



# Operation Manual

PRODUCT NAME

Trimmer Auto Switch

MODEL / Series / Product Number

*D-M9K/D-F7K/D-Y7K*  
*D-RNK/D-RPK*

**SMC Corporation**

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# Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of "Caution", "Warning" or "Danger". They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC)\*1), and other safety regulations.

\*1) ISO 4414: Pneumatic fluid power -- General rules relating to systems.

ISO 4413: Hydraulic fluid power -- General rules relating to systems.

IEC 60204-1: Safety of machinery -- Electrical equipment of machines. (Part 1: General requirements)

ISO 10218: Manipulating industrial robots -Safety.

etc.



## Caution

**Caution** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.



## Warning

**Warning** indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.



## Danger

**Danger** indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

## Warning

### 1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results.

The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product.

This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

### 2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly.

The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

### 3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.

2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.

3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

### 4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.

2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.

3. An application which could have negative effects on people, property, or animals requiring special safety analysis.

4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.



# Safety Instructions

## Caution

### **1. The product is provided for use in manufacturing industries.**

The product herein described is basically provided for peaceful use in manufacturing industries. If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary. If anything is unclear, contact your nearest sales branch.

## **Limited warranty and Disclaimer/Compliance Requirements**

The product used is subject to the following "Limited warranty and Disclaimer" and "Compliance Requirements".

Read and accept them before using the product.

### **Limited warranty and Disclaimer**

#### **1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first.\*2)**

Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.

#### **2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.**

This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.

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

**\*2) Vacuum pads are excluded from this 1 year warranty.**

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

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

### **Compliance Requirements**

#### **1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.**

#### **2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulation of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.**

## Operator

- ◆ This operation manual is intended for those who have knowledge of machinery using pneumatic equipment, and have sufficient knowledge of assembly, operation and maintenance of such equipment. Only those persons are allowed to perform assembly, operation and maintenance.
- ◆ Read and understand this operation manual carefully before assembling, operating or providing maintenance to the product.

### ■ Precautions

#### **Warning**

- Do not disassemble, modify (including changing the printed circuit board) or repair.  
An injury or failure can result.
- Do not operate the product outside of the specifications.  
Fire, malfunction, or damage to the product can result.  
Verify the specifications before use.
- Do not operate in an atmosphere containing flammable or explosive gases.  
Fire or an explosion can result.  
This product is not designed to be explosion proof.
- If using the product in an interlocking circuit:
  - Provide a double interlocking system, for example a mechanical system.
  - Check the product regularly for proper operation.Otherwise malfunction can result, causing an accident.
- The following instructions must be followed during maintenance:
  - Turn OFF the power supply.
  - Stop the air supply, exhaust the residual pressure and verify that the air is released before performing maintenance.Otherwise an injury can result.

## **Caution**

- Do not touch terminals and connectors while the power is ON.

Otherwise electric shock, malfunction or damage to the product can result.

- After completing maintenance, perform appropriate functional checks.

Stop operation if the equipment does not function correctly.

Safety cannot be assured in the case of unexpected malfunction.

Perform periodic maintenance checks as follows.

- 1) Securely tighten the product mounting screws.

If the screws have become loose and the required mounting position has been lost, re-adjust the product to the correct mounting position and re-tighten the screws.

- 2) Check that there is no damage to the cable.

If damage to the cable is found, replace the product, or repair the cable, to avoid faulty insulation.

- 3) Check the detecting position setting.

Confirm that the product ON/OFF position is at the centre of the operating range (green light range).

If the product operates with a red light ON at the ON/OFF position, the mounting position is not correct. Re-adjust the product to the optimum position at the centre of the operating range.

Some actuator and cylinder series have their own setting methods. In such cases, follow the instructions given.

- Check the wiring.

Incorrect wiring or short circuit of load may damage the product.

## ■NOTE

○Follow the instructions given below when designing, selecting and handling the product.  
"Cylinder" or "Actuator" indicates a cylinder, air gripper, rotary actuator, electrical actuator or cylinder, etc.

### ●Design and Selection

#### \*Product specifications

●Pay attention to the length of time the product will operate at an intermediate stroke position.

When a product is placed at an intermediate stroke position, and a load is driven during the time when the piston passes, the product will operate, but if the piston speed is too great, the operating time will be shortened, and the load may not operate correctly.

The maximum piston speed is:

$$V [\text{mm/s}] = \frac{\text{Operating range of product [mm]}}{\text{Operating time of load [ms]}} \times 1000$$

●Take precautions when multiple actuators are used close together.

When using two or more actuators with auto switches in close proximity to each other, maintain a minimum separation distance of at least 40 mm. (If the separation distance is specified for the actuator series, then use that value). The products may malfunction due to magnetic field interference. Use of a magnetic screen plate (MU-S025) or commercially available magnetic screening tape can reduce the interference of magnetic fields.

●Provide sufficient space for maintenance.

When designing an application, allow sufficient clearance for maintenance and inspection.

●Never mount the actuator with auto switch in a location that will be used as a footrest.

The product may be damaged if excessive force is applied by stepping or climbing onto it.

●Design the circuit to prevent reverse current during open circuit conditions or when the product is forced to operate for functional checks.

Reverse current can cause product damage or malfunction.

●Limitations of the detection position

There will be mounting positions or surfaces where the product cannot be mounted due to physical interference (e.g. rear side of the foot bracket), depending on the mounting conditions of the actuator. Select a product after confirming that the product mounting position does not interfere with the mounting bracket (e.g. trunnion, reinforcement ring).

●Wiring should be kept as short as possible.

Do not use a cable longer than 100 m. For long cable lengths, we recommend a ferrite core should be attached to both ends of the cable, to reduce noise. A contact protection box (used for reed type auto switches) is not necessary for solid state auto switches, because of the type of product construction.

●For products, the sensor cable length should be 3 m or less.

If the sensor cable length is longer than 3 m, the product will not be CE compliant.

●Do not use a load which generates a surge voltage.

When a load which generates a surge voltage is to be directly driven, operate such as a relay or solenoid, use a product with built-in surge protection.

●Pay attention to the internal voltage drop of the product.

In general, the internal voltage drop will be greater with a 2-lead wire solid state auto switch than with a reed type auto switch. When products are connected in series, the voltage drop will be "n" times larger when "n" products are connected. Even though a product may operate normally, the load may not operate. Note that a 12 VDC relay is not applicable.

●The product output will be unstable for 50 ms after power is supplied.

During the time after supplying power, the input device (e.g. PLC, relay) may consider the ON position as OFF output or the OFF position as ON output. Please set up the application to consider the signals will be invalid within 50 ms after power is supplied.

Perform a similar setting when using the SMC AHC system (Auto Hand Changing system) MA series.

## ● Product handling

### \*Installation

#### ● Do not drop or apply impact.

The product may be damaged or malfunction if it is dropped, bumped or applied with excessive impact (the sensor: 980 m/s<sup>2</sup>, the amplifier: 98 m/s<sup>2</sup>).

#### ● Observe the required tightening torque for mounting a product.

If a product is tightened beyond the specified tightening torque, the product, mounting screws, or mounting bracket may be damaged.

Tightening below the specified tightening torque will allow the product to move out of position.

#### ● Use only the screws installed in the product body for mounting the product.

If other screws are used, the product may be damaged.

#### ● Set the product based on the instructions for the cylinder or actuator.

Mounting the product close to the edge of its operating range (close to the border of ON/OFF operation) may cause unstable operation. Some actuator and cylinder series have their own setting methods. In such cases, follow the instructions given.

For products with 2-colour display, the operation may be unstable due to the installation environment and the effects of disturbance, even if the product is mounted in the correct operating range (green light range). (e.g. close proximity of actuators with built-in magnet, magnetic substances, external magnetic fields, temperature changes, or other fluctuating magnetic forces).

#### ● Check and adjust the actual product operation during installation.

The product may not operate in the correct actuator mounting position due to the installation environment.

Also check and adjust the product operation when used in intermediate stroke positions, according to the operating environment.

#### ● Ensure that the FG terminal is connected to ground when using a commercially available switch-mode power supply.

### \*Wiring

#### ● Do not pull hard on the cable. In particular, do not carry an actuator by the product cable.

This may cause a broken cable or damage to the product internal elements.

#### ● Check the insulation of the wiring.

Check that there is no faulty wiring insulation (short circuits, faulty ground connections, improper insulation between terminals, etc.), as this may damage the product due to over current.

#### ● Do not route the product wiring in the same place as power cables or high voltage cables.

Otherwise product malfunction may result due to noise and inrush current.

#### ● Avoid repeatedly bending or stretching the cable.

Wiring with repetitive bending stress or tensile stress can cause broken cable or peel of a sheath. If the cable can move, fix it near the body of the product.

#### ● Turn the power ON after connecting a load.

Other wise it can cause excess current causing instantaneous breakage of the product.

#### ● Avoid incorrect wiring

If connections are reversed (power supply wire + and -), the product will be protected by a protection circuit.

However, if the blue wire is connected to the power supply (+) and the black wire is connected to the power supply (-), the product will be damaged.



#### \*Environment

- Do not use in a location where magnetic fields are generated.  
Products will malfunction or the magnets inside actuators will become demagnetized.
- Do not use in an environment where the product will be continually exposed to water.  
Although products satisfy the IEC standard IP67 construction, do not use in applications continually exposed to water splashes or spray. Otherwise, insulation failure or malfunction may result.
- Do not use in an environment where oil or chemical splashes can occur.  
If products are used in an environment with coolants, cleaning solvents, oils or chemicals for even a short time, they may be adversely affected by insulation failure, malfunction due to swelling of the potting resin, or hardening of the cable.
- Do not use in an environment where there are cyclic temperature changes.  
Temperature cycles other than normal temperature changes can adversely affect the product internally.
- Avoid accumulation of iron debris or close contact with magnetic substances.  
When a large amount of iron waste such as machining chips or spatter has accumulated, or a magnetic substance (something attracted by a magnet) is brought into close proximity with the actuator, it may cause the product to malfunction due to a weakening of the magnetic force inside the actuator.
- Contact SMC for information regarding product water resistance, elasticity of cables, applications in welding sites, etc.
- Do not use in direct sunlight.
- Do not mount the product in locations where it is exposed to radiant heat.
- The product is CE marked, but not immune to lightning strikes. Take measures against lightning strikes in the system.
- Do not use in a location where surges are generated.  
When there are units (solenoid lifter, high frequency induction furnace, motor, etc.) which generate a large amount of surge in the area around the actuator with solid state auto switches, this may cause damage to the product internal circuit
- Do not install this product in a place subject to vibration and impact. (980 m/s<sup>2</sup> or less for the sensor unit, 98 m/s<sup>2</sup> or less for the amplifier unit)  
The internal parts can be damaged leading to malfunction even if the product body is not damaged.
- Take appropriate measure to prevent freezing when the operating temperature is 5 °C or less.

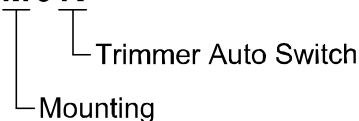
#### \*Maintenance

- Do not use solvents such as benzene, thinner, alcohol etc. to clean the product.  
This may damage the surface of the body or erase the markings on the body.  
For heavy stains, use a cloth soaked with diluted neutral detergent and fully squeezed, then wipe up the stains again with a dry cloth.

## Model Indication and How to Order

### ○Sensor unit

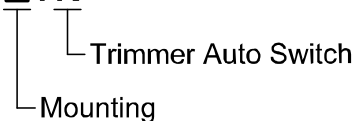
#### D-M9K



M	Direct mount into round groove
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\*: One sensor connector (e-con) is included in each package.

#### D-□7K

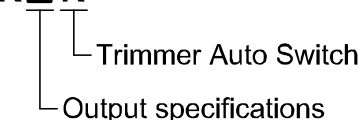


F	Rail mounting
Y	Direct mount into square groove

\*: One sensor connector (e-con) is included in each package.

