No.D-#S-OMG0006-A

Operation Manual

PRODUCT NAME

Trimmer Auto Switch

MODEL / Series / Product Number

D-F7K/D-Y7K
D-RNK/D-RPK

SMC Corporation

Table of Contents

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 10218-1992: 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.

⚠ Caution

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.
- Ensure the flow is shut off 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 auto switch mounting screws.
If the screws have become loose and the required mounting position has been lost, re-adjust the auto switch to the correct mounting position and re-tighten the screws.

2) Check that there is no damage to the lead wire.
If damage to the lead wire is found, replace the auto switch, or repair the lead wire, to avoid faulty insulation.

3) Check the detecting position setting.
Confirm that the auto switch ON/OFF position is at the centre of the operating range (green LED range).
If the auto switch operates with a red LED on at the ON/OFF position, the mounting position is not correct.
Re-adjust the auto switch 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 auto switch will operate at an intermediate stroke position.

When an auto switch is placed at an intermediate stroke position, and a load is driven during the time when the piston passes, the auto switch 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:

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

•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 auto switches 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 auto switch cannot be mounted due to physical interference (e.g. rear side of the foot bracket), depending on the mounting conditions of the actuator. Select an auto switch after confirming that the switch 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 wire 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 switch construction.

•For trimmer auto switches, 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 an auto switch with built-in surge protection.

•Pay attention to the internal voltage drop of the switch.

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

•The solid state auto switch 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 auto switch may be damaged or malfunction if it is dropped, bumped or applied with excessive impact (300 m/s^2 or more for reed switches, and 1000 m/s^2 or more for solid state switches).

•Observe the required tightening torque for mounting an auto switch.

If an auto switch is tightened beyond the specified tightening torque, the auto switch, mounting screws, or mounting bracket may be damaged.

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

•Do not carry an actuator by the auto switch lead wire.

This may cause a broken lead wire or damage to the auto switch internal elements.

•Use only the screws installed in the auto switch body for mounting the auto switch.

If other screws are used, the auto switch may be damaged.

•Set the trimmer auto switch based on the instructions for the cylinder or actuator.

Mounting the auto switch 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 auto switches with 2-colour display, the operation may be unstable due to the installation environment and the effects of disturbance, even if the switch is mounted in the correct operating range (green LED 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 auto switch operation during installation.

The auto switch may not operate in the correct actuator mounting position due to the installation environment. Also check and adjust the auto switch 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

•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 auto switch due to over current.

•Do not route the auto switch wiring in the same place as power cables or high voltage cables.

Otherwise auto switch malfunction may result due to noise and inrush current.

•Avoid repeatedly bending or stretching the lead wire.

Wiring with repetitive bending stress or tensile stress can cause broken lead wire or peel of a sheath. If the lead wire can move, fix it near the body of the Auto switch.

•Turn the power ON after connecting a load.

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

•Avoid incorrect wiring

If connections are reversed (power supply wire + and -), the switch 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 auto switch will be damaged.

∗Environment

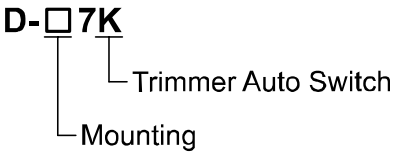
- Do not use in a location where magnetic fields are generated.
  Auto switches will malfunction or the magnets inside actuators will become demagnetized.
- Do not use in an environment where the auto switch will be continually exposed to water.
  Although auto switches satisfy the IEC standard IP67 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 auto switches 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 lead wires.
- Do not use in an environment where there are cyclic temperature changes.
  Temperature cycles other than normal temperature changes can adversely affect the auto switch 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 auto switch to malfunction due to a weakening of the magnetic force inside the actuator.
- Contact SMC for information regarding auto switch water resistance, elasticity of lead wires, applications in welding sites, etc.
- Do not use in direct sunlight.
- Do not mount the auto switch in locations where it is exposed to radiant heat.
- The auto switch 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 auto switch internal circuit
- Do not install this product in a place subject to vibration and impact. (980 m/s^2 or less for the sensor, 98 m/s^2 or less for the amplifier)
  The internal parts can be damaged leading to malfunction even if the sensor body is not damaged.
- Take appropriate measure to prevent freezing when the operating temperature is 5 ^{o}C or less.

∗Maintenance

- Do not use solvents such as benzene, thinner, alcohol etc. to clean the auto switch.
  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

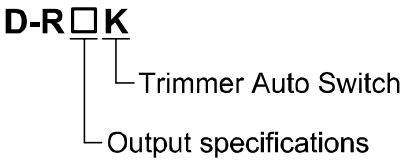
○Sensor unit



F	Rail mounting
Y	Direct mount to square groove

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

○Amplifier unit



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

○Accessories (Option)

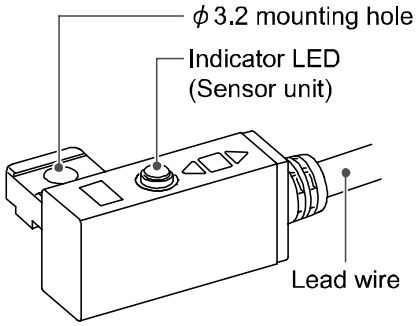
Product number	Contents	Remarks
ZS-28-C-1	Sensor Connector (e-con)	1 pc.
D-MS-A	Mounting thread (M2.5 × 4 L, Steel (Black zinc chromate))	1 pc.
D-MS-AP	Mounting thread (M2.5 × 4 L, Steel (Black zinc chromate))	10 pcs.
D-MS-B	Mounting thread (M2.5 × 4 L, SUS)	1 pc.
D-MS-BP	Mounting thread (M2.5 × 4 L,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

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

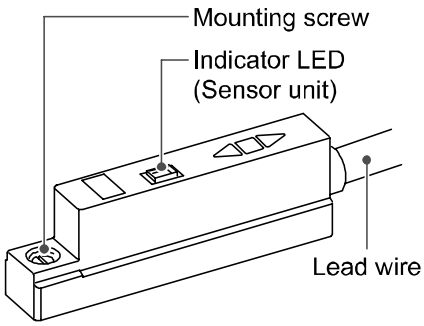
Summary of Product parts

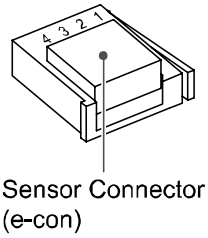
○Sensor unit

D-F7K



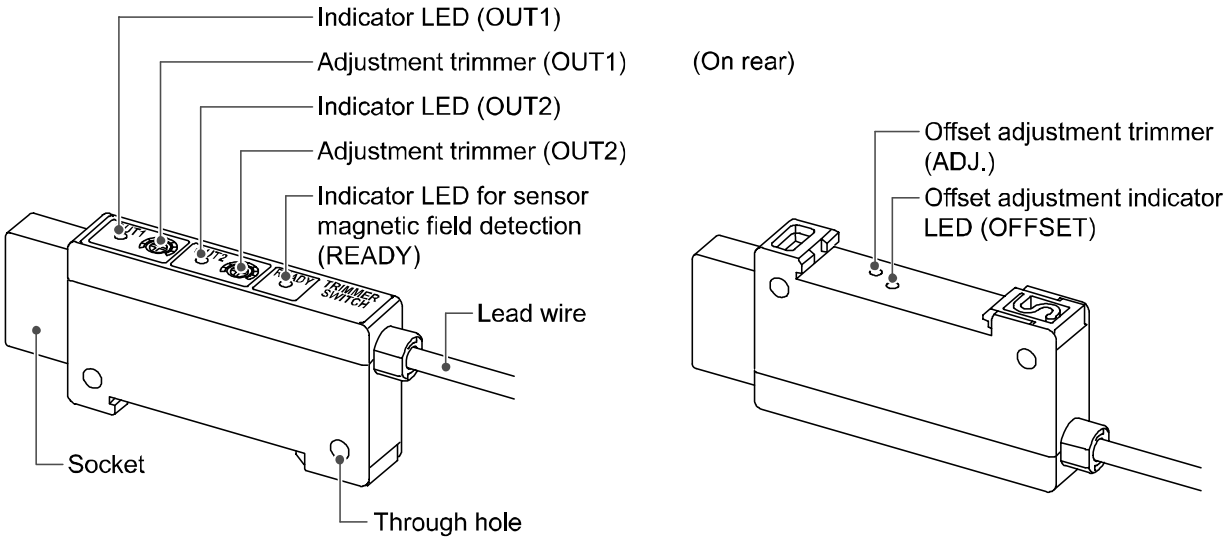
D-Y7K





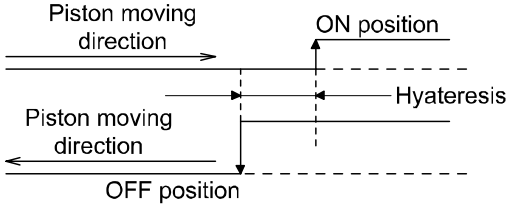
Description	Function
Indicator LED (Sensor unit)	The indicator is ON in red or green when the sensor detects the magnetic field.
ϕ3.2 mounting hole	Hole for mounting the switch to the actuator rail. (Use the mounting bracket included with the actuator)
Mounting screw	Slotted set screw for securing the sensor in the square groove in the actuator (M2.5 × 4 L).
Lead wire	Lead wire for power supply and outputs. (3 m)
Sensor Connector (e-con)	Sensor Connector supplied loose with the product (but shipped together).

○Amplifier unit



Description	Function
Indicator LED (OUT1)	Indicates the output status of OUT1. LED is ON (Green) when the output is ON.
Adjustment trimmer (OUT1)	Adjusts the detection range of OUT1.
Indicator LED (OUT2)	Indicates the output status of OUT2. LED is ON (Orange) when the output is ON.
Adjustment trimmer (OUT2)	Adjusts the detection range of OUT2.
Indicator LED for sensor magnetic field detection (READY)	The indicator LED is ON (Red) when the sensor detects the magnetic field. The detection ranges of OUT1 and OUT2 should be adjusted when this LED is ON.
Lead wire	Lead wire for power supply and outputs. (3 m)
Through hole	Used for direct mounting.
Socket	For connecting the sensor connector.
Offset adjustment trimmer (ADJ.)	This is used when the sensor is connected for the first time. Refer to Offset adjustment (page 17) for details.
Offset adjustment indicator LED (OFFSET)	The indicator LED is ON (Red) when the adjustment is completed.

