Technical Specifications

Product Name : Trimmer Auto Switch

Sensor Unit : D-F7K / D-Y7K

Amp Unit : D-RNK / D-RPK

SMC Corporation

Contents

1.Safety

This Auto Switch manual contains essential information for the protection of users and others from possible injury and property damage and to ensure correct handling.
Please check that you fully understand the definition of the following messages (signs) before going on to read the text, and always follow the instructions

♦Indications

IMPORTANT MESSAGES	
Read this manual and follow its instructions. Signal words such as WARNING and NOTE will be followed by important safety information that must be carefully reviewed.	
⚠WARNING	Indicates a potentially hazardous situation that could result in death or serious injury if you do not follow instructions.
⚠CAUTION	Indicates a potentially hazardous situation that, if not avoided, may result in minor injury or moderate injury.
NOTE	Gives you helpful information.

♦Operator

- This operation manual has been written for those who have knowledge of machinery and apparatus which use pneumatic equipment and have full knowledge of assembly, operation and maintenance of such equipment.
- Please read this operation manual carefully and understand it before assembling, operating or providing maintenance service to the auto switch.

♦Usage Restrictions

- This product is designed for use in general equipment for factory automation. Never use this product with equipment or apparatus that directly concerns human lives*1, or which malfunction or failure can cause a huge loss.
  *1: Equipment or apparatus that directly matters human lives means the following:
  - Medical equipment such as life support systems or equipment used in operating rooms
  - Compulsory equipment required by law such as the Fire Prevention Law, Construction Law and etc.
  - Equipment or apparatus that conforms with those mentioned above.
- Contact our sales department when plans are made for the product to be used for the system*2 including equipment that concerns itself with the safety of persons or that seriously affects the public. This usage needs special consideration*3.
  *2: The system including equipment that concerns itself with the safety of persons or that seriously affects the public means the following:
  - Nuclear reactor control systems in nuclear power plants, safety protection systems or other systems important for safety in nuclear power facilities
  - Driving control systems of mass transportation systems, and flight control systems
  - Equipment or apparatus that comes into contact with foods or beverages

  *3: Special consideration means discussing usage with our engineers to establish a safe system designed as fool-proof, fail-safe, redundant and etc.
- Special consideration of safety or maintainability should be taken to prevent hazard or loss caused by a failure or malfunction that is likely to occur in certain probability due to environmental stress (deterioration).
  The special consideration means to fully review the equipment or apparatus in design stage and to establish a backup system in advance such as a redundant system or fail-safe system.

⚠WARNING

1) The compatibility of pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.
Since the products specified here are used in various operating conditions, their compatibility with the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements.
2) Only trained personell should operate pneumatically operated machinery and equipment.
Compressed air can be dangerous if an operator is unfamiliar with it. Trained and experienced operators should perform assembly, handling or repair of pneumatic systems.
3) Do not service machinery/equipment or attempt to remove components until safety is confirmed.
   1. Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.
   2. When equipment is to be removed, confirm the safety process as mentioned above. Cut the supply pressure for the equipment and exhaust all residual compressed air in the system.
   3. Before machinery/equipment is re-started, take measures to prevent quick extensions of the cylinder piston rod etc. (Supply air into the system gradually to create back-pressure.)
4) Contact SMC if the product is to be used in any of the following conditions:
   1. Conditions and environments beyond the given specifications, or if product is used outdoors.
   2. Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverage, recreation equipment, emergency stop circuits, press applications, or safety equipment.
   3. An application, which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.

♦Do not disassemble, modify (including change of printed circuit board) or repair.
An injury or failure can result.

♦Do not operate the product beyond specification range.
Fire, malfunction or auto switch damage can result.

♦Do not operate in a combustible gas or explosive gas atmosphere.
Fire or an explosion can result.
This auto switch is not an explosion proof type.

♦These instructions must be followed when using the product in an interlocking circuit:
- Provide double interlocking by another system such as mechanical protection
- Check the auto switch regularly to ensure proper operation.

Otherwise malfunction can cause an accident.

♦These instructions must be followed while in maintenance:
Turn off the power supply, stop the supplied air, exhaust the residual pressure and verify the release of air before performing maintenance.
Otherwise it can cause injury.

⚠CAUTION

♦Do not touch the connector.
Otherwise it can cause electric shock, malfunction or damage to the unit.

♦Perform proper functional checks after maintenance.
Stop operation when an abnormality is observed such that the auto switch does not work properly.
Safety is not being assumed due to unexpected malfunction.

NOTE

◆ Follow the instructions given below when designing, selecting and handling your auto switch.

※The instructions on design and selection (installation, wiring, environment of use, adjustment, operation and maintenance etc.) described below must also be followed.

