



# Installation & Maintenance Manual

Auto Switch (Solid State)

Type **D-NF001**

**D-NF002**



Read this manual before using this product.

For future reference, please keep this manual in a safe place.

This manual should be read in conjunction with the current catalogue.

## 1.1 General recommendation

These safety instructions are intended to prevent a hazardous situation and/or equipment damage.

These instructions indicate the level of potential hazard by label of "Caution", "Warning" or "Danger".

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.

**⚠ Caution :** Operator error could result in injury or equipment damage.

**⚠ Warning:** Operator error could result in serious injury or loss of life.

**⚠ Danger :** In extreme conditions, there is a possible result of serious injury or loss of life.

## ⚠ WARNING

1.1.1. 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 for the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements.

1.1.2. Only trained personnel should operate pneumatically operated machinery and equipment.

Compressed air can be dangerous if an operator is unfamiliar with it. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced operators.

1.1.3. Do not service machinery/equipment or attempt to remove component 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. Switch off air and electrical supplies and exhaust all residual compressed air in the system.
- 3) Before machinery/equipment is re-started, ensure all safety measures to prevent sudden movement of actuators etc. (Supply air into the system gradually to create backpressure, i.e. incorporate a soft-start valve).

1.1.4. 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) Installations 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) Equipment intended for use in potentially explosive atmospheres. Applications which have the possibility of having negative effects on people, property or animals. Special safety analysis is required.

## 2. INSTALLATION AND OPERATING ENVIRONMENT

### ⚠ WARNING

#### Design and selection

- ① Confirm the specifications.  
Read the specifications carefully and use this product appropriately. The product may be damaged or malfunction if it is used outside the range of specifications for load current, voltage, temperature or impact.
- ② Take precautions when multiple actuators are used close together.  
When multiple auto switch actuators are used in close proximity, magnetic field interference may cause the switches to malfunction. Maintain a minimum actuator separation of 40mm.
- ③ Keep wiring as short as possible.  
Although longer wiring does not affect the function, please keep it to 100m or shorter
- ④ Do not use a load that generates surge voltage.  
Although a zener diode for surge protection is connected at the output side of a solid state auto switch, damage may still occur if the surge is applied repeatedly. When a load such as a relay or solenoid which generates surge is directly driven, use a type of switch with a built-in surge absorbing element.
- ⑤ Cautions for use in an interlock circuit.  
When an auto switch is used for an interlock signal requiring high reliability, devise a double interlock system to avoid trouble by providing a mechanical protection function, or by also using another switch (sensor) together with the auto switch.  
Also perform periodic maintenance and confirm proper operation.
- ⑥ Ensure sufficient clearance for maintenance activities.  
When designing an application, be sure to allow sufficient clearance for maintenance and inspections.

#### Mount / adjustment

- ① Do not drop or bump.  
Do not drop, bump or apply excessive impacts (1000m/s<sup>2</sup> or more for solid state switches) while handling. Although the body of the switch may not be damaged, the inside of the switch could be damaged and cause a malfunction.
- ② Do not carry a actuator by the auto switch lead wires.  
Never carry an actuator by its lead wires. This may not only cause broken lead wires, but it may cause internal elements of the switch to be damaged by the stress.
- ③ Mount switches using the proper tightening torque.  
If a switch is tightened beyond the range of tightening torque, the mounting screws, mounting brackets or switch may be damaged.  
On the other hand, tightening below the range of tightening torque may allow the switch to slip out of position.
- ④ Mount a switch at the center of the operating range.  
Adjust the mounting position of an auto switch so that the piston stops at the center of the operating range (the range in which a switch is ON). (The mounting position shown in the catalog indicates the optimum position at stroke end.) If mounted at the end of the operating range (around the borderline of ON and OFF), operation may be unstable.

