaft to move it to any position on the opening side. Slide the cylinder switch of the opening side from outside the operating range and fix it in the position where the LED is lit.



※ The actuator detects the rising edge of the cylinder switch and decelerates to a stop. Set the position of the cylinder switch in consideration of the deceleration stop distance.

※ Set the opening side and closing side positions of the cylinder switch correctly. If the mounting position is reversed, it may cause malfunction.

※ Do not rotate the manual rotation shaft with excessive force after gripping the workpiece. It may cause malfunction.

※ Make sure that both cylinder switches are lit. Operation without the light on may cause malfunction.

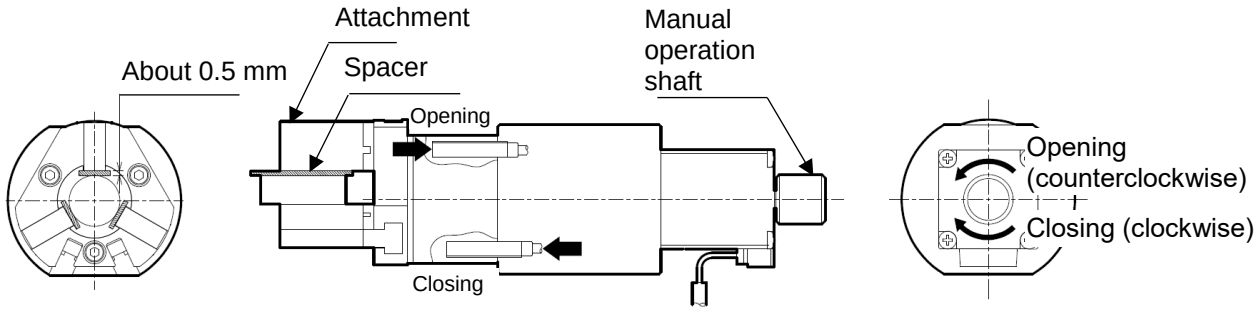
※ The lighting range of the cylinder switch slightly changes due to the influence of temperature. Fix the cylinder switch at a position that provides enough margin for the stroke.

※ When adjusting the position of the cylinder switch, pay attention to the sliding direction. If the cylinder switch is adjusted from the oposite sliding direction, a mulfunction may occur.

※ For the effective pressing range, see the instruction manual of electric actuators in “1.2. Instruction Manuals Related to This Product“.

■ DCKW series

Fabricate and install an attachment so that the position to grip the workpiece is within the effective pressing range. Insert a spacer of about 0.5 mm between the finger and the workpiece. Rotate the manual operation shaft and gently grip the workpiece and spacer. Slide the cylinder switch of the closing side from outside the operating range and fix it in the position where the LED is lit. Rotate the manual operation shaft to move it to any position on the opening side. Slide the cylinder switch of the opening side from outside the operating range and fix it in the position where the LED is lit.



※ The actuator detects the rising edge of the cylinder switch and decelerates to a stop. Set the position of the cylinder switch in consideration of the deceleration stop distance.

※ Set the opening side and closing side positions of the cylinder switch correctly. If the mounting position is reversed, it may cause malfunction.

※ Do not rotate the manual rotation shaft with excessive force after gripping the workpiece. It may cause malfunction.

※ Make sure that both cylinder switches are lit. Operation without the light on may cause malfunction.

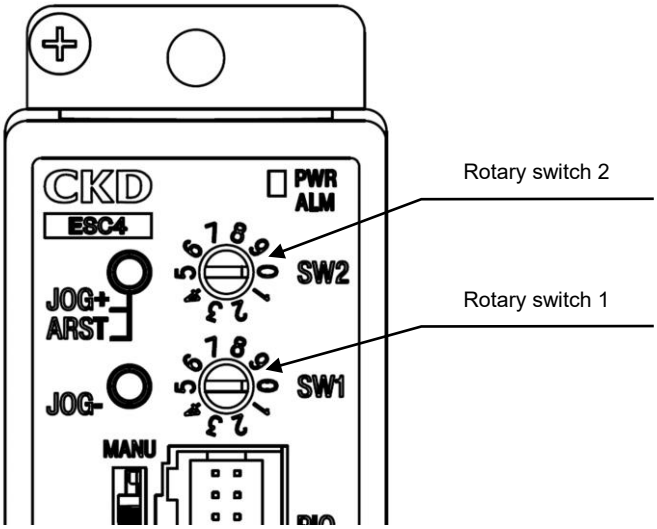
※ The lighting range of the cylinder switch slightly changes due to the influence of temperature. Fix the cylinder switch at a position that provides enough margin for the stroke.

※ When adjusting the position of the cylinder switch, pay attention to the sliding direction. If the cylinder switch is adjusted from the oposite sliding direction, a mulfunction may occur.

※ For the effective pressing range, see the instruction manual of electric actuators in “1.2. Instruction Manuals Related to This Product“.

3.1.4. Setting the speed

The actuator speed can be set by the rotary switch on the front of the controller.



■ DSSD2, DSTK, DSTG, DSTS, DSTL series

Rotary switch 2: Sets the PUSH speed.
Rotary switch 1: Sets the PULL speed.

Units: mm/s

Actuator model number				Rotary switch settings									
Series	Size	Screw lead	Direction	0	1	2	3	4	5	6	7	8	9
DSSD2 DSTK DSTG DSTS DSTL	20	6	PUSH	15	23	32	40	48	57	65	73	82	90
			PULL										
		9	PUSH	23	35	47	60	72	85	97	110	122	135
			PULL										
	32	6	PUSH	15	23	32	40	48	57	65	73	82	90
			PULL										
		12	PUSH	30	47	63	80	97	113	130	146	163	180
			PULL										
	50	6	PUSH	15	21	28	34	40	47	53	59	66	72
			PULL										
		12	PUSH	30	43	55	68	81	93	106	119	131	144
			PULL										

※ The speed setting is a guideline. Even if the settings are the same, there will be an error from the actual values due to switch adjustment, power supply voltage, individual difference in motor, variation in mechanical efficiency, and temperature.

■ DMSDG, DLSH, DCKW series

Rotary Switch 1: Sets both PUSH/opening speed and PULL/closing speed. Units: mm/s

Actuator model number				Rotary switch settings									
Series	Size	Spring lead	Direction	0	1	2	3	4	5	6	7	8	9
DMSDG	8	3.3	PUSH	8	13	17	22	27	31	36	40	45	50
			PULL										
	16	5.1	PUSH	13	14	16	17	18	20	21	23	24	26
			PULL	13	20	27	34	41	48	55	62	69	77
DLSH	20	4.2	Opening	11	16	22	28	34	40	45	51	57	63
			Closing										
	32	6	Opening	15	20	25	30	35	40	45	50	55	60
			Closing										
DCKW	20	4.2	Opening	11	21	32	42	53	63	74	84	95	105
			Closing										
	32	6	Opening	15	30	45	60	75	90	105	120	135	150
			Closing										

※ The speed setting is a guideline. Even if the settings are the same, there will be an error from the actual values due to switch adjustment, power supply voltage, individual difference in motor, variation in mechanical efficiency, and temperature.

- "Screw lead" and "spring lead" refer to the distance that a workpiece can be moved by one rotation of the motor in an electric actuator.

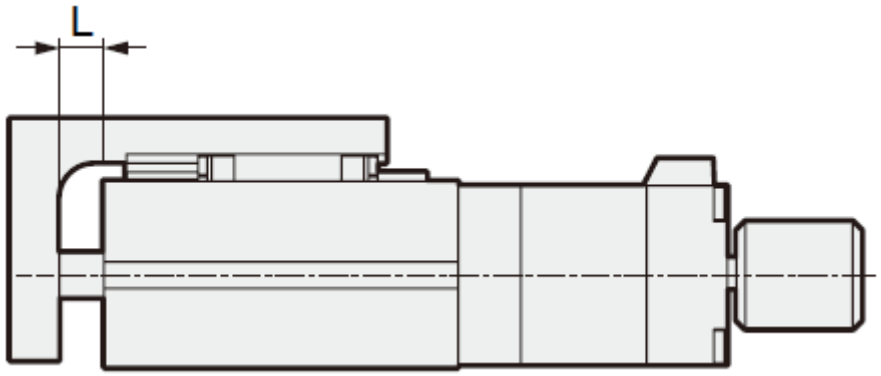
3.1.5. Setting the pressing and gripping forces

On the DMSDG, DLSH and DCKW series, the pressing and gripping forces can be set by rotary switch 2 on the front of the controller.

CAUTION

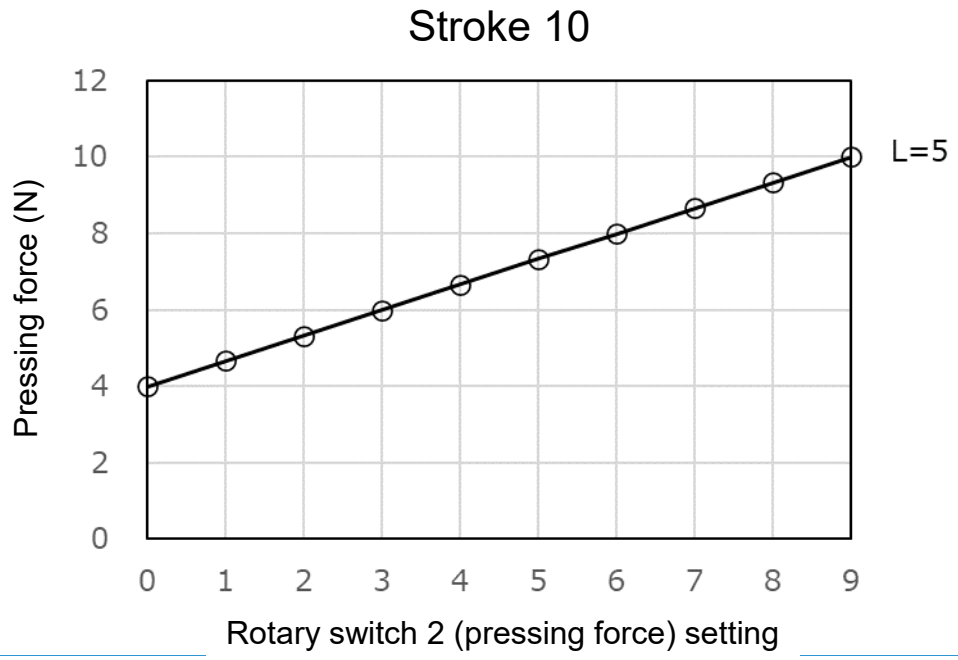
DSSD2, DSTK, DSTG, DSTS and DSTL series do not support pressing operation.
Only DMSDG, DLSH and DCKW series support pressing operation.
- DMSDG supports pressing operation when PUSH, and DLSH and DCKW support pressing operation only when closing.