***Product specifications**

- Operate auto switch with the specified voltage.
  Operation with a voltage beyond specifications can cause malfunction or damage of the auto switch.
- Do not place two or more actuators close together.
  When multiple auto switch actuators are used in close proximity, maintain a minimum actuator separation of 40mm to avoid magnetic field interference.
- Reserve a space for maintenance

※Instructions on handling

***Installation**

- Connect the terminal FG to earth when using a switching regulator obtained on the commercial market.
- Do not drop it, bring it into collision with other objects or apply excessive shock.
  Otherwise it can result in damage to the auto switch causing failure or malfunction.
- Follow the specified tightening torque.
  Refer to the following table for the appropriate torque values.

Nominal size of screws	Appropriate tightening torque
M2.5	0.05 to 0.1 N·m
M3	0.5 to 0.7 N·m

***Wiring**

- Perform wiring and cable correctly.
  Miswiring can break the auto switch depending on the miswired circuit.
- Do not connect wires while the power is on.
  Otherwise it can break the auto switch causing damage or malfunction.
- Do not lay wires or cables with power cable or high-voltage cable in the same wiring route.
  Otherwise the wires to the auto switch can be contaminated with noise or induced surge voltage from power lines or high-voltage lines causing malfunction.
  Lay the wires to the auto switch in a wire duct or protective tube, other than those for power lines or high- voltage lines.
- Verify the insulation of wiring.
  Poor insulation (interference with other circuits, poor insulation between terminals, etc..) can introduce excess voltage or current to the auto switch, causing damage.
- Keep wiring as short as possible to prevent interference from noise and induced surge voltages.
  Otherwise interference from noise can cause malfunction.

*** Environment**

- Do not use in an area where a magnetic field is generated.
  Auto switches will malfunction or magnets inside actuators will become demagnetized.
- Do not use in an environment where the auto switch will be continually exposed to water.
  Poor insulation or swelling of the potting resin inside switches may cause malfunction.
- Do not use in environments where oil or chemical splashes may occur.
  Auto switches may be adversely affected if they are used in an environment with coolant, cleaning solvents, various oils or chemicals, for even a short time.
- Do not use the auto switch in an environment where steel filings accumulate, or magnetic objects are in close proximity.
  When a large amount of ferrous powder such as machining chips or spatter is accumulated, or a magnetic substance is brought into close proximity with an auto switch actuator, it may cause the auto switch to malfunction, due to a loss of magnetic force inside the actuator.

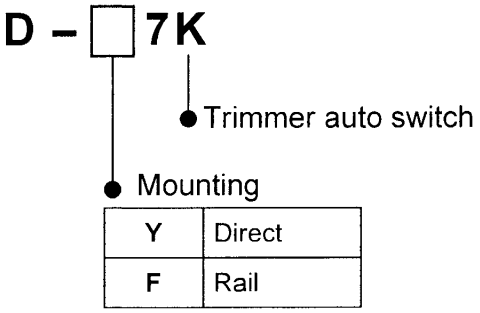
- Take measures to protect against freezing when using the product in the range of 5°C or less.
- Do not use in an environment with temperature cycles.
  Auto switches may be adversely affected if auto switches are used where there are temperature cycles other than normal temperature changes.
- Do not use the auto switch nearby a place where electric surges are generated.
  Internal circuit elements of the auto switch can deteriorate or break when equipment generating a large surge (electromagnetic lifter, high frequency induction furnace, motor, etc.) is located near the auto switch. Provide surge preventives, and avoid interference.
- Do not use a load generating a surge voltage.
  Use an auto switch equipped with surge protection when a surge-generating load, such as a relay or solenoid valve, is driven directly.
- Prevent foreign matter such as remnants of wire from entering this product.
  Take proper measures for the remnants not to enter the auto switch in order to prevent failure or malfunction.

∗Adjustment and Operation
- Please confirm the setting once a day.
- Turn the power on after connecting a load.
  Otherwise it can cause excess current, causing instantaneous damage to the auto switch.

∗Maintenance
- Perform maintenance and check regularly
  Otherwise an unexpected malfunction or mis-operation can occur due to a malfunction of the auto switch.

2. Model Indication Method

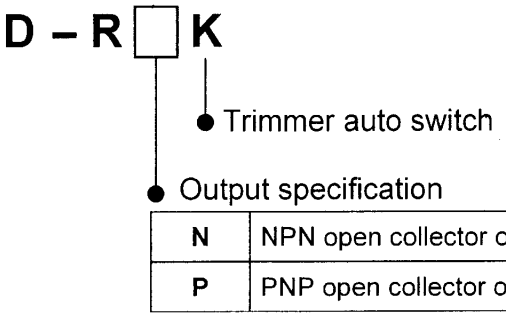
Sensor unit



Y	Direct
F	Rail

Accessory : Connector for sensor (1pc) ZS-28-C-1
Sensor wire is 3m in length.