#### Wiring

- ① Avoid repeatedly bending or stretching lead wires.  
Broken lead wires can result from wiring patterns which repeatedly apply bending stress or stretching force to the lead wires.
- ② Confirm proper insulation of wiring.  
Be certain that there is no faulty wiring insulation (contact with other circuits, ground fault, improper insulation between terminals, etc.)  
Damage may occur due to excess current flow into a switch.
- ③ Do not wire with power lines or high voltage lines.  
Wire separately from power lines or high voltage lines, avoiding parallel wiring or wiring in the same conduit with these lines. Control circuits containing auto switches may malfunction due to noise from these other lines.
- ④ Do not allow short circuit of loads.  
All models of switches do not have built-in short circuit protection circuits. Note that if a load is short circuited, the switch will be instantly damaged because of excess current flow into the switch.
- ⑤ Avoid incorrect wiring.  
If wiring is incorrect, the switches will be damaged.

### ⚠ WARNING

#### Operating environment

- ① Do not use in an area where a magnetic field is generated.  
Auto switches can malfunction or magnets inside actuators can become demagnetized.
- ② Do not use in an environment where the auto switch will be continually exposed to water.  
Although switches satisfy IEC standard IP67 construction (JIS C 0920: watertight construction), avoid using switches in applications with continual exposure to water splash or spray. Poor insulation or swelling of the potting resin inside switches may cause malfunction.
- ③ Do not use in an environment with oil or chemicals.  
Consult SMC if auto switches are to be used in an environment with coolant, cleaning solvent, various oils or chemicals. If auto switches are used under these conditions for even a short time, they may be adversely affected by improper insulation, malfunction due to swelling of the potting resin, or hardening of the lead wires.
- ④ Do not use in an environment with temperature cycles.  
Consult SMC if switches are used where there are temperature cycles other than normal air temperature changes, as there may be adverse effects inside the switches.
- ⑤ Do not use in an area where surges are generated.  
When there are units (solenoid type lifter, high frequency induction furnace, motor, etc.) which generate a large amount of surge in the area around actuators with solid state auto switches, this may cause deterioration or damage to the switches. Avoid sources of surge generation and crossed lines.
- ⑥ Avoid accumulation of iron waste 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 an auto switch actuator, it may cause auto switches to malfunction due to a loss of the magnetic force inside the actuator.

#### Maintenance

- ① Perform the following maintenance periodically in order to prevent possible danger due to unexpected auto switch malfunction.
  - 1) Securely tighten switch mounting screws.  
If screws become loose or the mounting position is dislocated, retighten them after readjusting the mounting position.
  - 2) Confirm that there is no damage to lead wires.  
To prevent faulty insulation, replace switches or repair lead wires, etc., if damage is discovered.

#### Others

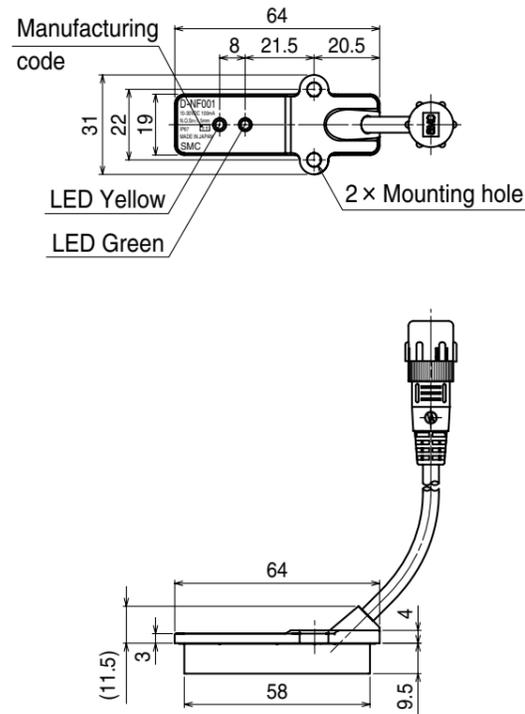
- ① For durability against water, elasticity, application at welding site, please consult us.
- ② If ON and OFF position (hysteresis) cause problems, please consult us.

