Techical Specification

Solid State Auto Switch

D-M9B Series

D-M9N Series

D-M9P Series

D-M9*V* Series

SMC Corporation

Contents

1.Safety

The Solid-state Auto Switch and this manual contain essential information for the protection of users and others from possible injury and damage to property 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.
Also read carefully the instruction manual of relevant equipment or apparatus before use.

• Indications

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

- Use for an interlocking circuit.
  When using the Auto switch as a sensor for interlock, adopt a double interlocking method such as equipping the mechanical protection function in order to deal with a AUTO switch failure.
  Check the Auto switch regularly to ensure proper operation.

⚠WARNING

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

- Do not operate the Auto switch beyond specification range.
  Operation at a range that exceeds the specifications can cause a fire, malfunction, or damage to the Auto switch.
  Verify the specifications before use.

- Do not use the Auto switch in an atmosphere containing combustible or explosive gas.
  A fire or explosion can result.
  This Auto switch is not an explosion-proof type.

- These instructions must be followed when using the Auto switch 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.

⚠CAUTION

- Do not touch terminals and printed circuit board inside the switch
  Otherwise it can cause electric shock, malfunction or damage to the unit.

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, maintenance and etc.) described below must also be followed.
  - Do not place two or more actuators close together.
    When using more than two Auto switches mounted parallel with each other, keep 40 mm or more between actuator tubes to prevent influence (malfunction) due to magnetic interference. (Keep the allowable displacement for each Auto switch if specified)
  - Detection of a piston by Auto switch mounted in the middle part of a cylinder stroke depends on the speed of the piston. Satisfy the conditional equation below.
    Where the maximum detectable piston speed =V[mm/s]

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

  - Reserve a space for maintenance.
    Remember to leave space for maintenance when installing the product.

- Product handling
  - Installation
    - Follow the specified tightening torque. (0.1 to 0.2N・m)
      Excessive tightening torque can break the mounting screws, mounting bracket or Auto switch.
      Insufficient tightening torque can displace the Auto switch from the original position. (Refer to the installation manual)
    - Connect frame-ground terminal (FG terminal) to the ground when using a switching power supply.
    - Do not drop, hit or apply excessive shock (larger than 1000 m/s^2) to the Auto switch.
      Otherwise it can result in damage to the Auto switch causing failure or malfunction.

  - Wiring
    - Do not pull the lead wires.
      Especially never lift actuator equipped with Auto switch by holding the lead wires.
      It can result in damage to inside of Auto switch causing malfunction.
    - Do not bend or apply tensile stress to lead wires repeatedly.
      Wiring with repetitive bending stress or tensile stress can cause breakage of lead wires.
      A bend radius of about 40 to 80 mm is recommended. Contact us for the details.
    - Connect wires and cables 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 circuit inside the Auto switch causing malfunction.
    - Do not lay wires or cables with power cable or high-voltage cable in the same wiring route.
      Lay the wires to the Auto switch to a wire duct or in a protective tube other than those for power cables or high-voltage cables to prevent contamination with noise or induced surge voltage from power lines or high-voltage lines.
    - Verify the insulation of wiring.
      Poor insulation (interference with other circuit, poor insulation between terminals and etc.) can introduce excess voltage or current to the Auto switch causing damage.
    - Keep wiring as short as possible to prevent contamination from noise and induced surge voltage.
      Do not use a cable longer than 100 m.
    - When stripping the cable envelope, please pay attention to the stripping direction.
      Insulator might be split or hurt depending on the directions.

- Environment
  - Never use the product for a corrosive gas or liquid.
    It can cause failure or malfunction.
  - Do not use the product in a place where strong magnetic field exists.
    It can cause a malfunction of the Auto switch, or demagnetization of a magnet inside actuator.
  - Do not use the Auto switch in an environment where the Auto switch is always splashed with water drips.
    It can cause poor insulation or malfunction due to swelling of a resin filled inside the Auto switch.

