



ORIGINAL INSTRUCTIONS

Instruction Manual

5 Port Solenoid Valve

Series VF1000/3000/5000



The intended use of this valve is to control the movement of an actuator.

1 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^{*)}, and other safety regulations.

^{*)} 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 10218-1: Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots.

- Refer to product catalogue, Operation Manual and Handling Precautions for SMC Products for additional information.
- Keep this manual in a safe place for future reference.

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

- Always ensure compliance with relevant safety laws and standards.
- All work must be carried out in a safe manner by a qualified person in compliance with applicable national regulations.
- If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Caution

- The product is provided for use in manufacturing industries only. This product must not be used in residential areas.

2 Specifications

2.1 Valve specifications

Model	VF1000	VF3000	VF5000
Fluid	Air		
Operating pressure range [MPa]	Standard	2 position single/3 position	0.15 to 0.7
	High pressure	2 position double	0.1 to 0.7
Ambient and fluid temperature [°C]	Standard	2 position single/3 position	0.15 to 1.0
	High pressure	2 position double	0.1 to 1.0
Flow characteristics	Refer to catalogue		
Response time [ms]	Refer to catalogue		
Duty cycle	Contact SMC		
Min. operating frequency	1 cycle / 30 days		
Max. operating frequency [Hz]	2 position single/double	10	5
	3 position	-	3
type	Low wattage	2 position	5
	3 position	-	3

2 Specification - continued

Manual override	Non-locking push type, Push-turn locking (slotted/lever) type
Lubrication	Not required
Impact/Vibration resistance [m/s ²] ^{Note 1)}	300/50 (150/30 for Low wattage type)
Enclosure (based on IEC60529)	IP40 (IP65 ^{Note 2)} for D, Y, T)
Mounting orientation	Unrestricted
Weight	Refer to catalogue

Table 1.

Note 1) Impact resistance: No malfunction occurred when it was tested with a drop tester in the axial direction and at right angles to the main valve and armature; in both energized and de-energized states and for every time in each condition. (Values quoted are for a new valve)
Vibration resistance: No malfunction occurred in a one-sweep test between 45 and 2000 Hz. Tests are performed at both energized and de-energized states in the axial direction and at right angles to the main valve and armature. (Values quoted are for a new valve).

Note 2) When using IP65, select main/pilot valve common exhaust type.

2.2 Solenoid specifications

Type/Pilot valve	G/H, L/M(N/O) V211##-###	D(O), Y(O), T V212##-#	Low wattage specification
Coil rated voltage	DC [VDC]	12, 24	
	AC [VAC]	24	24, 100, 110, 200, 220, 240
Electrical entry	Grommet, L/M-type plug connector	DIN/Conduit terminal	Grommet, L/M-type plug connector, DIN terminal
	Class B		
Coil insulation class	Class B		
Allowable voltage fluctuation	±10% of rated voltage ^{Note 1)} ^{Note 2)} ^{Note 3)}		
Apparent power [VA] ^{Note 4)}	24 VAC	1.5 (1.55)	1.5 (1.75)
	100 VAC	-	-
	110 VAC	-	-
	115 VAC	-	-
	200 VAC	-	-
	220 VAC	-	-
	230 VAC	-	-
240 VAC	-	-	

Power consumption [W] ^{Note 4)}	Standard	1.5 (1.55)	1.5 (1.75)	0.35 (0.4)	0.35 (0.45)
With power saving circuit	0.55 ^{Note 5)}	Starting 1.55, Holding 0.55	Starting 1.75, Holding 0.75	-	-
Surge voltage suppressor	Diode (Non-polar type: Varistor)				
Indicator light	AC	LED	Neon light	-	Neon light
	DC	LED			

Table 2.

Note 1) Common solenoid between 110 VAC and 115 VAC, and between 220 VAC and 230 VAC.

Note 2) Allowable voltage fluctuation is -15% to +5% of the rated voltage for 115 VAC or 230 VAC.

Note 3) Since voltage drops due to the internal circuit in S, Z, T types (with power saving circuit), the allowable voltage fluctuation should be within the following range. 24 VDC: -7% to +10% 12 VDC: -4% to +10%.

Note 4) Bracketed values (#) refers to with indicator light.

Note 5) Refer to Specific Product Precautions 4 in catalogue.