## Specification

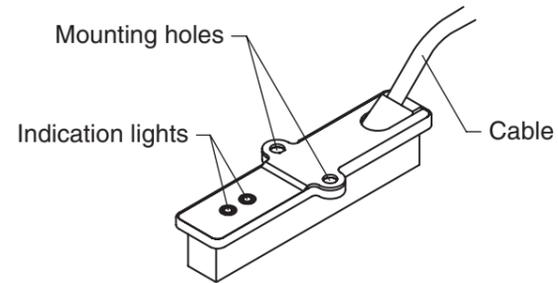
Item	Specifications
Wiring	2 wire
Output	-
Application	24VDC Relay/PLC
Power voltage	-
Current consumption	-
Load voltage	24VDC (10 to 28VDC)
Load current	2.5 to 100mA
Internal voltage drop	5V or less
Leakage current	0.6mA or less
Indication light	Yellow : Clamped, Green : Unclamped
Electrical entry system	Grommet
Standard applicable to connector	JISC4524, JISC4525, IEC60947-5-2, NECA4020
Lead wire	Oil and spatter resistance cable $\phi$ 4.8 4 wire
Impact proof	1000m/s <sup>2</sup>
Insulation resistance	50M $\Omega$ or more under the test voltage 500VDC (between case and cable)
Withstand voltage	1000VAC 1min (between case and cable)
Ambient temperature	-10 to 70°C
Enclosure	IEC60529 criteria IP67

## Outline with Dimensions (in mm)

### D-NF001



## Names and Functions of Individual Parts

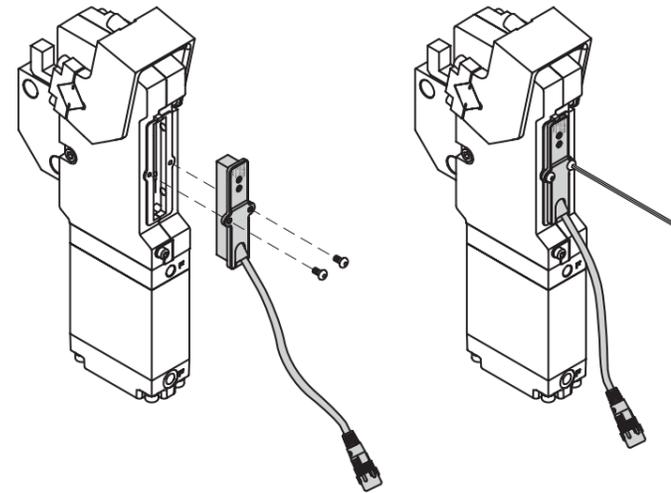


Terms	Meaning and Definition
Hysteresis	Difference between ON and OFF point which are to prevent chattering. This is called hysteresis.
Operating position	A distance to inverse the switch output when detected object approaches in vertical direction to sensing part of the auto switch.
Sequence controller (PLC)	Device to control the sequence. Input the Auto switch signals according to the program and output them to the other device.
Internal voltage drop	The voltage applied between COM and signal line when the switch is turned on.
Leakage current	Current applied to the load when the switch is turned off.
Load current	Current applied to the load when the switch is turned on.
Solid state auto switch	Auto switch to output ON-OFF regardless of the presence of mechanical contact such as transistor.
Reproducibility	Consistency of each positioning performed under the same conditions by the same method.

