



ORIGINAL INSTRUCTIONS

Instruction Manual
Series D-M9BA#-917
Solid State Auto Switch
Intrinsic Safety



- II 1G Ex ia IIC T5 Ga
Class I, Zone0, Group ABCD AEx/Ex ia IIC T5 Ta=60°C
- (1) Please take countermeasures against dust and/or water according to the operating environment.
- (2) The operating ambient temperature of the Auto switch is -10 to 60 °C.

<Explanation of terms>

1. Equipment grouping

Group II : Electrical equipment used in an atmosphere with explosive gas, other than mines, where explosive gas may be generated.

2. Group II subdivisions

Group II subdivision corresponds to the gas explosion class in the conventional regulations. It is classified into A, B or C according to the characteristics of the explosive gas. The danger level of the gas is C > B > A. The SMC Auto switch is applicable to the gas type A, B and C.

3. Temperature class

The temperature class corresponds to Classification of maximum surface temperatures in the conventional regulations, and it is classified into six classes, T1 to T6. The SMC Auto switch is applicable to the temperature class T1 to T5.

Table1 - Classification of maximum surface temperatures

Temperature class	Maximum surface temperature °C
T1	450
T2	300
T3	200
T4	135
T5	100
T6	85

4. Hazardous area
- Zone 0: Available to use
- Place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas or vapour is present continuously or for long periods or frequently.
- Zone 1: Available to use
- Place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas or vapour is likely to occur in normal operation occasionally.
- Zone 2: Available to use
- Place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas or vapour is not likely to occur in normal operation but, if it does occur, will persist for a short period only.
5. Degree of protection of enclosure IP67
- Protection from infiltration of dust and from water when the product is immersed in water with pressure and time specified in the regulations, according to IEC 60529.

1 Safety Instructions

This manual contains essential information for the protection of users and others from possible injury and/or equipment damage.

•Read this manual before using the product, to ensure correct handling, and read the manuals of related apparatus before use.

•Keep this manual in a safe place for future reference.

•These instructions indicate the level of potential hazard by label of "Caution", "Warning" or "Danger", followed by important safety information which must be carefully followed.

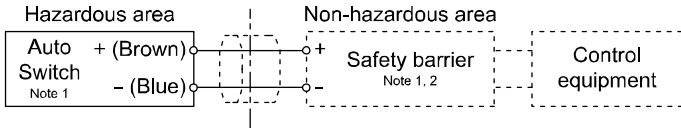
•To ensure safety of personnel and equipment the safety instructions in this manual and the product catalogue must be observed, along with other relevant safety practices.

1 Safety Instructions (Continued)

	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.

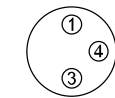
Warning

Danger

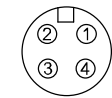


Connector pin assignment

Wiring		Meaning
Connector pin No. M8/M12	Wiring colour	
1	Brow	OUT(+)
2	-	N.C.
3	-	N.C.
4	Blue	OUT(-)



M8 connector
pin assignment



M12 connector
pin assignment

When mounting, a spanner should be used.

Tightening torque: M8: 0.2 to 0.3 N•m

M12: 0.4 to 0.5 N•m

Tighten to the specified torque of pre-wire connector connection destination.

Notes:

1. Wiring connected to the Auto switch or associated apparatus shall be performed so that current and voltage that may damage the performance of the intrinsic safety circuit are not induced due to electromagnetic or electrostatic induction.
2. Install the safety barrier according to the manufacturers operation manual for the safety barrier.