### ○Amplifier unit

#### D-R□K



N	NPN (2 outputs)
P	PNP (2 outputs)

### ○Accessories (Option)

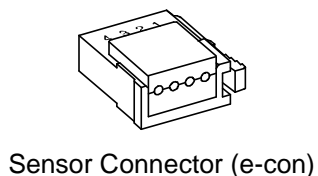
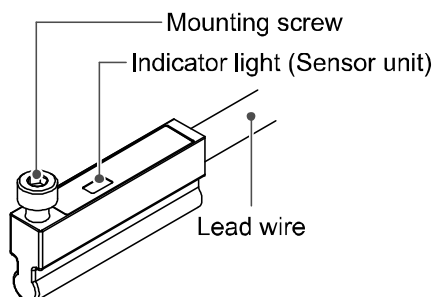
Product number	Contents	Remarks
ZS-28-C-1	Sensor Connector (e-con)	1 pc.
D-MS-A	Mounting screw (M2.5 x 4 L, Steel (Black zinc chromate))	1 pc.
D-MS-AP	Mounting screws (M2.5 x 4 L, Steel (Black zinc chromate))	10 pcs.
D-MS-B	Mounting screw (M2.5 x 4 L, SUS)	1 pc.
D-MS-BP	Mounting screws (M2.5 x 4 L, SUS)	10 pcs.
ISA-2-1	DIN rail (Width 35 mm x Length 105 mm)	1 pc.
ISA-2-2	DIN rail (Width 35 mm x Length 140 mm)	1 pc.
ISA-2-3	DIN rail (Width 35 mm x Length 175 mm)	1 pc.
ISA-2-4	DIN rail (Width 35 mm x Length 210 mm)	1 pc.
ISA-2-5	DIN rail (Width 35 mm x Length 245 mm)	1 pc.
ISA-2-6	DIN rail (Width 35 mm x Length 280 mm)	1 pc.
ISA-2-7	DIN rail (Width 35 mm x Length 315 mm)	1 pc.

\*: Each accessory is not assembled with the product, but shipped together.

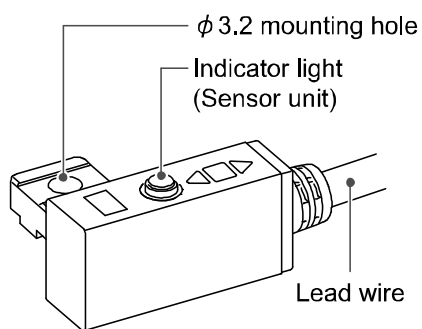
## Summary of Product parts

### ○ Sensor unit

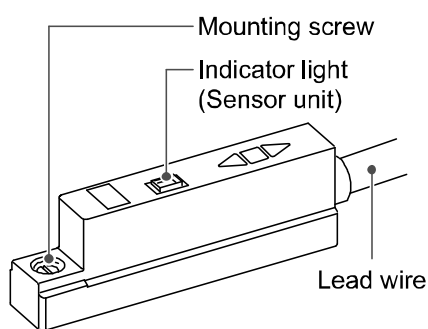
#### D-M9K



#### D-F7K

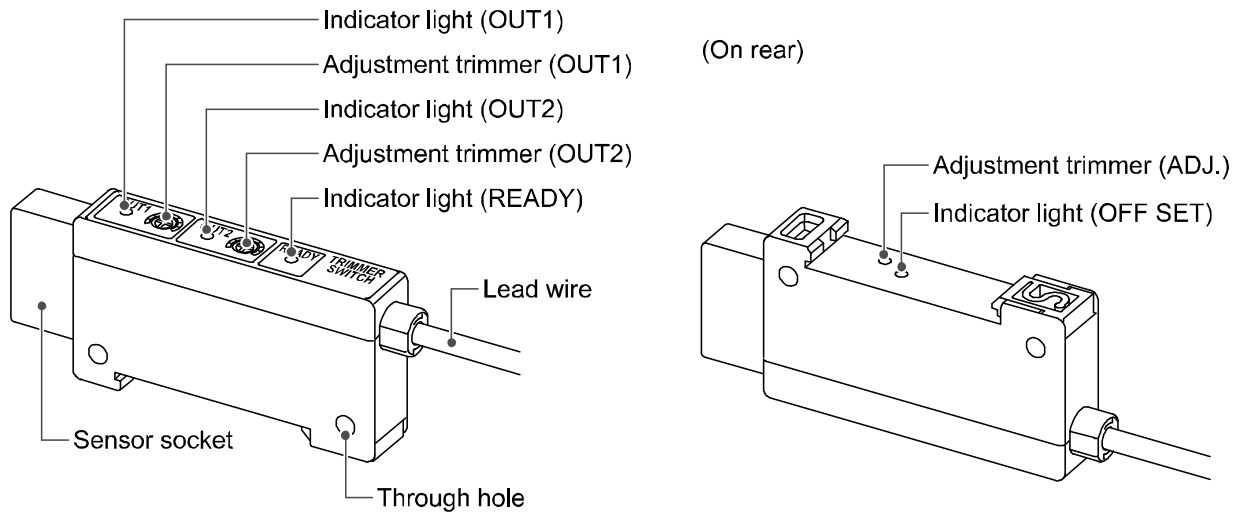


#### D-Y7K




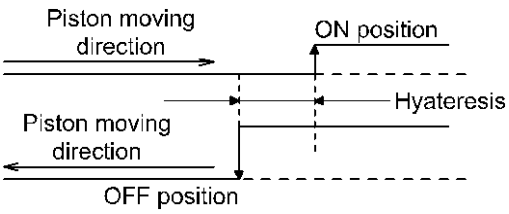
Element	Description
Mounting screw	Screw for securing the sensor unit in the groove in the actuator.
$\phi 3.2$ mounting hole	Hole for mounting the product to the actuator rail. (Use the mounting bracket included with the actuator)
Indicator light (Sensor unit)	The indicator is ON (red or green) when the Sensor unit detects the magnetic field.
Lead wire	Lead wire for power supply and outputs. (3 m)
Sensor Connector (e-con)	Sensor Connector supplied loose with the product.

○ Amplifier unit



Element	Description
Indicator light (OUT1)	Indicates the output status of OUT1. The OUT1 light is ON (Green) when the output is ON.
Adjustment trimmer (OUT1)	For adjusting the detection range of OUT1.
Indicator light (OUT2)	Indicates the output status of OUT2. The OUT2 light is ON (Orange) when the output is ON.
Adjustment trimmer (OUT2)	For adjusting the detection range of OUT2.
Indicator light (READY)	The READY light is ON (Red) when the sensor unit detects the magnetic field. The detection ranges of OUT1 and OUT2 should be adjusted when this light is ON.
Lead wire	Lead wire for power supply and outputs. (3 m)
Through hole	Hole for direct mounting.
Sensor socket	For connecting the sensor.
Adjustment trimmer (ADJ.)	For adjusting the sensor unit when it is connected for the first time. Refer to Offset adjustment (page 17) for details.
Indicator light (OFF SET)	The OFFSET light is ON (Red) when the adjustment is completed.

## ■ Definition and terminology

	Terms	Meaning
2	2-colour indication	<p>Indication in which a red light is ON in the operating position, and a green light is ON in the optimum operating range.</p> 
H	Hysteresis	<p>The difference between the points where the product turns ON and OFF, which is provided to prevent chattering.</p> 
I	Internal voltage drop	The voltage applied between the COM and signal line when the product turns ON.
L	Load current	The current flowing to the load when the product turns on.
M	Most sensitive position	The centre position of the sensor (which provides the strongest reaction from the sensor), and also the centre position of the operating range.
N	Non-polarity	A 2-lead wire type of connection for which polarity is not important. For example the load can be connected to either of (+) or (-).
S	Sequence controller (PLC)	A device which performs sequence control, such as receipt of inputs from the product along with programming and sending of the output to other equipment.
	Solid state Auto switch	Product which generates ON and OFF outputs with or without mechanical contact by using for example a transistor.

## Mounting and Installation

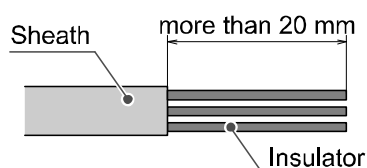
### ■Wiring

- Connections should only be made with the power supply turned OFF.
- Use separate routes for the product wiring and any power or high voltage wiring. Otherwise, malfunction may result due to noise.
- Ensure that the FG terminal is connected to ground when using a commercially available switch-mode power supply. When a switch-mode power supply is connected to the product, switching noise will be superimposed and the product specification can no longer be met. This can be prevented by inserting a noise filter, such as a line noise filter and ferrite core, between the switch-mode power supply and the product, or by using a series power supply instead of a switch-mode power supply.

### ●Connecting the wiring

#### Attaching the sensor connector to the sensor wire

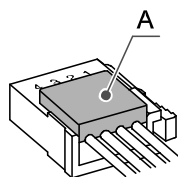
- Strip the sensor wire as shown. Do not cut the insulator.



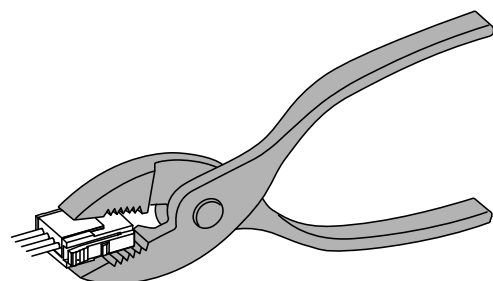
- Insert the corresponding wire colour shown in the table into the pin number printed on the sensor connector, to the bottom.

Pin number on connector	Wire colour	Contents
1	Black	SOUT1
2	Blue	GND
3	White	SOUT2
4	Brown	Vsw

- Check that the above preparation has been performed correctly, then part A shown should be pressed in by hand to make temporary connection.



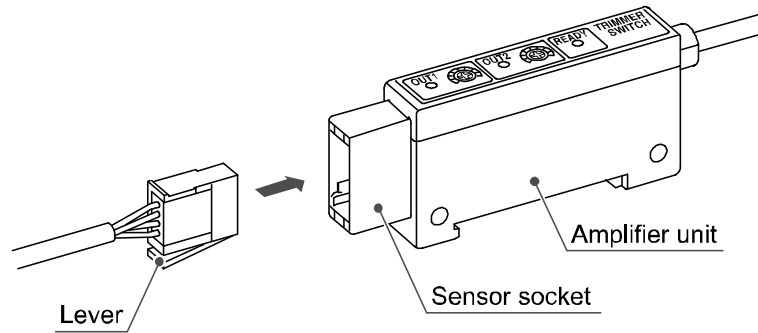
- Part A should then be pressed in using a suitable tool, such as pliers.



- The sensor connector cannot be re-used once it has been fully crimped. In cases of connection failure such as incorrect order of wires or incomplete insertion, please use a new connector. (ZS-28-C-1)

● Installation / Removal of the sensor connector to the amplifier unit

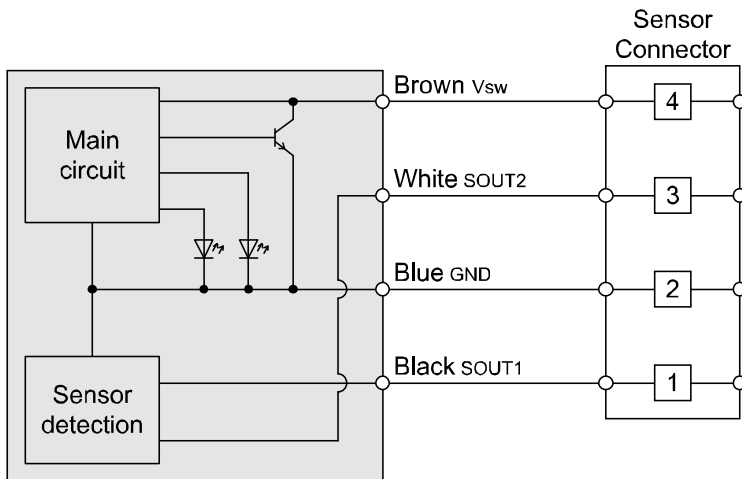
- When connecting the connector, insert it straight into the socket until the connector clicks.
- When removing the connector, press down the lever to release the hook from the sensor socket and pull the connector straight out.