■Definition and terminology

	Terms	Meaning
2	2-colour indication	Indication in which a red LED is ON in the operating position, and a green LED is ON in the optimum operating range. 
H	Hysteresis	The difference between the points where the Auto switch turns on and off, which is provided to prevent chattering. 
I	Internal voltage drop	The voltage applied between the COM and signal line when the Auto switch turns on.
L	Load current	The current flowing to the load when the Auto switch turns on.
M	Most sensitive position	The centre position of the sensor unit (which gets the strongest reaction from the sensor), which also means the centre position of the operating range.
N	Non-polarity	A 2-wire type of connection for which polarity is not important. For example 2-wire connection, 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 Auto switch along with programming and sending of the output to other machines.
	Solid state Auto switch	Auto switch which generates on and off outputs with or without mechanical contact by using for example a transistor.

Mounting and Installation

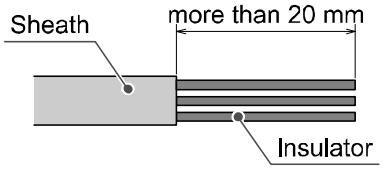
■Wiring

- 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

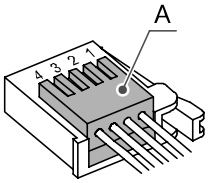
- Strip the sensor wire as shown. Do not cut the insulator.



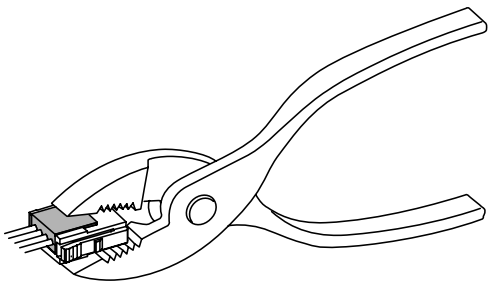
- Insert the corresponding wire colour shown in the table into the pin number printed on the sensor connector, to the bottom.

Pin number on connector	Wire colour (D-F7K/D-Y7K)	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.



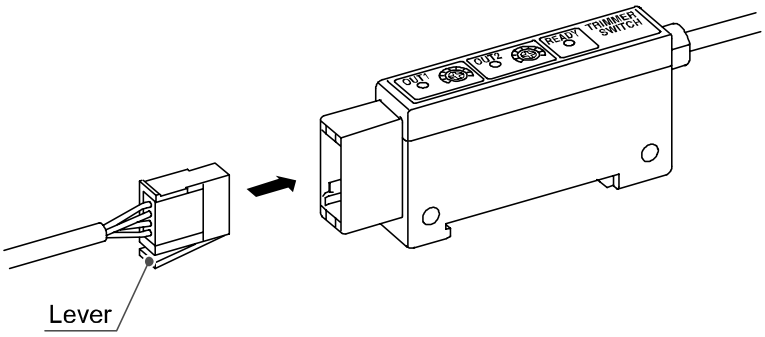
- Part A should then be pressed in using a suitable tool, such as pliers.



- 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 the new connector.

●Installation / Removal of the sensor connector to the amplifier

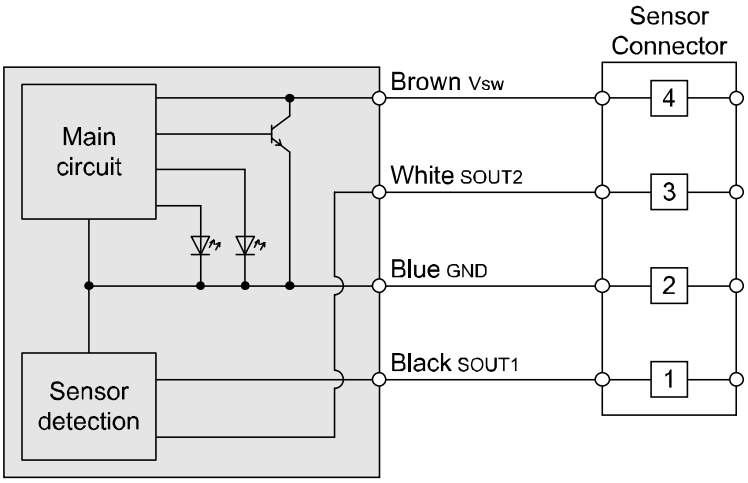
- When connecting, insert the sensor connector straight into the housing until it clicks.
- When removing the connector, press down the lever to release the hook from the housing and pull the connector straight out.



■Internal circuit and wiring example

○Sensor internal circuit

D-□7K



○Amplifier internal circuit

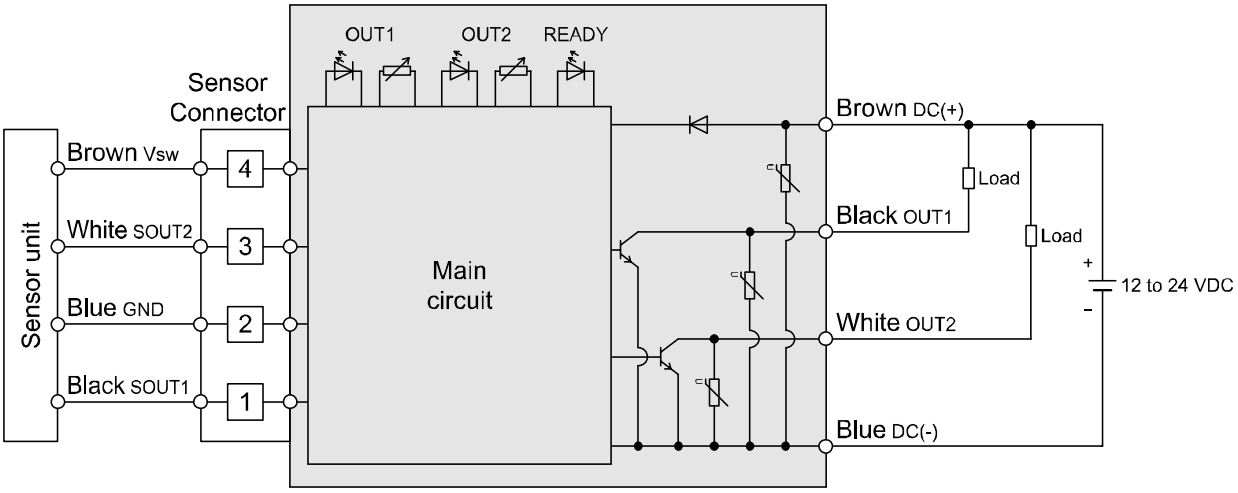
NPN (2 output) type

D-RNK:

Max. load current: 80 mA

Max. applied voltage: 28 V

Internal voltage drop: 1.5 V or less

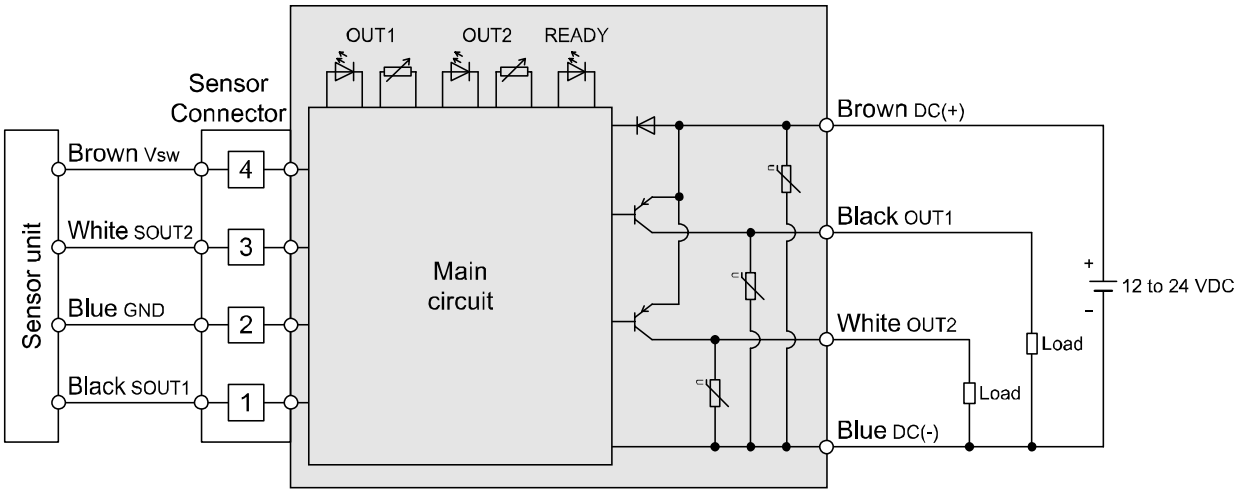


PNP (2 output) type

D-RPK:

Max. load current: 80 mA

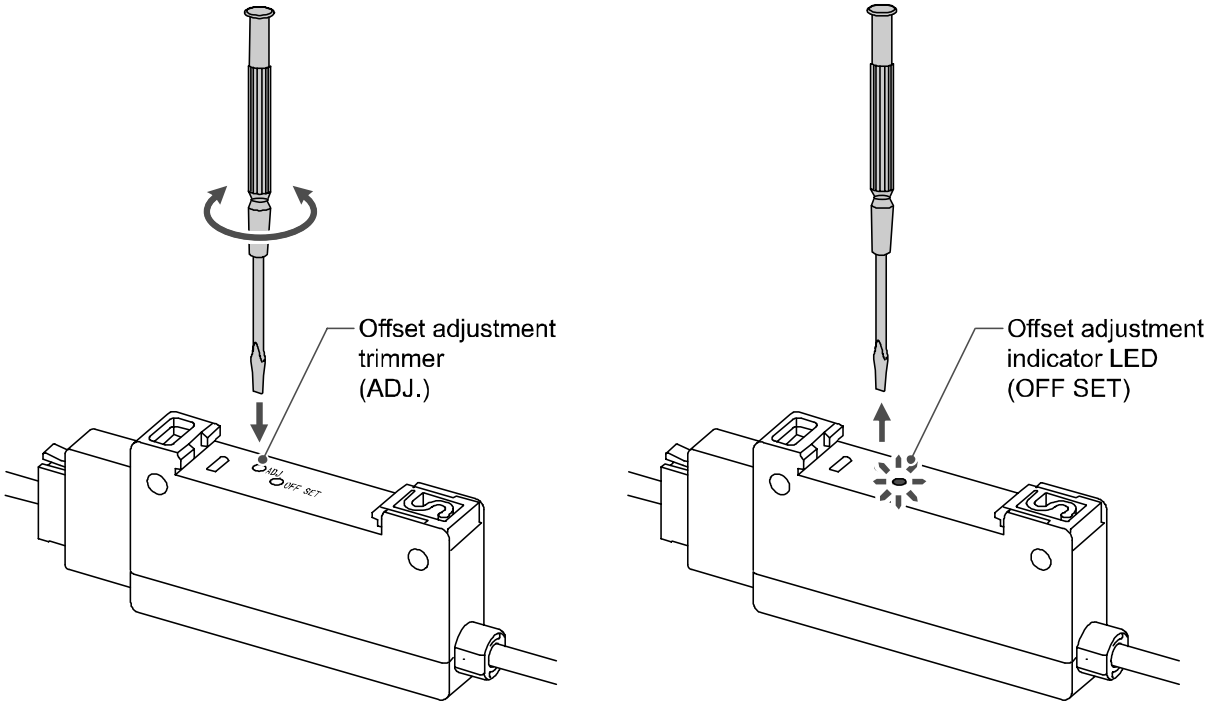
Internal voltage drop: 1.5 V or less



■Offset adjustment

[Note] When the sensor is mounted to the actuator, remove the sensor from the actuator so that no magnetic field is present. Keep the sensor away from any magnetic field as far as possible because the sensor may detect a magnetic field even when the operation LED is not ON.