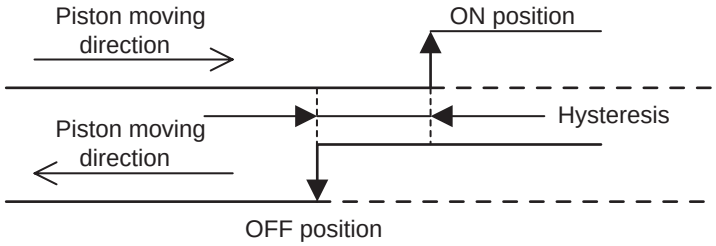
- Do not use the product in an atmosphere containing oils or chemicals.
  Use of the Auto switch in an atmosphere containing various oils or chemicals such as coolant or detergent can result in giving bad influence (poor insulation, malfunction die to swelling of a resin filled inside the Auto switch, or hardening of lead wires) even if in a short operating period.
- Do not use the product in an atmosphere where steel dusts accumulate or magnetic bodies are gathered closely.
  When an amount of steel chips or steel dusts such as sputters of welding accumulate around an actuator equipped with Auto switch, or magnetic bodies (those attracted by magnet) are gathered closely to the actuator, they can weaken a magnet inside the actuator causing inoperativeness of the Auto switch.
- Do not use the product in an environment where heat cycle exists.
  Heat cycles other than ordinary change of the temperature can affect the inside of Auto switch.
- Do not use the Auto switch nearby a place where electric surges are generated.
  Internal circuit elements of 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 surge voltage.
  Use Auto switch equipped with surge absorber when a surge-generating load such as a relay or solenoid valve is driven directly.

- Adjustment and Operation
  - Adjust an Auto switch in the middle of operating area and then fix it.
    Adjust the position of Auto switch in a way that a piston stops at about the middle of operating area (where switch is in ON status).
    Mounting the Auto switch close to the end of operating area can cause instability of operation.
    Air chucking rotary actuators have their own setting method. Follow their instructions.
  - Turn the power on after connecting a load.
    Otherwise it can cause excess current causing instantaneous breakage of the Auto switch.

- Maintenance
  - Perform maintenance and check regularly.
    Otherwise safety is not assured due to an unexpected malfunction or misoperation.
  - Do not touch terminals or printed circuit board inside the switch while the power is on.
    Otherwise it can cause in malfunction or damage to AUTO switch.

- Others
  - Contact SMC for water-proof capability, endurance of wire bending or use at welding shop.
  - Contact SMC when there is a problem of switch's ON/OFF positions (hysteresis).

Hysteresis



2.Model Indication Method and Specification

2 - 1 How to order

Output

Type	Specification
N	3 wire NPN output
P	3 wire PNP output
B	2 wire

Lead wire length

Type	Specification
No symbol	0.5m
L	3m

Electrical entry

型式	Specification
No symbol	In line
V	Perpendicular

2 - 2 Product Specification

PLC：Programmable Logic Controller

Switch model number	D-M9N	D-M9NV	D-M9P	D-M9PV	D-M9B	D-M9BV
Wiring	3 wire				2 wire	
Output	NPN		PNP		—	
Extraction type	In line	Perpendicular	In line	Perpendicular	In line	Perpendicular
Application	IC circuit/Relay/PLC				24V DC Relay/PLC	
Power voltage	5/12/24V DC (4.5 to 28V DC)				—	
Current consumption	10mA or less				—	
Load voltage	28V DC or less		—		24V DC (DC10 to 28VDC)	
Load current	40mA or less				2.5 to 40mA	
Internal voltage drop	0.8V or less				4V or less	
Current leakage	100μA or less at 24V DC				0.8mA or less	
Operating time	1ms or less					
Indication light	ON: Red light emitting diode					
Electrical entry system	Grommet					
Lead wire	Vinyl sheath cable 2.7 × 3.2 oval, 0.15mm^2, 2 wire (D-M9B), 3 wire (D-M9N,D-M9P)					
Impact proof	1000m/s^2					
Insulation resistance	50MΩ or more under the test voltage 500V DC (between case and cable)					
Withstand voltage	1000V AC 1min (between case and cable)					
Ambient temperature	-10 to 60°C					
Enclosure	IEC529 criteria IP67, JISC0920 watertight construction					

2 - 3 Applicable actuator and operation range

Unit：Operation range[mm], Operation angle[°]