2.3 Manifold specifications

2.3.1 Body ported valve manifold

Series	VF1000	VF3000	VF5000
Manifold	VV5F1-30	VV5F1-31	VV5F3-30
EXH port type	Common	Individual	Common
1(P) size	1/8	1/4	3/8
2(B), 4(A) size	1/8	1/8, 1/4	1/4, 3/8
3(R/EB), 5 (R/EA) size	1/8	M5 x 0.8	1/4
Applicable valve model	VF1#30 VF1#33	VF3#30 VF3#33	VF5#20 VF5#23
Stations	2 to 20		2 to 15

Table 3.

2.3.2 Base mounted valve manifold

Series	VF3000	VF5000
Manifold	VV5F3-40	VV5F5-40
EXH port type	Common	Common
1(P) size	1/4	3/8

2 Specification - continued

2(B), 4(A) size	1/4	1/4
3(R/EB), 5 (R/EA) size	1/4	3/8
Pilot exhaust (PE) size	-	M5 x 0.8
Applicable valve model	VF3#40, VF3#43	VF5#44
Stations ^{Note 1)}	2 to 20	2 to 10

Table 4.

Note 1) Supply pressure to 1(P) ports and exhaust pressure from R ports on both sides for 10 or more station for VF3000, or for 5 or more stations for VF5000.

2.4 Pneumatic symbol

Refer to catalogue.

2.5 Indicator light

Refer to catalogue for indicator light location.

2.6 Special products

Warning

Special products (-X) might have specifications different from those shown in this section. Contact SMC for specific drawings.

3 Installation

3.1 Installation

Warning

- Do not install the product unless the safety instructions have been read and understood.

3.2 Environment

Warning

- Do not use in an environment where corrosive gases, chemicals, salt water or steam are present.
- Do not use in an explosive atmosphere.
- Do not expose to direct sunlight. Use a suitable protective cover.
- Do not install in a location subject to vibration or impact in excess of the product's specifications.
- Do not mount in a location exposed to radiant heat that would result in temperatures in excess of the product's specifications.

- Products compliant with IP65 enclosures are protected against dust and water, however, these products cannot be used in water.
- Products compliant with IP65 enclosures satisfy the specifications by mounting each product properly. Be sure to read the Specific Product Precautions for each product.

3.3 Piping

Caution

- Before connecting piping make sure to clean up chips, cutting oil, dust etc.
- When installing piping or fittings, ensure sealant material does not enter inside the port. When using seal tape, leave 1 thread exposed on the end of the pipe/fitting.
- Tighten fittings to the specified tightening torque.

Model	Port	Thread	Tightening torque [N·m]
Body ported VF1000 (Low wattage specification)	1(P), 2(B), 3(EB), 4(A), 5(EA)	M5	1 to 1.5
	3(EB), 5(EA)		
Body ported VF1000 (Standard)	1(P), 2(B), 4(A)	1/8	3 to 5
	1(P), 2(B), 4(A)		
Body ported VF3000 (Standard/Low wattage specification)	3(EB), 5(EA)	1/4	8 to 12
	1(P), 2(B), 4(A)		
Base mounted VF3000 sub-plate (Standard/Low wattage specification), Body ported/Base mounted VF5000 sub-plate	1(P), 2(B), 3(EB), 4(A), 5(EA)	3/8	15 to 20
	1(P), 2(B), 3(EB), 4(A), 5(EA)		
Base mounted VF5000 sub-plate	1(P), 2(B), 3(EB), 4(A), 5(EA)	1/2	20 to 25

Table 5.

- Refer to 2.3 for manifold port sizes.

3 Installation - continued

3.3.1 One-touch fittings

Caution

When fittings are used, they may interfere with one another depending on their types and sizes. Therefore, the dimensions of the fittings to be used should first be confirmed in their respective catalogues. Refer to catalogue for fittings compliant with VF series. If the fitting within the applicable range is selected, there will not be any interference.

3.3.2 Precautions on other tube brands

Caution

Refer to the Specific Product Precautions in the fittings and tubing catalogue.

3.4 Lubrication

Caution

- SMC products have been lubricated for life at manufacture, and do not require lubrication in service.
- If a lubricant is used in the system, refer to catalogue for details.