(1)Connect the sensor to the amplifier, and connect the amplifier wiring to the power supply.
(2)Insert a precision screwdriver into the offset adjustment trimmer (ADJ.) to turn the trimmer clockwise or counterclockwise.
Be careful where the screwdriver is inserted. Inserting the screwdriver into the offset adjustment indicator LED (OFFSET) may damage the LED.
Rotation torque applied to the offset adjustment trimmer must be 20 mN•m or less. Effective rotation is 12 turns.
The offset adjustment trimmer does not have any rotational stop. If the desired adjustment is not made by rotating in one direction, then try the other direction.
(3)When the offset adjustment indicator LED is red, adjustment is complete.



Offset Adjustment
- Offset Adjustment is the optimization of the electrical reference point of the sensor.
- 2 sensors are built into the trimmer sensor (D-F7K / D-Y7K). As there is individual differences between any 2 switches, there will be an offset between their reference points. This difference is corrected by the offset adjustment trimmer.
- Without offset adjustment, on/off of the output signal cannot be operated correctly.
- When the sensor is used for the first time, always perform offset adjustment.
- After the adjustment, further adjustment is not necessary unless the sensor is replaced.

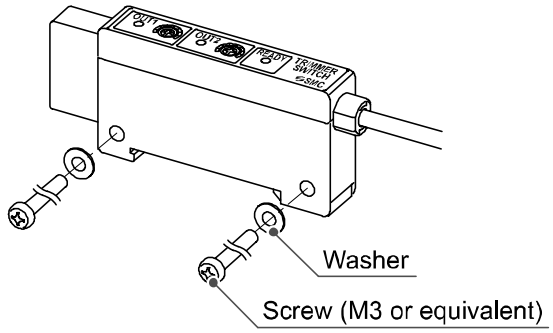
■Installation

●Installation of the amplifier

•Perform offset adjustment before the installation of the amplifier. See page 17.

○Direct installation

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

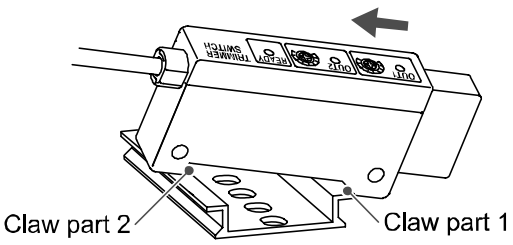


○Installation of DIN rail

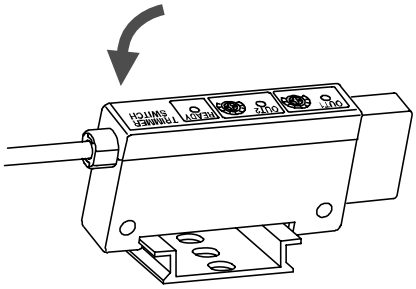
Mounting

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

(1)



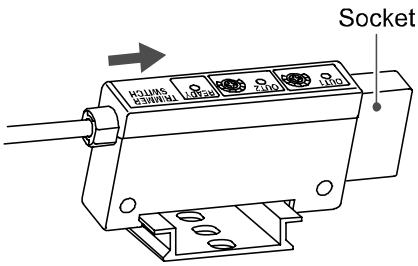
(2)



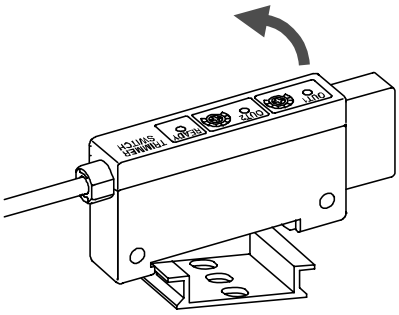
Removal

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

(1)



(2)

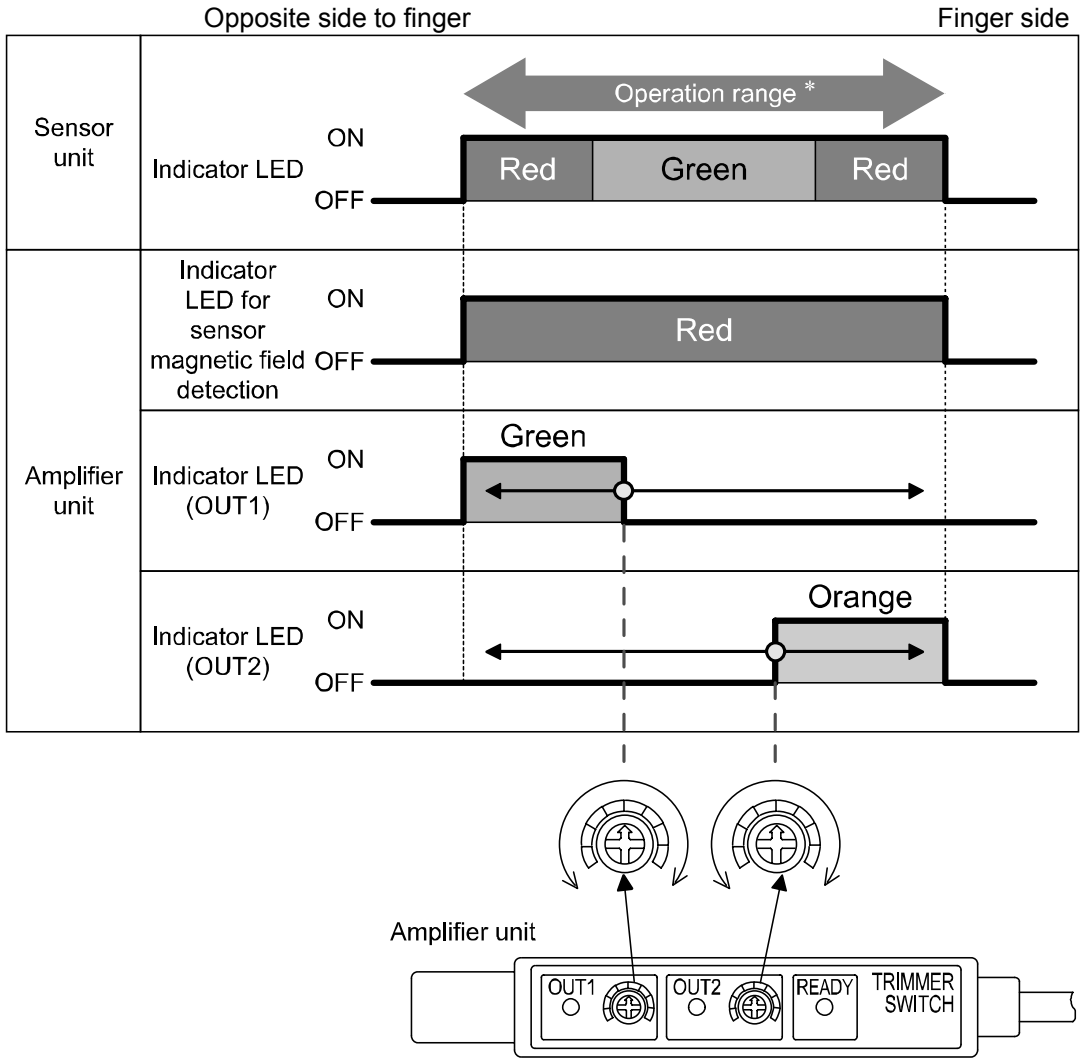


∗: We recommend using an end plate when mounting onto DIN rail. Refer to DIN rail end plate manufacturers for further details.

■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 varying the detection range of OUT1 and OUT2 within the operation range using the adjustment trimmer. (See below)



∗: As for standard products, the operation range depends on the actuator and bore size. It cannot be varied.

- Appropriate adjustment trimmer value is 2 to 20 mN•m. Maximum value is 260 degrees. Make adjustment within the specification range.
- The scale of the trimmer does not show the operation range. Please 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.
- Detection range may vary depending on the air supply pressure, variation of the ambient magnetic field, or the presence of any magnetic material.
- Minimum detection width is 0.5 mm. This product is not applicable when the size difference of the work piece is less than 0.5 mm in stroke direction.
- This product is not suitable for work pieces with unstable shapes such as rubber parts.