<Rated parameters of the Auto switch>

Maximum input voltage (Ui) = 12.5 V

Maximum input current (Ii) = 25 mA

Maximum input power (Pi) = 78 mW

Maximum Internal inductance (Li) = 13.5 µH

Maximum Internal capacitance (Ci) = 0.74 µF

<Safety barrier connected to the Auto switch>

The safety barrier connected to the auto switch must be compliant with IECEx certification and meet the following conditions:

Maximum output voltage (Uo) = 12.5 V or less

Maximum output current (Io) = 25 mA or less

Maximum output power (Po) = 78 mW or less

Intrinsic safety and groups of electrical equipment

Intrinsic safety (for EPL Ga): ia

Groups of electrical equipment: IIC

Use the following parameters for the maximum external capacitance (Co) and the maximum external inductance (Lo).

Maximum external inductance (Lo): 13.5 µH or more

Maximum external capacitance (Co): 0.74µF or more

- Perform electrical connections according to the polarity indication of "+" and "-".
- Avoid repeatedly bending or stressing the wires.

If Po of the safety barrier is unknown, use the following calculating formula.

Po = (Uo x Io) / 4

1 Safety Instructions (Continued)

Maintenance and repair of the Auto switch

Warning

- Basically, maintenance of the Auto switch cannot be performed other than a visual inspection. To avoid a risk of static electricity, make sure to always use a damp cloth for cleaning.
- The intrinsic safety Auto switch as a rule cannot be repaired. Please replace the product if necessary. When replacing the Auto switch, make sure that there is no gas explosive atmosphere present and that the power supply for the barrier is OFF. After wiring, confirm that the Auto switch is correctly connected to the control equipment and equipment related to intrinsic safety.

Disassembly and modification of the Auto switch

Warning

- Do not disassemble or modify the Auto switch. It may cause not only loss of the explosion-proof, but also an accident.

Warning

- Do not disassemble, modify or repair.
- Otherwise, an injury or failure can result.
- Do not operate the product outside of the specifications.
- Do not use the product with flammable or harmful fluids.
- Fire, malfunction, or damage to the product can result.
- Check the specifications before use.
- If using the product in an interlocking circuit:
- Provide a double interlocking system, for example a mechanical system.
 - Check the product regularly for proper operation.
- Otherwise malfunction can result, causing an accident.
- The following instructions must be followed during maintenance:
- Turn off the power supply
 - Stop the air supply, exhaust the residual pressure in piping and verify that the air is released before performing maintenance work.
- Otherwise an injury can result.

Caution

- Do not touch the terminals and connectors while the power is on.
- Otherwise electric shock, malfunction and damage to the product can result.
- After maintenance is complete, perform appropriate functional inspections.
- Stop operation if the equipment does not function correctly.
- Otherwise, an unexpected malfunction may occur and it will become impossible to ensure safety.

■Handling Precautions

- Follow the instructions given below for selection and handling of the solid state Auto switch.
 - The instructions on design and selection (installation, wiring, environment, adjustment, operation, maintenance, etc.) described below must be followed.
- *Product specifications
- Use the specified voltage.
 - Otherwise failure or malfunction can result.
 - Do not place multiple actuators close together.
- When using two or more actuators closely in parallel, keep a distance of at least 40 mm between the actuator tubes to prevent magnetic interference from affecting the product, which can cause malfunction. (If the separation distance is specified for the actuator series, then use that value).
- Detection by an Auto switch mounted in a mid-stroke position depends on the piston speed. Conditions must satisfy the equation below.

Detectable maximum piston speed: V [mm/s]

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

- Design the product to prevent reverse current when the circuit is open or the product is forced to operate for operational checks.
- Reverse current can cause product damage or malfunction.
- Reserve a space for maintenance.
- Design the system to allow the required space for maintenance.