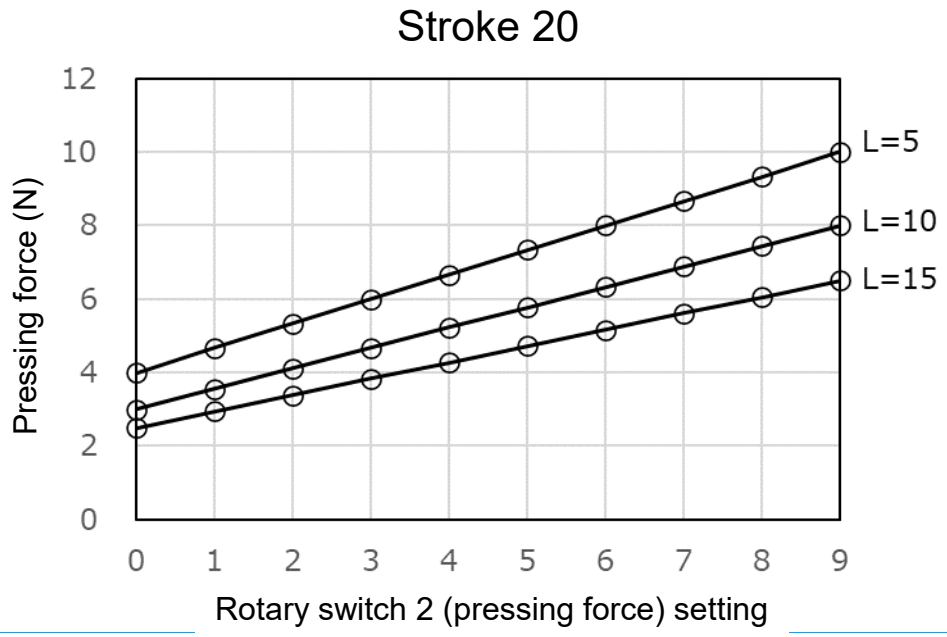
- The following figure shows the pressing position L for pressing/gripping.

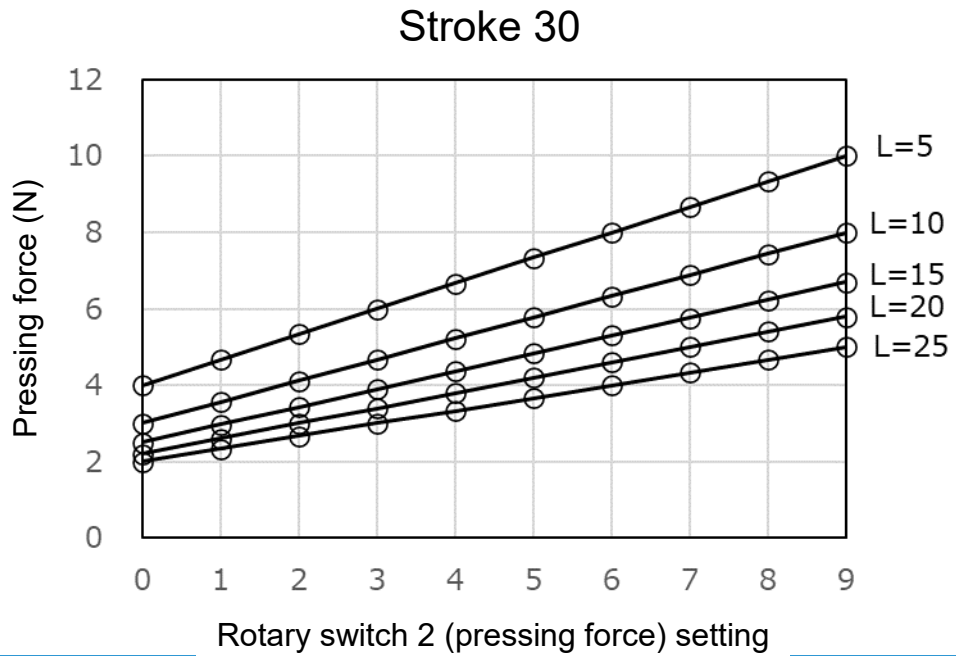


■ DMSDG series

DMSDG-08

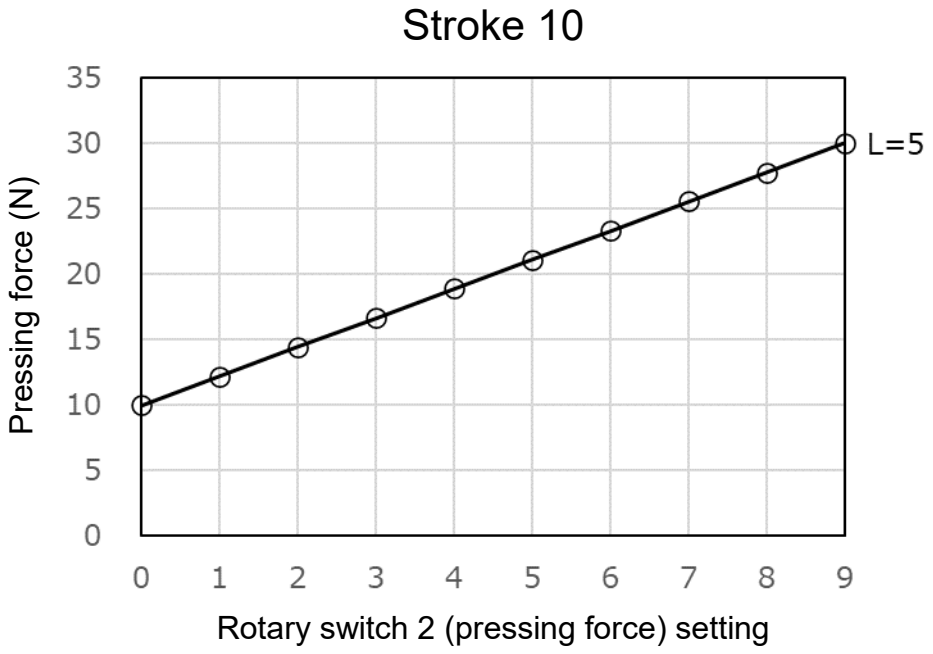




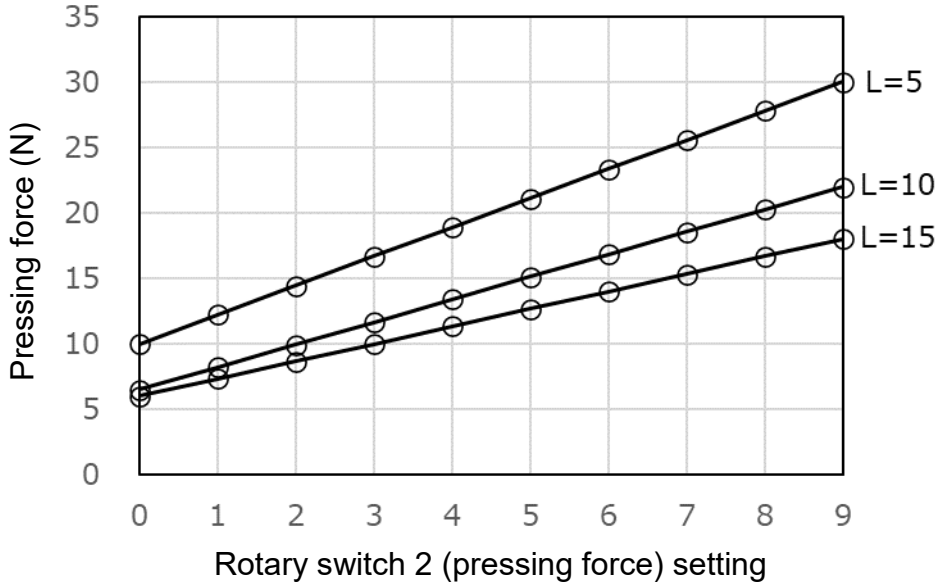


※ The pressing force are approximate. There will be an error due to pressing position and cylinder switch adjustment.
※ Pressing operation is possible only when PUSH. Pressing is not supported when PULL.
※ In the case that the setting of rotary switch 1 (speed) is 9.
※ When motor is out of step at the time of pressing, turn down the settings of rotary switches 1 and 2.