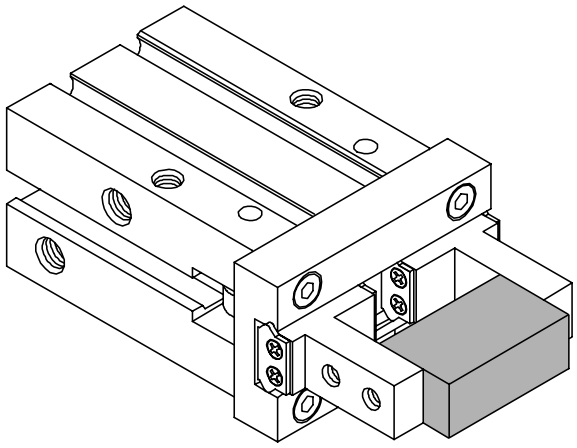
●Setting procedure 1

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

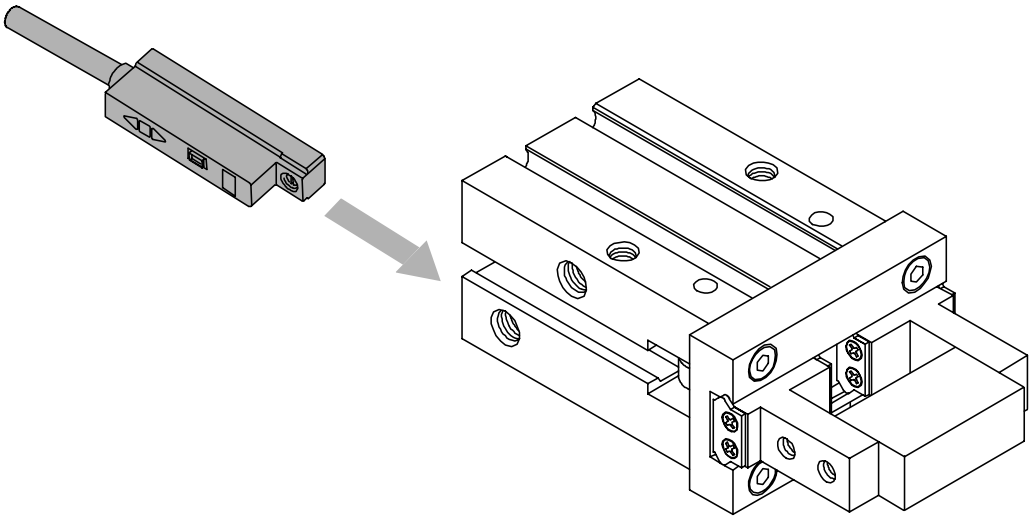
<<Verify 4 work pieces below using Air Gripper (MHZ2 series)>>

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

(1)Hold the maximum conformant work piece by applying air.

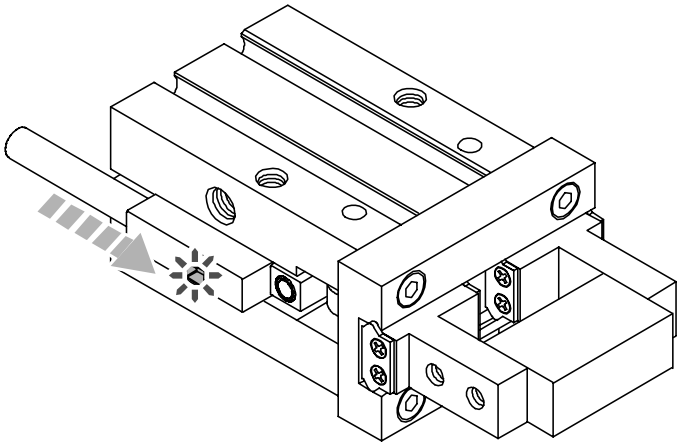


(2)Insert the sensor into the mounting groove. (Figure below) *

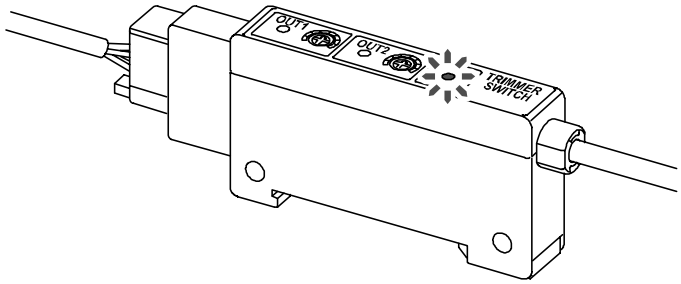


*: The relationship between OUT1 and OUT2 is reversed if the mounting direction is opposite. Detection range may change. Operation check with actual equipment should be performed as the location of OUT1 and OUT2 is reversed depending on the air gripper structure.

(3)Position the sensor within the range where the sensor indicator LED is green.

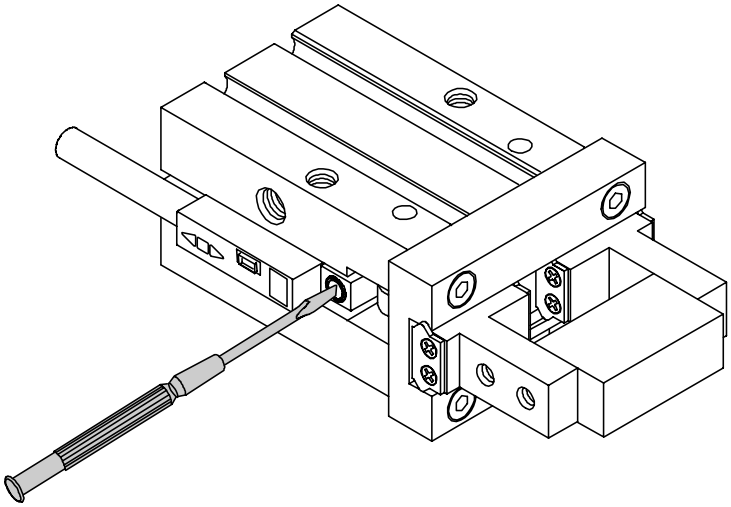


(4)Make sure that the indicator LED for sensor magnetic field detection at the amplifier (READY) is on.



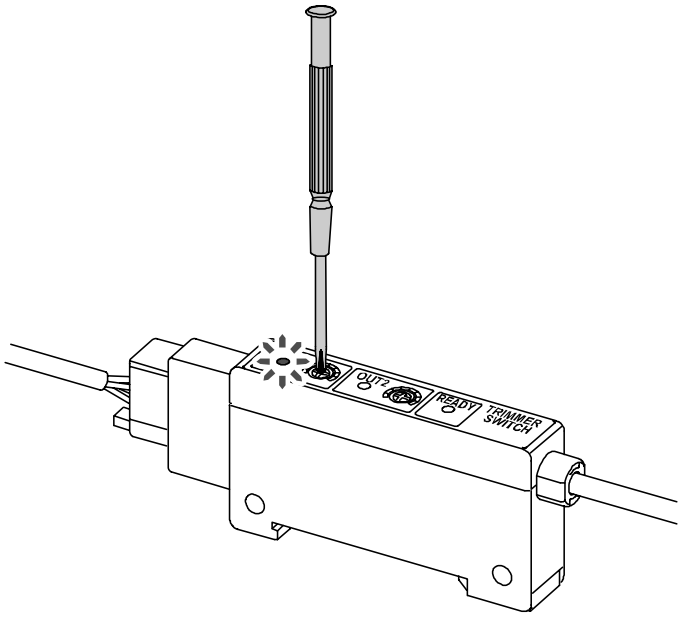
(5)Fix the sensor with the mounting screw or a mounting bracket.
Refer to the table below for the tightening torque.

Model	Mounting	Tightening torque
D-Y7K	Mounting screw included with the sensor (M2.5)	0.05 to 0.1 N•m

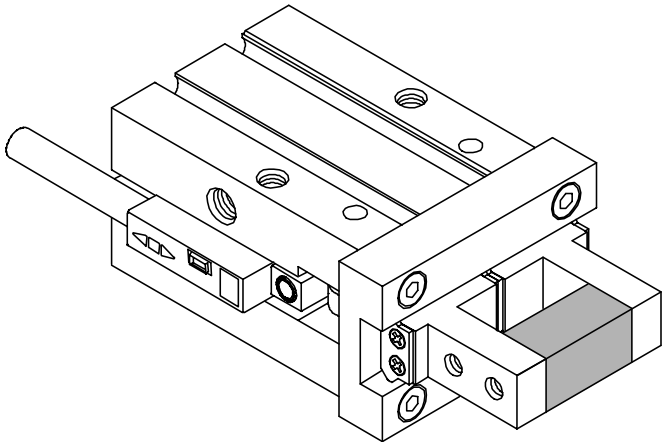


∗: "How to mount" depends on the actuator type and tube I.D. Please refer to the actuator catalogue.

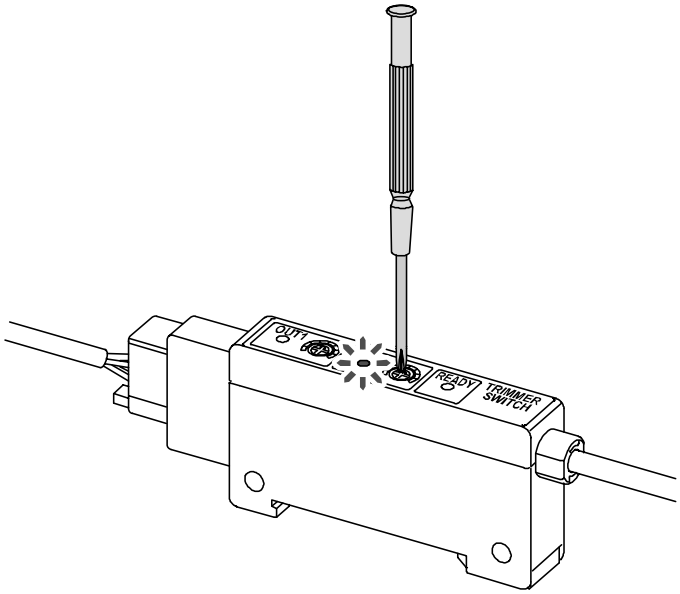
(6)Turn the adjustment trimmer (OUT1) with a screwdriver. Stop turning the screwdriver when the indicator LED (OUT1) is ON.
(If the indicator LED (OUT1) is already on, turn the trimmer to turn off the LED, then adjust the trimmer).



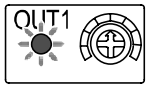
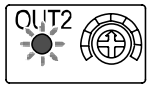
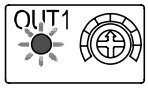
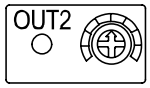
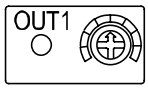
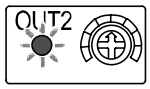
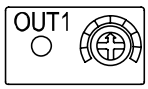
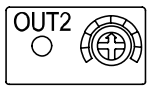
(7)Replace the held maximum work piece with the minimum conformant work piece.