Amp unit



N	NPN open collector output, 2 outputs
P	PNP open collector output, 2 outputs

* Power and output lead wire is 3m in length.

3. Specification

3-1. Specification for sensor unit

Part No.	D-F7K	D-Y7K
Mounting	Rail	Direct
Applicable amplifier	D-RNK, D-RPK	
Operation display	Red light ON at sensitive position, Green light ON at optimum detecting position	
Electrical entry	Grommet	
Lead wire	Oil-proof vinyl 'cabtire' cable ϕ3.5, 0.14mm^2 x 4 cores	
Impact resistance	980m/s^2	
Insulation resistance	50MΩ or more at 500VDC (between case and lead wire)	
Withstand voltage	1000VAC for 1min. (between case and lead wire)	
Ambient temperature	-10 to 60 °C	
Enclosure	IP67	
Mass (Weight)	58g (Connector included)	

3-2. Specification for Amp unit (sensor connected)

Part No.	D-RNK	D-RPK
Application	For Relay/PLC	
Power supply voltage	12 to 24VDC	
Current consumption	40mA or less	
Output type	NPN open collector output, 2 outputs	PNP open collector output, 2 outputs
Load voltage	28VDC or less	—
Load current	80mA or less	
Internal voltage drop	1.5V or less	
Leakage current	100μA or less	
Response time	1ms or less	
Operating indication light	READY : Illuminates at detection of piston position (Red). (when connected to sensor unit.) OUT1 : Illuminates when ON. (Green), OUT2 : Illuminates when ON. (Orange)	
Electrical entry	Connection of sensor unit : e-con connector, Power cable : Grommet	
Lead wire	Oil-proof vinyl 'cabtire' cable ϕ3.5, 0.14mm^2 x 4 cores	
Impact resistance	98m/s^2	
Insulation resistance	50MΩ or more at 500VDC (between case and lead wire)	
Withstand voltage	1000VAC for 1min (between case and lead wire)	
Ambient temperature	-10 to 60 °C	
Enclosure	IP40	
Mass (Weight)	70g	

3-3. Applicable actuator and Operating range

Sensor Unit : D-Y7K

unit : mm or degree (°)

Series	Bore										
	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 standard including hysteresis, and is not guaranteed.

Sensor Unit : D-F7K

unit : mm

Series	Bore												
	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	-	-	-	-	-	-	-

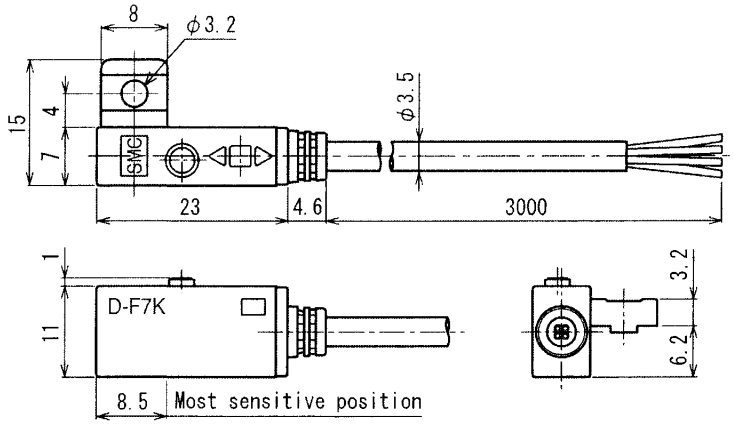
* CM2 must use custom-made product (-XC13 : auto switch rail mounting type).
* The range of operation is standard including hysteresis, and is not guaranteed.

If used with CA2, CM2, CQ2 Series, please use the non-rotation rod mechanism on the equipment.
(When non-rotation rod is used, there is no necessity to perform this.)