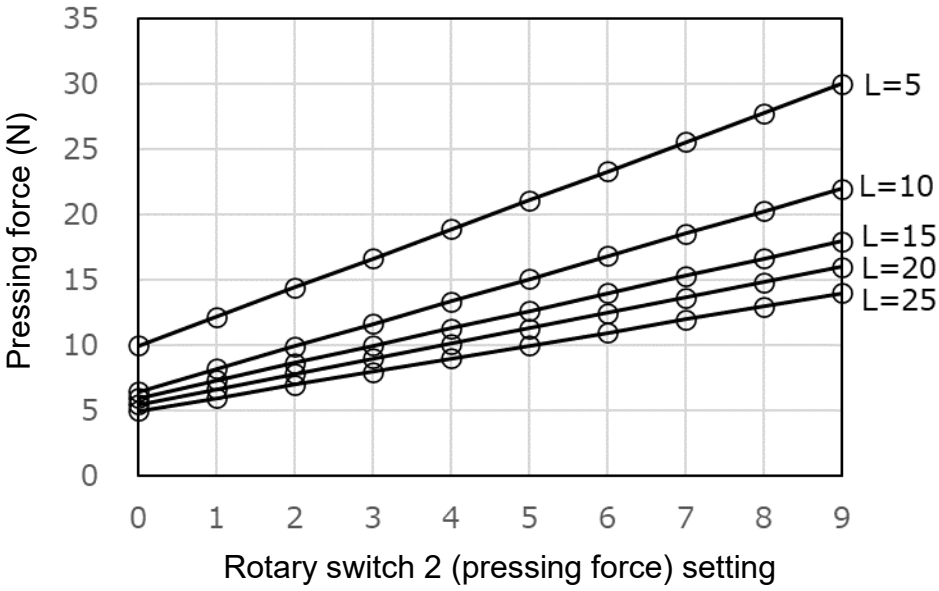
DMSDG-16



Stroke 20

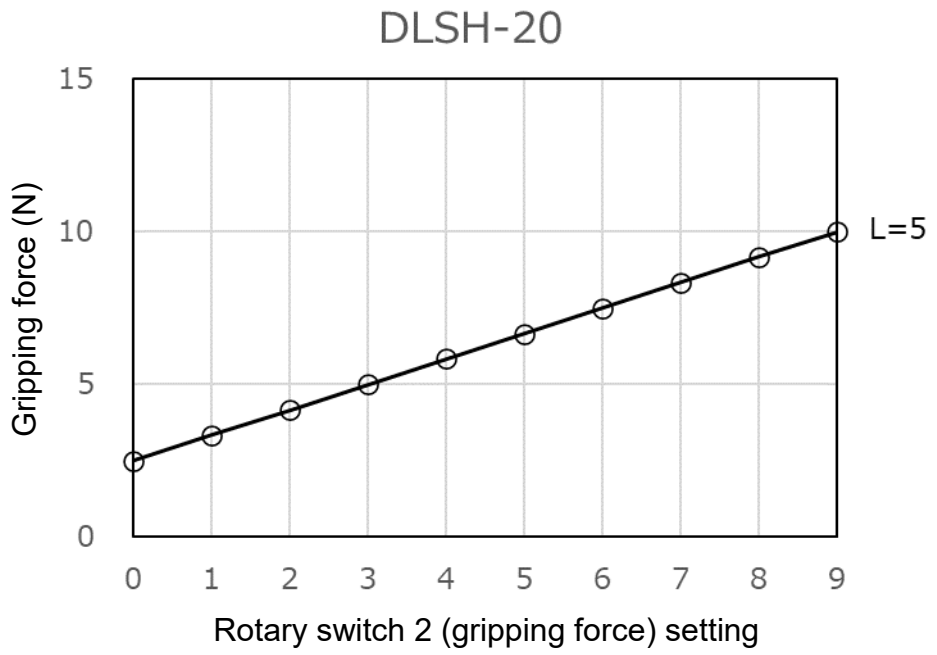


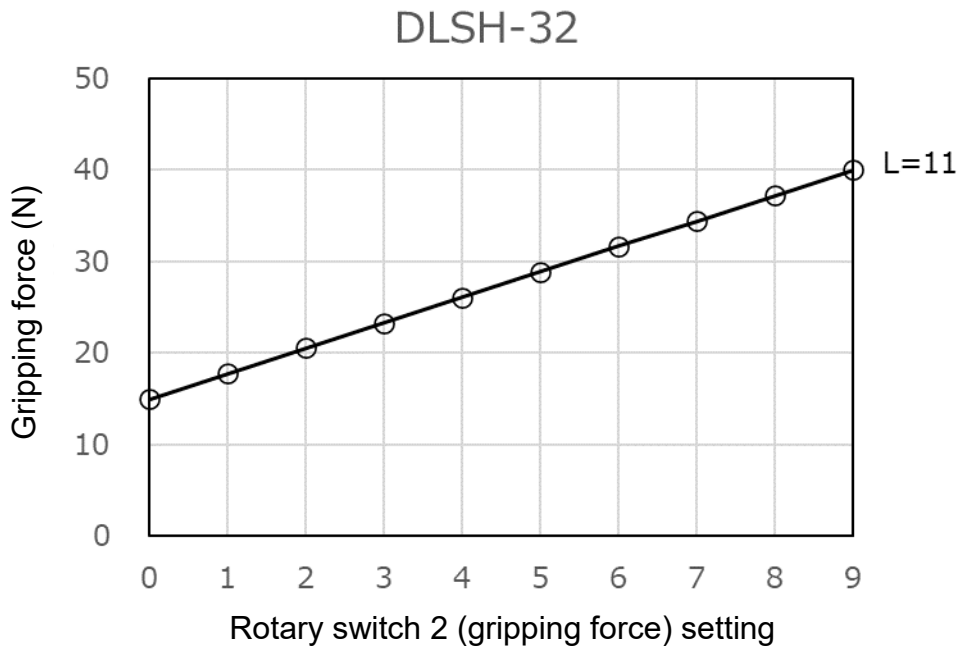
Stroke 30



※ The pressing force are approximate. There will be an error due to pressing position and cylinder switch adjustment.
※ Pressing operation is possible only when PUSH. Pressing is not supported when PULL.
※ In the case that the setting of rotary switch 1 (speed) is 9.
※ When motor is out of step at the time of pressing, turn down the settings of rotary switches 1 and 2.

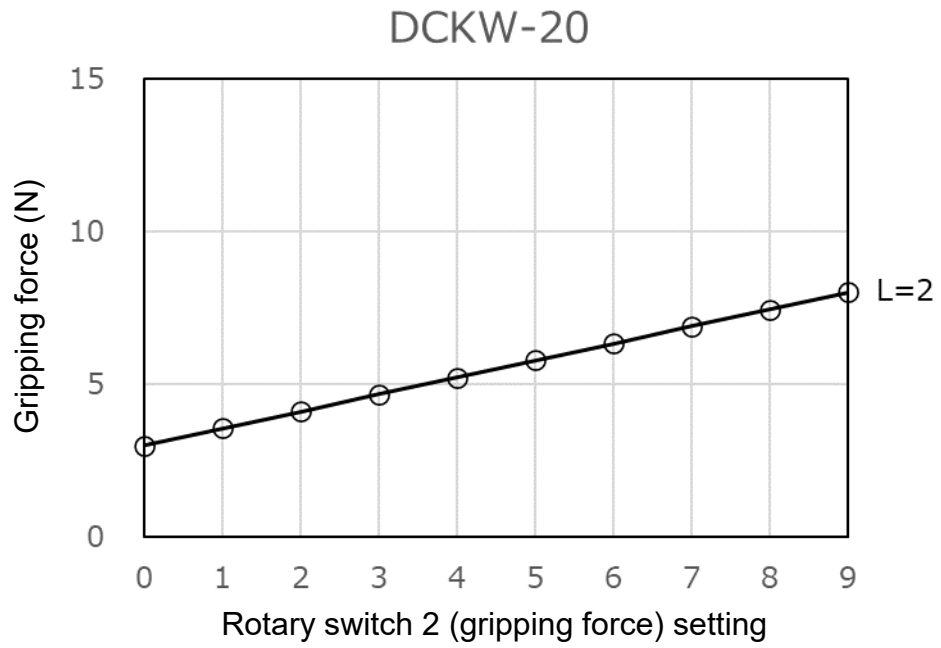
■ DLSH series

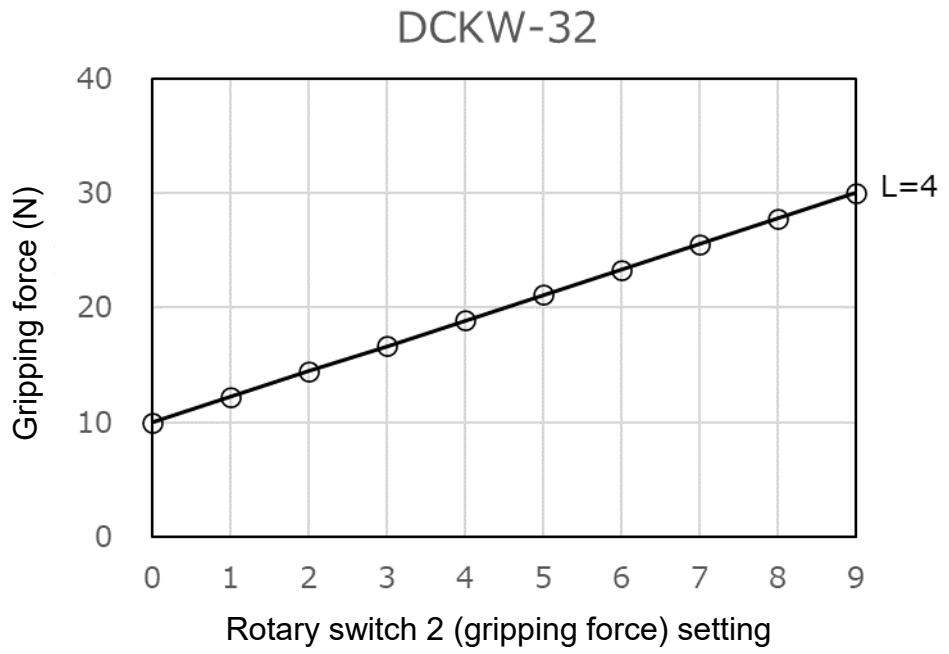




※ The gripping force are approximate. There will be an error due to gripping position and cylinder switch adjustment.
※ This product is for gripping outside diameter. It does not support for gripping inner diameter.
※ In the case that the setting of rotary switch 1 (speed) is 9.
※ When motor is out of step at the time of pressing, turn down the settings of rotary switches 1 and 2.
※ For the self-lock, see the instruction manual “SM-A69064-A” of electric actuators.

■ DCKW series





※ The gripping force are approximate. There will be an error due to gripping position and cylinder switch adjustment.
※ This product is for gripping outside diameter. It does not support for gripping inner diameter.
※ In the case that the setting of rotary switch 1 (speed) is 9.
※ When motor is out of step at the time of pressing, turn down the settings of rotary switches 1 and 2.
※ For the self-lock, see the instruction manual “SM-A69064-A” of electric actuators.

3.2. Operation and Time Chart

3.2.1. Basic Operation

WARNING

When turning the servo OFF, check that it is safe even if the actuator stops.
- If the servo is turned OFF during operation, the moving part may fall, causing injury or damage to the workpiece.

CAUTION

Do not change the power supply voltage after turning on the power.
- The actuator may not operate normally when executing the travel.

When turning the power on again, confirm that it is safe for the actuator to operate.
- The actuator may start moving depending on the input state of the host device (PLC, etc.).

When turning the servo ON, check that the actuator operates safely.
- In the solenoid valve mode double 3-position type, the operation input signal is level input , so it may operate simultaneously with servo ON. This may cause injury or damage to the work piece.

Be careful of the operation signal input timing.
- Depending on settings such as position, speed, etc., it may not operate as settings.

Operation starts with the PUSH/opening operation input, and decelerate to a stop when the PUSH/opening side cylinder switch detects. Similarly, operation starts with the PULL/closing operation input, and decelerate to a stop when the PULL/closing side cylinder switch detects.

■ Control mode: Solenoid valve mode double 2-position type

<Input signal>

PUSH/opening operation input	PULL/closing operation input	Description
1 ↑	0	Starts PUSH/opening operation.
0	1 ↑	Starts PULL/closing operation
×	×	Retains the previous operation.

0: OFF (level input), 1 ↑: ON (edge input), x: Not specified (regardless of ON/OFF state)

※ Secure the state of each input signal at least 20 msec.

<Output signal>

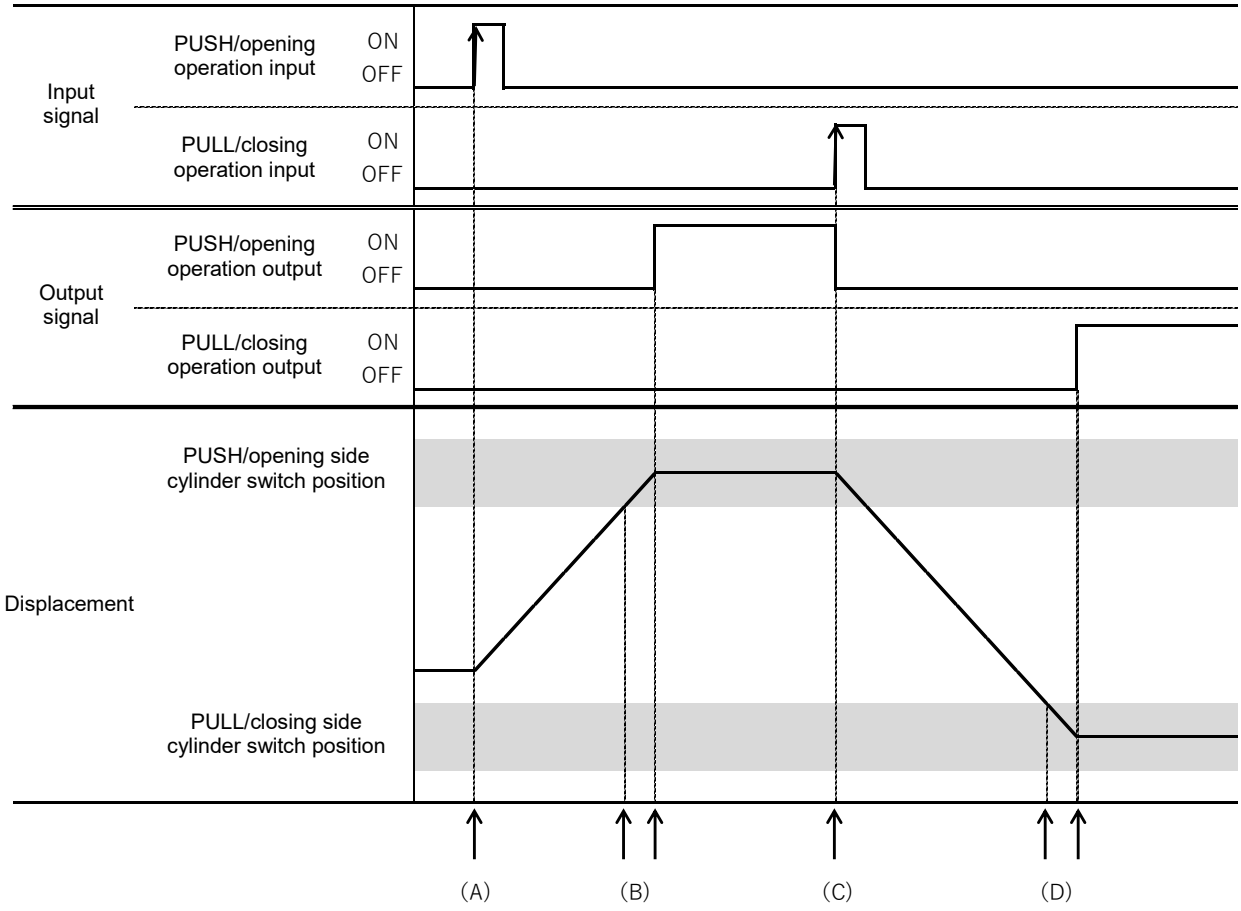
PUSH/opening operation complete output	PULL/closing operation complete output	Description
1	0	Turns ON when the PUSH/opening side cylinder switch detects and it decelerates to a stop.
0	1	Turns ON when the PULL/closing side cylinder switch detects and it decelerates to a stop.