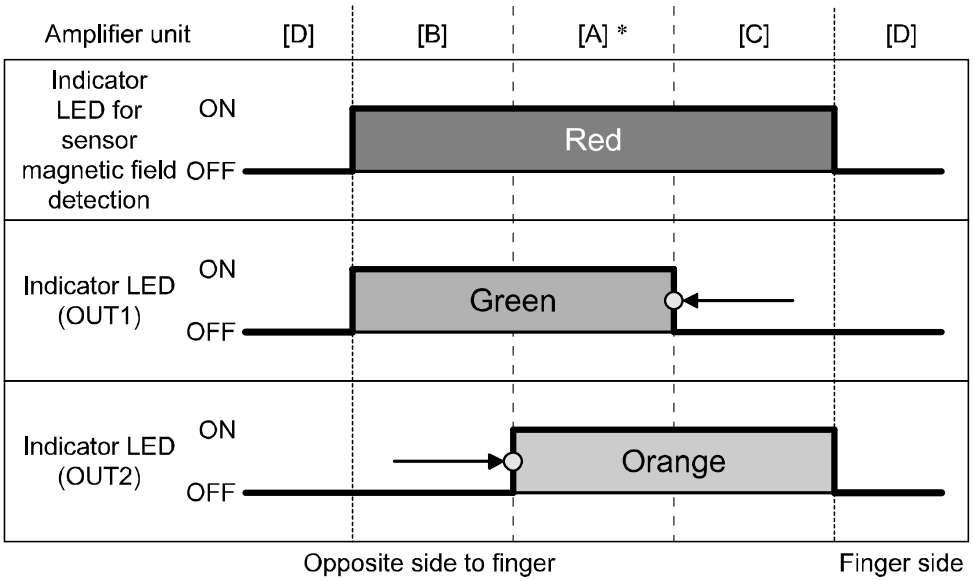


(8)Turn the adjustment trimmer (OUT2) with a screwdriver. Stop turning the screwdriver when the indicator LED (OUT2) is ON.
(If the indicator LED (OUT2) is already on, turn the trimmer to turn off the LED, then adjust the trimmer).



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)	ON  (Work piece is smaller than the upper limit. Conformance)	ON  (Work piece is larger than the lower limit. Conformance)
[B]	Work piece size is too small	ON  (Work piece is smaller than the upper limit. Conformance)	OFF  (Work piece is smaller than the lower limit. Non-conformance)
[C]	Work piece size is too large	OFF  (Work piece is larger than the upper limit. Non-conformance)	ON  (Work piece is larger than the lower limit. Conformance)
[D]	No work piece	OFF  (Work piece is larger than the upper limit. Non-conformance)	OFF  (Work piece is smaller than the lower limit. Non-conformance)



∗: The width for [A] should be 0.5 mm or longer in the stroke direction.

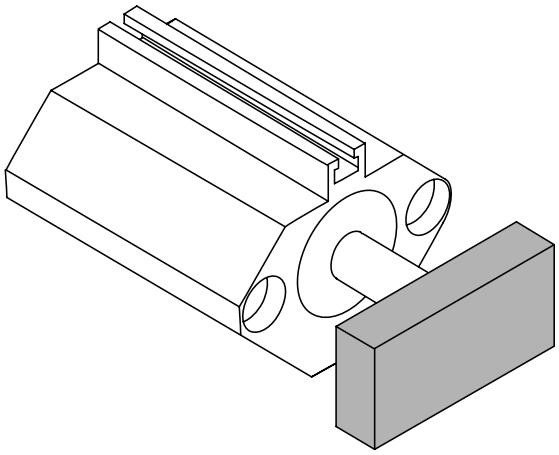
●Setting procedure 2

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

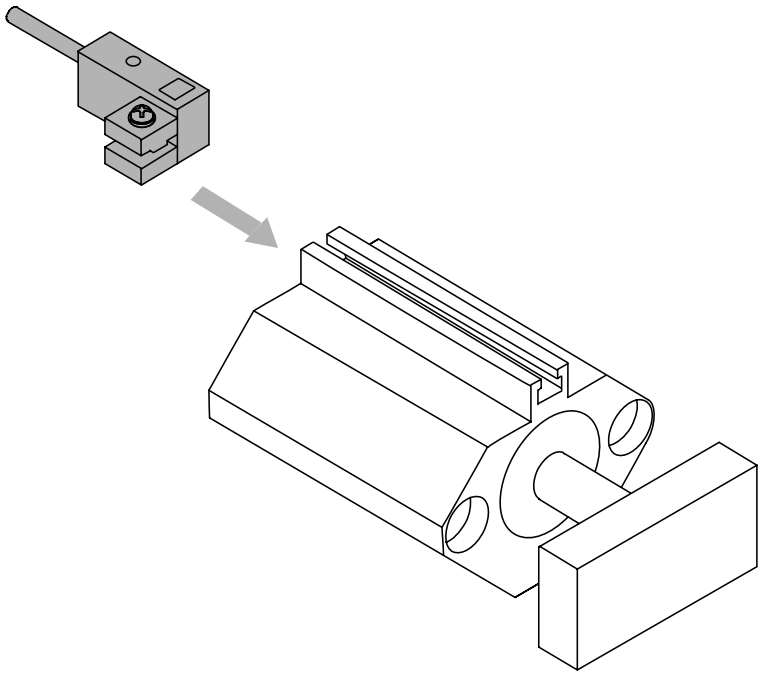
<<Verify 4 work pieces below using Air Gripper (CQ2 series)>>

[A]	Work piece size is correct
[B]	Work piece is too thick
[C]	Work piece is too thin
[D]	No work piece

(1)Push the thinnest conformant work piece by supplying air.

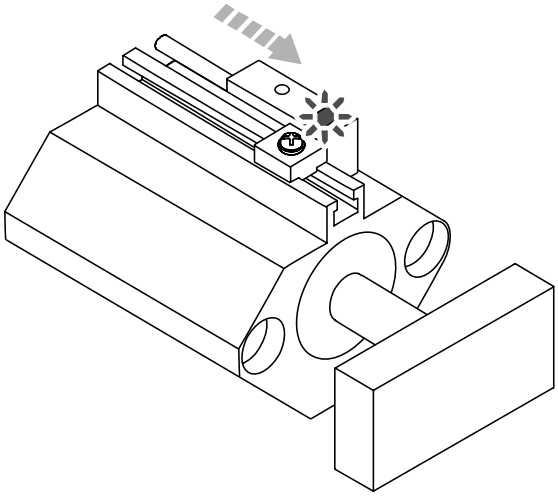


(2)Insert the sensor into the mounting groove. (Figure below) *

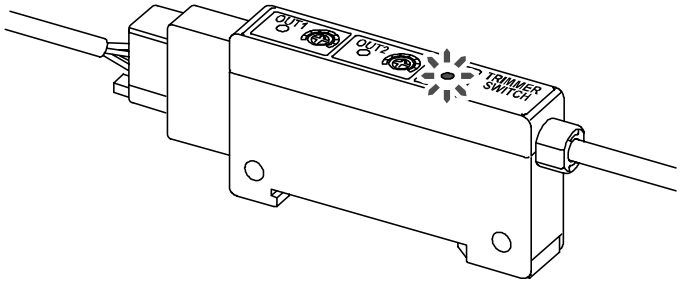


*: The relationship between OUT1 and OUT2 is reversed if the mounting direction is opposite. Detection range may change. Operation check with actual equipment should be performed as the location of OUT1 and OUT2 is reversed depending on the cylinder structure.

(3)Slide the sensor from the finger side to the opposite side and position the sensor where the indicator LED changes from red to green.

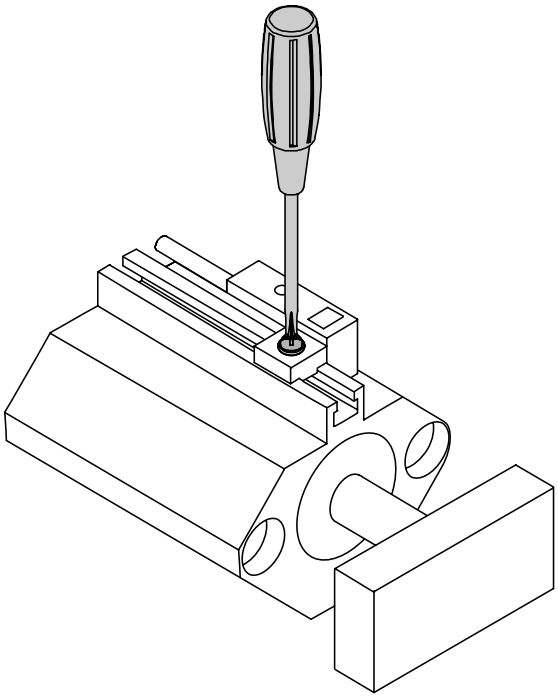


(4)Make sure that the indicator LED for sensor magnetic field detection at the amplifier (READY) is ON.



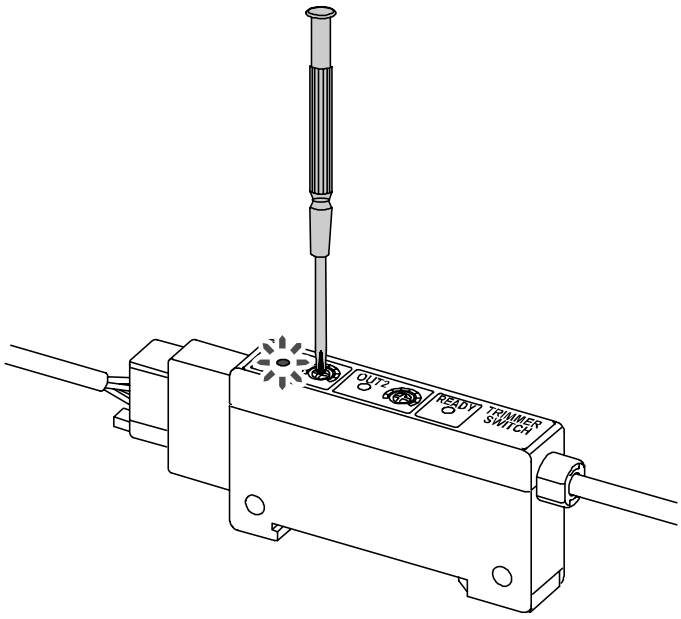
(5)Fix the sensor using the mounting screw or a mounting bracket.
Refer to the table below for the tightening torque.

Model	Mounting	Tightening torque
D-F7K	Mounting bracket + Mounting screw (M3)	0.5 to 0.7 N•m

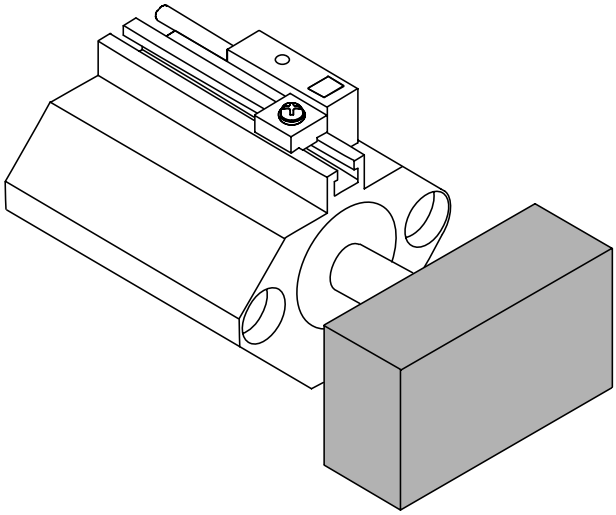


∗: “How to mount” depends on the actuator type and tube I.D. Please refer to the actuator catalogue.