■ Internal circuit

○ Sensor unit internal circuit

**D-M9K / D-□7K**





○ Amplifier unit internal circuit

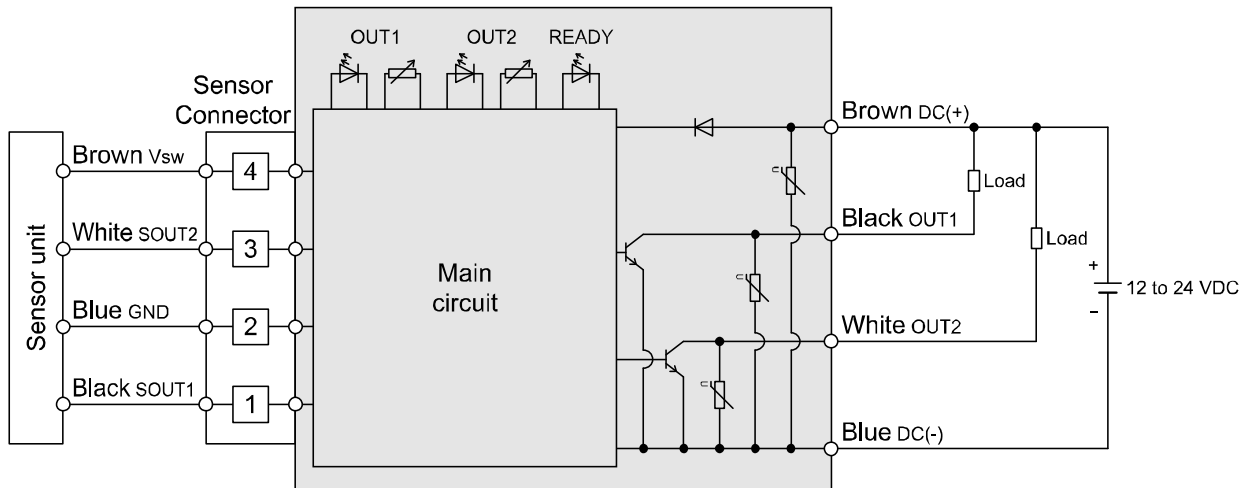
NPN (2 output) type

**D-RNK:**

Max. load current: 80 mA

Max. applied voltage: 28 V

Internal voltage drop: 1.5 V or less

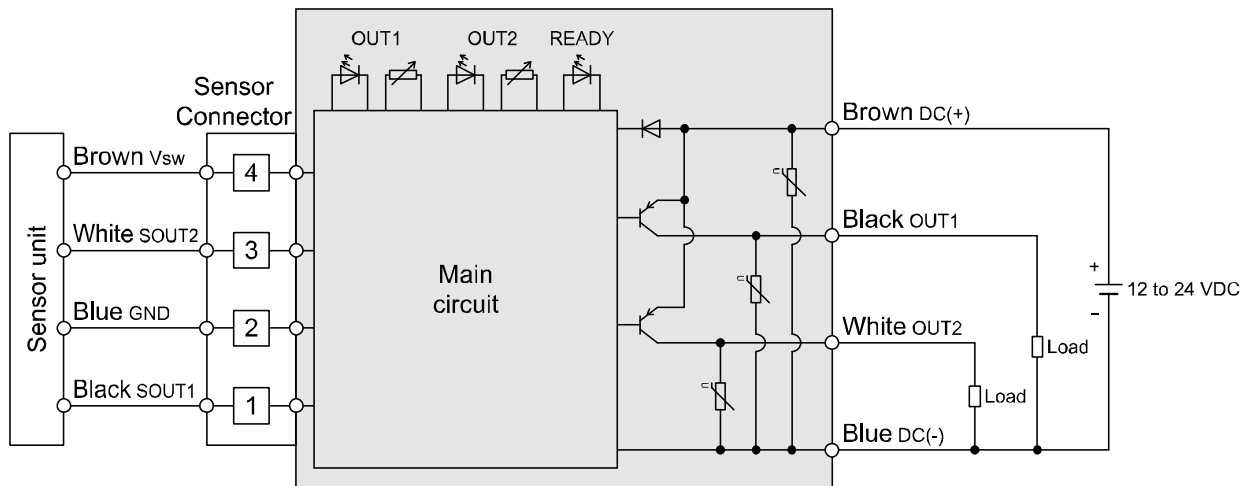


PNP (2 output) type

**D-RPK:**

Max. load current: 80 mA

Internal voltage drop: 1.5 V or less

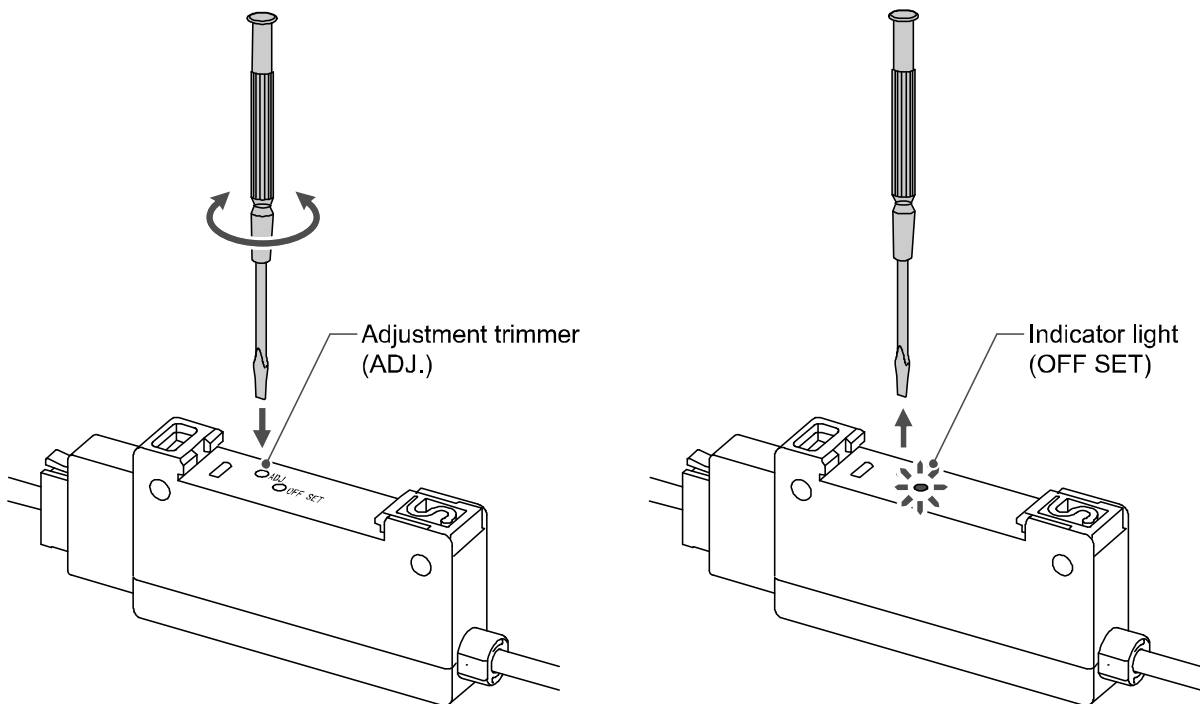


[Note] Please contact SMC if using AND connection.

## ■ Offset adjustment

[Note] During offset adjustment, if the sensor unit is mounted to an actuator, remove the sensor unit from the actuator so that no magnetic field is present. Keep the sensor unit away from any magnetic field as far as possible because the sensor may detect a magnetic field even when the operation light is not ON.

- (1) Connect the sensor unit to the amplifier unit, and connect the amplifier unit to the power supply.
- (2) Insert a small flat blade screwdriver into the adjustment trimmer (ADJ.) to turn the trimmer clockwise or counterclockwise.  
Be careful where the screwdriver is inserted. Inserting the screwdriver into the indicator light (OFFSET) hole may damage the light.  
The recommended torque applied to the adjustment trimmer must be 20 mNm or less. The effective rotation is 12 turns.  
The adjustment trimmer does not have any rotational stop. If the desired adjustment is not achieved by rotating in one direction, then try the other direction.
- (3) When the indicator light (OFF SET) is red, adjustment is complete.



### Offset Adjustment

- Offset Adjustment is the optimization of the electrical reference point of the sensor.
- Without offset adjustment, ON/OFF of the output signal cannot be operated correctly.
- When the sensor unit is used for the first time, always perform offset adjustment.
- After the adjustment, further adjustment is not necessary unless the sensor unit is replaced.

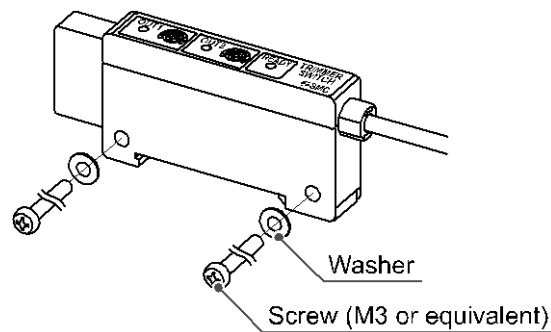
## ■ Installation

### ● Installation of the amplifier unit

- Perform offset adjustment before the installation of the amplifier unit. Refer to page 17.

#### ○ Direct installation

- For direct mounting, use M3 screws (2 pcs.) or equivalent.
- The recommended tightening torque of the screw is 0.5 to 0.7 Nm.
- Mount the product on a flat and even surface. Mounting on an uneven surface can damage the case.
- Screws and washers should be supplied by the user.

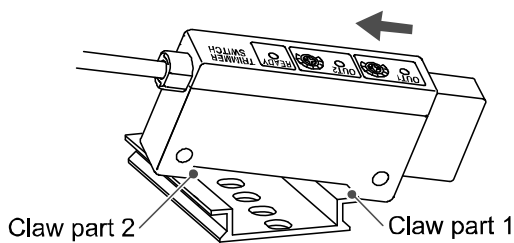


#### ○ Installation using DIN rail

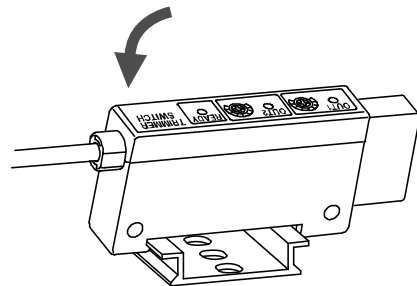
##### Mounting

- (1) Hook the claw part 1 to the DIN rail (35 mm width).
- (2) Push the claw part 2 down until it clicks.

(1)



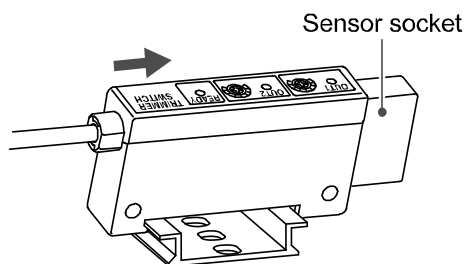
(2)



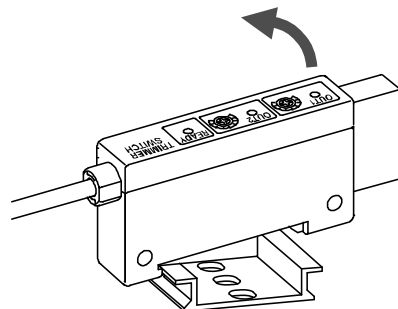
##### Removal

- (1) Push the body towards the Sensor socket end.
- (2) Pull the Sensor socket end upwards.