0: OFF, 1: ON

- When the operation mode switch is set to "MANU", the controller does not accept signals from the PLC. Use with the operation mode selector switch set to "PIO".

<Time-chart>

Horizontal axis: Time



(A) When the PUSH/opening operation input is turned ON, the PUSH/opening operation starts.

(B) When the PUSH/opening side cylinder switch detects and it decelerates to a stop, the PUSH/opening operation completion output turns ON.

(C) When the PULL/closing operation input is turned ON, the PULL/closing operation starts. The PUSH/opening operation complete output turns OFF.

(D) When the PULL/closing side cylinder switch detects and it decelerates to a stop, the PULL/closing operation completion output turns ON.

■ Control mode: Solenoid valve mode double 3-position type

<Input signal>

PUSH/opening operation input	PULL/closing operation input	Description
1	0	PUSH/opening operation
0	1	PULL/closing operation
0	0	Stop on the spot.
1	1	Retains the previous operation.

0: OFF, 1: ON

※ Secure the state of each input signal at least 20 msec.

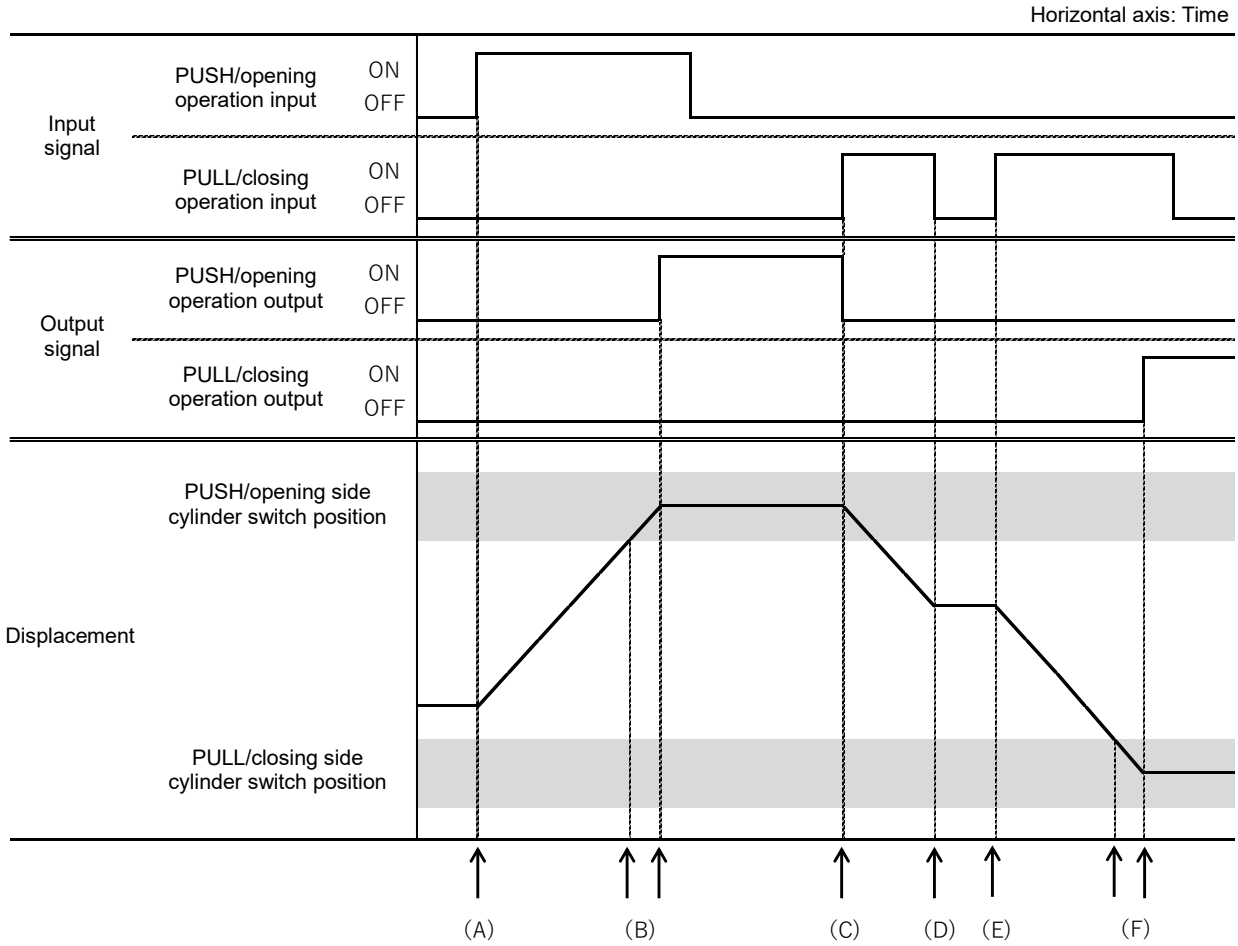
<Output signal>

PUSH/opening operation complete output	PULL/closing operation complete output	Description
1	0	Turns ON when the PUSH/opening side cylinder switch detects and it decelerates to a stop.
0	1	Turns ON when the PULL/closing side cylinder switch detects and it decelerates to a stop.

0: OFF, 1: ON

- When the operation mode switch is set to "MANU", the controller does not accept signals from the PLC. Use with the operation mode selector switch set to "PIO".

<Time chart>



(A) When the PUSH/opening operation input is turned ON, the PUSH/opening operation starts.

(B) When the PUSH/opening side cylinder switch detects and it decelerates to a stop, the PUSH/opening operation completion output turns ON.

(C) When the PULL/closing operation input is turned ON, the PULL/closing operation starts. The PUSH/opening operation complete output turns OFF.

(D) Since both the PUSH/opening operation input and the PULL/closing operation input are OFF, it stops on the spot.

(E) When the PULL/closing operation input is turned ON, the PULL/closing operation starts again.

(F) When the PULL/closing side cylinder switch detects and it decelerates to a stop, the PULL/closing operation completion output turns ON.

■ JOG operation

Use the following input and output signals for operation.

Front panel switch		Description
JOG(-)	JOG(+)	
0	1 ↑	Starts JOG movement in the PUSH/opening direction.
X	0	Stops JOG movement in the PUSH/opening direction.
1 ↑	0	Starts JOG movement in the PULL/closing direction.
0	X	Stops JOG movement in the PULL/closing direction.

0: OFF (level input), 1↑: ON (edge input), x: Not specified (regardless of ON/OFF state)

- When the operation mode selector switch is set to "PIO", JOG operation cannot be performed with the switch on the front of the controller. Use with the operation mode selector switch set to "MANU".

<Operation method>

1. Set the JOG speed

Set as desired with the rotary switch.

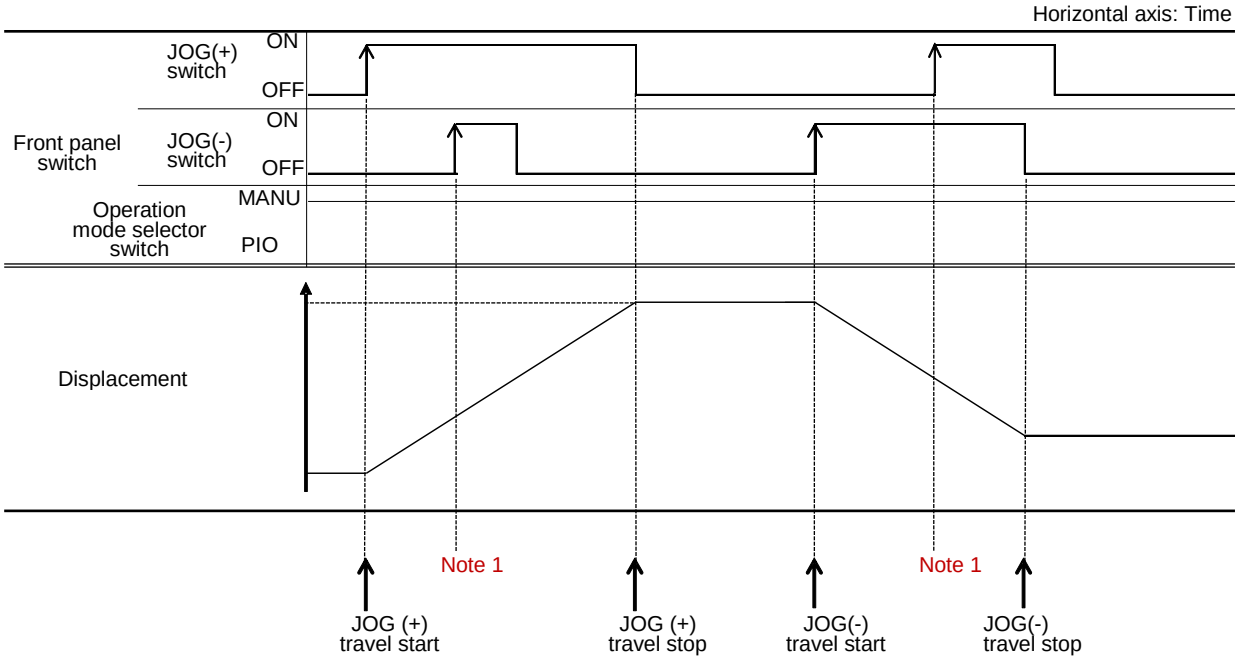
2. Turn ON JOG travel start.

To operate in the PUSH/opening direction, turn on the JOG(+) switch.
To operate in the PULL/closing direction, turn on the JOG(-) switch.

3. Turn OFF the JOG travel start.

When the actuator travels to the target position, turn OFF the JOG(+) switch or the JOG(-) switch that was ON.

<Time-chart>



Note 1: The jog travel start command that is continuously turned on takes precedence, and unless it is turned off once, the jog travel start command in the opposite direction is not accepted.