3.5 Air supply

Warning

- Use clean air. If the compressed air supply includes chemicals, synthetic materials (including organic solvents), salinity, corrosive gas etc., it can lead to damage or malfunction.

Caution

- Install an air filter upstream of the valve. Select an air filter with a filtration size of 5 µm or smaller.

3.6 Manual override

Warning

- Regardless of an electric signal for the valve, the manual override is used for switching the main valve. Since connected equipment will operate when the manual override is activated, confirm that conditions are safe prior to activation.
- Locked manual overrides might prevent the valve responding to being electrically de-energised or cause unexpected movement in the

equipment.

- Refer to the catalogue for details of manual override operation.
- Do not apply excessive torque when turning the locking type manual override (0.1 N·m or less).

3.7 Mounting

Caution

- Ensure gaskets are in good condition, not deformed and are dust and debris free.
- When mounting valves ensure gaskets are present, aligned and securely in place and tighten the M4 (M4 x 39.5 for VF1000/3000, M4 x 48 for VF5000) mounting screws to a torque of 1.4 N·m.

3.8 Electrical circuits

Caution

- Surge suppression should be specified by using the appropriate part number. If a valve type without suppression (Type 'Nil') is used, suppression must be provided by the host controller as close as possible to the valve.
- Please connect correctly the lead wires to + (positive) and - (negative) indications on the connector. (For non-polar type, the lead wires can be connected to either one.)
- When the valve with polarity protection diode is used, the voltage will drop by approx. 1 V. Therefore, pay attention to the allowable voltage fluctuation (For details, refer to the solenoid specifications of each type of valve).
- Solenoids, whose lead wires have been pre-wired: + (positive) side red and - (negative) side black.

3 Installation - continued

3.8.1 DC - Polar type

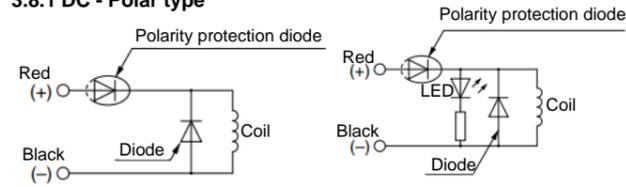


Figure 1. With surge voltage suppressor (#S)

Figure 2. Grommet or L/M-type plug with light/surge voltage suppressor (#Z)

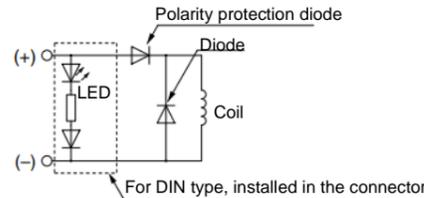


Figure 3. DIN or Conduit terminal with light/surge voltage suppressor (Standard type #Z)

3.8.2 DC - Non-polar type

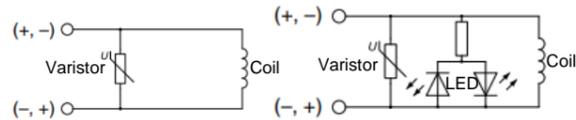


Figure 4. With surge voltage suppressor (Standard #R/Low wattage type #R, #S)

Figure 5. Grommet or L/M-type plug with light/surge voltage suppressor (#U)

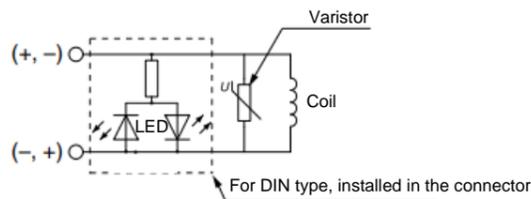


Figure 6. DIN or Conduit terminal with light/surge voltage suppressor (Standard #U/Low wattage type #Z)

3.8.3 Power saving

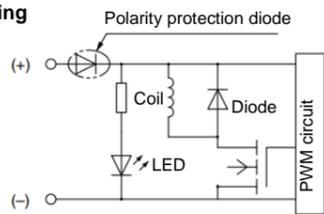


Figure 7. Power saving circuit

Note) Effective energizing time is over 40 ms at 24 VDC. Refer to catalogue for details of the electrical power waveform.