(1)



(2)



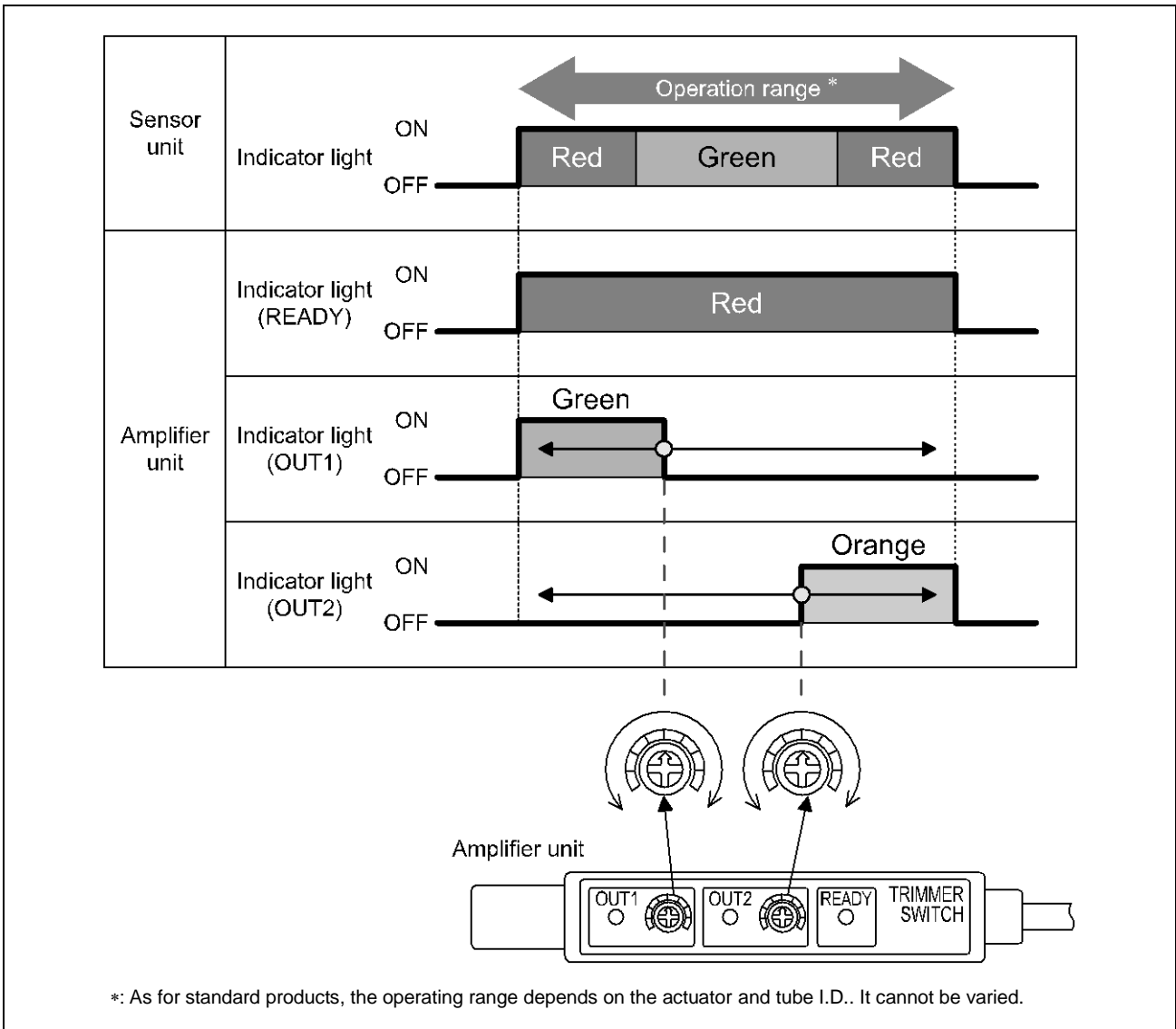
\*: We recommend using an end plate when mounting onto DIN rail. Refer to DIN rail end plate manufacturers for further details.

## ■ Setting

Setting using the Adjustment trimmer.

“How to mount” depends on the actuator type and tube I.D.. Please refer to the actuator catalogue.

The size of the work piece (correct, too small, too large, or no work piece) can be verified by setting the detection range of OUT1 and OUT2 within the operation range using the adjustment trimmer. (See below)



- The recommended torque applied to the adjustment trimmer is 2 to 20 mNm. The maximum rotation is 260 degrees. Make the adjustment within the specification range.
- The scale of the trimmer does not show the operation range. Please only use this as a guide for setting.

### <<Cautions when designing>>

- For setting, do not move the actuator by hand. Use air to start the actuator.
- The Detection range may vary depending on the air supply pressure, variation of the ambient magnetic field, or the presence of any magnetic material.
- The Minimum detection distance is 0.5 mm. This product is not applicable when the size difference of the work piece is less than 0.5 mm in the stroke direction.
- This product is not suitable for work pieces with unstable shapes such as rubber parts.

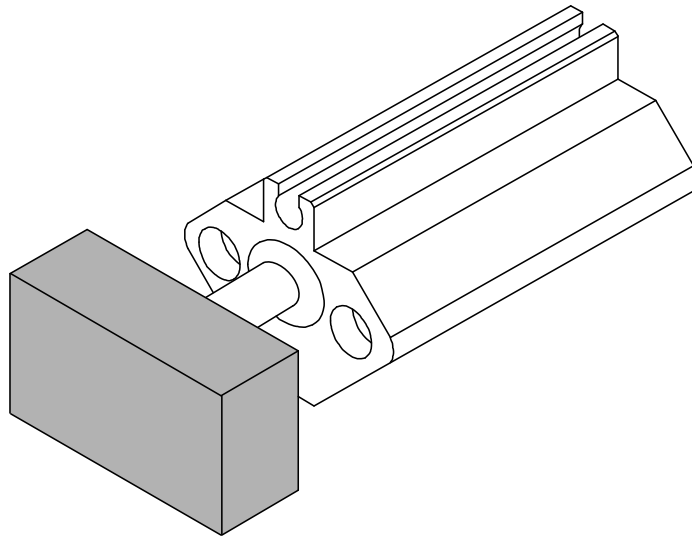
●Setting procedure 1

This is an example of setting.  
Perform the setting and operation check with actual equipment.

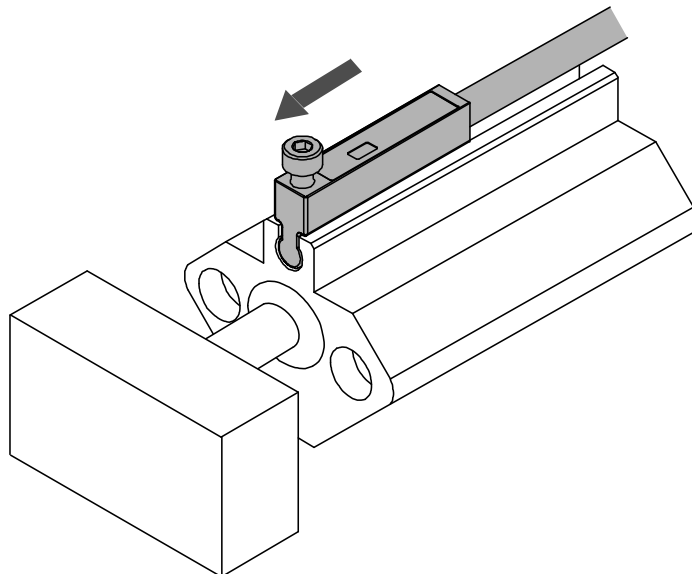
<<Verify 4 work pieces below using Air Gripper (CQ2 series)>>

[A]	Work piece size is correct
[B]	Work piece is too large
[C]	Work piece is too small
[D]	No work piece

(1) Push the largest conformant work piece by supplying air to the actuator.

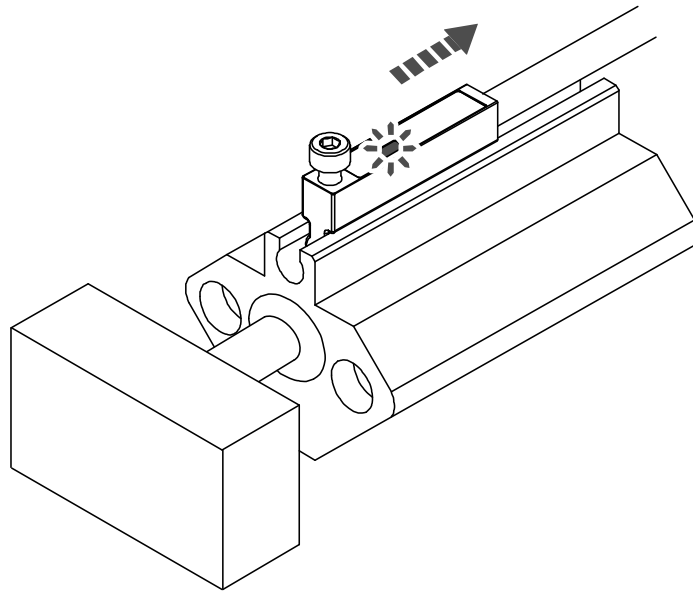


(2) Insert the sensor unit up to the end of the mounting groove. (Figure below) \*

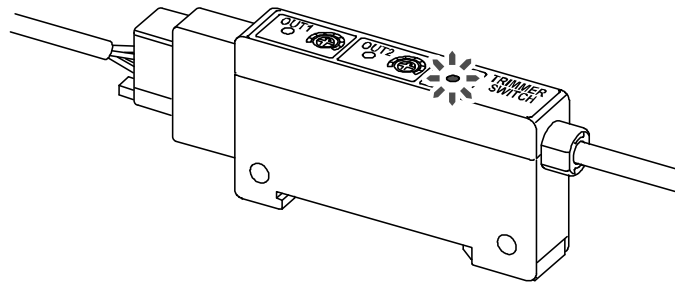


\*: The relationship between OUT1 and OUT2 is reversed if the mounting direction is opposite. The Detection range may change. An Operation check with actual equipment should be performed as the location of OUT1 and OUT2 is reversed depending on the cylinder structure.

(3) Pull back the sensor unit. Position the sensor unit where the indicator light changes from red to green.

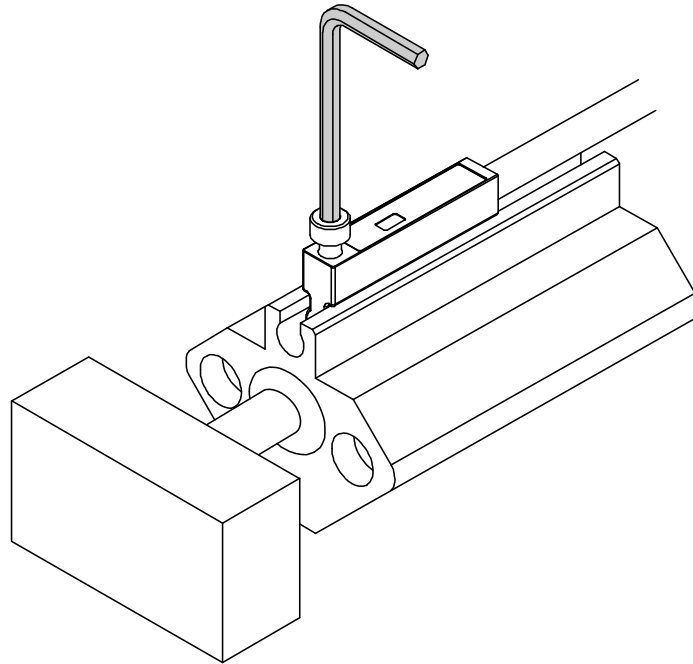


(4) Make sure that the indicator light (READY) on the amplifier unit is ON.



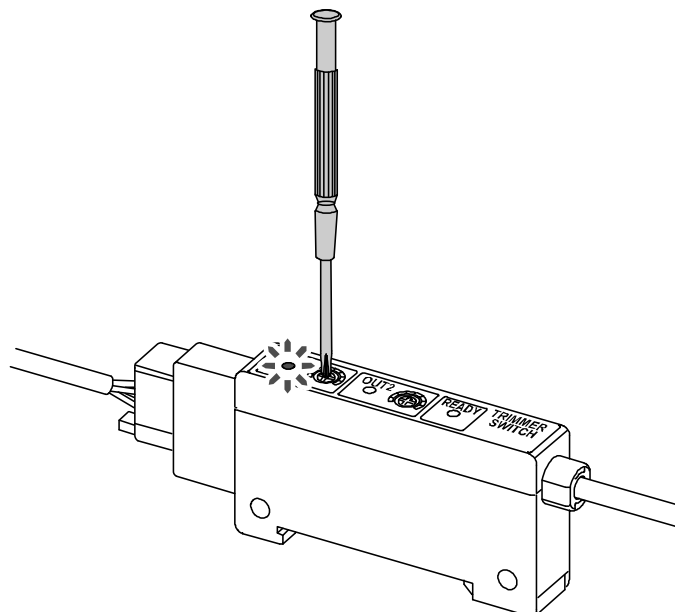
- (5) Fix the sensor unit using the mounting screw or a mounting bracket.  
Refer to the table below for the tightening torque.