※ it is necessary to set the operation mode selector switch to "MANU".

3.2.2. Emergency stop and cancellation

WARNING

When turning on the motive power supply, confirm that it is safe for the actuator to operate.

- The operation input signal is level input for the solenoid valve mode double 3-position type, so it may operate simultaneously with motive power supply ON. This may cause injury or damage to the work piece.

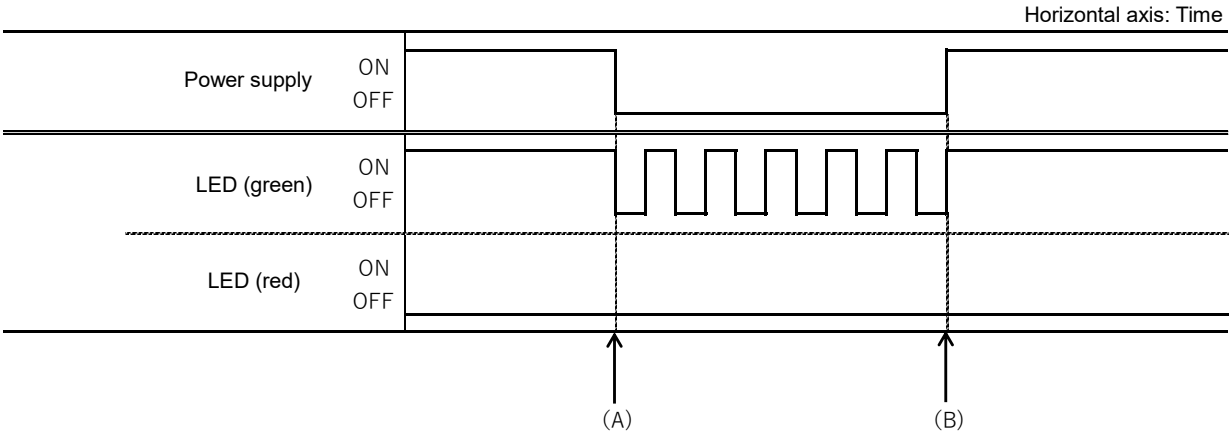
CAUTION

Be careful of emergency stop wiring disconnection.

- Power OFF state is not output as an alarm.

To make an emergency stop, turn off the motive power supply. Input signals are not accepted when the motive power supply is OFF. After the motive power supply is turned ON, a waiting time of about 1 second is required to stabilize the excitation to the motor. It becomes operational after this time has elapsed. However, input signals are accepted during the waiting time.

<Time-chart>



※ The above figure shows a time chart when the operation mode selector switch is switched to "PIO". When the operation mode selector switch is set to "MANU", the LED (green) blinks even when the motive power supply is ON.

(A) When the motive power supply is OFF, the LED (green) blinks.

(B) When the motive power supply is ON, the LED (green) lights up.

- When the motive power supply is turned off during operation, operation may become unstable depending on operating conditions.

3.2.3. Operation alarm

If the cylinder switch cannot recognize both ends of the actuator for any reason, an operation alarm (cancelable alarm) is generated. The operation alarm is canceled by the alarm reset input (ON edge) or by the motive power supply OFF.

<Input signal>

Alarm reset input	Description
1 ↑	Cancels the operation alarm.
×	Disabled

1 ↑: ON (edge input), x: Not specified (regardless of ON/OFF state)

※ Secure the state of each input signal at least 20 msec.

※ When the operation mode is manual, it is possible to cancel the alarm by turning on (pressing) the alarm reset switch.

<Output signal>

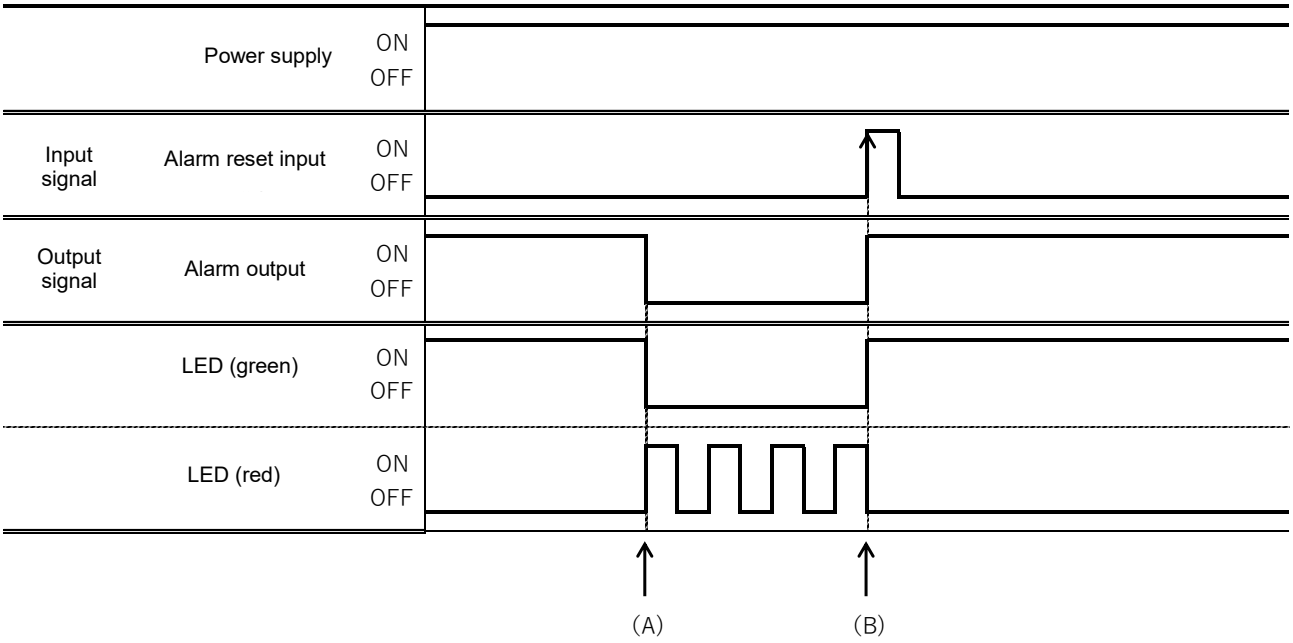
Alarm output	Description
1	Normal status (no alarm).
0	Alarm has been issued.

0: OFF, 1: ON

■ Cancelation by alarm reset input

<Time-chart>

Horizontal axis: Time



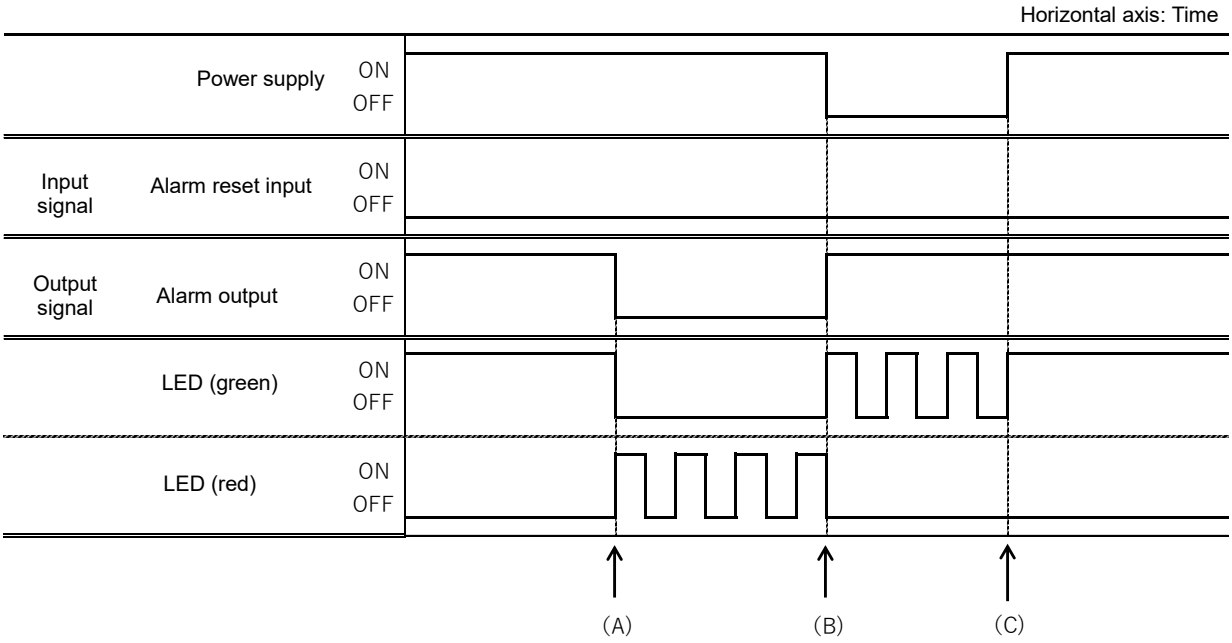
※ The above figure shows a time chart when the operation mode selector switch is switched to "PIO". When the operation mode selector switch is set to "MANU", the LED (green) blinks even when the motive power supply is ON.

(A) When an operation alarm occurs, the alarm output turns OFF. The LED (green) turns off. The LED (red) blinks.

(B) When the alarm reset input is turned ON, the operation alarm is canceled and the alarm output is turned ON. The LED (green) lights up. The LED (red) turns off.

■ Cancellation by turning off the motive power supply

<Time-chart>



※ The above figure shows a time chart when the operation mode selector switch is switched to "PIO". When the operation mode selector switch is set to "MANU", the LED (green) blinks even when the motive power supply is ON.

(A) When an operation alarm occurs, the alarm output turns OFF. The LED (green) turns off. The LED (red) blinks.

(B) When the motive power supply is turned OFF, the operation alarm is canceled and the alarm output is turned ON. The LED (green) blinks. The LED (red) turns off.

(C) When the motive power supply is ON, the LED (green) lights up.

4. MAINTENANCE AND INSPECTION

WARNING

Do not perform disassembly or modification of products that are not specified in this manual.
- An injury, accident, malfunction, or failure may occur; in addition, the specifications described in this manual may not be satisfied.

Do not attach or remove wires and connectors with the power turned on.
- A malfunction, failure, or electric shock may occur.

Do not work with wet hands.
- Doing so may cause electric shock.

Do not touch the inside of the controller or the actuator motor.
- Electric shock or burns may result.

Install the product before wiring.
- An electric shock may occur.

Before performing inspection, wait five minutes or longer after turning off the power and check the voltage with a tester.
- An electric shock may occur.

CAUTION

Take measures to prevent a third person from turning on the power unexpectedly when performing maintenance, inspection, or repair.

Wiring and inspections must be performed by specialists.

Use a power cable with a sufficient capacity that allows the maximum instantaneous current.
- A heat generation or damage may occur during operation.

Perform periodic inspections (two to three times a year) to confirm that the product operates properly.

Turn off the power immediately if abnormal heat, smoke, odor, sound, or vibration occurs in the product.
- Damage to the product or fire may occur.

4.1. Precautions on Product Disposal

CAUTION

When disposing of the product, comply with “Waste Management and Public Cleansing Act” and have an industrial waste disposal company dispose of the product.

5. TROUBLESHOOTING

5.1. Cause of Trouble and Treatment Method

If the product does not operate as intended, confirm the table below for a possible solution.

