



Operation Manual

PRODUCT NAME

SI unit

MODEL / Series / Product Number

EX140-SDN1

SMC Corporation




Table of Contents

1. Safety instructions	2
2. Specifications	7
2-1. General specifications	7
2-2. Electrical ant network specifications	7
2-3. Applicable solenoid valve series	8
3. Wiring and setting	8
3-1 Connection type	8
3-2 Address setting	11
4. LED indicator and Physical dimensions	13
4-1 LED indication	13
4-2 Physical dimensions	13
5. Troubleshooting	14

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) *1) and other safety regulations.

- *1) 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 10218-1992: Manipulating industrial robots -Safety.
- etc.

-  **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

- 1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.**

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.
- 2. Only personnel with appropriate training should operate machinery and equipment.**

The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.
- 3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.**
 1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
 2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
 3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.
- 4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.**
 1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
 2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.
 3. An application which could have negative effects on people, property, or animals requiring special safety analysis.
 4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

Caution

The product is provided for use in manufacturing industries.

The product herein described is basically provided for peaceful use in manufacturing industries. If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.
If anything is unclear, contact your nearest sales branch.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following "Limited warranty and Disclaimer" and "Compliance Requirements".

Read and accept them before using the product.

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first. *2)

Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.

2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.

This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.

3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

*2) Vacuum pads are excluded from this 1 year warranty.

A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.

Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.

2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulation of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

Operator

- ◆ This operation manual is intended for those who have knowledge of machinery using pneumatic equipment, and have sufficient knowledge of assembly, operation and maintenance of such equipment. Only those persons are allowed to perform assembly, operation and maintenance.
- ◆ Read and understand this operation manual carefully before assembling, operating or providing maintenance to the product.

■ Precautions

Warning

- Do not disassemble, modify (including changing the printed circuit board) or repair.
An injury or failure can result.
- Do not operate the product outside of the specifications.
Do not use for flammable or harmful fluids.
Fire, malfunction, or damage to the product can result.
Verify the specifications before use.
- Do not operate in an atmosphere containing flammable or explosive gases.
Fire or an explosion can result.
This product is not designed to be explosion proof.
- If using the product in an interlocking circuit:
 - Provide a double interlocking system, for example a mechanical system.
 - Check the product regularly for proper operationOtherwise 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 and verify that the air is released before performing maintenanceOtherwise an injury can result.

Caution

- After maintenance is complete, perform appropriate functional inspections.
Stop operation if the equipment does not function properly.
Safety cannot be assured in the case of unexpected malfunction.
- Provide grounding to assure the safety and noise resistance of the product.
Individual grounding should be provided close to the product with a short cable.

■NOTE

- Follow the instructions given below when designing, selecting and handling the product.
- The instructions on design and selection (installation, wiring, environment, adjustment, operation, maintenance, etc.) described below must also be followed.
- *Product specifications
 - When conformity to UL is required, the SI unit should be used with a UL1310 Class 2 power supply.
 - Use the specified voltage.
Otherwise failure or malfunction can result.
 - Reserve a space for maintenance.
Allow sufficient space for maintenance when designing the system.
 - Do not remove any nameplates or labels.
This can lead to incorrect maintenance, or misreading of the operation manual, which could cause damage or malfunction to the product.
- Precautions on handling
 - *Installation
 - Do not drop, hit or apply excessive shock to the product.
Otherwise damage to the product can result, causing malfunction.
 - Tighten to the specified tightening torque.
If the tightening torque is exceeded the mounting screws may be broken.
 - Never mount a product in a location that will be used as a foothold.
The product may be damaged if excessive force is applied by stepping or climbing onto it.
 - *Wiring
 - Avoid repeatedly bending or stretching the cables, or placing heavy load on them.
Repetitive bending stress or tensile stress can cause breakage of the cable.
 - Wire correctly.
Incorrect wiring can break the product.
 - Do not perform wiring while the power is on.
Otherwise damage to the product can result, causing malfunction.
 - Do not route wires and cables together with power or high voltage cables.
Otherwise the product can malfunction due to interference of noise and surge voltage from power and high voltage cables to the signal line.
Route the wires (piping) of the product separately from power or high voltage cables.
 - Confirm proper insulation of wiring.
Poor insulation (interference from another circuit, poor insulation between terminals, etc.) can lead to excess voltage or current being applied to the product, causing damage.
 - Take appropriate measures against noise, such as using a noise filter, when the product is incorporated into equipment.
Otherwise noise can cause malfunction.