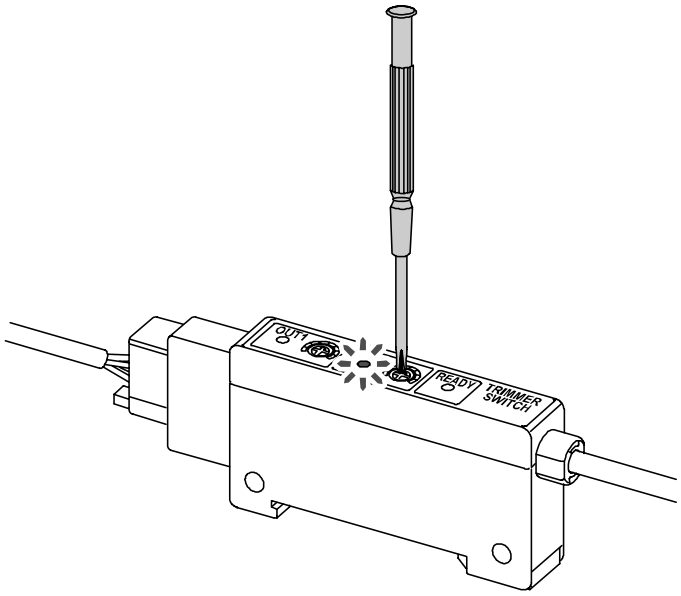
(6)Turn the adjustment trimmer (OUT1) with a screwdriver. Stop turning the screwdriver when the indicator LED (OUT1) is ON.
(If the indicator LED (OUT1) is already on, turn the trimmer to turn off the LED, then adjust the trimmer).



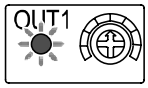
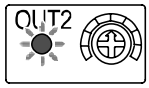
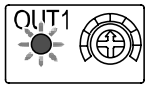
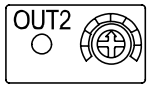
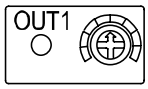
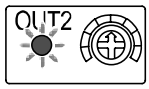
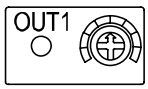
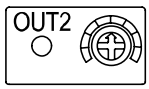
(7)Replace the pushed work piece with the thickest conformant work piece.

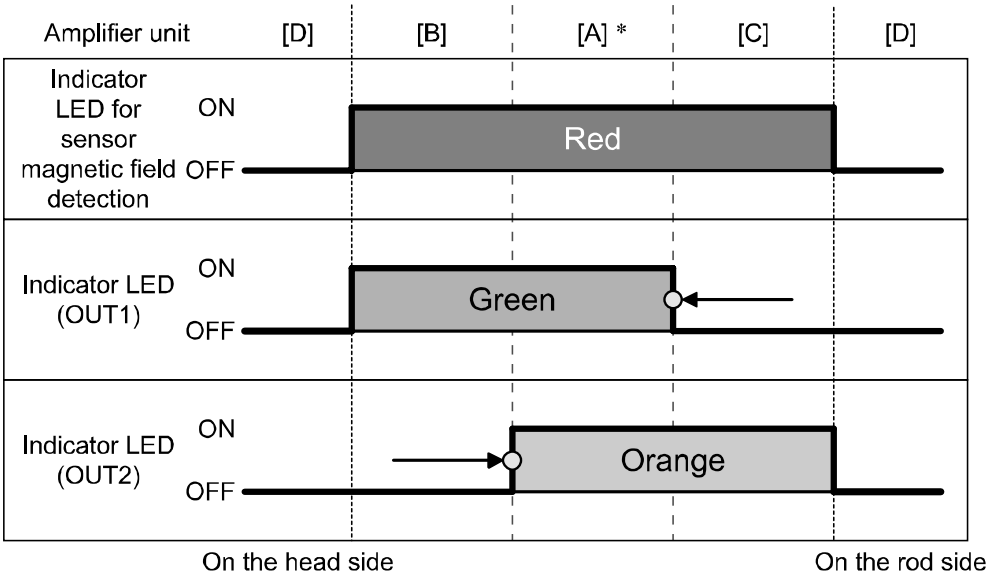


(8)Turn the adjustment trimmer (OUT2) with a screwdriver. Stop turning the screwdriver when the indicator LED (OUT2) is ON.
(If the indicator LED (OUT2) is already on, turn the trimmer to turn off the LED, then adjust the trimmer).



Verification of the work piece

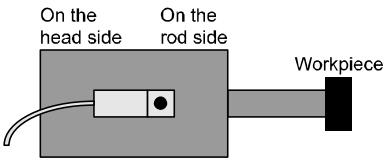
		OUT1 output (Detects the upper limit of the work piece)	OUT2 output (Detects the lower limit of the work piece)
[A]	Work piece size is correct (Conformant range)	ON  (Work piece is thinner than the upper limit. Conformance)	ON  (Work piece is thicker than the lower limit. Conformance)
[B]	Work piece is too thin	ON  (Work piece is thinner than the upper limit. Conformance)	OFF  (Work piece is thinner than the lower limit. Non-conformance)
[C]	Work piece is too thick	OFF  (Work piece is thicker than the upper limit. Non-conformance)	ON  (Work piece is thicker than the lower limit. Conformance)
[D]	No work piece	OFF  (Work piece is thicker than the upper limit. Non-conformance)	OFF  (Work piece is thinner than the lower limit. Non-conformance)

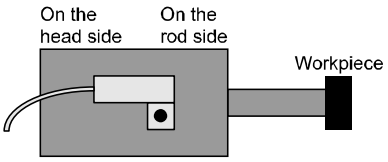
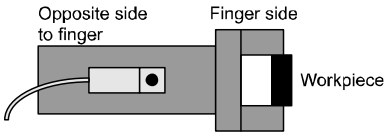


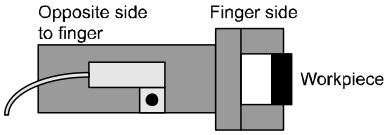
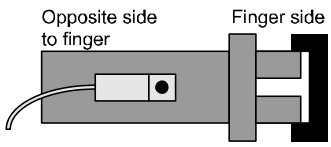
∗: The width for [A] should be 0.5 mm or longer in the stroke direction.

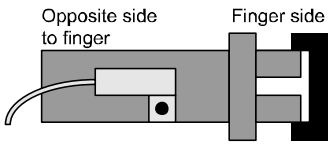
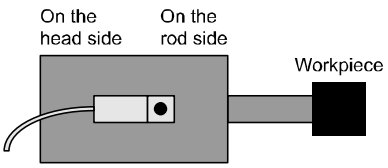
●Summary of setting (example)

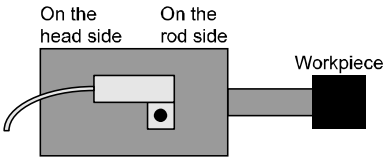
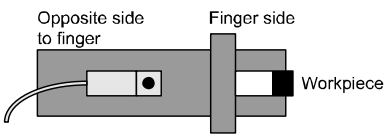
Setting when the sensor lead wire is on the opposite side to the work piece

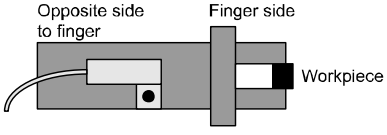
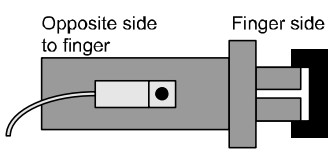
<table>
<tr><th></th><th>When pushing with the cylinder</th><th>When holding on the outside (outer diameter)</th><th>When holding on the inside (inner diameter)</th></tr>
<tr><td>OUT1</td><td>Adjust the trimmer while pushing the small work piece (thin / low).
D-Y7K
 

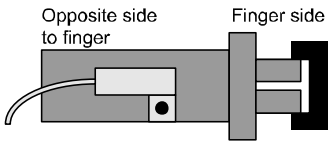
D-F7K
 
</td><td>Adjust the trimmer while holding the large work piece (thick).
D-Y7K
 

D-F7K
 
</td><td>Adjust the trimmer while holding the work piece with large I.D.
D-Y7K
 

D-F7K
 
</td></tr>
<tr><td colspan="4">Cylinder magnet located close to the work piece.</td></tr>
<tr><td>OUT2</td><td>Adjust the trimmer while pushing the large work piece (thick or high).
D-Y7K
 

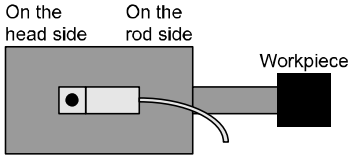
D-F7K
 
</td><td>Adjust the trimmer while holding the small work piece (thin).
D-Y7K
 

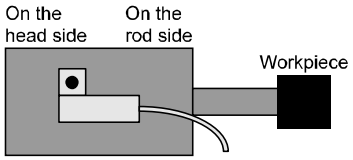
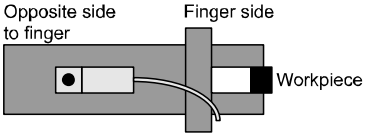
D-F7K
 
</td><td>Adjust the trimmer while holding the work piece with small I.D.
D-Y7K
 

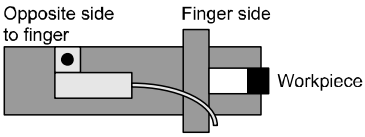
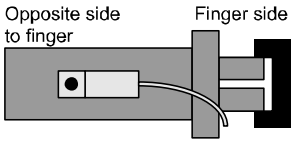
D-F7K
 
</td></tr>
<tr><td colspan="4">Cylinder magnet located close to the head side.</td></tr>
<tr><td rowspan="5">Judgment</td><td></td><td>OUT1</td><td>OUT2</td><td></td><td>OUT1</td><td>OUT2</td><td></td><td>OUT1</td><td>OUT2</td></tr>
<tr><td>Work piece size is correct (Conformance range)</td><td>ON</td><td>ON</td><td>Work piece size is correct (Conformance range)</td><td>ON</td><td>ON</td><td>Work piece size is correct (Conformance range)</td><td>ON</td><td>ON</td></tr>
<tr><td>Work piece size is large</td><td>ON</td><td>OFF</td><td>Work piece size is small</td><td>ON</td><td>OFF</td><td>I.D. is small</td><td>ON</td><td>OFF</td></tr>
<tr><td>Work piece size is small</td><td>OFF</td><td>ON</td><td>Work piece size is large</td><td>OFF</td><td>ON</td><td>I.D. is large</td><td>OFF</td><td>ON</td></tr>
<tr><td>No work piece</td><td>OFF</td><td>OFF</td><td>No work piece</td><td>OFF</td><td>OFF</td><td>No work piece</td><td>OFF</td><td>OFF</td></tr>
</table>

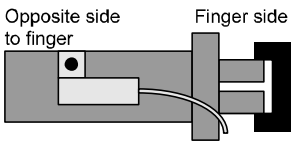
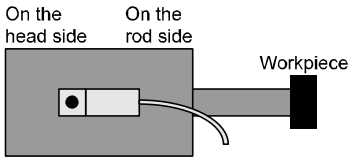
∗: These tables are not for guaranteeing the performance of the switch.
Perform operation check after setting the switch.