Model	Mounting	Mounting tool	Tightening torque
D-M9K	Hexagon socket head cap screw (M2.5 x 12 L)	Hexagon driver (width across flats:2 mm)	0.1 to 0.2 Nm
D-F7K	Mounting bracket + Mounting screw (M3)	Phillips head screwdriver	0.5 to 0.7 Nm
D-Y7K	Mounting screw (M2.5 x 4 L)	Small flat blade screwdriver	0.05 to 0.1 Nm

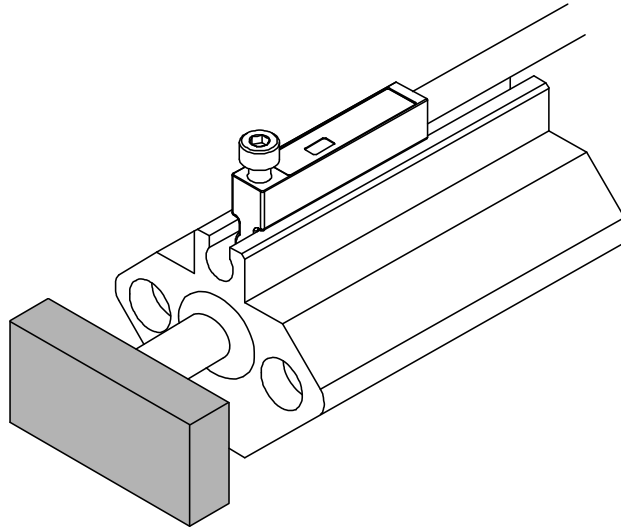


\*: "How to mount" depends on the actuator type and tube I.D.. Please refer to the actuator catalogue.

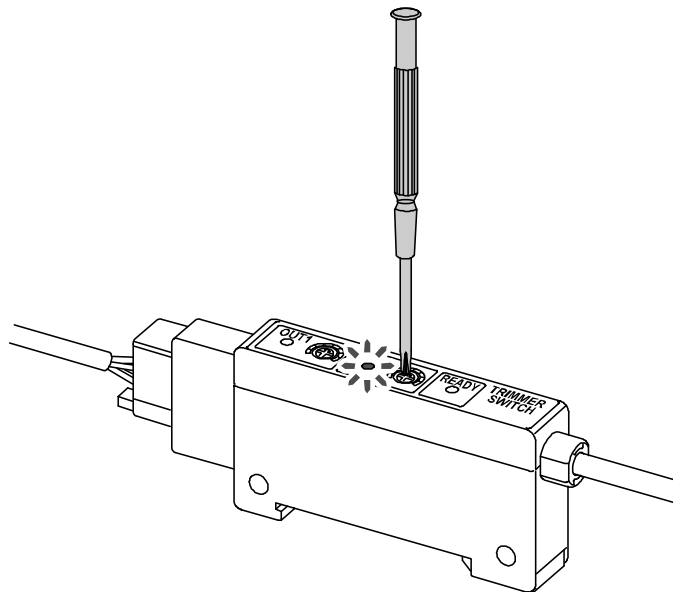
- (6) Turn the adjustment trimmer (OUT1) with a screwdriver. Stop turning the screwdriver when the indicator light (OUT1) is ON.  
(If the indicator light (OUT1) is already ON, turn the trimmer to turn OFF the light, then adjust the trimmer).



(7) Replace the pushed work piece with the smallest conformant work piece.

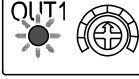

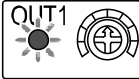
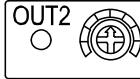
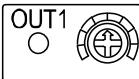
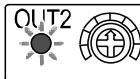




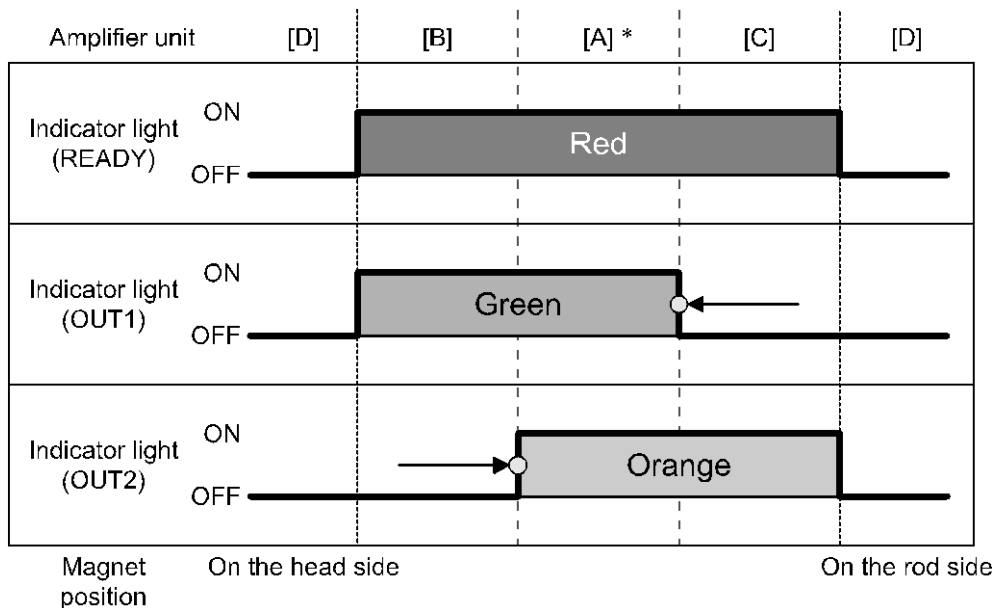
(8) Turn the adjustment trimmer (OUT2) with a screwdriver. Stop turning the screwdriver when the indicator light (OUT2) is ON.  
(If the indicator light (OUT2) is already ON, turn the trimmer to turn OFF the light, then adjust the trimmer).





### Verification of the work piece

		OUT1 output (Detects the upper limit of the work piece)	OUT2 output (Detects the lower limit of the work piece)
[A]	Work piece size is correct (Conformant range)	<p>ON</p>  <p>(Work piece is smaller than the upper limit. Conformance)</p>	<p>ON</p>  <p>(Work piece is larger than the lower limit. Conformance)</p>
[B]	Work piece is too small	<p>ON</p>  <p>(Work piece is smaller than the upper limit. Conformance)</p>	<p>OFF</p>  <p>(Work piece is smaller than the lower limit. Non-conformance)</p>
[C]	Work piece is too large	<p>OFF</p>  <p>(Work piece is larger than the upper limit. Non-conformance)</p>	<p>ON</p>  <p>(Work piece is larger than the lower limit. Conformance)</p>
[D]	No work piece	<p>OFF</p>  <p>(Work piece is larger than the upper limit. Non-conformance)</p>	<p>OFF</p>  <p>(Work piece is smaller than the lower limit. Non-conformance)</p>



\*: The dimension for [A] should be 0.5 mm minimum in the stroke direction.

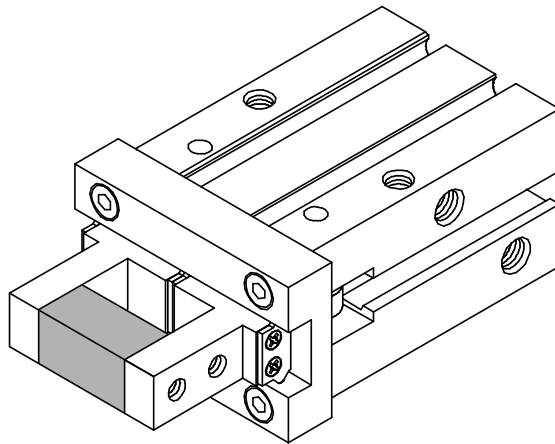
●Setting procedure 2

This is an example for setting.  
Perform the setting and operation check with actual equipment.

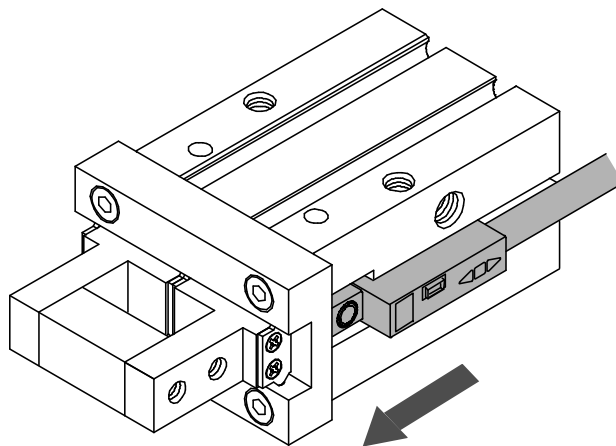
<<Verify 4 work pieces below using Air Gripper (MHZ2 series)>>

[A]	Work piece size is correct
[B]	Work piece size is too large
[C]	Work piece size is too small
[D]	No work piece

(1) Hold the minimum conformant work piece by supplying air to the gripper.

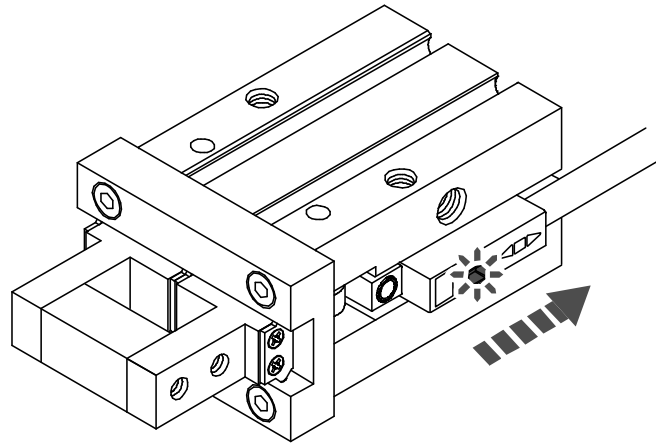


(2) Insert the sensor unit up to the end of the mounting groove. (Figure below) \*

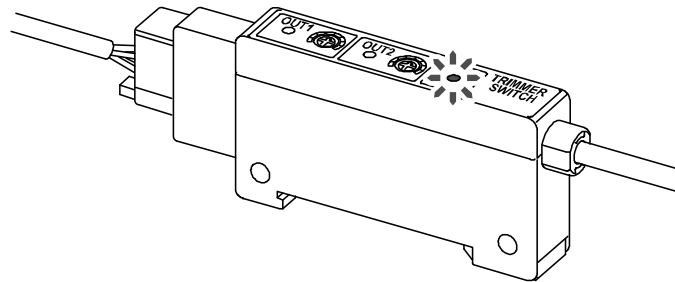


\*: The relationship between OUT1 and OUT2 is reversed if the mounting direction is opposite. The Detection range may change.  
An Operation check with actual equipment should be performed as the location of OUT1 and OUT2 is reversed depending on the air gripper structure.

(3) Pull back the sensor unit. Position the sensor unit where the indicator light changes from red to green.

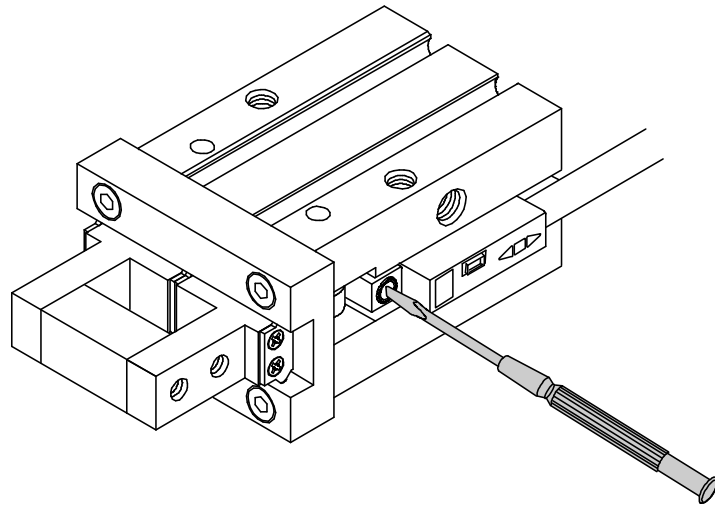


(4) Make sure that the indicator light (READY) on the amplifier unit is ON.