## Installation and Internal Circuit

### Installation

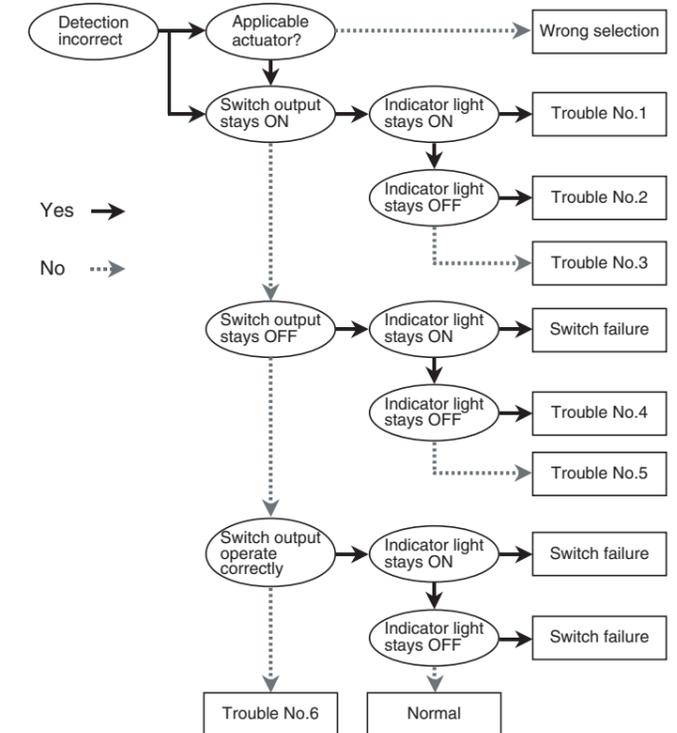
- Use a screw attached as an accessory to mount a switch on an actuator.



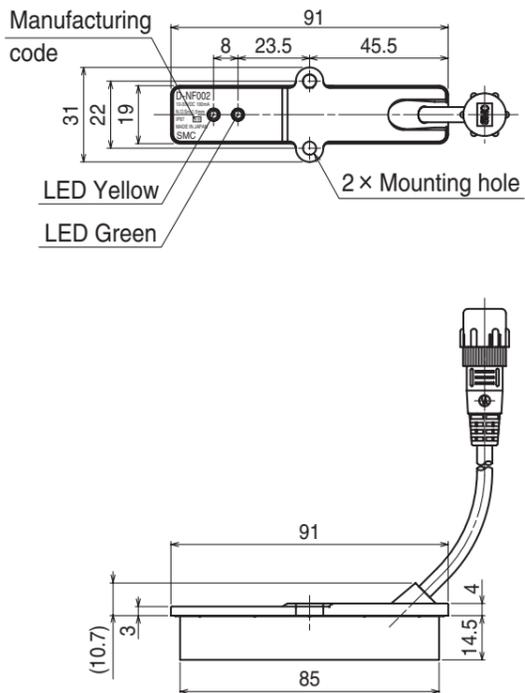
- Proper tightening torque  
Use special tool or torque wrench for tightening the set screw.  
M4 mount screw tightening torque shall be 0.5 to 0.9 N•m.

## Troubleshooting

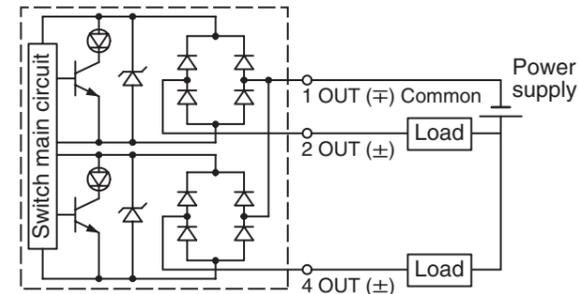
Refer to the flow chart below, in case of, operational failure of the auto switch.  
Auto switch failure is possible due to the operating environment (application).  
For this case, please consult SMC.



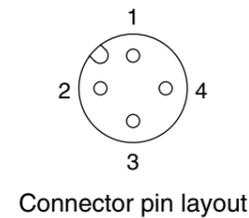
### D-NF002



### Internal Circuit



Two circuits of 2 wire are in one switch. Each ground is common.