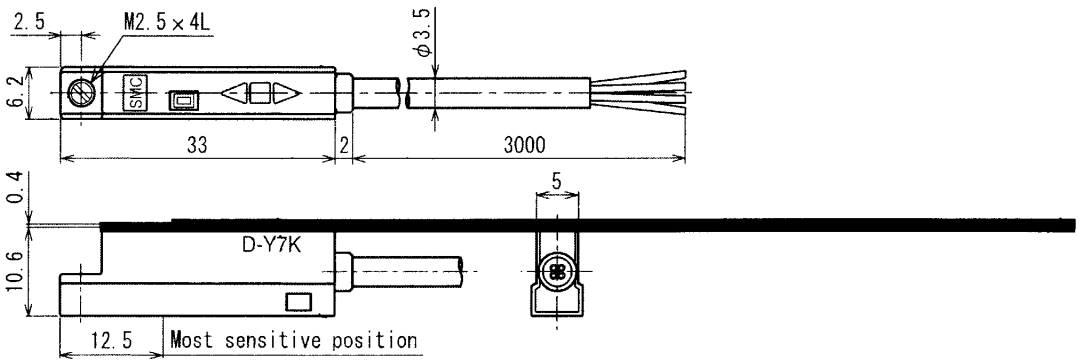
4.Full view with Dimensions

Sensor unit

D-F7K

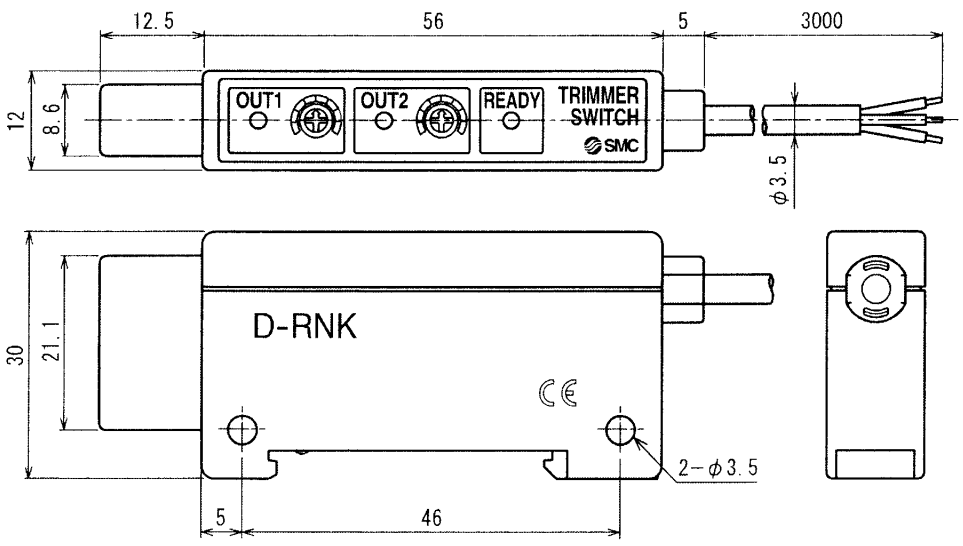


D-Y7K



Amp unit

D-R□K

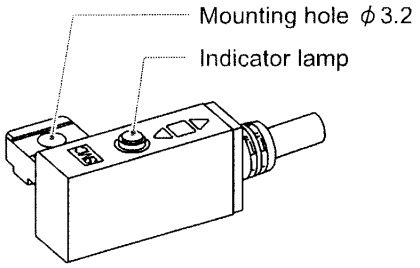


5. Names and Functions of Individual

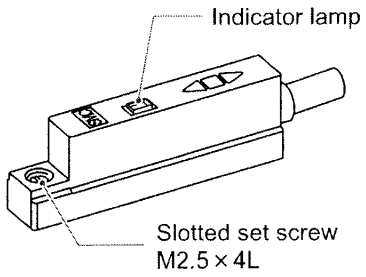
5-1. Sensor unit

Indicator lamp : The red lamp lights ON when the sensor detects the magnetic field. The green lamp lights ON at the magnetic field optimum detecting position (including most sensitive position).

Mounting hole ϕ3.2, Slotted set screw M2.5×4L : This hole is used to mount the sensor to the actuator.



D-F7K



D-Y7K

5-2. Amp unit

Output (OUT1) indication (green) : Illuminates when OUT1 outputs.

Output (OUT2) indication (orange) : Illuminates when OUT2 outputs.

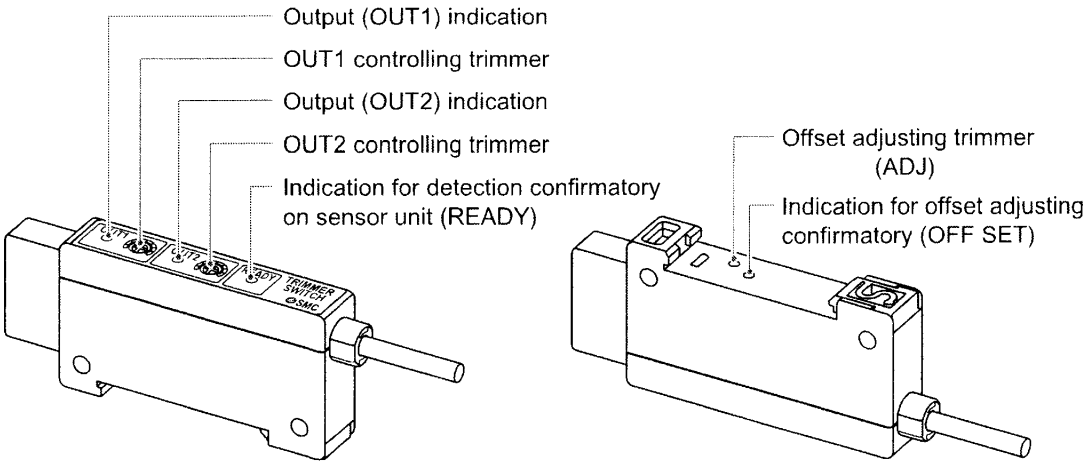
OUT1 controlling trimmer : Control output range of OUT1 at detection of magnetic field on sensor unit.