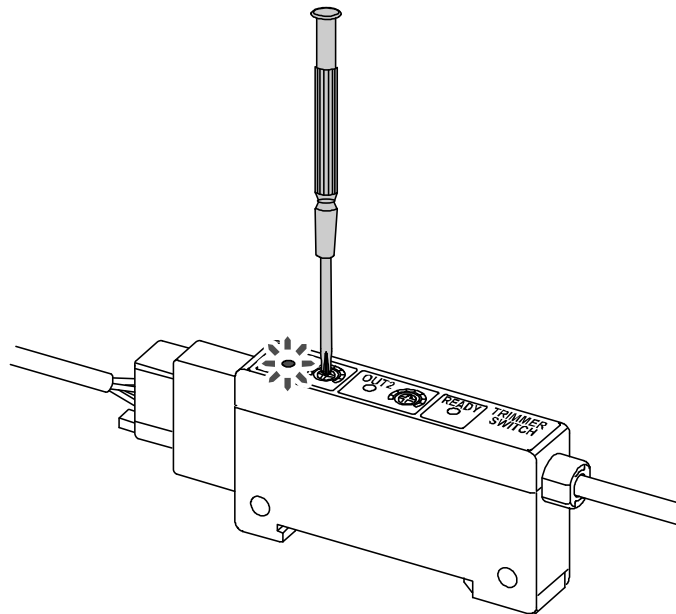
- (5) Fix the sensor unit with the mounting screw or a mounting bracket.  
Refer to the table below for the tightening torque.

Model	Mounting	Mounting tool	Tightening torque
D-Y7K	Mounting screw (M2.5 x 4 L)	Small flat blade screwdriver	0.05 to 0.1 Nm
D-M9K	Hexagon socket head cap screw (M2.5 x 12 L)	Hexagon driver (width across flats:2 mm)	0.1 to 0.2 Nm
D-F7K	Mounting bracket + Mounting screw (M3)	Phillips head screwdriver	0.5 to 0.7 Nm

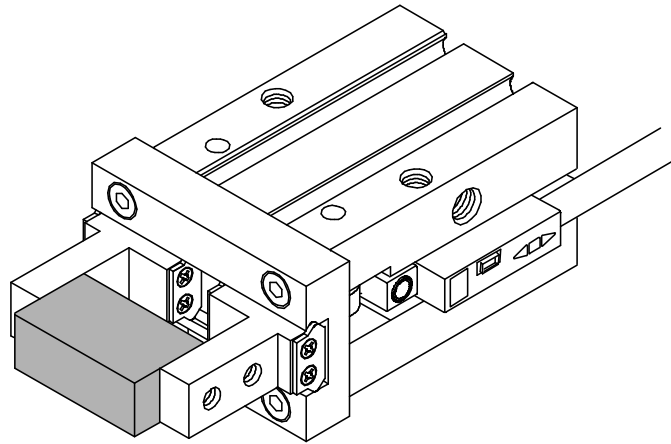


\*: "How to mount" depends on the actuator type and tube I.D.. Please refer to the actuator catalogue.

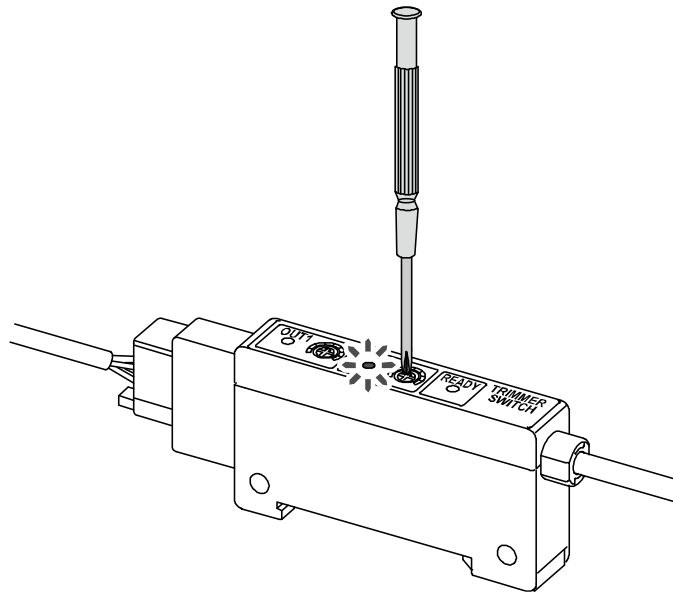
- (6) Turn the adjustment trimmer (OUT1) with a screwdriver. Stop turning the screwdriver when the indicator light (OUT1) is ON.  
(If the indicator light (OUT1) is already ON, turn the trimmer to turn OFF the light, then adjust the trimmer).



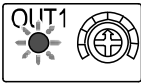
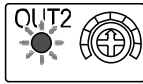
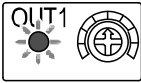
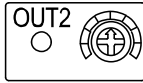
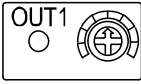
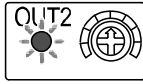
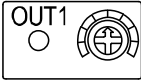
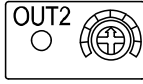
(7) Replace the work piece with the maximum conformant work piece.

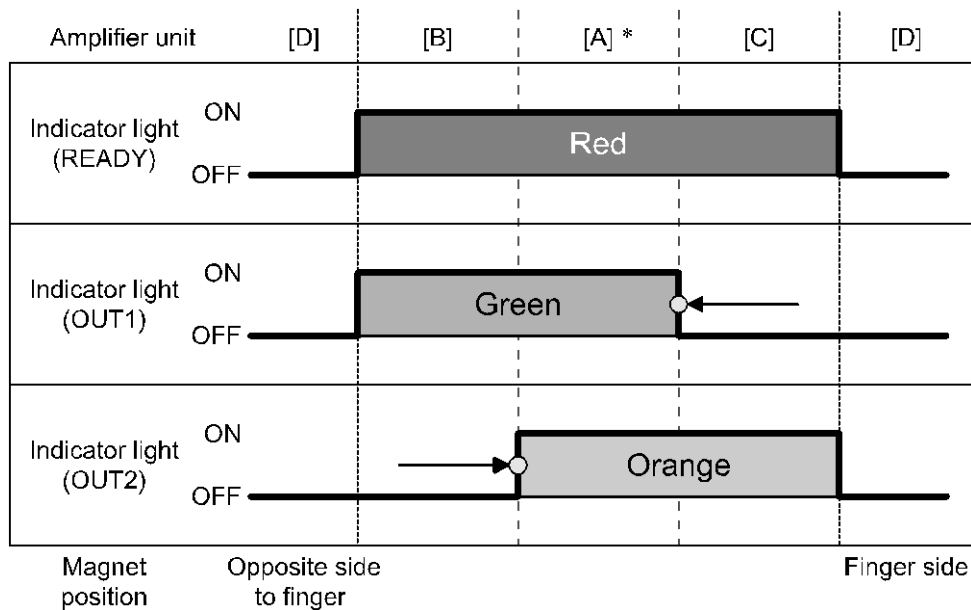


(8) Turn the adjustment trimmer (OUT2) with a screwdriver. Stop turning the screwdriver when the indicator light (OUT2) is ON.  
(If the indicator light (OUT2) is already ON, turn the trimmer to turn OFF the light, then adjust the trimmer).



### Verification of the work piece

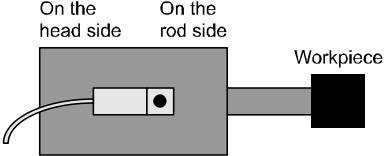
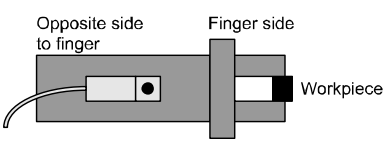
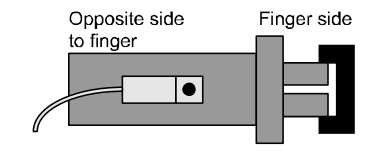
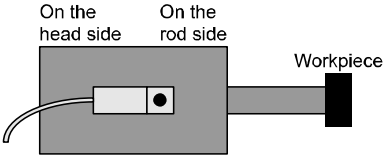
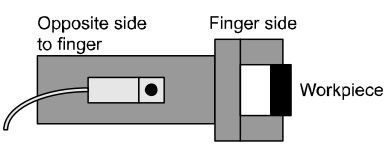
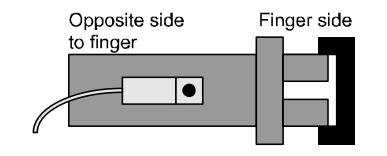
		OUT1 output (Detects the lower limit of the work piece)	OUT2 output (Detects the upper limit of the work piece)
[A]	Work piece size is correct (Conformant range)	<p>ON</p>  <p>(Work piece is larger than the lower limit. Conformance)</p>	<p>ON</p>  <p>(Work piece is smaller than the upper limit. Conformance)</p>
[B]	Work piece size is too large	<p>ON</p>  <p>(Work piece is larger than the lower limit. Conformance)</p>	<p>OFF</p>  <p>(Work piece is larger than the upper limit. Non-conformance)</p>
[C]	Work piece size is too small	<p>OFF</p>  <p>(Work piece is smaller than the lower limit. Non-conformance)</p>	<p>ON</p>  <p>(Work piece is smaller than the upper limit. Conformance)</p>
[D]	No work piece	<p>OFF</p>  <p>(Work piece is smaller than the lower limit. Non-conformance)</p>	<p>OFF</p>  <p>(Work piece is larger than the upper limit. Non-conformance)</p>



\*: The dimension for [A] should be 0.5 mm minimum in the stroke direction.

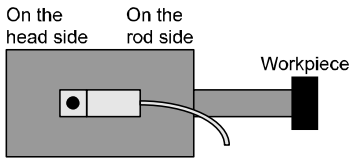
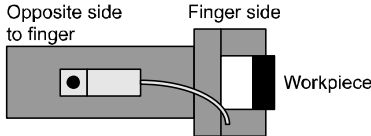
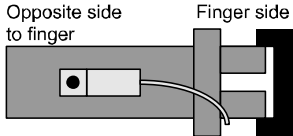
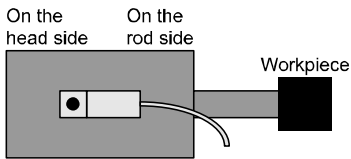
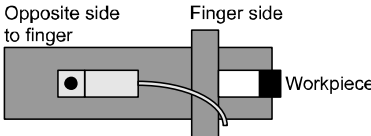
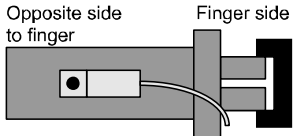
## ● Summary of setting (example)

Setting when the sensor wire is on the side away from the work piece

	When pushing with the cylinder		When holding on the outside (outer diameter)		When holding on the inside (inner diameter)				
OUT1	Adjust the trimmer while pushing the large work piece (thick or high).		Adjust the trimmer while holding the small work piece (thin).		Adjust the trimmer while holding the work piece with small I.D.				
				Cylinder magnet located close to the work piece.					
OUT2	Adjust the trimmer while pushing the small work piece (thin or low).		Adjust the trimmer while holding the large work piece (thick).		Adjust the trimmer while holding the work piece with large I.D.				
				Cylinder magnet located close to the head side.					
Judgement		OUT1	OUT2		OUT1	OUT2		OUT1	OUT2
	Work piece size is correct (Conformance range)	ON	ON	Work piece size is correct (Conformance range)	ON	ON	Work piece size is correct (Conformance range)	ON	ON
	Work piece size is small	ON	OFF	Work piece size is large	ON	OFF	I.D. is large	ON	OFF
	Work piece size is large	OFF	ON	Work piece size is small	OFF	ON	I.D. is small	OFF	ON
No work piece	OFF	OFF	No work piece	OFF	OFF	No work piece	OFF	OFF	

\*: These tables are not for guaranteeing the performance of the switch.  
Perform operation check after setting the switch.