1 Safety Instructions (Continued)

- Product handling
- *Mounting
 - Tighten to the specified tightening torque.
 - If the tightening torque is exceeded, the mounting screws, mounting bracket and the Auto switch may be broken. On the other hand, tightening below the range of tightening torque may allow the auto switch to slip out of position.
- Never mount the actuator with Auto switch on 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.
- Do not drop, hit or apply excessive shock (1000 m/s² or more) to the product.
- The internal parts of the Auto switch may get damaged and cause malfunction.
- *Wiring (Including connecting/disconnecting of the connectors)
- Do not pull hard on the lead wire. In particular, never lift the Auto switch by holding the lead wire when it is mounted on the actuator.
- The internal parts of the Auto switch may get damaged and cause malfunction.
- Avoid repeatedly bending, stretching or applying a heavy object or force to the lead wire.
- Repetitive bending stress or tensile stress can cause the sheath of the wire to peel off, or breakage of the wire.
- If the lead wire can move, fix it near the body of the Auto switch.
- The recommended bending radius is R17 mm or more. For details, please contact SMC.
- Wire correctly.
- Incorrect wiring can cause malfunction or breakage of the Auto switch.
- Do not perform wiring while the power is on.
- The internal parts of the Auto switch may get damaged and cause malfunction.
- Do not route wires and cables together with power or high voltage cables.
- Route the wires of the Auto switch separately from power or high voltage cables in order to avoid noise or surge entering the signal line.
- Confirm proper insulation of wiring.
- Poor insulation (interference with other circuits, poor insulation between terminals etc.) can apply excessive voltage or current to the Auto switch, causing damage.
- Design the circuit to prevent reverse current when the product is forcibly performed for operational checks.
- Depending on the circuit used, insulation may not be maintained when operation is forcibly performed, allowing the reverse current to flow, which can cause malfunction or damage to the product.
- *Operating environment
- Do not use the product in the presence of a magnetic field.
- Auto switches will malfunction or the magnets inside actuators will become demagnetized.
- Do not use the product in a place where iron powder is accumulated or magnetic substance is present.
- When a large amount of iron powder 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.
- Do not use the product in an environment where the product is constantly exposed to water splashes.
- Poor insulation or malfunction due to swelling of the resin inside the Auto switch may occur.
- Do not use the product in a place where the product could be splashed by oil or chemicals.
- If Auto switches are used in an environment with oils or chemicals such as coolants or cleaning solvents for even a short time, they may be adversely affected by insulation failure, malfunction due to swelling of the resin in the Auto switch, or hardening of the lead wires.
- Do not use the product in an environment where corrosive gases or fluids can be splashed.
- The Auto switch may get damaged and cause malfunction.
- Do not use the product in an area where surges are generated.
- When there are machines or equipment that generate large surges near the actuator with Auto switch (magnetic type lifter, high frequency inductive furnace, motor, etc.), this can result in deterioration and damage of the internal components. Take protective measures to isolate the surge sources, and prevent the lines from coming into close contact.

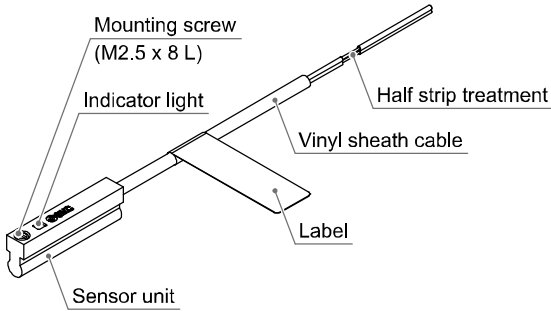
- ### Adjustment and Operation
- Fix the Auto switch after adjusting it to the centre of its operating range.
 - Adjust the Auto switch so that the piston stops near the middle of the operating range (the range that it is ON).
 - Mounting the auto switch close to the edge of the operating range (near the borderline of ON / OFF) can cause operation to be unstable.
 - Air grippers and rotary actuators have their own setting methods. Follow their instructions.
 - Connect the load before turning the power supply on.
- If the power supply is turned on with no load connected to the Auto switch, over current may flow, causing the product to break instantly.

- Others
- Please contact SMC concerning water resistance, elasticity of lead wires, usage at welding sites, etc.
- Please contact SMC if there is a problem with the ON / OFF positions (hysteresis).