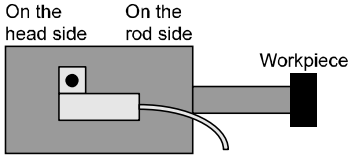
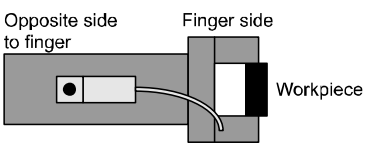
Setting when the sensor lead wire is on the work piece side

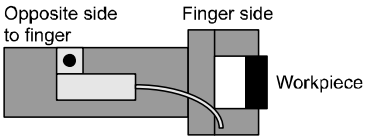
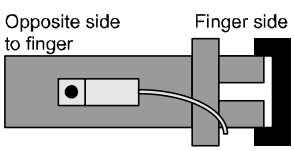
<table>
<tr><th></th><th>When pushing with the cylinder</th><th>When holding on the outside (outer diameter)</th><th>When holding on the inside (inner diameter)</th></tr>
<tr><td>OUT1</td><td>Adjust the trimmer while pushing the large work piece (thick or high).
D-Y7K
 

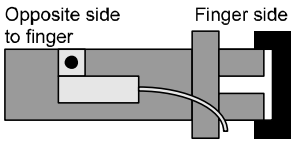
D-F7K
 
</td><td>Adjust the trimmer while holding the small work piece (thin).
D-Y7K
 

D-F7K
 
</td><td>Adjust the trimmer while holding the work piece with small I.D.
D-Y7K
 

D-F7K
 
</td></tr>
<tr><td colspan="4">Cylinder magnet located close to the head side</td></tr>
<tr><td>OUT2</td><td>Adjust the trimmer while pushing the small work piece (thin / low).
D-Y7K
 

D-F7K
 
</td><td>Adjust the trimmer while holding the large work piece (thick).
D-Y7K
 

D-F7K
 
</td><td>Adjust the trimmer while holding the work piece with large I.D.
D-Y7K
 

D-F7K
 
</td></tr>
<tr><td colspan="4">Cylinder magnet located close to the work piece side.</td></tr>
<tr><td>Judgment</td><td colspan="3"><table>
<tr><th></th><th>OUT1</th><th>OUT2</th></tr>
<tr><td>Work piece size is correct (Conformance range)</td><td>ON</td><td>ON</td></tr>
<tr><td>Work piece size is small</td><td>ON</td><td>OFF</td></tr>
<tr><td>Work piece size is large</td><td>OFF</td><td>ON</td></tr>
<tr><td>No work piece</td><td>OFF</td><td>OFF</td></tr>
</table></td><td colspan="3"><table>
<tr><th></th><th>OUT1</th><th>OUT2</th></tr>
<tr><td>Work piece size is correct (Conformance range)</td><td>ON</td><td>ON</td></tr>
<tr><td>Work piece size is large</td><td>ON</td><td>OFF</td></tr>
<tr><td>Work piece size is small</td><td>OFF</td><td>ON</td></tr>
<tr><td>No work piece</td><td>OFF</td><td>OFF</td></tr>
</table></td><td colspan="3"><table>
<tr><th></th><th>OUT1</th><th>OUT2</th></tr>
<tr><td>Work piece size is correct (Conformance range)</td><td>ON</td><td>ON</td></tr>
<tr><td>I.D. is large</td><td>ON</td><td>OFF</td></tr>
<tr><td>I.D. is small</td><td>OFF</td><td>ON</td></tr>
<tr><td>No work piece</td><td>OFF</td><td>OFF</td></tr>
</table></td></tr>
</table>

∗: 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

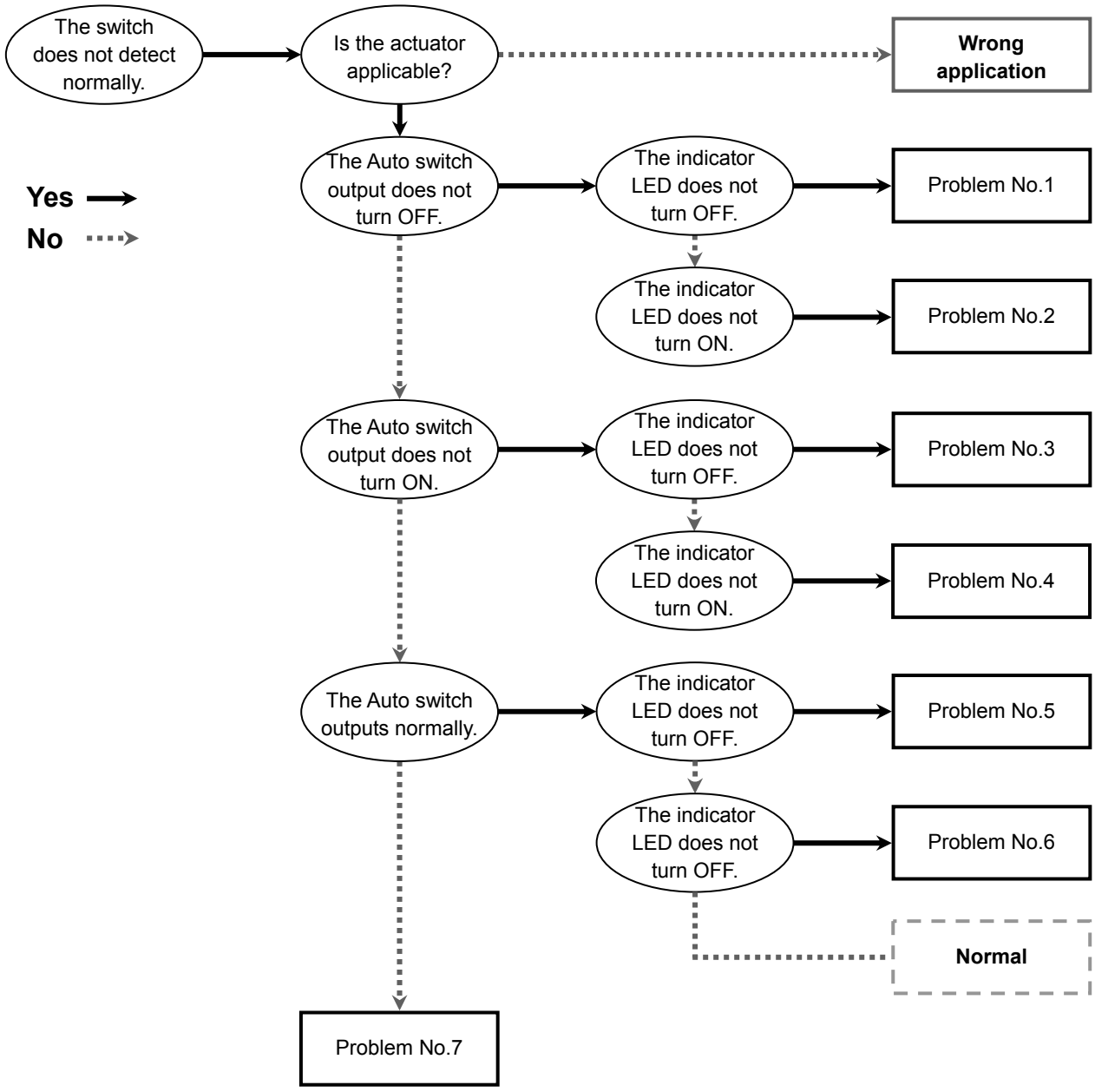
Regarding set up, contents of the program may be maintained by customer's application systems. Be sure to confirm safety when returning operation of the actuator because it could have been stopped in an unstable condition.

Perform the following maintenance regularly to avoid possible danger due to unexpected trimmer auto switch malfunction.

- Make sure that the Adjustment trimmer is set in the correct setting position.
  If the switch is not mounted in the correct position, tighten the product at the correct position using the appropriate tightening torque.
- 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 lead wire is not damaged.
  Broken lead wire may lead to insulation failure. Repair or replace the lead wire.

Troubleshooting

When the Auto switch in operation, identify the trouble with the following flow chart.
A failure of the Auto switch might depend on the operating environment (application etc.) and needs to be given a test by contacting to us separately.



•Troubleshooting List

Problem No.	Problem	Possible cause	Countermeasure
1	The switch output does not turn OFF. Indicator LED 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 auto switch operation range is larger than the piston stroke range, position the auto switch away from the centre of the operation range.
2	The switch output dose not turn OFF. Indicator LED does not turn ON.	Product failure	Replace the Product.
3	The switch output dose not turn ON. Indicator LED does not turn OFF.	Product failure	Replace the Product.
4	The switch output does not turn ON. Indicator LED 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 auto switch is operating near the limit of the operating range, position the auto switch to the centre of the operating range.
		Displacement (mounting) from 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 angle	When the stop position of the actuator piston is inconsistent, take measures to stabilize the position.
		Reduction in magnetic force for detection (demagnetization)	Keep the actuator 40mm 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. Indicator LED does not turn ON.	Reduction in magnetic force for detection (demagnetization)	Remove any magnetized substances such as cutting chips or spatter from around the actuator.
		Breakage of lead wire	Replace the product. If repeated stress such as bending force or tensile force is applied to the lead wire, take measures to protect the product from the stress.
5	Switch output is correct. Indicator LED does not turn OFF.	Product failure	Replace the Product.
6	Switch output is correct. Indicator LED does not turn ON.	Product failure	Replace the Product.
7	The operation is unstable. (chattering)	Improper setting (mounting) position	If the auto switch is operating near the limit of the operating range, position the auto switch to the centre of the operating range.
		Displacement (mounting) 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.
		Breakage of lead wire	Replace the product. If repeated stress such as bending force or tensile force is applied to the lead wire, take measures to protect the product from the stress.
		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.
	Auto switch turns on even when the piston magnet is not in the operating range. (the Auto switch 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.