Series	Section	Bore diameter																
		6	8	10	12	15	16	20	25	30	32	40	50	63	70	80	100	200
CU	Operation range	2.5	—	2.5	—	—	3.5	5	5	—	5	—	—	—	—	—	—	—
CQS	Operation range	—	—	—	2	—	2.5	3.5	3.5	—	—	—	—	—	—	—	—	—
CQ2	Operation range	—	—	—	—	—	—	—	—	—	4	4	4	5	—	5	5.5	—
RQ	Operation range	—	—	—	—	—	—	4	4	—	4	4	4.5	—	—	—	—	—
MXH	Operation range	2	—	2	—	—	3	3.5	—	—	—	—	—	—	—	—	—	—
MXU	Operation range	2	—	2	—	—	3	—	—	—	—	—	—	—	—	—	—	—
MXS	Operation range	2	2	—	2.5	—	3	3.5	3.5	—	—	—	—	—	—	—	—	—
MXS□L	Operation range	2	2	—	2.5	—	3	3.5	3.5	—	—	—	—	—	—	—	—	—
MXQ	Operation range	2.5	2.5	—	3	—	3	3.5	3.5	—	—	—	—	—	—	—	—	—
MXF	Operation range	—	2	—	2	—	3.5	4	—	—	—	—	—	—	—	—	—	—
MXW	Operation range	—	2	—	3	—	3	4	4	—	—	—	—	—	—	—	—	—
MXP	Operation range	2.5	—	2.5	2.5	—	2.5	—	—	—	—	—	—	—	—	—	—	—
MY1B	Operation range	—	—	2.5	—	—	3	3.5	—	—	—	—	—	—	—	—	—	—
MY1M	Operation range	—	—	—	—	—	6.5	7	—	—	—	—	—	—	—	—	—	—
MY1C	Operation range	—	—	—	—	—	6.5	7	—	—	—	—	—	—	—	—	—	—
MY1H	Operation range	—	—	2	—	—	3	3.5	—	—	—	—	—	—	—	—	—	—
MY1□W	Operation range	—	—	—	—	—	6.5	7	—	—	—	—	—	—	—	—	—	—
CXT	Operation range	—	—	—	2.5	—	3	4	4	—	4	4	—	—	—	—	—	—
CLQ	Operation range	—	—	—	—	—	—	2.5	3.5	—	4	4	4.5	4.5	—	5	5.5	—
REBR	Operation range	—	—	—	—	3	—	—	—	—	—	—	—	—	—	—	—	—
MK	Operation range	—	—	—	2	—	2.5	—	—	—	4.5	4	4.5	5	—	—	—	—
MK2	Operation range	—	—	—	—	—	—	—	—	—	4.5	4.5	5	5	—	—	—	—
RSQ	Operation range	—	—	—	2	—	—	—	—	—	3.5	3.5	4.5	—	—	—	—	—
CEP1	Operation range	—	—	—	2.5	—	—	3	—	—	—	—	—	—	—	—	—	—
CE1	Operation range	—	—	—	—	—	—	—	—	—	4.5	4.5	4.5	4.5	—	—	—	—
MY2H	Operation range	—	—	—	—	—	3.5	—	4	—	—	4.5	—	—	—	—	—	—
MY2HT	Operation range	—	—	—	—	—	3.5	—	3.5	—	—	3	—	—	—	—	—	—
MY2C	Operation range	—	—	—	—	—	3	—	3.5	—	—	5	—	—	—	—	—	—
CY3R	Operation range	—	—	—	—	3	—	3	—	—	—	—	—	—	—	—	—	—

Unit : Operation range[mm], Operation angle[°]

Series	Section	Bore diameter																		
		0.5	1	6	8	10	12	15	16	20	25	30	32	40	50	63	70	80	100	200
MTS	Operation range	–	–	–	2.5	–	3.5	–	3.5	3.5	4	–	3.5	4	–	–	–	–	–	–
RSQ	Operation range	–	–	–	–	–	2	–	–	–	–	–	3.5	3.5	4.5	–	–	–	–	–
CXSJ	Operation range	–	–	2	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–
MIS	Operation range	–	–	–	2	–	2	–	–	2.5	4	–	5	–	–	–	–	–	–	–
MIW	Operation range	–	–	–	2	–	3	–	–	3.5	4	–	5	–	–	–	–	–	–	–
MHF2	Operation range	–	–	–	1.5	–	1.5	–	1.5	1.5	–	–	–	–	–	–	–	–	–	–
MGZ	Operation range	–	–	–	–	–	–	–	–	3	3	–	3.5	–	–	–	–	–	–	–
RZQ	Operation range	–	–	–	–	–	–	–	–	–	–	–	4	4	4.5	4.5	–	–	–	–
MY3	Operation range	–	–	–	–	–	–	–	3	3	–	–	–	–	–	–	–	–	–	–
CRQ2	Operation angle	–	–	–	–	41	–	32	–	25	–	20	–	17	–	–	–	–	–	–
MSQ	Operation angle	–	–	–	–	31	–	–	–	25	–	23	–	–	19	–	16	–	14	10
CRJ	Operation angle	35	30	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
MRHQ	Operation angle	–	–	–	–	15	–	–	15	15	15	–	–	–	–	–	–	–	–	–

Note1) It is not for guarantee but measure including hysteresis. (Dispersion is approx. ±30%)
It might be changed drastically depending on the ambient.