OUT2 controlling trimmer : Control output range of OUT2 at detection of magnetic field on sensor unit.

READY: Indication for detection confirmation on sensor unit (red) :
Sensor illuminates at detection of magnetic field. Ability to control output width of OUT1 and OUT2 while this indication light is illuminated.

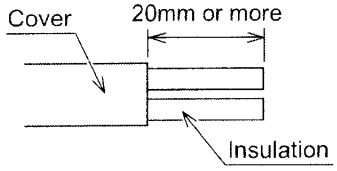
Offset adjusting trimmer : Adjust sensor unit on connection. (Having adjusted sensor unit, adjustment is not necessary, unless the sensor unit is replaced. Be sure to adjust with the sensor unit removed from actuator. Refer to "Offset adjustment method".)

Indication for OFFSET adjusting confirmation (red) : Illuminates when offset adjustment is completed.



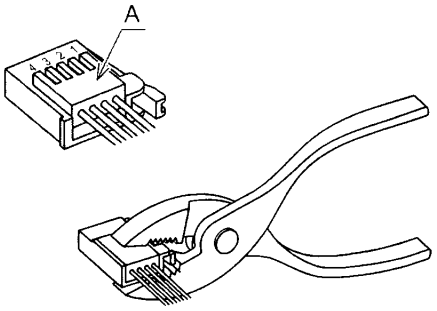
D-R□K

Attaching the connector to the lead wire



- Cut the sensor wire as shown in the figure (right).
- The core of the corresponding color shown in the following table is inserted into the pin of the number marked on the connector, for sensor connection.

Pin No.	Color of cable core
1	Black (SOUT1)
2	Blue (GND)
3	White (SOUT2)
4	Brown (Vsw)



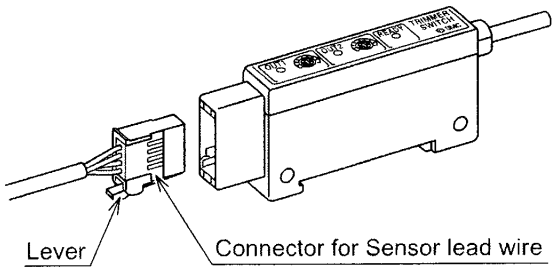
- Check that the above-mentioned preparation work has been performed correctly, and 'A' part shown (right) is pressed by hand to make temporary connection.
- Press 'A' part center in straight, using a tool, such as pliers.
- A sensor connector cannot be re-used once the connection is completed.
- Please use the SMC connector for sensor lead wire (ZS-28-C-1) or e-con connector, as below.

Maker	Model No.
(c)Sumitomo 3M	37104-3122-000FL
Tyco Electronics AMP K.K.	1473562-4

- Please contact the connector manufacturer about e-con connector catalogues.

Connector Connecting / Disconnecting

- When connecting to sensor, insert the connector straight on to pins and lock into the square groove in the housing, until connector clicks.
- When removing the connector, push down the lever, to dis-engage the lever claw from the square groove. Then pull out the connector straight.



Mounting Sensor unit on actuator

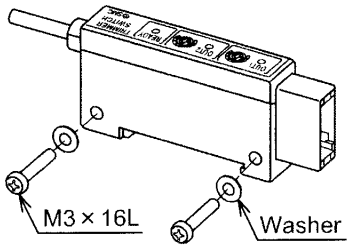
- When auto switch is mounted on actuator with clamp. Please refer to catalog regarding how to mount the clamp, as actuator types and I.D of tube is different.

For mounting Amp unit

- Use mounting screw (M3×16L 2pcs) or DIN rail (35mm width).
- Adjust the offset point before connecting with Amp unit. Refer to "Offset adjustment method" in detail.