Setting when the sensor wire is on the work piece side

	When pushing with the cylinder	When holding on the outside (outer diameter)	When holding on the inside (inner diameter)						
OUT1	Adjust the trimmer while pushing the small work piece (thin or low). 	Adjust the trimmer while holding the large work piece (thick). 	Adjust the trimmer while holding the work piece with large I.D. 						
	Cylinder magnet located close to the head side								
OUT2	Adjust the trimmer while pushing the large work piece (thick or high). 	Adjust the trimmer while holding the small work piece (thin). 	Adjust the trimmer while holding the work piece with small I.D. 						
	Cylinder magnet located close to the work piece side.								
Judgement		OUT1	OUT2		OUT1	OUT2		OUT1	OUT2
	Work piece size is correct (Conformance range)	ON	ON	Work piece size is correct (Conformance range)	ON	ON	Work piece size is correct (Conformance range)	ON	ON
	Work piece size is large	ON	OFF	Work piece size is small	ON	OFF	I.D. is small	ON	OFF
	Work piece size is small	OFF	ON	Work piece size is large	OFF	ON	I.D. is large	OFF	ON
No work piece	OFF	OFF	No work piece	OFF	OFF	No work piece	OFF	OFF	

\*: These tables are not for guaranteeing the performance of the switch.  
Perform operation check after setting the switch.



## Maintenance

### **How to reset the product after a power cut or when the power has been unexpectedly removed**

Regarding set up, contents of the program may be maintained by the customer's application systems. Be sure to confirm safety when returning operation of the actuator because it could have been stopped in an unstable condition.

Perform the following maintenance regularly to avoid possible danger due to unexpected product malfunction.

- Make sure that the Adjustment trimmer of the amplifier unit is set in the correct setting position.

- Check if the mounting bracket or mounting screws are loose.

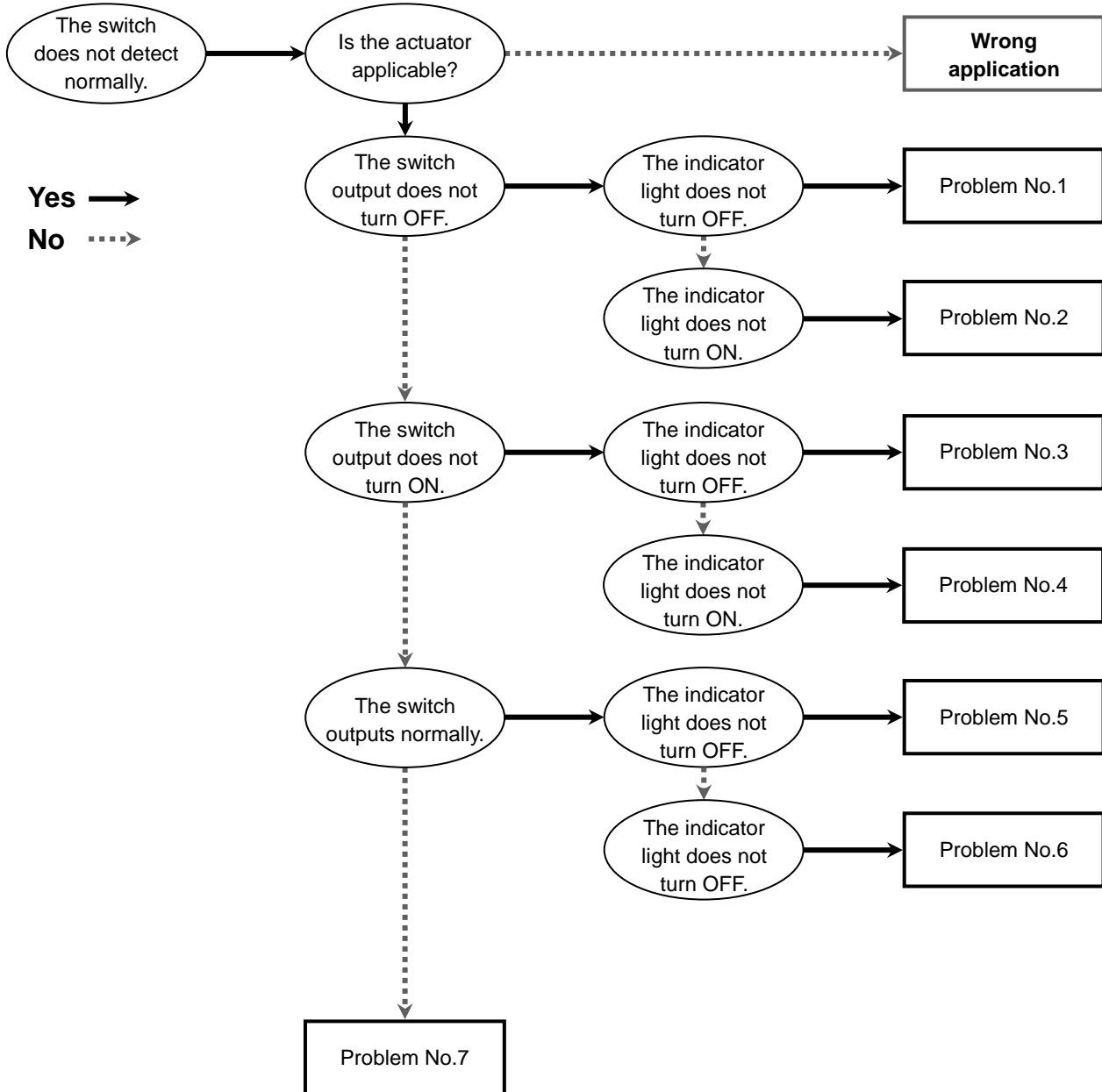
If the mounting bracket or mounting screws are loose, tighten them using the appropriate tightening torque.

- Make sure that the cable is not damaged.

A damaged cable may lead to insulation failure. Repair the cable or replace the product.

# Troubleshooting

With the product in operation, identify the problem from the following flow chart.  
 A failure of the product might depend on the operating environment (application etc.) and may need to be investigated by contacting SMC.



•Troubleshooting List

Problem No.	Problem	Possible cause	Countermeasure
1	The switch output does not turn OFF. The Indicator light does not turn OFF.	Malfunction due to magnetic field	Keep the actuator 40 mm or more away from adjacent actuators to avoid the influence of magnetic fields. Install a magnetic shielding plate between the actuators.  If a magnetic field source is present near the actuator (electric welding machine conductor, motor, strong magnet etc.), use a magnetic shielding plate between the magnetic field source and the actuator.
		Improper setting (mounting) position (Narrow angle)	When the product operation range is larger than the piston stroke range, position the product away from the centre of the operation range.
2	The switch output does not turn OFF. The Indicator light does not turn ON.	Product failure	Replace the Product.
3	The switch output does not turn ON. The Indicator light does not turn OFF.	Product failure	Replace the Product.
4	The switch output does not turn ON. The Indicator light does not turn ON.	Power supply failure	Supply the specified power supply voltage (when the power supply voltage is zero or very low).
		Incorrect wiring	Check and correct the wiring.
		Improper setting (mounting) position	If the product is operating near the limit of the operating range, position the product to the centre of the operating range.
		Displacement from the set position	If the mounting bracket or mounting screws are loose, tighten them using the appropriate tightening torque at the correct position.
		Displacement of the actuator stopping position	When the stop position of the actuator piston is inconsistent, take measures to stabilize the position.
		Reduction in magnetic detection force (demagnetization)	Keep the actuator 40 mm or more away from adjacent actuators to avoid the influence of magnetic fields. Install a magnetic shielding plate between the actuators.  If a magnetic field source is present near the actuator (electric welding machine conductor or strong magnet), use a magnetic shielding plate between the magnetic field source and the actuator.

Problem No.	Problem	Possible cause	Countermeasure
4	The switch output does not turn ON. The Indicator light does not turn ON.	Reduction in magnetic detection force (demagnetization)	Remove any magnetized substances such as cutting chips or spatter from around the actuator.
		Damaged cable	Replace the product. If repeated stress such as bending stress or tensile force is applied to the cable, take measures to protect the product.
5	The switch output is correct. The Indicator light does not turn OFF.	Product failure	Replace the Product.
6	The switch output is correct. The Indicator light does not turn ON.	Product failure	Replace the Product.
7	The operation is unstable. (chattering)	Improper setting (mounting) position	If the product is operating near the limit of the operating range, position the product to the centre of the operating range.
		Displacement from set position	If the mounting bracket or mounting screws are loose, tighten them using the appropriate tightening torque at the correct position.
		Incorrect wiring	Check and correct the wiring.
		Damaged cable	Replace the product. If repeated stress such as bending stress or tensile force is applied to the cable, take measures to protect the product.
		Malfunction due to magnetic field	Keep the actuator 40 mm or more away from adjacent actuators to avoid the influence of magnetic fields. Install a magnetic shielding plate between the actuators.
	If a magnetic field source is present near the actuator (electric welding machine conductor, motor, strong magnet etc.), use a magnetic shielding plate between the magnetic field source and the actuator.		
	The Sensor turns ON even when the piston magnet is not in the operating range. (or the product operates at multiple points).	Malfunction due to magnetic field	Keep the actuator 40 mm or more away from adjacent actuators to avoid the influence of magnetic fields. Install a magnetic shielding plate between the actuators.
If a magnetic field source is present near the actuator (electric welding machine conductor, motor, strong magnet etc.), use a magnetic shielding plate between the magnetic field source and the actuator.			

# Specification

## ■ Specifications

### Specifications for sensor unit

Model	D-M9K	D-F7K	D-Y7K
Mounting	Direct mount (round groove)	Rail mounting	Direct mount (square groove)
Applicable amplifier unit	D-RNK, D-RPK		
Impact resistance	980 m/s <sup>2</sup>		
Insulation resistance	50 MΩ or more under the test voltage 500 VDC (between case and cable)		
Withstand voltage	1000 VAC 1min (between case and cable)		
Ambient temperature	-10 to 60 °C		
Enclosure	IP67		
Weight	55 g (including connector)	58 g (including connector)	
Standards	CE		

### Specifications for amplifier unit

Model	D-RNK	D-RPK
Applicable amplifier unit	D-M9K, D-Y7K, D-F7K	
Applicable load	Relay · PLC	
Voltage output	12 to 24 VDC	
Current output	40 mA or less	
Output type	NPN 2 output	PNP 2 output
Load voltage	28 V or less	-
Load current	80 mA or less / 1 output	
Internal voltage drop	1.5 V or less	
Leakage current	100 μA or less / 1 output	
Response time	1 ms or less	
Impact resistance	98 m/s <sup>2</sup>	
Insulation resistance	50 MΩ or more under the test voltage 500 VDC (between case and cable)	
Withstand voltage	1000 VAC 1min (between case and cable)	
Ambient temperature	-10 to 60 °C	
Enclosure	IP40	
Weight	70 g	
Standards	CE	

### Oil proof flexible cable (sensor unit and amplifier unit)

Sheath	Outside diameter	φ3.5 mm
Insulator	Colours	Brown, Blue, Black, White
	Diameter	φ1 mm
Conductor	Nominal cross section area	0.15 mm <sup>2</sup> (AWG26)
	Wire diameter	φ0.08 mm
Minimum bending radius (Reference value)		21 mm

■ Applicable actuator and operating range

**Sensor unit: D-M9K**

Air gripper

(Values shown for the auto switch operating range used with air grippers includes the range for both fingers opening.)  
Unit: mm or degree ( ° )

Series	Tube I.D.										
	10	16	20	25	32	40	50	63	80	100	125
MHZ2	-	3.0	5.5	6.5	8.0	7.5	-	-	-	-	-
MHZJ2	-	3.0	5.5	6.5	-	-	-	-	-	-	-
MHS2 (2 fingers) *1	-	-	4.0	4.0	6.5	6.5	8.0	6.5	-	-	-
MHS3 (3 fingers) *1	-	-	5.0	4.0	6.5	6.5	8.0	6.5	7.5	7.5	7.5
MHS4 (4 fingers) *1	-	-	5.0	3.0	6.5	6.5	8.0	6.5	-	-	-
MHC2 *2	-	-	-10° to 16°	-10° to 11°	-	-	-	-	-	-	-

Air cylinder

Unit: mm

Series	Tube I.D.										
	12	16	20	25	32	40	50	63	80	100	125
CQ2-Z	3.5	4.5	4.5	5.0	5.5	5.0	5.0	6.0	6.0	6.0	7.5
CQM	3.5	4.0	4.5	4.5	5.0	5.0	5.0	6.0	5.5	6.0	-
RZQ	-	-	-	-	5.0	5.0	5.0	5.5	-	-	-
MK-Z	3.0	3.5	3.5	4.0	4.5	4.0	4.5	4.5	-	-	-
MGP-Z	3.5	5.0	4.5	5.0	5.5	5.5	5.5	5.5	5.5	5.5	-
MGZ □2	-	-	3.5	4.5	4.5	4.5	5.0	5.5	5.5	-	-

Series	Tube I.D.			
	140	160	180	200
CQ2-Z	7.5	8.0	7.0	7.0
CQM	-	-	-	-
RZQ	-	-	-	-
MK-Z	-	-	-	-
MGP-Z	-	-	-	-
MGZ *2	-	-	-	-

\* : The range of operation is a standard including hysteresis, and is not guaranteed.