*Environment

- Do not use the product in area that is exposed to corrosive gases, chemicals, sea water, water or steam.
Otherwise failure or malfunction can result.
- Do not use in an area where surges are generated.
If there is equipment which generates a large amount of surge (solenoid type lifter, high frequency induction furnace, motor, etc.) close to the product, this may cause deterioration or breakage of the internal circuit of the product. Avoid sources of surge generation and crossed lines.
- Prevent foreign matter such as remnant of wires from entering the product to avoid failure and malfunction.
- Mount the product in a place that is not exposed to vibration or impact.
Otherwise failure or malfunction can result.
- Do not use the product in an environment that is exposed to temperature cycle.
Heat cycles other than ordinary changes in temperature can adversely affect the inside of the product.
- Do not expose the product to direct sunlight.
If using in a location directly exposed to sunlight, shade the product from the sunlight.
Otherwise failure or malfunction can result.
- Keep within the specified ambient temperature range.
Otherwise malfunction can result.
- Do not operate close to a heat source, or in a location exposed to radiant heat.
Otherwise malfunction can result.

*Adjustment and Operation

- Set the switches by using a sharp-pointed screwdriver etc.
It may damage set switches.
- Perform settings suitable for the operating conditions.
Incorrect setting can cause operation failure.
- Please refer to the PLC manufacturer's manual etc. for details of programming and addresses.
For the PLC protocol and programming refer to the relevant manufacturer's documentation.

*Maintenance

- Turn off the power supply, stop the supplied air, exhaust the residual pressure and verify the release of air before performing maintenance.
There is a risk of unexpected malfunction.
- Perform regular maintenance and inspections.
There is a risk of unexpected malfunction.
- After maintenance is complete, perform appropriate functional inspections.
Stop operation if the equipment does not function properly.
Otherwise safety is not assured due to an unexpected malfunction or incorrect operation.
- Do not use solvents such as benzene, thinner etc. to clean the product.
They could damage the surface of the body and erase the markings on the body.
Use a soft cloth to remove stains.
For heavy stains, use a cloth soaked with diluted neutral detergent and fully squeezed, then wipe up the stains again with a dry cloth.

2. Specifications

2-1. General specifications

Item	Specifications
Operating temperature range	Operating: 0 to +50°C, Storage: -20 to +60°C (No freezing or condensation)
Storage temperature range	35 to 85%RH (No condensation)
Withstand voltage	1500VAC for 1 minute, between external terminals and ground
Insulation resistance	500VDC 2MΩ or more, between external terminals and ground
Environment	No corrosive gas and no dust in included
Enclosure	IP20
Weight	80g or less

2-2. Electrical and network specifications

Item	Specifications
Applicable system	DeviceNet Release 2.0
Power supply (Communication)	11VDC to 25VDC (supplied by communication connector)
Power supply (Valve)	24VDC+10%-5% (Supplied from the power supply connector of the solenoid valve)
Current consumption	Communication and internal power supply: 100mA or less (24VDC) Power supply for solenoid valve: 1.5A or less (24VDC)
Polarity of output	Sink/NPN (Positive common)
Connected load	24VDC 1.5W (SMC) solenoid valve with circuit protection of surge voltage
Insulation type	Opt-coupler insulation type
Residual voltage	0.3V or less
Applicable DeviceNet	Volume I -Release 1.2 Volume II -Release 1.1
Node address range	0 to 63
Baud Rate (Transmission speed)	500kbps/250Kbps/125Kbps
Slave (branch station) type	Group 2 Only Server
Connection type	T branch type, Multi drop type
Device type	27
Product code	1202
Setting file	EDS file (downloaded from our web site.)
Vendor ID	7
Corresponding message	Polled command (I/O message), Explicit message

SI unit I/O data (Receiving and sending data of polled command)

Item		Output(Poll request)	Input(Poll response)
Occupied byte		2 byte (Solenoid valve output)	0 byte
Sending/ receiving data	Address +0	Output No. 0 to 7	
	Address +1	Output No. 8 to 15	

*) Mapping method of sending / receiving data is different by PLC.