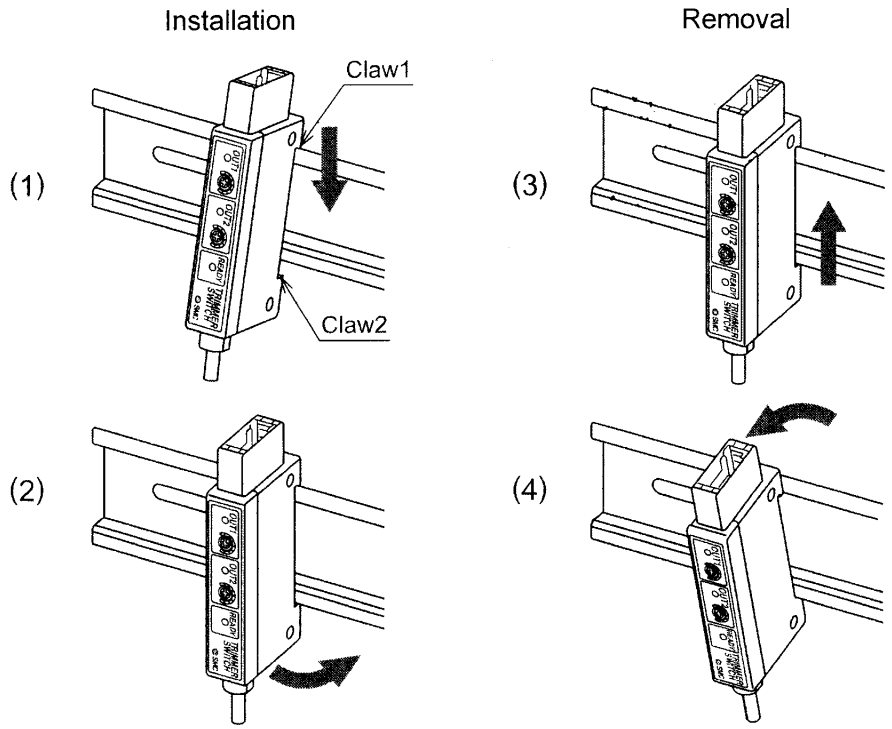
Mounting method of screw

- Tightening torque of mounting screw M3×16L (2pcs) should be 0.5 to 0.7Nm.
- Install this switch on a flat surface. Otherwise sensor case damage can result.



Installation and removal method of DIN rail

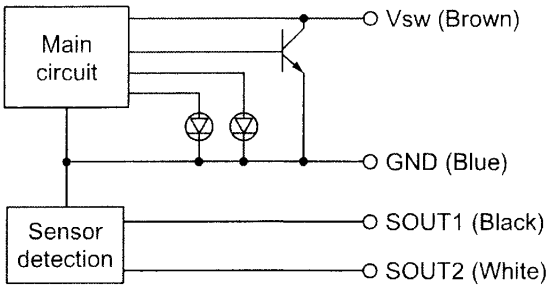
- Hook claw 1 of switch body on the upper part of DIN rail, press down and fit claw 2 horizontally until click. – Installation (1), (2)
- When removing switch, push the body up and remove it horizontally while pulling forward from claw1. – Removal (3), (4)



- It is recommended to use the following end plates when DIN rail mounting. For further information about end plates, including handling, please contact the manufacturer.

Manufacturer	Model No.
Omron	PFP-M
IZUMI Corporation	BNL6

Internal Circuit of Sensor unit

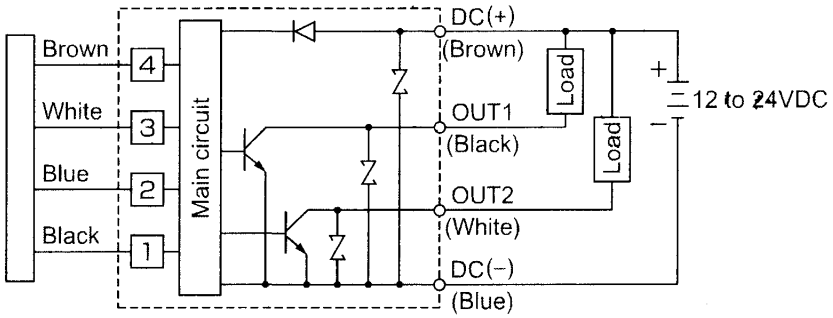


Internal Circuit of Amp unit

D-RNK :

NPN open collector output, 2 outputs

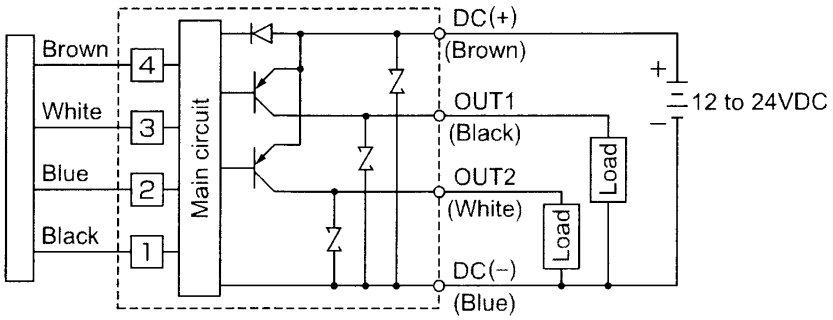
Max. 28V, 80mA, Internal voltage drop : 1.5V or less



D-RPK :