Problem	Cause	Solution	References
The LED does not light up or blink even when the power supply is turned ON.	Wiring is not correct.	Check the wiring.	"2.3.1 Wiring with the power supply"
	The cable is broken.	Check for cable sheath damage, disconnection, connectors and terminals.	"2.3.1 Wiring with the power supply"
	Product is malfunctioning or is damaged.	It will need to be repaired.	"5.1.1 Items to check when a problem occurs"
	The power supply is malfunctioning.	Repair or replace the power supply.	-
	Power capacity is insufficient.	Use a power supply with a larger capacity.	"2.3.1 Wiring with the power supply"
The LED remains blinking green.	24 VDC is not applied to M24V.	Apply 24 VDC to M24V.	"3.2.2 Emergency stop and cancellation"
	Wiring is not correct.	Check the wiring.	"2.3.1 Wiring with the power supply"
	The cable is broken.	Check for cable sheath damage, disconnection, connectors and terminals.	"2.3.1 Wiring with the power supply"
	The power supply is malfunctioning.	Repair or replace the power supply.	-
The LED remains blinking red.	Operation alarm has been issued.	Review the mounting condition of the cylinder switch. Check that there is no damage to the cylinder switch, switch relay cable, or motor relay cable.	"2.3.2 Wiring to the Actuator" "3.1.3 Setting the stop position"
The LED remains lit red.	System alarm has been issued.	It will need to be repaired.	"5.1.1 Items to check when a problem occurs"

Problem	Cause	Solution	References
Product does not operate as intended with PLC signal. **Or, product cannot be operated with PLC.**	Input signal is unstable.	The input signal from the host equipment may be chattering. Ensure the input signal is at least 20 msec.	"3.2.1 Basic Operation"
	Wiring is not correct.	Check the wiring.	"2.3.3 Wiring with the I/O cable"
	The cable is broken.	Check for cable sheath damage, disconnection, connectors and terminals.	"2.3.3 Wiring with the I/O cable"
	The position setting is incorrect.	Check the mounting position of the cylinder switches.	"3.1.3 Setting the stop position"
	The speed setting is incorrect.	Check the settings of rotary switches 1 and 2.	"3.1.4 Setting the speed"
	The setting of pressing force or gripping force is incorrect.	Check the settings of rotary switches 1 and 2.	"3.1.5 Setting the pressing and gripping forces"
	Setting of control mode is incorrect.	Check the setting of control mode selector switch.	"3.1.2 Setting the control mode"
	Product is malfunctioning or is damaged.	It will need to be repaired.	"5.1.1 Items to check when a problem occurs"
	Power capacity is insufficient.	Confirm that the power capacity satisfies the required voltage and current.	"2.3.1 Wiring with the power supply"
	It stops during operation.	The transport load may be too large. Recheck the specifications.	Catalogs and instruction manuals for each actuator
	Friction load is too large.	Check the friction load during transport. Confirm that it is not seizing with the workpiece.	-
	It is colliding with the workpiece.	Check the assembly and setting status.	-
	Internal resistance of product has increased.	Check the environment conditions and the conditions of use. Check the usage period (operating distance).	-
	Actuator body is damaged.	It will need to be repaired.	"5.1.1Items to check when a problem occurs"
	The operation mode is manual.	Switch to the PIO mode with the operation mode selector switch.	"3.1.1Setting the operation mode"

Problem	Cause	Solution	References
The operation completion output does not turn on.	The mounting positions of the cylinder switches on both sides are too far apart for the moving distance.	Check the mounting position of the cylinder switches.	"3.1.3 Setting the stop position"
	The mounting positions of the cylinder switches on both sides are reversed.	Check the mounting position of the cylinder switches.	"3.1.3 Setting the stop position"
Product cannot reach target takt time.	The speed setting is incorrect.	Check the settings of rotary switches 1 and 2.	"3.1.4 Setting the speed"
Pressing operation cannot be performed.	Pressing operation is not supported.	Models other than the DMSDG, DLSH, and DCKW series do not support pressing operation. Use the DMSDG, DLSH or DCKW series.	Catalogs and instruction manuals for each actuator
It moves due to the workpiece weight during the motive power supply OFF.	When the motive power supply is OFF, the servo is turned off.	Use an external stopper or holding mechanism (such as a brake).	Catalogs and instruction manuals for each actuator
Product itself vibrates.	Connection to actuator is loose.	Tighten the bolts, etc. again.	Catalogs and instruction manuals for each actuator
The actuator is making abnormal sound.	Resonation occurs.	Review the speed setting.	Catalogs and instruction manuals for each actuator
		Review the carrying load.	Catalogs and instruction manuals for each actuator
	Actuator body is damaged.	It will need to be repaired.	"5.1.1Items to check when a problem occurs"

Problem	Cause	Solution	References
The actuator does not work.	The motive power supply is OFF.	Turn on the motive power supply.	"3.2.2 Emergency stop and cancellation"
	Power capacity is insufficient.	Confirm that the power capacity satisfies the required voltage and current.	"2.3.1 Wiring with the power supply"
	The load is large.	The transport load may be too large. Recheck the specifications.	Catalogs and instruction manuals for each actuator
	It is colliding with the workpiece.	Check the assembly and setting status.	-
	Actuator body is damaged.	It will need to be repaired.	"5.1.1Items to check when a problem occurs"

If you have any other questions or concerns, contact your nearest CKD sales office or distributor.

5.1.1. Items to check when a problem occurs

<table>
<tr><th>Item</th><th>What to check</th></tr>
<tr><td>Controller</td><td>Check the controller LED display.
<table>
<tr><th colspan="3">Controller status</th><th>Servo lamp (green)</th><th>Alarm lamp (red)</th></tr>
<tr><td colspan="3">Control power OFF</td><td>Off</td><td rowspan="3">Off</td></tr>
<tr><td rowspan="3">Normal</td><td rowspan="2">When PIO operation mode is selected</td><td>Motor energized state</td><td>ON</td></tr>
<tr><td>Motor de-energized state</td><td>Blinking
(Lit once per second)</td></tr>
<tr><td colspan="2">When the manual operation mode is selected</td><td>Blinking
(Lit once every 0.5 seconds)</td></tr>
<tr><td rowspan="2">At alarm occurrence</td><td colspan="2">When an operation alarm occurs</td><td rowspan="2">Off</td><td>Blinking
(Lit once per second)</td></tr>
<tr><td colspan="2">When a system alarm occurs</td><td>ON</td></tr>
<tr><td rowspan="3">At the time of the occurrence of warning</td><td rowspan="2">When PIO operation mode is selected</td><td>Motor energized state</td><td>ON</td><td rowspan="3">Blinking
(lit once per 2 seconds)</td></tr>
<tr><td>Motor de-energized state</td><td>Blinking
(Lit once per second)</td></tr>
<tr><td colspan="2">When the manual operation mode is selected</td><td>Blinking
(Lit once every 0.5 seconds)</td></tr>
</table></td></tr>
<tr><td>Alarm</td><td>Check the controller LED display.</td></tr>
<tr><td>PLC</td><td>Check whether there is an error on the PLC.</td></tr>
<tr><td>PLC communication</td><td>Check the I/O status using the monitoring function of the PLC side.</td></tr>
<tr><td>Actuator connection check</td><td>Check whether the controller model number supports the connected actuator.</td></tr>
<tr><td>Cable connection check</td><td>Make sure that the cables are connected properly without "disconnection" or "damaged sheath".
Before checking the continuity, be sure to turn off the power and remove the cables to prevent an electric shock.</td></tr>
<tr><td>Control power</td><td>Check the voltage of the control power supply (24 VDC).</td></tr>
<tr><td>Power supply</td><td>Check the voltage of the motive power supply (24 VDC).</td></tr>
</table>

Item	What to check
Anti-noise measure	Check that measures (such as connecting ground wire and attaching a surge protector) have been taken against noise.
Situation check	Check the history leading up to the trouble occurring and the operation condition when the trouble occurred.
Serial number	Check the product's serial No. It may be requested for confirmation when you make an inquiry.

※ Examine the cause of the trouble on the basis of the above items. Also, refer to “5.1 Cause of Trouble and Treatment Method”or “5.2 Alarm Indications and Countermeasures” as a solution.

5.2. Alarm Indications and Countermeasures

5.2.1. Alarm

An alarm is output from the controller when an abnormality affecting the actuator operation is detected.
Check the alarm items, contents, causes/countermeasures. As a tip for countermeasures, the reference is described.
After taking corrective action, confirm that there is no problem before canceling the alarm.

- There are two alarm cancellation methods depending on the degree of abnormality.
  Cancelable alarm: The alarm can be canceled by resetting the alarm from the host device (PLC, etc.) or by emergency stop (turning off the motive power supply).
  Non-cancelable alarm: The alarm can be canceled by turning on the power again.

Alarm Item	Phenomenon	Cause/Solution	References	Cancellation methods
Operation alarm (Cancelable alarm)	When operated in the PUSH/opening direction, the cylinder switch on the PUSH/opening side cannot be detected.	Review the mounting condition of the cylinder switch. Check that there is no damage to the cylinder switch, switch relay cable, or motor relay cable.	"3.1.3 Setting the stop position"	Alarm reset
	When operated in the PULL/closing direction, the cylinder switch on the PULL/closing side cannot be detected.	Review the mounting condition of the cylinder switch. Check that there is no damage to the cylinder switch, switch relay cable, or motor relay cable.	"3.1.3 Setting the stop position"	Alarm reset
System alarm (Non-cancelable alarm)	The controller malfunctioned due to internal failure or noise.	Make sure there are no noise sources nearby.	-	Power cycle
	The temperature in the controller is high.	Turn off the power and eliminate the cause of high temperature rise.	-	Power cycle
	An overcurrent has flown into the motor.	-	-	Power cycle

※ If the error reoccurs even after power cycling, contact your nearest CKD sales office or distributor.

Alarm Item	Phenomenon	Cause/Solution	References	Cancellation methods
Warning	The motive power supply voltage has dropped below a certain value.	The motive power supply voltage detected by the controller is less than 21.6 V while the motive power supply is ON. Adjust the motive power supply voltage. The warning is canceled when the motive power supply voltage detected by the controller is 21.6 V or more.	"2.3.1 Wiring with the power supply"	Eliminating the cause of occurrence

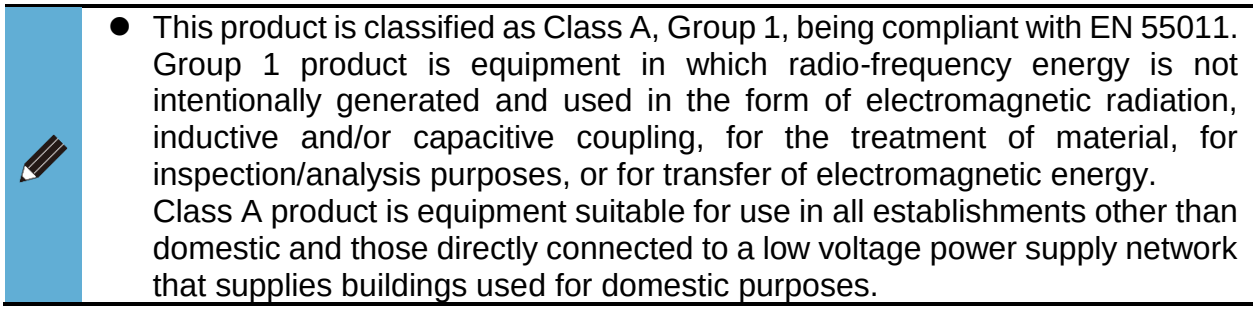
※ If the error reoccurs even after power cycling, contact your nearest CKD sales office or distributor.