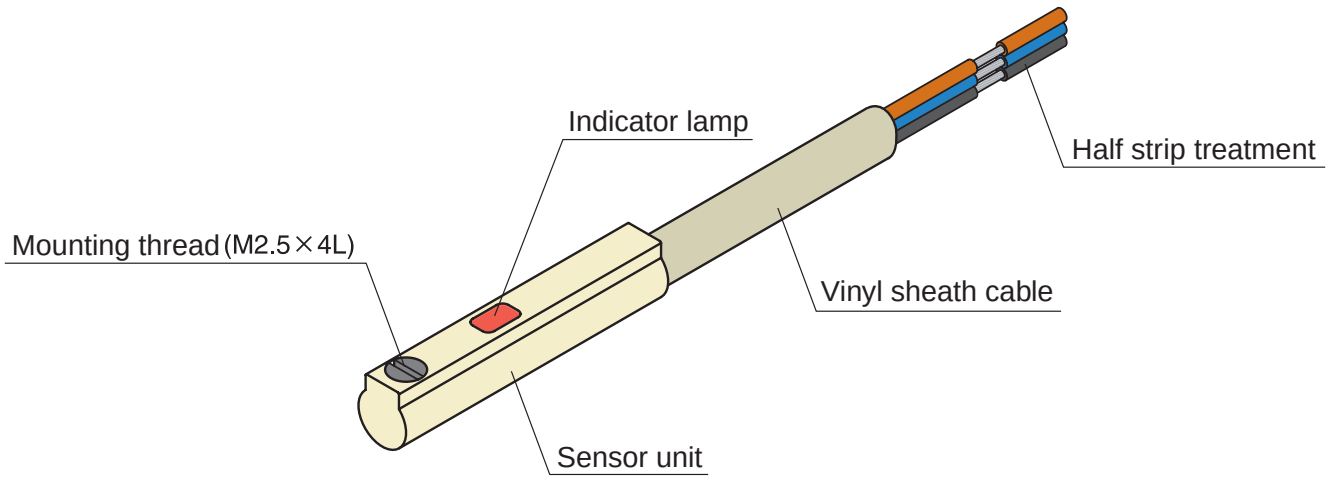
Unit：Histeresis[mm]

Series	Section	Bore diameter																
		6	8	10	12	15	16	20	25	30	32	40	50	63	70	80	100	200
MHZ2	Histeresis	0.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
MHZL2	Histeresis	—	—	0.5	—	—	0.5	0.5	0.5	—	—	—	—	—	—	—	—	—
MHZJ2	Histeresis	0.5	—	0.5	—	—	0.5	0.5	0.5	—	—	—	—	—	—	—	—	—
MHQ2	Histeresis	0.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
MHQJ2	Histeresis	—	—	0.5	—	—	0.5	0.5	0.5	—	—	—	—	—	—	—	—	—
MHR2	Histeresis	—	—	1	—	1	—	1	—	1	—	—	—	—	—	—	—	—
MHR3	Histeresis	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—
MHK2	Histeresis	—	—	—	0.5	—	0.5	0.5	0.5	—	—	—	—	—	—	—	—	—
MHS2	Histeresis	—	—	—	—	—	0.5	0.5	0.5	—	—	—	—	—	—	—	—	—
MHS3	Histeresis	—	—	—	—	—	0.5	0.5	0.5	—	—	—	—	—	—	—	—	—
MHSJ3	Histeresis	—	—	—	—	—	0.5	0.5	0.5	—	1	1	1	1	—	1	—	—
MHSH3	Histeresis	—	—	—	—	—	0.5	0.5	0.5	—	1	1	1	1	—	1	—	—
MHSL3	Histeresis	—	—	—	—	—	0.5	0.5	0.5	—	—	—	—	—	—	—	—	—
MHS4	Histeresis	—	—	—	—	—	0.5	0.5	0.5	—	—	—	—	—	—	—	—	—
MHT2	Histeresis	—	—	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—
MHY2	Histeresis	—	—	1	—	—	1	1	1	—	—	—	—	—	—	—	—	—
MHC2	Histeresis	0.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Note1) It is not for guarantee but measure including hysteresis. (Dispersion is approx. ±30%)
It might be changed drastically depending on the ambient.