3 Installation - continued

3.8.4 AC

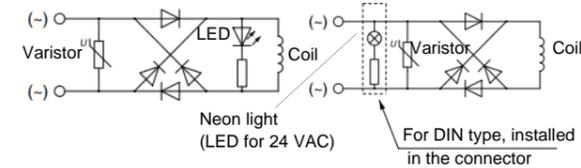


Figure 8. Grommet or L/M-type plug with light/surge voltage suppressor (#Z)

Figure 9. DIN or Conduit terminal with light/surge voltage suppressor (#Z)

3.9 Electrical connectors

Caution

3.9.1 DIN terminal

- Refer to catalogue for how to use DIN connector.
- Refer to catalogue for how to change DIN connector direction.
- Applicable cable diameter O.D.: $\phi 3.5$ to $\phi 7$.

3.9.2 DIN (EN175301-803) terminal

Y type DIN terminal corresponds to the DIN connector with terminal pitch 10 mm, which complies with EN175301-803B. Since the terminal pitch is different from the D type DIN connector, these two types are not interchangeable.

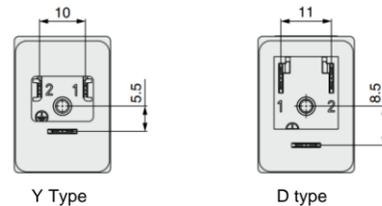


Figure 10. D/Y type DIN terminal diagram

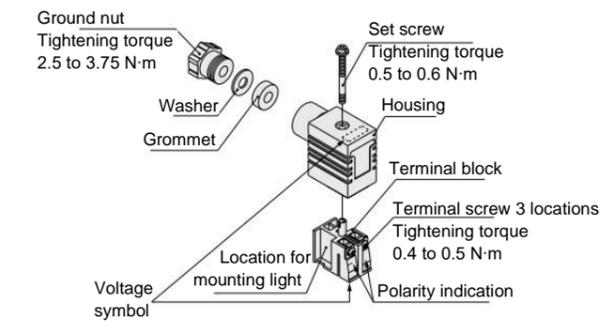


Figure 11. DIN connector assembly (Standard type)

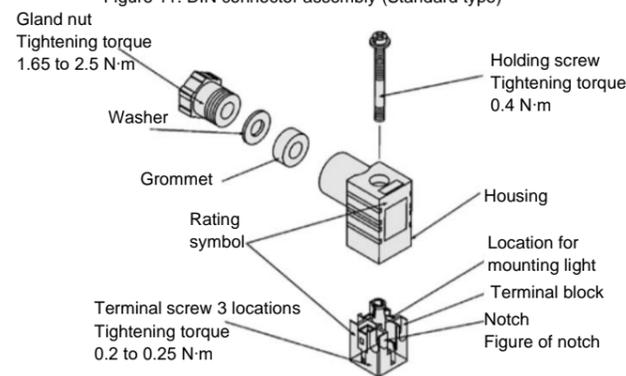
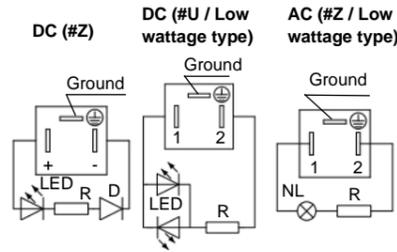


Figure 12. DIN connector assembly (Low wattage specification)

3 Installation - continued



D: Protective diode R: Resistor NL: Neon light

Figure 13. DIN connector pin wiring diagram

3.9.3 Conduit terminal

- Refer to catalogue for how to use Conduit terminal.
- For polar type refer to terminal polarity shown in figure 14.
- Applicable cable diameter O.D.: $\phi 4.5$ to $\phi 7$.