\*1: Bore sizes 32 and higher for the MHS series require a separate mounting bracket. (Bracket Part number: BMG2-012)

\*2: All bore sizes for the MGZ and MHC series require a separate mounting bracket. (Bracket Part number: BMG2-012)

### Sensor unit: D-Y7

Air gripper

(Values shown for the auto switch operating range used with air grippers includes the range for both fingers opening.)

Unit: mm or degree ( ° )

Series	Tube I.D.										
	10	12	16	20	25	32	40	50	63	80	100
MHZ2	3.0	-	5.0	7.0	7.0	8.0	8.5	-	-	-	-
MHZL2	6.0	-	7.0	10.0	11.0	-	-	-	-	-	-
MHL2	7.0	-	8.0	8.5	10.5	11.0	12.5	-	-	-	-
MHS2	-	-	-	-	-	6.5	7.0	7.5	8.5	-	-
MHS3, MHS(L)3	-	-	-	-	-	6.5	7.0	7.5	8.0	-	-
MHS4	-	-	-	-	-	6.5	7.0	7.5	8.5	-	-
MHC2	30° to -10°	-	30° to -10°	30° to -10°	22.5° to -10°	-	-	-	-	-	-
MHW2	-	-	-	88° to -5°	54° to -6°	58° to -5°	41° to -5°	30° to -4°	-	-	-

Air cylinder

Unit: mm

Series	Tube I.D.										
	10	12	16	20	25	32	40	50	63	80	100
MGP	-	3.5	5.0	4.5	4.5	5.5	5.5	5.5	5.5	5.5	6.0
MGZ	-	-	-	-	-	-	5.5	6.5	6.5	-	-
CA2	-	-	-	-	-	-	4.0	4.0	6.0	6.0	6.0

### Sensor unit: D-F7K

Air cylinder

Unit: mm

Series	Tube I.D.													
	10	12	16	20	25	32	40	50	63	80	100	125	140	160
CJ2	4.0	-	4.5	-	-	-	-	-	-	-	-	-	-	-
CM2 *3	-	-	-	3.5	3.5	3.5	3.5	-	-	-	-	-	-	-
CQ2 *4	4.5	4.5	5.5	5.5	5.0	5.5	5.5	5.5	6.0	5.5	6.0	7.5	7.5	7.5
MU	-	-	-	-	5.5	6.5	6.5	6.5	6.5	-	-	-	-	-
MK MK2	-	-	-	5.0	5.0	6.5	6.0	6.0	6.5	-	-	-	-	-

\* : The range of operation is a standard including hysteresis, and is not guaranteed.

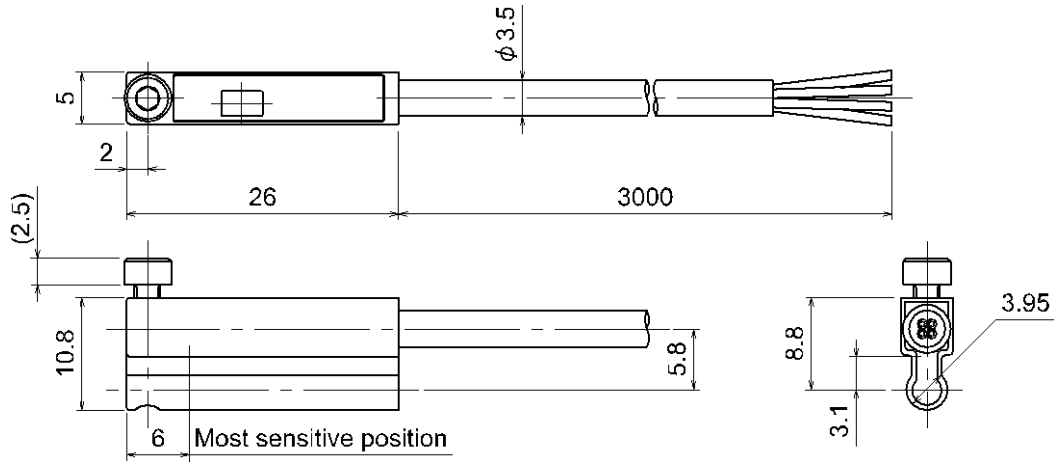
\*3: For CM2, use made-to-order product (-XC13: Rail mounting type)

\*4: CQ2□□□□-□□□Z-□ series is not applicable.

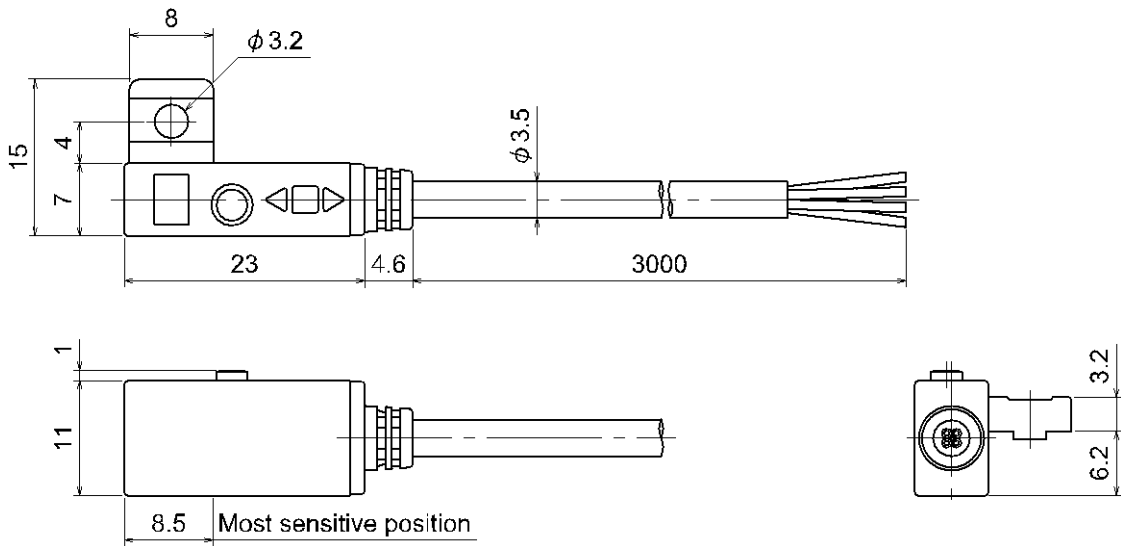
When using with a CA2, CM2 or CQ2 Series, apply a non-rotation mechanism to the rod.  
(When a non-rotation rod type is used, this is not necessary).

■ Dimensions

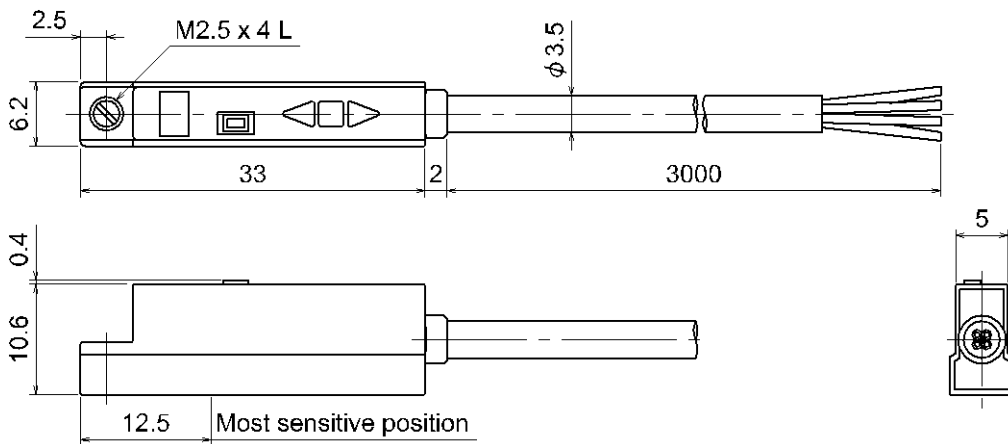
D-M9K



D-F7K

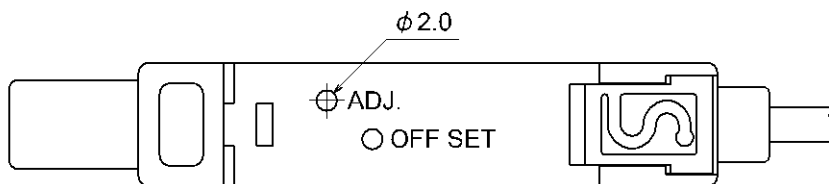
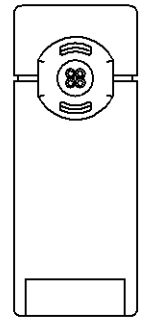
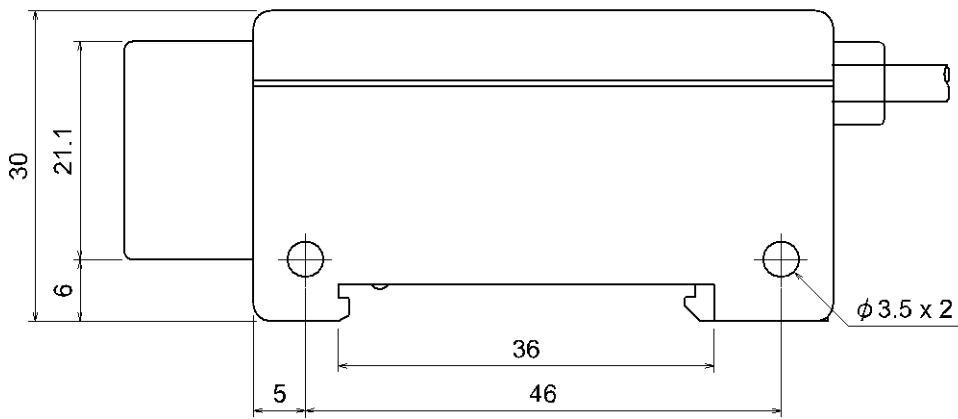
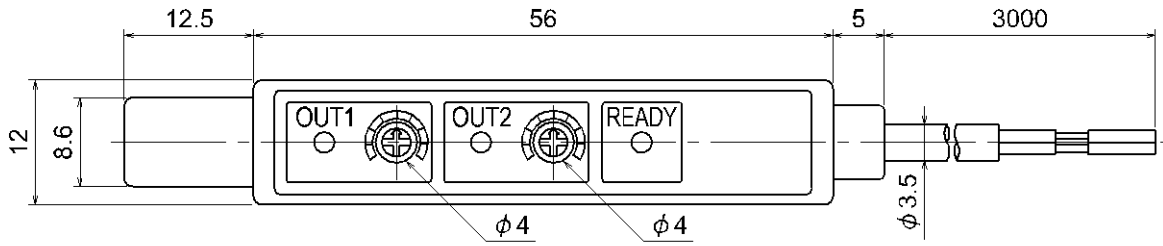


D-YF7K





D-R□K



#### Revision history

- A: Contents changed due to the change of the format.
- B: Add the product model.
- C: Add the note. [November 2020]

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