PNP open collector output, 2 outputs

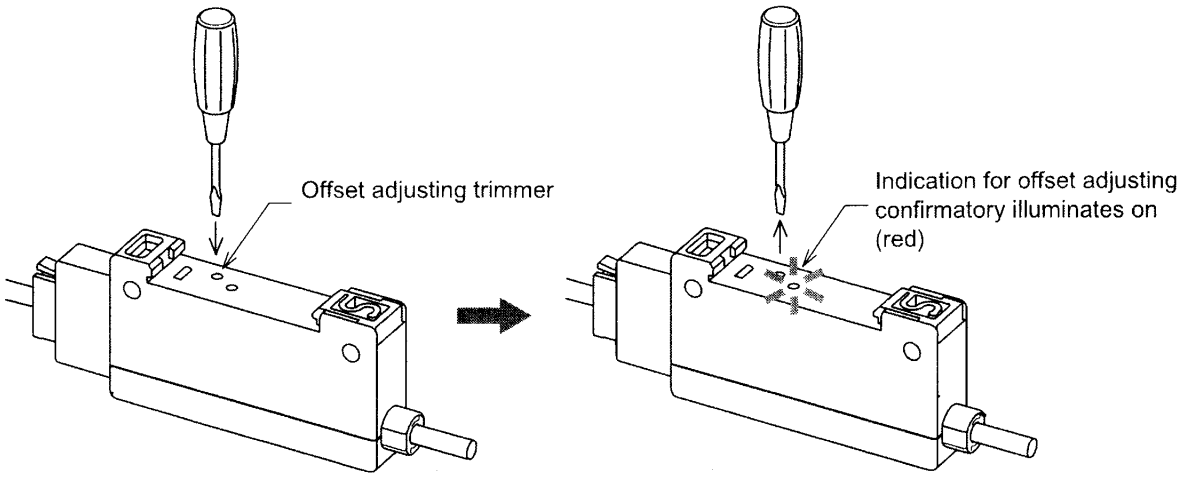
Max. 80mA, Internal voltage drop : 1.5V or less



8.Offset adjustment method

Offset adjustment

1. During offset adjustment, disconnect the sensor unit from the actuator. *1
2. Connect the sensor unit to amplifier, and connect the units to power supply, after confirming wiring.
3. Insert small screw-driver into offset adjusting trimmer (indicated as ADJ) on the top of amplifier, and rotate the trimmer either clockwise or counterclockwise. *2
4. Then, indicator lamp for offset adjustment lights ON (red) and adjustment is finished. (The offset adjusting trimmer is not equipped with non-rotation mechanism. If it cannot be adjusted by rotation in one direction, proceed to rotate it in the opposite direction.)

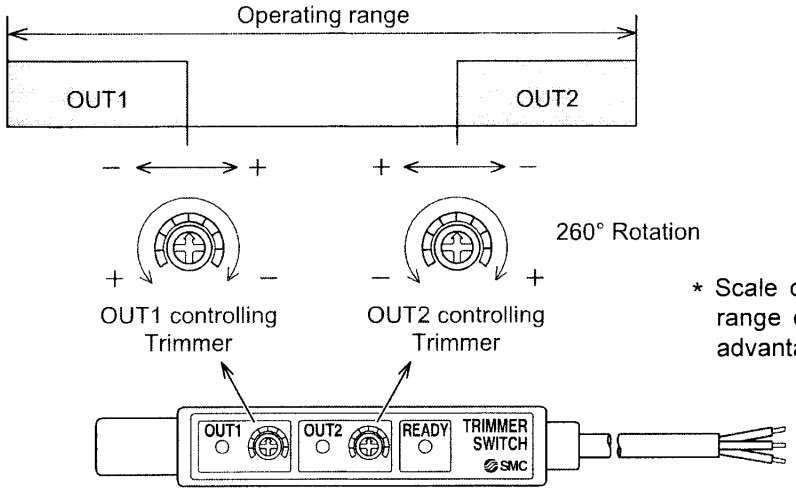


*1 Be sure to perform offset adjustment in non-magnetic field, which is created by disconnection of the sensing unit from the actuator. Also, since the sensing unit could detect the magnetic field, even if the indicator lamp of sensing unit is not illuminated, adjustment should be done as far away as possible from the magnetic field.

*2 Keep torque of offset adjusting trimmer less than 20mNm and effective rotation number of 12. Also, take care about the side where the driver should be inserted. If the driver is inserted in side indicated as OFFSET, the indication for offset adjustment could be damaged.