Note2) Please contact SMC sales division regarding another models.

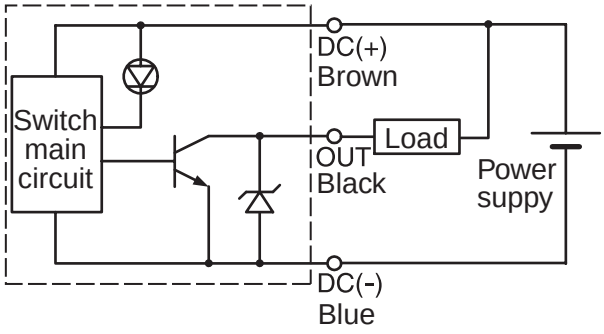
3.Names and Functions of Individual Parts



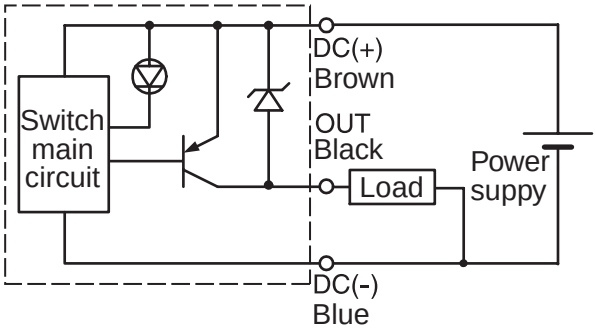
4.Internal Circuit and Setting

4 - 1 Circuit diagram

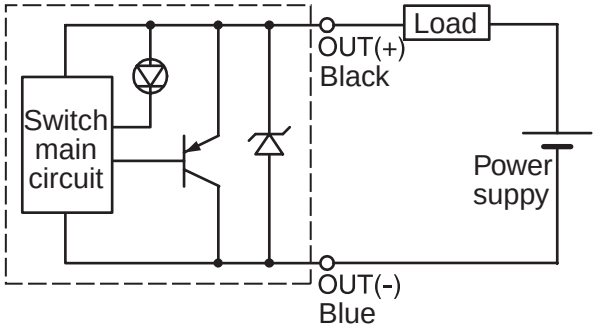
D-M9N(V)



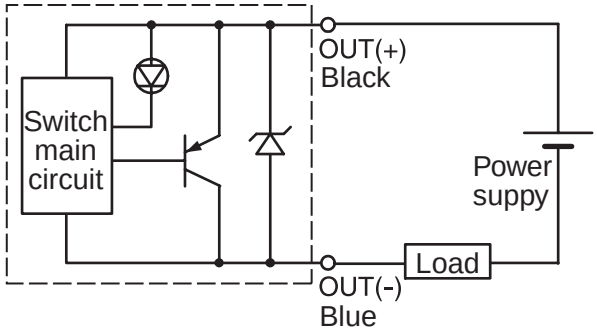
D-M9P(V)



D-M9B(V) (Sink input mode)