Specifications

■Specifications

Specification for sensor unit

Model	D-F7K	D-Y7K
Mounting	Rail mounting	Direct mount into square groove
Applicable amplifier	D-RNK, D-RPK	
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	58 g (including connector)	
Standards	CE	

Specification for Amplifier unit

Model	D-RNK	D-RPK
Applicable load	Relay • PLC	
Voltage output	12 to 24 V DC	
Current output	40 mA or less	
Output type	NPN2 outout	PNP2 outout
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	
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 Cabtyre lead wire (sensor and amplifier)

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

■Applicable actuator and Operating range

Sensor unit: D-Y7 Unit: mm or degree (°)

Series	Bore size										
	10	12	16	20	25	32	40	50	63	80	100
MHZ2	4	-	5	7	7	8	8.5	-	-	-	-
MHQG2	-	-	-	-	-	12.5	11.5	-	-	-	-
MHL2	6.8	-	8	8.5	10.5	11	12.5	-	-	-	-
MHS2	-	-	-	-	-	6.5	7	7.5	8.5	-	-
MHS3	-	-	-	-	-	6.5	7	7.5	8	-	-
MHS4	-	-	-	-	-	6.5	7	7.5	8.5	-	-
MHC2	40°	-	40°	40°	32°	-	-	-	-	-	-
MHW2	-	-	-	93°	60°	63°	46°	34°			
MGP	-	3.5	5	4.5	4.5	5.5	5.5	5.5	5.5	5.5	6
CA2	-	-	-	-	-	-	4	4	6	6	6

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

Sensor unit: D-F7K Unit: mm or degree (°)

Series	Bore size												
	12	16	20	25	32	40	50	63	80	100	125	140	160
CQ2	4.5	5.5	5.5	5	5.5	5.5	5.5	6	5.5	6	7.5	7.5	7.5
CM2	-	-	3.5	3.5	3.5	3.5	-	-	-	-	-	-	-

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

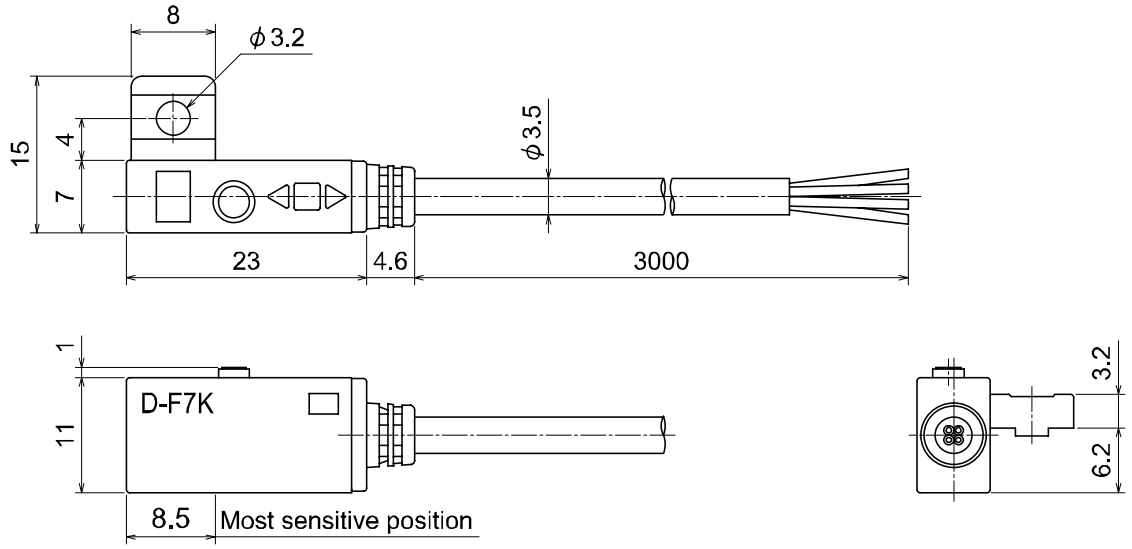
∗: CQ2□□□□-□□□Z-□ series is not applicable.

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

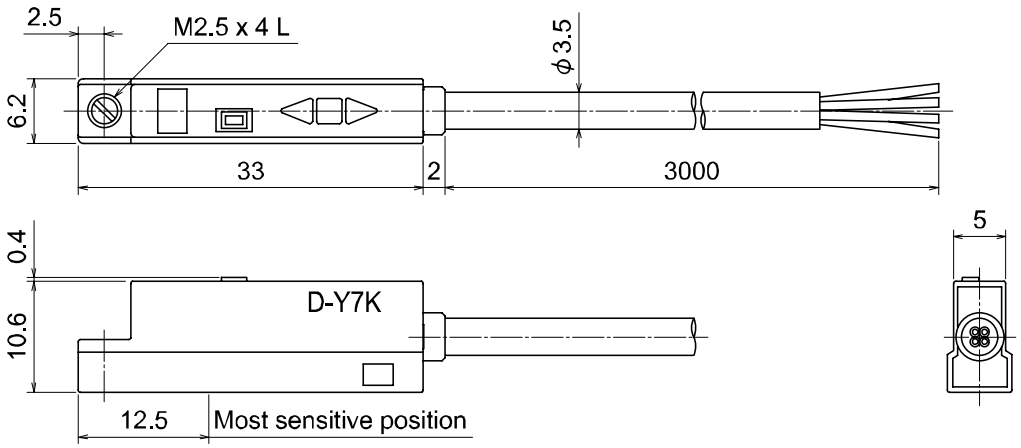
When using with a CA2, CM2, CQ2 Series, please apply a non-rotation mechanism to the rod.
(When a non-rotation rod type is used, this is not necessary).

■Dimensions

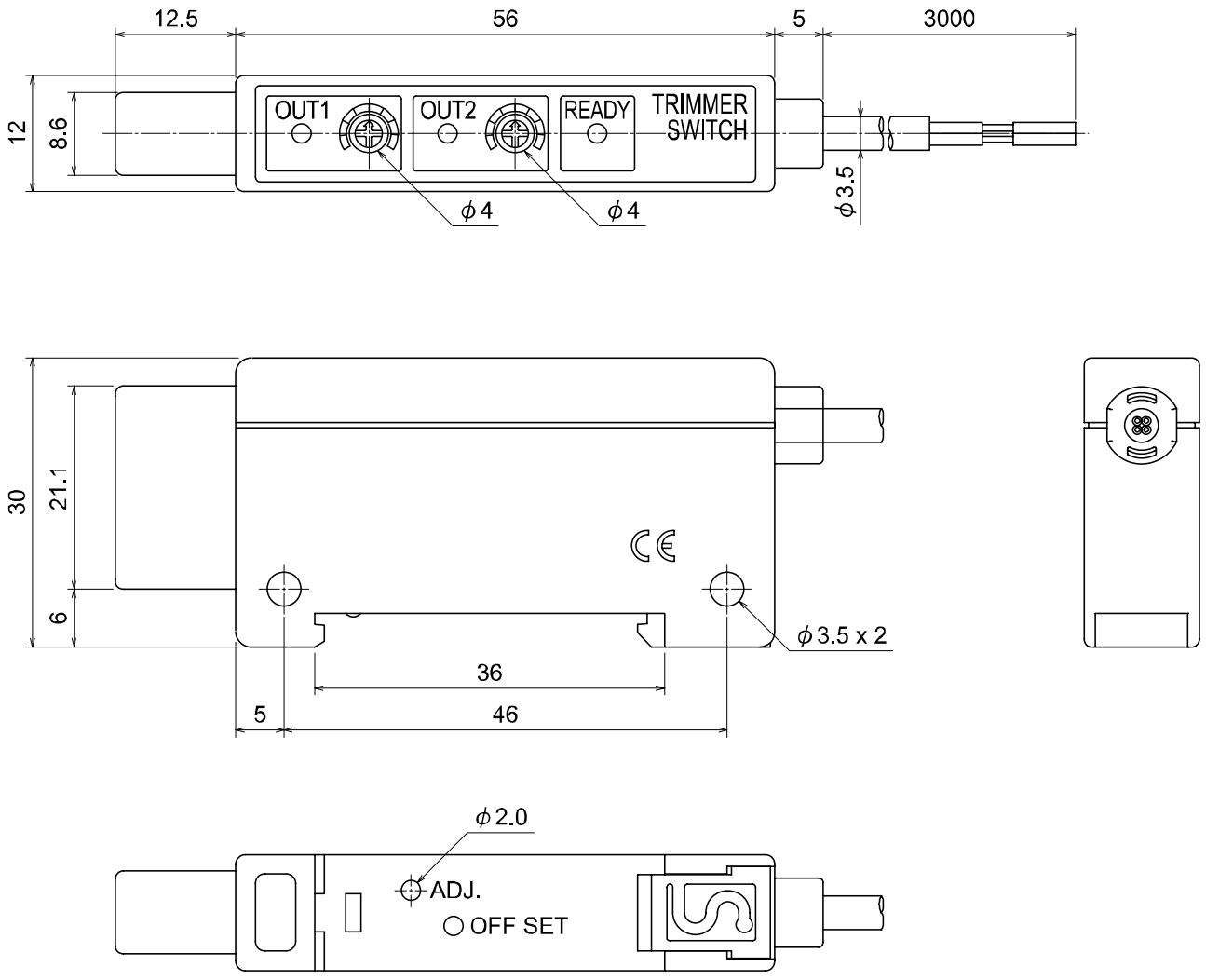
D-F7K



D-YF7K



D-R□K


12.5
56
5
3000
12
8.6
OUT1
OUT2
READY
TRIMMER
SWITCH
ϕ4
ϕ4
ϕ3.5
30
21.1
6
ϕ3.5 x 2
36
5
46
ϕ2.0
ADJ.
OFF SET

Revision history
A: Contents changed due to the change of the format.

SMC Corporation

4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021 JAPAN
Tel: +81 3 5207 8249 Fax: +81 3 5298 5362
URL http://www.smcworld.com

Note: Specifications are subject to change without prior notice and any obligation on the part of the manufacturer.
© 2012 SMC Corporation All Rights Reserved

No.D-#S-OMG0006-A