6. STANDARD COMPLIANCE

Products with the CE marking conform to European standards.
This product is intended to be incorporated into the customer equipment and use as a part of equipment. The CE marking affixed to the product itself indicates that CKD has declared conformity to the EMC Directive under our limited conditions. If the customer equipment incorporating this product is to be shipped to or used in the European Economic Area as a final product, it is the responsibility of the customer to confirm compliance with the EU Directives.

6.1. EU Directives/European Standards

- EMC Directive: 2014/30/EU
  EN 61000-6-2:2005
  EN 55011:2016 +A1:2017 +A11:2020
  EN 55011:2016 +A2:2021
  (Group1 Class A)
- RoHS Directive: 2011/65/EU and (EU)2015/863
  EN 50581:2012



- This product is classified as Class A, Group 1, being compliant with EN 55011. Group 1 product is equipment in which radio-frequency energy is not intentionally generated and used in the form of electromagnetic radiation, inductive and/or capacitive coupling, for the treatment of material, for inspection/analysis purposes, or for transfer of electromagnetic energy.
  Class A product is equipment suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network that supplies buildings used for domestic purposes.

6.2. Precautions for Use in Europe (EU Member States)

6.2.1. Suitable actuator

Combinations of controller model numbers and suitable actuators are listed below.

Controller model number	Suitable actuator
ESC4 Series	DSSD2 series DSTK series DSTG series DSTS series DSTL series DMSDG series DLSH series DCKW series

6.2.2. Working environment

When using, storing or transporting the product, check the following environmental temperature and atmosphere.

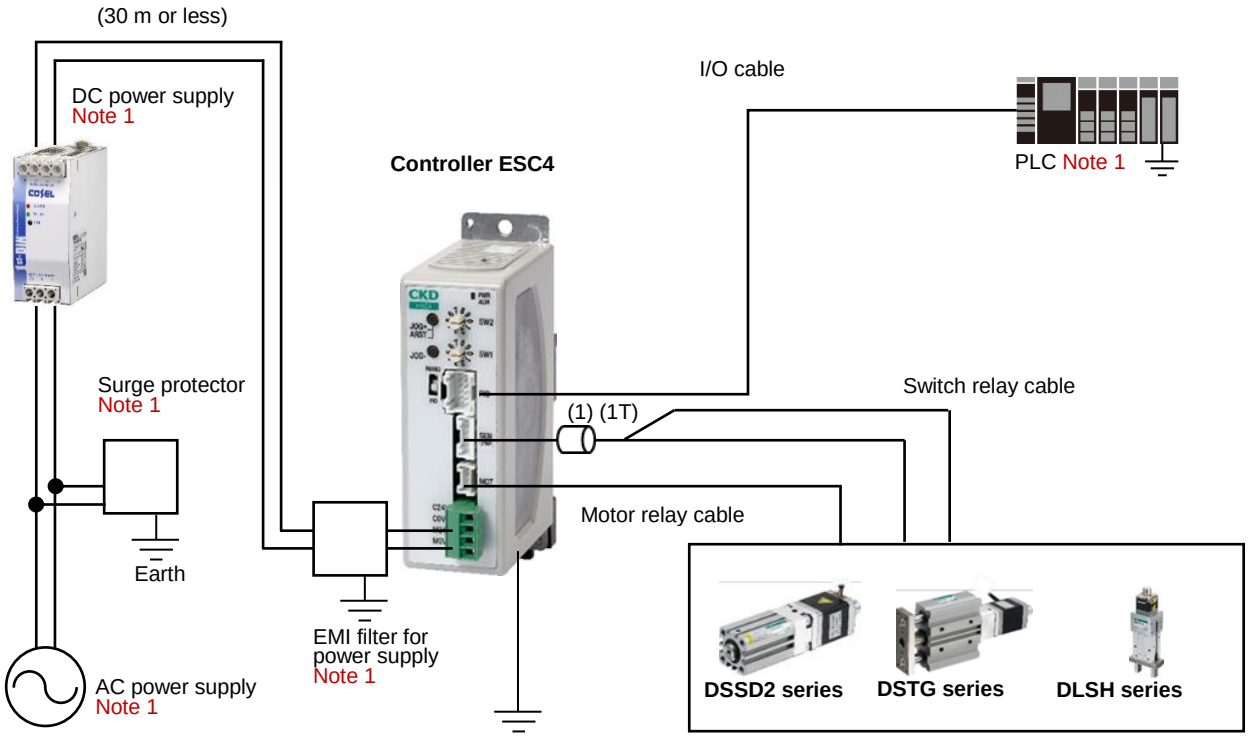
Condition	Temperature	Humidity
During use	0 to 40°C (no freezing)	35 to 80% RH (no condensation)
During storage	-10 to 50°C (no freezing)	35 to 80% RH (no condensation)
During transport	-10 to 50°C (no freezing)	35 to 80% RH (no condensation)

6.2.3. System structure

- This product is not intended for use in residential areas. It may also not be able to provide sufficient protection for wireless receivers in the same environment.
- If this product is used in a residential environment, it may interfere with other equipment.
- Do not use this product in a residential environment unless you take measures to reduce electromagnetic interference so as not to interfere with radio and television reception status.
- Surge protector and noise filters should be installed near the input device and wired at the shortest possible distance.
- The ferrite core must be installed close to the equipment or ground point.

■ EMC measures Implementation example

The following figure shows how to install this product when it complies with European standards. A surge protector, EMI filter for power supply, and ferrite cores are required to comply with European standards.

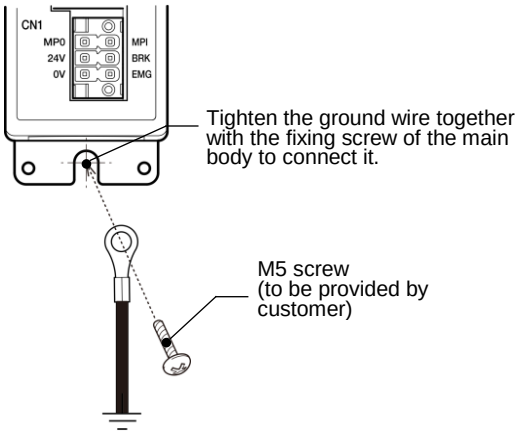


Note 1: Peripheral equipment and cables are customer-supplied. However, the motor relay cable, switch relay cable and I/O cable are dedicated cables. Please buy them from us.

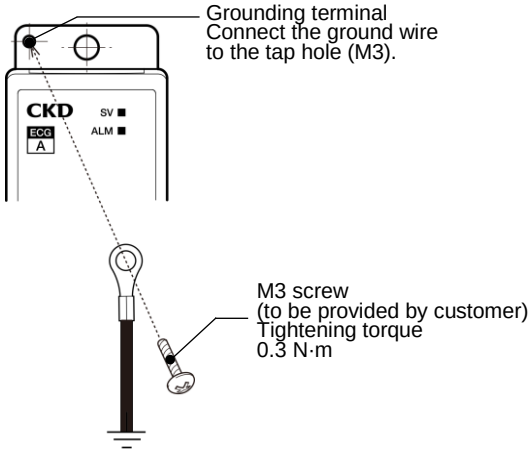
Part used	Model	Manufacturer
Surge protector	RSPD-250-Q4	Okaya Electric Industries Co., Ltd.
	RSPD-250-U4	
	LT-CS32G801WS	Soshin Electric Co., Ltd.
	LT-C32G801WS	
EMI filter for power supply	AX-NSF-NF2015A-OD	Soshin Electric Co., Ltd.
Ferrite core (1)	E04SR401938	Seiwa Electric MFG Co., Ltd.

■ Example of preventive measure against EMC (controller grounded)

Standard mount type



DIN rail mount type



7. WARRANTY PROVISIONS

7.1. Warranty Conditions

■ Warranty coverage

If the product specified herein fails for reasons attributable to CKD within the warranty period specified below, CKD will promptly provide a replacement for the faulty product or a part thereof free of charge or repair the faulty product at one of CKD's facilities free of charge.
However, the following failures are excluded from this warranty:

- Failure caused by handling or use of the product under conditions and in environments that deviate from those stated in the catalog, the Specifications, or this Instruction Manual.
- Failures due to excess durability (number of times, distance, time, etc.) and consumables
- Failure not caused by the product.
- Failure caused by use not intended for the product.
- Failure caused by modifications/alterations or repairs not carried out by CKD.
- Failure caused by reasons unforeseen at the level of technology available at the time of delivery.
- Failure caused by causes that are not CKD responsibility, such as natural disasters and disasters.

The warranty stated herein covers only the delivered product itself. Any loss or damage induced by failure of the delivered product is excluded from this warranty.

■ Confirmation of product compatibility

It is the responsibility of the customer to confirm compatibility of the product with any system, machinery, or device used by the customer.

■ Others

The terms and conditions of this warranty stipulate basic matters.
When the terms and conditions of the warranty described in individual specification drawings or the Specifications are different from those of this warranty, the specification drawings or the Specifications shall have a higher priority.

7.2. Warranty Period

The product is warranted for one (1) year from the date of delivery to the location specified by the customer.