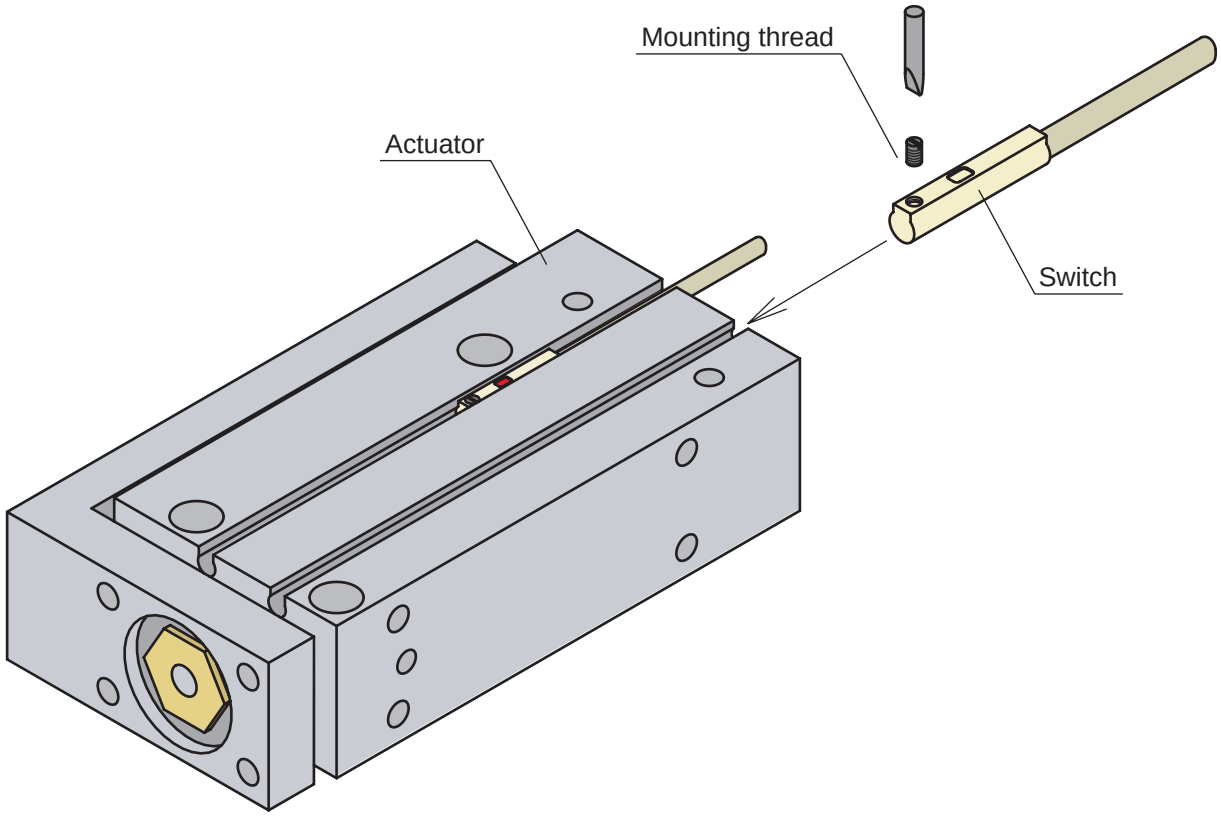
D-M9B(V) (Source input mode)



4 - 2 Mounting method

When mounting auto-switch to actuator it should be done with clamp for actuator.
"How to mount" depends on actuator type and tube I.D. Please refer the actuator catalogue.
When auto-switch is mounted newly, please prepare the clamp for actuator after confirms that the actuator built in magnet.

- Proper tightening torque
  Use a watchmaker driver whose grip dia, is 5 to 6mm when tightening the mounting screw.
  M2.5 mount biss tightening torque shall be 0.1 to 0.2N • m (1.0 to 2.0kgf • cm)