The diagram illustrates the hysteresis effect in a piston-based valve. It consists of two parts. The top part shows a piston moving to the right (indicated by an arrow) towards the 'ON position'. The bottom part shows a piston moving to the left (indicated by an arrow) towards the 'OFF position'. The distance between the two switching points is labeled 'Hysteresis'.

Model	D-M9BA-917/D-M9BA##PC-917	
Load voltage	8.2 VDC (7 to 12.5 VDC)	
Output current when ON (Load current)	≥2.1 mA	
Output current when OFF (Leakage current)	≤1.2 mA	
Operating time	1 ms or less	
Indicator light	Operating range: Red LED illuminates Proper operating range: Green LED illuminates	
Electrical entry	Grommet	
Lead wire	Oilproof heavy-duty lead wire: $\phi 2.6, 0.15 \text{ mm}^2$	
Impact resistance	Switch: 1000 m/s^2 Connector: 300 m/s^2	
Enclosure	IP67	
Insulation resistance	≥100 MΩ (at 500 VDC mega)	
Withstand voltage	1000 VAC, 1 minute (between case and cable)	
Ambient temperature	-10 to 60°C	
CE marked	EMC directive, RoHS directive, ATEX directive	
Intrinsic safety circuit parameters	Maximum input voltage (Ui)	12.5 V
	Maximum input current (Ii)	25 mA
	Maximum input power (Pi)	78 mW
	Maximum Internal inductance (Li)	13.5 μH
	Maximum Internal capacitance (Ci)	0.74 μF

3 Names of Parts of Product

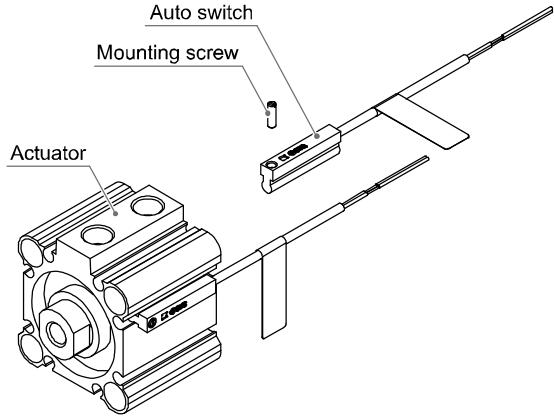


D- M9 BA SAPC - 917

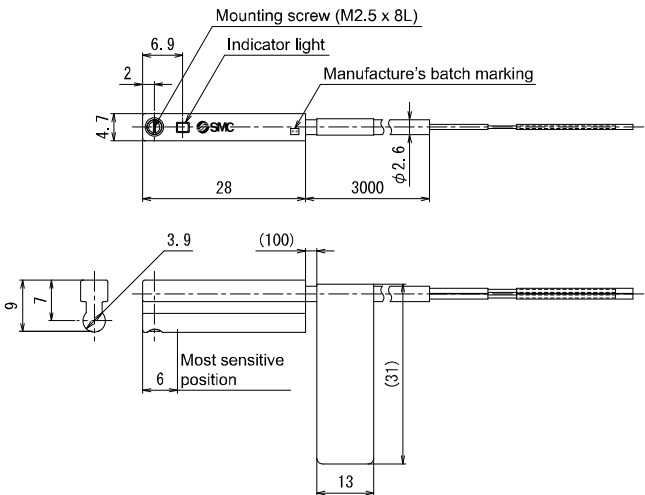
No symbol	3000 mm
SAPC	M8-3 pin: 500 mm
SDPC	M12-4 pin: 500 mm

— Solid State Auto Switch

- Correct tightening torque
For the tightening of the mounting screws, use a precision screwdriver with a handle diameter of approximately 5 to 6 mm.
The tightening torque of the M2.5 mounting screw must be 0.1 to 0.18 N•m.