For further information, refer to the manual for PLC master (scanner)

Bit of each output data and corresponding solenoid valve no.								
Offset	MSB				LSB			
0	No.7	No.6	No.5	No.4	No.3	No.2	No.1	No.0
1	No.15	No.14	No.13	No.12	No.11	No.10	No.9	No.8

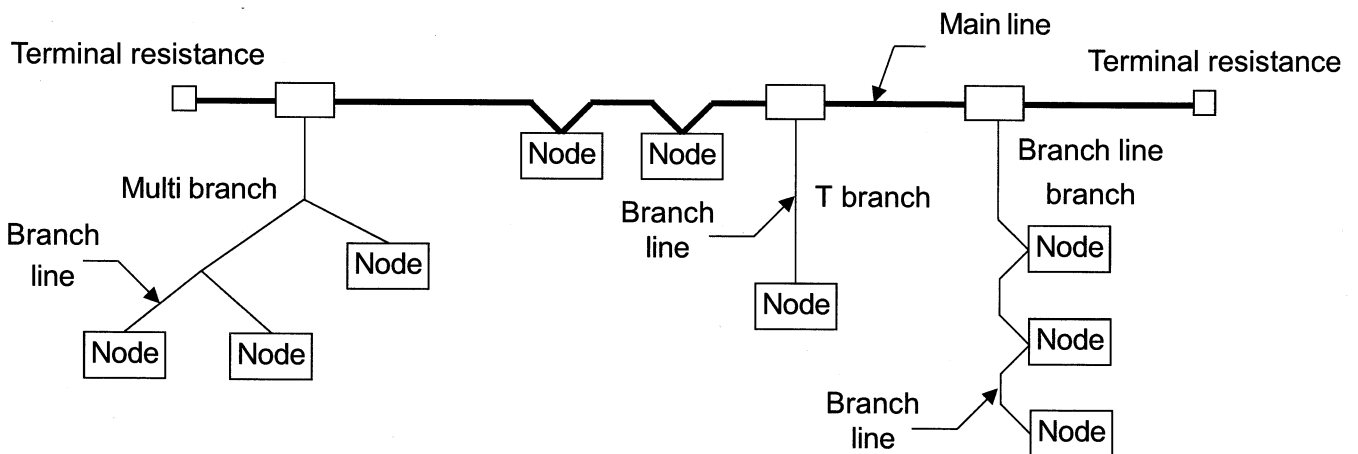
2-3. Applicable solenoid valve series

Valve type	Valve series
SQ series	SQ1000, SQ2000
SZ series	SZ3000

3. Wiring and Setting

3-1.Connection type

DeviceNet can be connected by T branch, Multi branch, Branch line branch and Multi drop. Total extension length of trunk and Branch line is different for different Baud rate and thickness of communication cable.



Length of cable

Communication distance	Baud rate	Total length of trunk	Length of branch line	Total length of branch line
Thick cable	500 kbps	100m or less	6m or less	39m or less
	250 kbps	250m or less		78m or less
	125 kbps	500m or less		156m or less
Thin cable	Common	100m or less		
Terminal resistance	121 ohm (1/2W)			

Cable specification

Item	Thick cable		Thin cable	
	Communication Signal	Power supply	Communication Signal	Power supply
Conductor cross section	0.82 mm ²	1.65 mm ²	0.20 mm ²	0.33 mm ²
Colors	Blue, White	Red, Black	Blue, White	Red, Black
Impedance	120 Ω ± 10%(1MHz)	---	120 Ω ± 10%(1MHz)	---
Propagation delay	1.36ns / ft(max)	---	1.36ns / ft(max)	---
Attenuation rate	500k: 0.25dB / ft 125k: 0.13dB / ft 1.00M: 0.40dB / ft	---	500k: 0.50dB / ft 125k: 0.29dB / ft 1.00M: 0.70dB / ft	---
Conductor resistance	6.9 Ω / 1000ft(max)	3.6 Ω / 1000ft (max)	28 Ω / 1000ft(max)	17.5 Ω / 1000ft(max)