## Troubleshooting (continued)

## Trouble list

Trouble No.	Trouble phenomenon	Possible cause of trouble	Check point	Trouble shooting
1	Output stays ON Display stays ON	Malfunction due to nearby magnetic field	Effect of magnetic field	Check the operating environment (presence of a welding machine etc.)
2	Output stays ON Display stays OFF	Wiring failure	Check the mounting condition of the connector.	Correct wiring (See Internal Circuit)
		Switch failure		Replace the switch
3	Output stays ON Display normal	No match with load spec.	Check if load spec. satisfies the formula below. Load ON voltage >(Switch leak current x n) x Load resistance n: Number of switches connected in parallel	Reduce the number of switches connected in parallel
		Wiring failure	Check the mounting condition of the connector.	Correct wiring (See Internal Circuit)

## Troubleshooting (continued)

Trouble No.	Trouble phenomenon	Possible cause of trouble	Check point	Trouble shooting
5	Output stays OFF Display is normal	No match with load spec.	Check if load spec. satisfies the formula below. Load ON voltage <Load voltage ÷ (Switch internal voltage drop x n) n : Number of switches connected in series	Reduce the number of switches connected in series
		Wiring failure (Output line)	Connect condition (connector contact pin/crimp terminal)	Correct wiring (Re-wiring the connecting part)
		Lead wire disconnection	Presence of repeated bending stress to one point of the lead wire (Bend radius/Tensile force to lead wire)	Replace the switch (Correct tensile force/increase bend radius)

Trouble No.	Trouble phenomenon	Possible cause of trouble	Check point	Trouble shooting
4	Output stays OFF Display stays OFF	Abnormal power source	Check the load voltage (Zero or very low)	Set the source voltage to specified voltage (See the Specification table, load voltage)
		Wiring failure	Check the mounting condition of the connector.	Correct wiring (See Internal Circuit)
		Set position displacement	Looseness of switch mounting screw.	Fix at the right position with correct torque. Tightening torque : 0.5 to 0.9N•m.
		Stop position displacement of the piston	Check if the stroke stop position is Inconsistent	Stabilize stop position
		Lead wire disconnected	Presence of repeated bending stress to one point of the lead wire (Bend radius/Tensile force to lead wire)	Replace the switch (Correct tensile force/increase bend radius)

Trouble No.	Trouble phenomenon	Possible cause of trouble	Check point	Trouble shooting
6	Unstable operation (Chattering)	Set position displacement	Looseness of switch mounting screw	Fix at the right position with correct torque Tightening torque : 0.5 to 0.9N•m
		Wiring failure	Condition of connecting part (connector contact pin crimp terminal)	Correct wiring (Re-wiring of connecting part)
		Lead wire disconnection	Presence of repeated bending stress to one point of the lead wire (Bend radius/ Tensile force to lead wire)	Replace the switch (Correct tensile force/increase bend radius)
		Malfunction due to nearby magnetic field	Presence of magnetic field generating source around the cylinder (Cylinder, electric welding machine conductor, motor, magnet etc.)	Keep the cylinder away from magnetic field generating source

## Contact

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BELGIUM	(32) 3 355 1464	NORWAY	(47) 67 12 90 20
CZECH REP.	(420) 541 424 611	POLAND	(48) 22 211 9600
DENMARK	(45) 7025 2900	PORTUGAL	(351) 21 471 1880
FINLAND	(358) 207 513513	SLOVAKIA	(421) 2 444 56725
FRANCE	(33) 1 6476 1000	SLOVENIA	(386) 73 885 412
GERMANY	(49) 6103 4020	SPAIN	(34) 945 184 100
GREECE	(30) 210 271 7265	SWEDEN	(46) 8 603 1200
HUNGARY	(36) 23 511 390	SWITZERLAND	(41) 52 396 3131
IRELAND	(353) 1 403 9000	UNITED KINGDOM	(44) 1908 563888
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