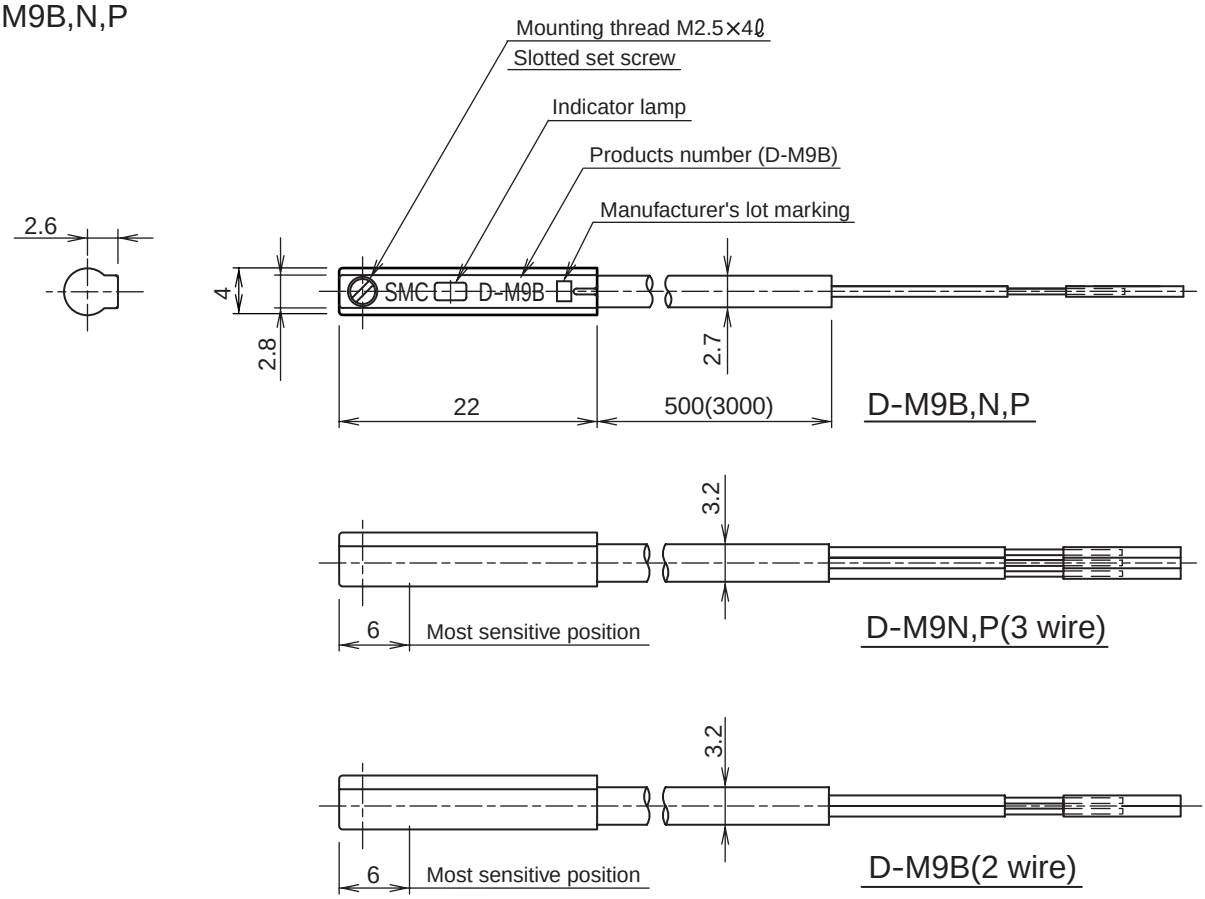


- Setting the detecting position
  Set the actuator at the stroke end. Set the switch in the area to where the auto switch red lamp light.

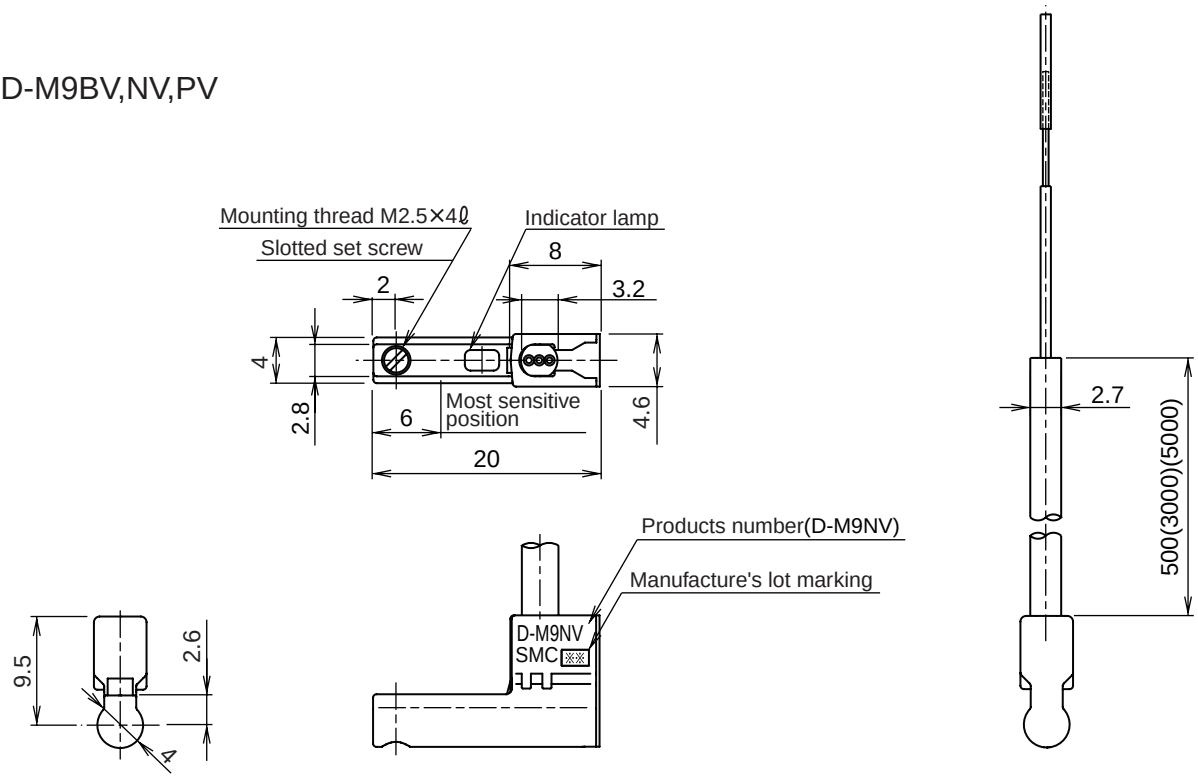
  (Detecting actuator end)
  Based on A and B dimensions in the actuator catalogue, set the switch.