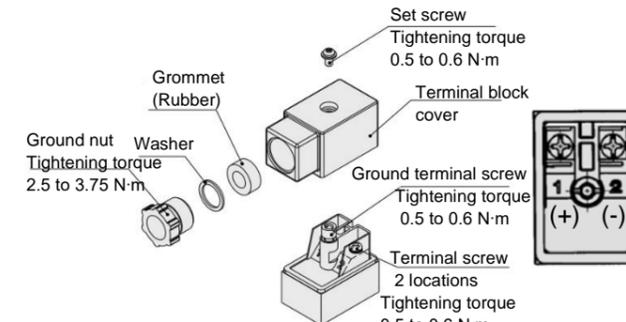


Figure 14. Conduit terminal assembly

3.9.4 L/M-Type plug connector

Refer to catalogue for how to order and how to use plug connector assembly

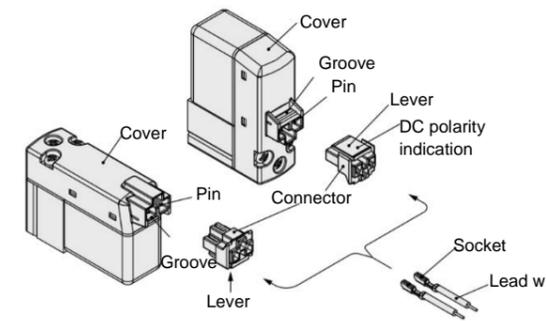


Figure 15. Connector attachment/detachment (standard type)

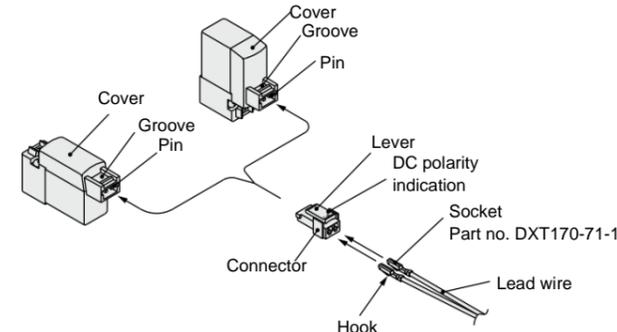


Figure 16. Connector attachment/detachment (low wattage type)

3 Installation - continued

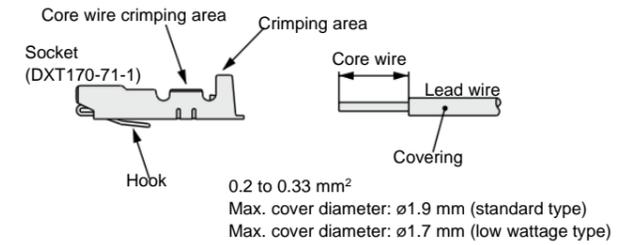


Figure 17. Crimping lead wire and socket connection

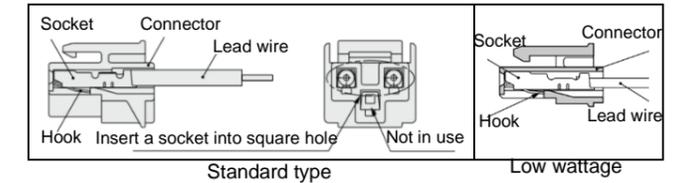


Figure 18. Socket with lead wire attachment/detachment

3.10 Residual voltage

Caution

- If a diode or varistor voltage suppressor is used, the suppressor arrests the back EMF voltage from the coil to the level indicated in Table 6.
- Ensure the transient voltage is within the specification of the host controller.
- Valve response time is dependent on surge suppression method selected.

Surge voltage suppressor	DC		AC
	24 V	12 V	
Diode	Approx. 1 V		Approx. 1 V
Varistor	Approx. 47 V	Approx. 32 V	-

Table 6.

3.11 Countermeasure for surge voltage

Caution

- At times of sudden interruption of the power supply, the energy stored in a large inductive device may cause non-polar type valves in a de-energised state to switch.
- When installing a breaker circuit to isolate the power, consider a valve with polarity (with polarity protection diode), or install a surge absorption diode across the output of the breaker.

3.12 Extended period of continuous energization

Warning

- If a valve is continuously energized for an extended period of time, the temperature of the valve will increase due to the heat generated by the coil assembly. This will likely adversely affect the performance of the valve and any nearby peripheral equipment. Therefore, if the valve is to be energized for periods of longer than 30 minutes at a time or if during the hours of operation the energized period per day is longer than the de-energized period, we advise using a valve with specifications listed below.
- Pilot operated: A 0.4 W or lower valve, such as the SY series, or a valve with a power-saving circuit.