Setting of trimmer

Relationship between rotation direction and output of trimmer during setting



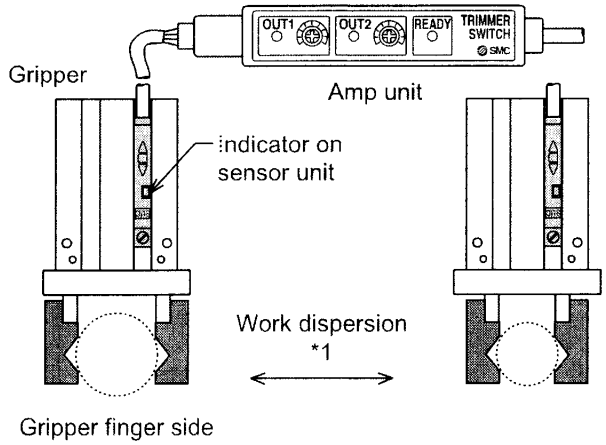
* Scale of trimmer does not indicate setting range or detecting position. Please take advantage of it at resetting.

- With opposite installation of sensor, the relation of OUT1 and OUT2 will be opposite. In addition, it might cause change of detection range.
- Due to working air pressure of actuator, fluctuation of ambient magnetic field, or with or without magnetic material, detection position might be deviated.
- Operating torque of OUT1/OUT2 controlling trimmer is 2 to 20mNm, mechanical angle is 260°. Take care to observe this specification.
- Be sure to supply air for the actuator when controlling OUT1 and OUT2 outputs.

Setting example

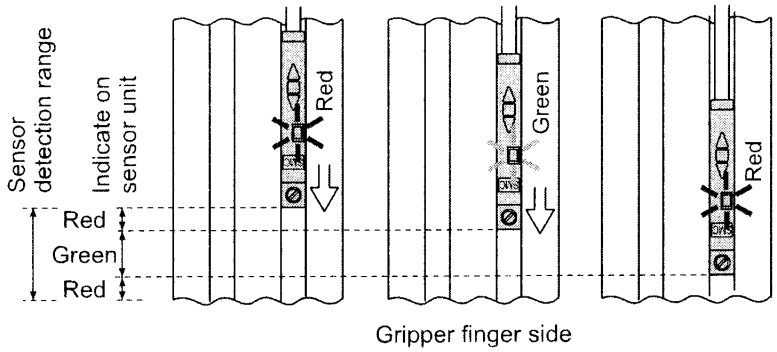
To verify good/bad work piece with an air gripper.

- Identify suitability of work while holding the work with an air gripper.



* This application is not applicable when work dispersion is less than 0.5mm, or when work, such as rubber, etc.. is easy to deform. Also, prior to setting, be sure to perform offset adjustment. Refer to "Offset adjustment method" in detail.

1) Hold the thickest (largest) good work. *1
2) Slide the sensor from opposite side of gripper finger until indicator on sensor unit illuminates Red.
3) Further, move sensor unit and fasten it to make indicator illumination green, and make sure that "READY" on Amp unit illuminates under this condition. *2

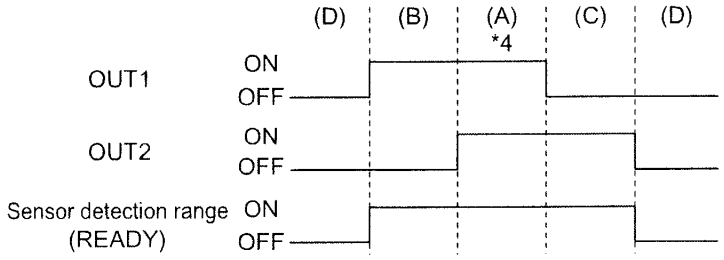


4) Turn OUT1 controlling trimmer slowly until OUT1 indication light of the amp lights, and stop when it does. (When the OUT1 indication light already lights, control after turning the light off when rotating the trimmer.) *3
5) Remove work.
6) Hold the thinnest (smallest) good work. *1.
7) Turn OUT2 controlling trimmer slowly until OUT2 indication light of the amp lights, and stop when it does. (When the OUT2 indication light already lights, control after turning the light off when rotating the trimmer.) *3

With the above situations,

When there is no dimension abnormality :	OUT1=ON, OUT2=ON	(A)
When work is too thin (small) :	OUT1=ON, OUT2=OFF	(B)
When work is too thick (large) :	OUT1=OFF, OUT2=ON	(C)
When piston is out of detection range :	OUT1=OFF, OUT2=OFF	(D)

(Refer to the table stated below.)



*1 Make sure that indicator on sensor unit or "READY" on amp unit illuminates ON when holding work. During lights out, fine adjustment of sensor positioning should be done and let indicator illuminate for both big and small work.
*2 Setting is available even with red lamp light ON, but should be done in a range where green lamp light is ON as much as possible.
*3 During setting, when neither LED illuminates, even if OUT1 or OUT2 control is carried out when "READY" is illuminating, excess current might flow to output. In this case, cut off power to remove the element generating excess current, turn on power again, and control OUT1 and OUT2.
*4 Detection available of the work dispersion is more than 0.5mm. Keep range(A) more than 0.5mm.