5.Full View with Dimensions

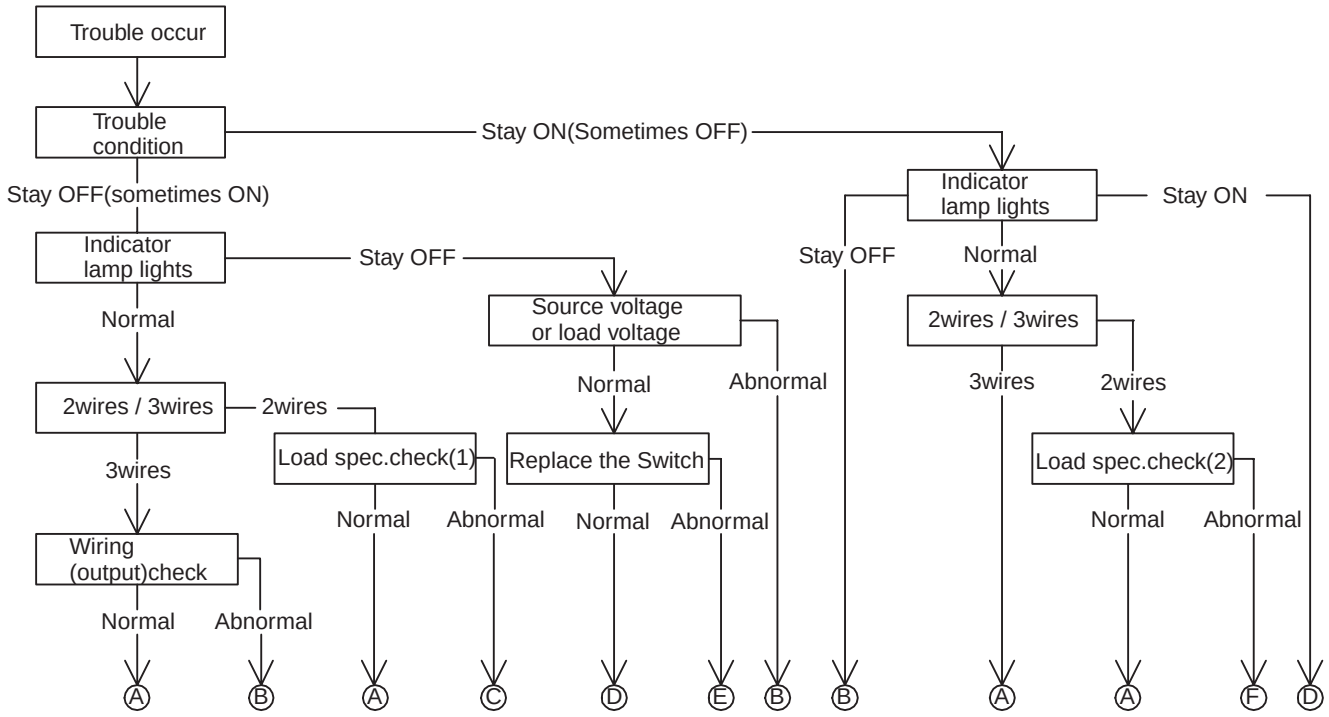
○ D-M9B,N,P



○ D-M9BV,NV,PV



6.Trouble shooting



Load spec. check(1) ----- ON voltage > Load voltage-Internal voltage drop
Load spec. check(2) ----- OFF current > Leak current

Ⓐ --- Switch output parts failure(replace)
Ⓑ --- Correct wiring
Ⓒ --- Replace switch 2 wires --> 3 wires
Ⓓ --- Switch failure
Ⓔ --- Replace cylinder. Detectable magnet field in adequate (No magnet)
Ⓕ --- Replace PLC input board or replace switch 2 wires --> 3 wires