3.13 Effect of back pressure when using a manifold

Warning

- Use caution when valves are used on a manifold, because an actuator may malfunction due to back-pressure.
- Special caution must be taken when using 3 position exhaust centre valve or when driving a single acting cylinder. To prevent a malfunction, implement counter measures such as using a single EXH spacer assembly or an individual exhaust manifold.

4 How to Order

Refer to catalogue for 'How to Order'.

5 Outline Dimensions

Refer to catalogue for outline dimensions.

6 Maintenance

6.1 General maintenance

⚠ Caution

- Not following proper maintenance procedures could cause the product to malfunction and lead to equipment damage.
- If handled improperly, compressed air can be dangerous.
- Maintenance of pneumatic systems should be performed only by qualified personnel.
- Before performing maintenance, turn off the power supply and be sure to cut off the supply pressure. Confirm that the air is released to atmosphere.
- After installation and maintenance, apply operating pressure and power to the equipment and perform appropriate functional and leakage tests to make sure the equipment is installed correctly.
- If any electrical connections are disturbed during maintenance, ensure they are reconnected correctly and safety checks are carried out as required to ensure continued compliance with applicable national regulations.
- Do not make any modification to the product.
- Do not disassemble the product, unless required by installation or maintenance instructions.

6.2 Mounting

⚠ Caution

Refer to 3.7 Mounting for how to mount valve to sub-plate or manifold.

6.3 Maintainable parts

⚠ Caution

- Refer to catalogue for how to order pilot for how to order and replace pilot valves (Not available for Low wattage specification valves). Recommended tightening torque for M2.5 pilot valve mounting screws: 0.32 N·m.
- Refer to catalogue for how to order gaskets, mounting screws, manifold accessories, electrical connector assemblies and sub-plates.

7 Limitations of Use

7.1 Limited warranty and disclaimer/compliance requirements

⚠ Caution

Refer to Handling Precautions for SMC Products.

⚠ Warning

7.2 Effect of energy loss on valve switching

	Single solenoid	Double solenoid	3 Position
Air supply present, electrical supply cut	Spool returns to the OFF position by air and spring force	Spool stops moving after electricity cut (Position cannot be defined)	Spool returns to the OFF position by spring force
Electrical supply present, air supply cut	Spool stops moving after air pressure cut (Position cannot be defined)	Spool stops moving after air pressure cut (Position cannot be defined)	Spool returns to the OFF position by spring force

Table 7.

Note) Applies to when the spool is at the end position and at an intermediate position.

7.3 Cannot be used as an emergency shut-off valve

This product is not designed for safety applications such as an emergency shut-off valve. If the valves are used in this type of system, other reliable safety assurance measures should be adopted.

7.4 Intermediate stopping

Refer to Handling Precautions for 3/4/5 port Solenoid Valves.

7.5 Holding of pressure

Since valves are subject to air leakage, they cannot be used for applications such as holding pressure (including vacuum) in a system.

⚠ Caution

7.6 Leakage voltage

Ensure that any leakage voltage caused by the leakage current when the switching element is OFF causes $\leq 3\%$ (for DC coils) or $\leq 8\%$ (for AC coils) of the rated voltage across the valve.

7 Limitations of Use - continued

7.7 Low temperature operation

Unless otherwise indicated in the specifications for each valve, operation is possible to -10°C , but appropriate measures should be taken to avoid solidification or freezing of drainage and moisture, etc.

7.8 Momentary energization

If a double solenoid valve is operated with momentary energization, it should be energized for at least 0.1 second. However, depending on the secondary load conditions, it should be energized until the cylinder reaches the stroke end position, as there is a possibility of malfunction otherwise.

7.9 Class and group description

- This product is group 1, class A equipment according to EN55011.
- Group 1 equipment does not intentionally generate radio-frequency energy in the range 9kHz to 400 GHz.
- Class A equipment is equipment suitable for use in all locations other than those allocated in residential environments and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.
- This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

7.10 Cable length to connect

The cable to connect the product shall be less than or equal to 30m.

7.11 Connecting the power supply

This product is not intended to be directly connected to any DC Distribution network.

8 Product Disposal

This product shall not be disposed of as municipal waste. Check your local regulations and guidelines to dispose this product correctly, in order to reduce the impact on human health and the environment.

9 Contacts

Refer to www.smcworld.com or www.smc.eu for your local distributor/importer.

SMC Corporation

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