8. REFERENCE INFORMATION

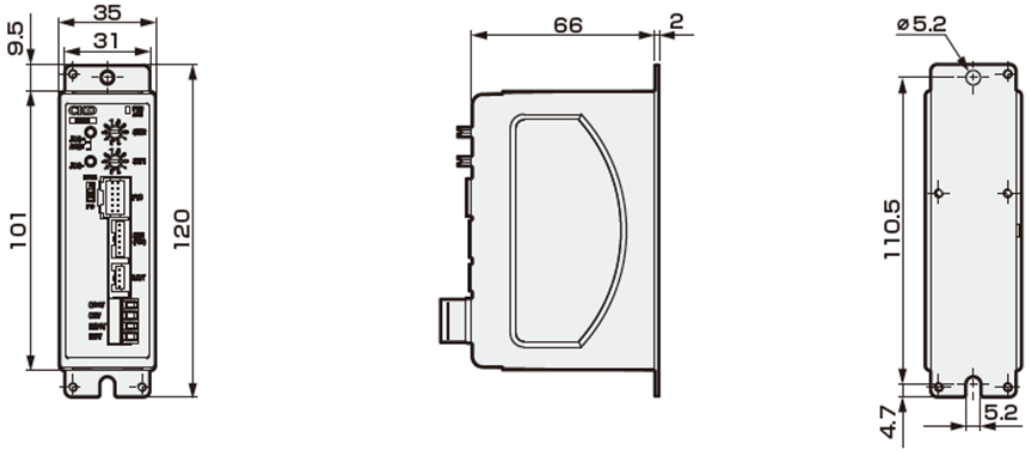
8.1. Specifications

8.1.1. Basic specifications

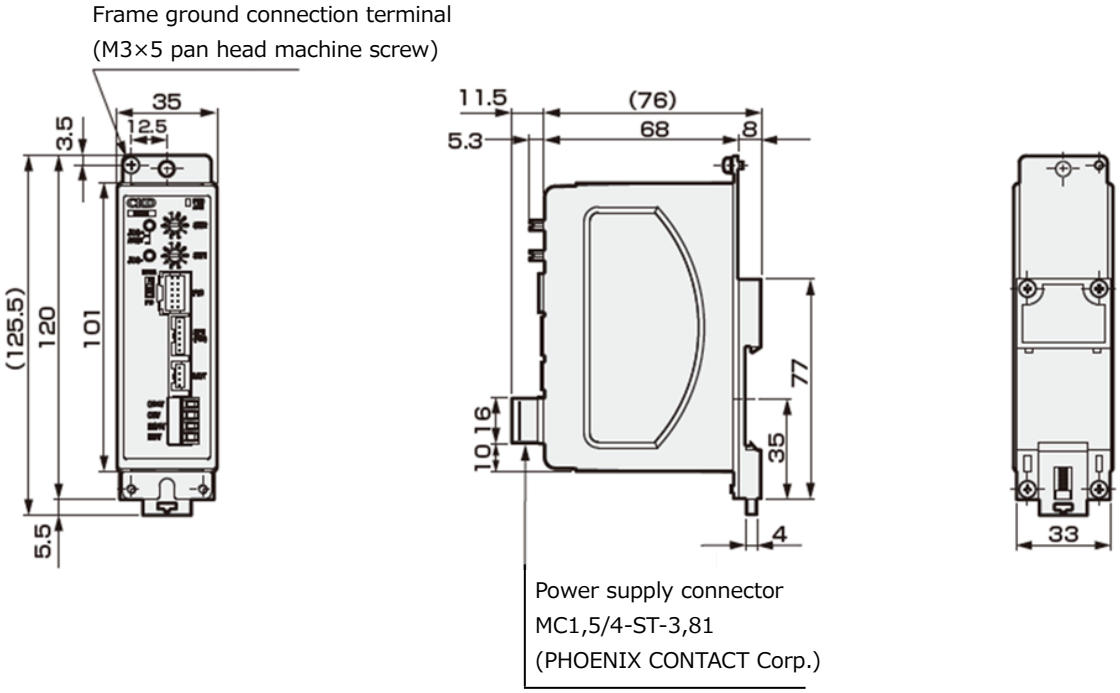
Item	Description	
Controller	ESC4 Series	
Applicable actuators	Screw drive system	Spring drive system
	DSSD2 series DSTK series DSTG series DSTS series DSTL series	DMSDG series DLSH series DCKW series
Setting tool	Rotary switch 1, rotary switch 2, control mode selector switch, operation mode selector switch, JOG(+), alarm reset switch, JOG(-) switch	
Control mode	Solenoid valve mode, double 2-position type Solenoid valve mode, double 3-position type	
Number of inputs	3 points	
Number of outputs	3 points	
Power supply voltage	24 VDC ± 10%	
Indicator lamps	Lit green: Motor energized state Blinking green: Motor not energized state or manual operation mode Lit red: When a system alarm occurs Blinking red: When an operation alarm or warning occurs	
Insulation resistance	500 VDC 10 MΩ or more	
Withstand voltage	500 VAC 1 minute	
Operating ambient temperature	0 to 40°C (no freezing)	
Operating ambient humidity	35 to 85% RH no condensation	
Storage ambient temperature	-10 to 50°C no freezing	
Storage ambient humidity	35 to 85% RH no condensation	
Operating atmosphere	No corrosive gas, explosive gas, or dust	
Degree of protection	IP20	
Weight	About 180 g	

8.2. Dimensions

■ Panel mounting



■ DIN rail mounting



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Glossary

CRC
Abbreviation for Cyclic Redundancy Check. Also referred to as cyclic redundancy checking. A method to check whether data was transmitted, recorded, or replicated accurately.

HDLC
Abbreviation for High-level Data Link Control, and a type of protocol of the data link layer. Transmission efficiency is high because continuous transmission can be performed without waiting for the other party's response, and data error detection using CRC enables highly reliable data transmission.

NPN
It indicates that NPN transistors are generally used in the output unit of a PLC in the connection of the parallel I/O specification. Even if the NPN transistor is not used, if the − side of the external power supply is connected to the output COM (output common) and the + side of the external power supply is connected to the input COM (input common), the term NPN is used. Also referred to as negative common type or sink type.

PNP
It indicates that PNP transistors are generally used in the output unit of a PLC in the connection of the parallel I/O specification. Even if the PNP transistor is not used, if the + side of the external power supply is connected to the output COM (output common) and the - side of the external power supply is connected to the input COM (input common), the term PNP is used. Also referred to as positive common type or source type.

PLC
Abbreviation for Programmable Logic Controller. A programmable controller for controlling industrial equipment. Possible to control multiple motors, sensors, robots, and other various devices.

WDT
Abbreviation for watchdog timer. A timer that detects an error in the computation time, monitors the time of one scan of the program, and issues an alarm if processing does not finish within the scheduled time.

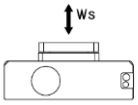
Inching operation
It is used when you want to move by relative position specification by the amount of travel set from the current position.

Overhang amount
It indicates the distance from the center of the top surface of the slider to the center of gravity of the object transferred. In the catalog, the amount of overhang that is allowed in the front-back, left-right, and up-down directions is listed for each mass.

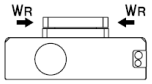
Regenerative current
Current that is generated by the motor operating like a generator when the moving part of the actuator is moved by an external force. Reverse current flows from the motor to the controller, causing malfunction or damage.

Portable mass
It indicates the maximum mass that the actuator can transfer.

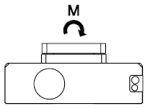
Allowable thrust load
Limit value of the load that can be applied in the direction of the actuator rotation axis. WS is used in this Instruction Manual, the instruction manual described in the "Instruction manual for this product", and the catalog.



Allowable radial load
Limit value of the load that can be applied perpendicular (laterally) to the actuator rotation axis. WR is used in this Instruction Manual, the instruction manual described in the "Instruction manual for this product", and the catalog.



Allowable moment load
Limit value of the load that can be applied in the direction of tilting the actuator rotation axis. M is used in this Instruction Manual, the instruction manual described in the "Instruction manual for this product", and the catalog.



Positioning repeatability
A term that is used only for grippers. It indicates the difference between the maximum and minimum stop positions when positioning operation is repeated from the same direction to the same position.

Repeatability
It Indicates the difference between the maximum and minimum stop positions when positioning operation is repeated from the same direction to the same position. However, in the case of grippers, it indicates the variation when the same workpiece is repeatedly gripped under the same operating conditions.

Grease
It is applied to bearings, bearings, etc., to reduce friction and smooth the operation of the machine. Because the performance cannot be demonstrated due to deterioration of grease or adhesion of foreign material, periodic maintenance is required.

Surge protector
A device that protects equipment and communication equipment from transient abnormal high voltage such as lightning.

Servo OFF
It indicates that the motor is not energized.

Servo ON
It indicates that the motor is energized.

Cyclic communication (transmission)
It indicates periodic communication between the host device (PLC, etc.) and the controller.

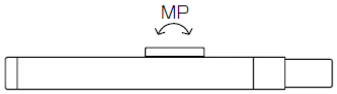
Jog operation
While the travel command is issued, the actuator continues to operate at the set speed.

Cylinder switch
A magnetic proximity sensor that detects and outputs the position of the piston rod of the electric actuator.

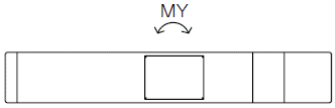
Slave station
A general term for stations other than the master station.

Static allowable moment
Limit value of the load moment that can be applied to the slider when the actuator is stationary. How to apply each moment in the slider type is as follows.

• Pitching moment
A moment acting in the front-rear direction on the slider movement axis. MP is used in this Instruction Manual, the instruction manual described in the "Instruction manual for this product", and the catalog.



• Yawing moment
A moment that acts in the left-right direction on the slider movement axis. MY is used in this Instruction Manual, the instruction manual described in the "Instruction manual for this product", and the catalog.



• Rolling moment
A moment that acts in the axial rotation direction on the slider movement axis. MR is used in this Instruction Manual, the instruction manual described in the "Instruction manual for this product", and the catalog.

Installation category
A concept that expresses how well an electrical device can withstand the application of a transient voltage from an AC power source. The installation category 2 corresponds to "primary side circuit for equipment using a power cord connected to an outlet".

Full-duplex communication
A communication method that allows simultaneous transmission and reception.

Dynamic brake
A method that quickly stops the rotation of the motor by consuming rotational energy as heat energy by short-circuiting the motor terminals via a resistor in the event of a power failure or emergency stop. Since there is no holding torque during stop, it is necessary to use an electromagnetic brake for vertical installation.

Electric Actuator
It is a combination of a motor and mechanical parts, and can control operations such as speed, angle, and force. The rotational force of the motor is transmitted to the drive system and converted into rotational motion or linear motion.

Screw lead
It refers to the distance that the workpiece can be moved when the motor rotates once in the electric actuator.

Noise filter
An electrical circuit or electronic circuit that removes noise, or a device that contains it.

Backlash
A mechanical play in gears, etc.. The lower the backlash, the less rattling.

Half-duplex communication
A communication method in which both transmission and reception cannot be performed at the same time (only one of them can be performed).

Function block (FB)
It is a component of a circuit block that is used repeatedly so that it can be reused in a sequence program. By making them into the components, the control that combines multiple functions can be simplified as if it were a single command.

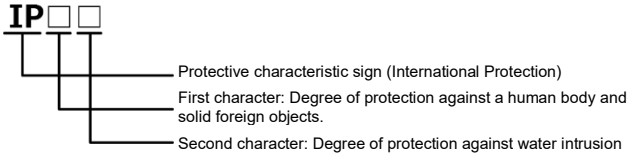
Ferrite core
It is magnetic material using ferrite material. It is used to attenuate high frequency noise.

Polling
If multiple devices communicate separately, processing and signals can conflict and cause problems. Polling is the process in which the main device (master station) checks in order whether there are any requests from other devices (slave station) in order to communicate smoothly.
When polling response is being performed, it means that there is polling from the master station to the slave station, and the slave station is responding to the polling from the master station.

Ball screw
A mechanical element that can convert rotational motion to linear motion. Unlike sliding screws, the ball rolls between the screw shaft and nut, reducing energy loss due to friction. It is used to convert the rotational motion of the motor into the linear motion of the actuator.

Baud rate
It indicates the communication speed. A value that indicates how many times per second digital data can be modulated and demodulated.

Protective class IP20/IP40
The protective class indicates the degree of protection from solid foreign materials such as dust and water. The first digit of the number indicates the degree of protection against the human body and solid foreign materials, and "2" indicates that it is protected against foreign solid materials with a diameter of 12.5 mm or more and "4" indicates that it is protected against foreign solid substances with a diameter of 1.0 mm or more. The second digit of the number indicates the degree of protection against water intrusion, and "0" indicates no protection. It is specified in JIS C 0920 and IEC 60529.



Master station
A station that controls the entire network. One master station is required for one network.

Mechanical end
A position where the moving part of the actuator stops mechanically.

Message communication (transmission)
It indicates communication that occurs irregularly (when necessary) between the host device (PLC, etc.) and the controller.

Lost motion
It is the maximum value of the difference between the average values at the stop position after rotating in the forward and reverse directions multiple times. It is affected by the backlash and the rigidity of the mechanism.