- D-M9BA-917



- Diagram illustrating the relationship between the **Year** and **Month** tables:

 - Year Table:** Columns: Mark, Year
 - Month Table:** Columns: Mark, Month
 - Relationships:
 - Year (Year Table) is linked to Year (Month Table) via a double slash and a cross symbol (//).
 - Mark (Year Table) is linked to Mark (Month Table) via a double slash and a cross symbol (//).

Technical drawing of the SMC connector assembly. The drawing shows a side view of the assembly with the following dimensions:

- Overall length: 500
- Length of the connector housing: 32.7
- Outer diameter of the connector housing: $\varnothing 11.3$
- Connector size: M8

Technical drawing of the SMC-1000 probe assembly. The drawing shows a side view of the probe with dimensions. The total length of the probe is 500 mm. The distance from the probe tip to the center of the connector is 42.3 mm. The connector is labeled "Connector size M12" and has a diameter of 15 mm. The probe body is labeled "SMC".

```

graph TD
    A[Trouble occur] --> B[Trouble condition]
    B -- "Stays ON  
(Sometimes OFF)" --> C[Indicator LED is ON]
    B -- "Stay OFF  
(Sometimes ON)" --> D[Indicator LED is ON]
    C -- "Stay OFF" --> E[Source voltage or load voltage]
    C -- "Normal" --> F((A))
    C -- "Stay ON" --> G((A))
    E -- "Normal" --> H[Replace the switch]
    E -- "Abnormal" --> I((B))
    H -- "Normal" --> J((A))
    H -- "Abnormal" --> K((C))
    D -- "Stay OFF" --> L((B))
    D -- "Normal" --> M((A))
    D -- "Stay ON" --> N((A))
  
```

The flowchart for troubleshooting a switch starts with 'Trouble occur', leading to 'Trouble condition'. From 'Trouble condition', there are two main paths: 'Stays ON (Sometimes OFF)' and 'Stay OFF (Sometimes ON)'. Both paths lead to 'Indicator LED is ON'. From 'Indicator LED is ON', there are three main paths: 'Stay OFF', 'Normal', and 'Stay ON'. The 'Stay OFF' path leads to 'Source voltage or load voltage'. If 'Source voltage or load voltage' is 'Normal', it leads to 'Replace the switch'. If 'Replace the switch' is 'Normal', it leads to 'A'. If 'Replace the switch' is 'Abnormal', it leads to 'C'. If 'Source voltage or load voltage' is 'Abnormal', it leads to 'B'. The 'Normal' path from 'Indicator LED is ON' leads to 'A'. The 'Stay ON' path from 'Indicator LED is ON' leads to 'A'. The 'Stay OFF' path from 'Indicator LED is ON' leads to 'B'. The 'Stay ON' path from 'Source voltage or load voltage' leads to 'B'. The 'Normal' path from 'Source voltage or load voltage' leads to 'Replace the switch'. The 'Abnormal' path from 'Replace the switch' leads to 'C'. The 'Normal' path from 'Replace the switch' leads to 'A'. The 'Abnormal' path from 'Replace the switch' leads to 'C'. The 'Stay OFF' path from 'Source voltage or load voltage' leads to 'B'. The 'Abnormal' path from 'Source voltage or load voltage' leads to 'B'. The 'Normal' path from 'Source voltage or load voltage' leads to 'Replace the switch'. The 'Abnormal' path from 'Source voltage or load voltage' leads to 'B'. The 'Stay OFF' path from 'Indicator LED is ON' leads to 'B'. The 'Normal' path from 'Indicator LED is ON' leads to 'A'. The 'Stay ON' path from 'Indicator LED is ON' leads to 'A'.

Regarding the actuator operation set up, the contents of the program may be maintained by the customer's application system. Take care to confirm safety when the power is re-connected, and the actuator operation is resumed, because the operation may have stopped in an unstable condition.

SMC Corporation

URL: <https://www.smcworld.com> (Global) <https://www.smc.eu> (Europe)
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