CAUTION

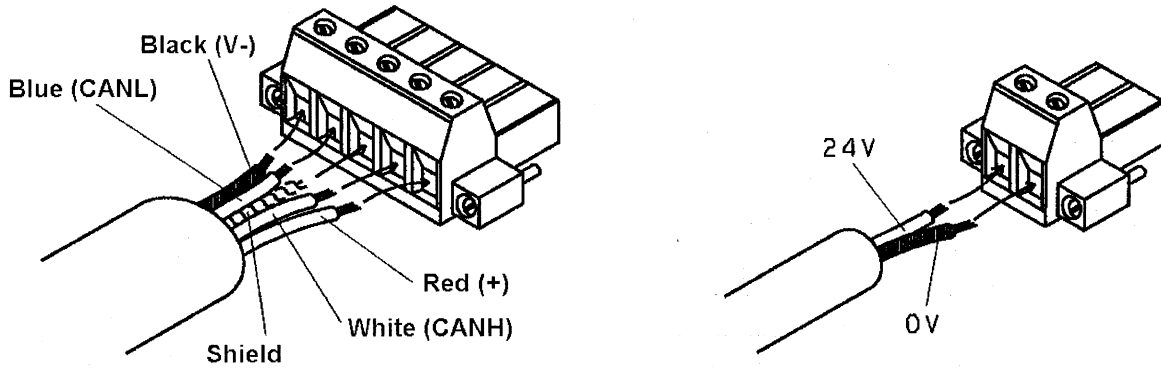
For Multi drop connection, prepare plug connector for T branch separately.

(Example: TMSTBP 2.5...- STF -5.08 made by Phoenix Contact Corp.)

Use DeviceNet special cable for communication cable.

Be sure to connect DeviceNet special terminal resistor with both ends of trunk.

○ Wiring of cable for solenoid valve power supply and communication



Communication connection for DeviceNet

Terminal	Wire color	Connected to
V-	Black	(-) side of power supply cable
CANL	Blue	Low side of communication cable
FG	—	Ground / Shield
CANH	White	High side of communication cable
V+	Red	(+) side of power supply cable

Power supply connector for solenoid valve

Terminal	Wire color	Connected to
24V	—	(+) side of solenoid valve source supply
0V	—	(-) side of solenoid valve source supply

Applicable cable of the power supply connector

Cable cross section	Single wire, stranded wire	0.2mm ² to 2.5mm ² /AWG12 to 24
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⚠ CAUTION

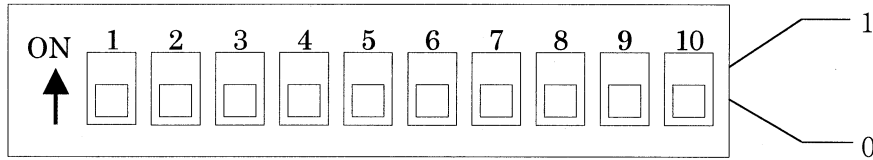
- Before wiring, be sure to turn power supply off.
- Securely tighten the set screws for cable and connector using the tightening torque of 0.5 to 0.6 [Nm].
- SI unit isn't available for monitoring of power supply for solenoid valve.
- Do not put cable specified by DeviceNet with/near high voltage line or strong electric line such as driving line.

3-2. Address setting

Before setting of address by DIP switch, turn power supply for communication cable in SI unit "OFF".

Setting (binary) of following items is available by DIP switch installed to cover.

- 1) Node address (00~63)
- 2) Communication speed (125kbps, 250kbps, 500kbps)



<Setting of node address>

Node address	SW1	SW2	SW3	SW4	SW5	SW6
	1	2	4	8	16	32
# 0	0	0	0	0	0	0
# 1	1	0	0	0	0	0
# 2	0	1	0	0	0	0
·						
·						
·						
# 62	0	1	1	1	1	1
# 63	1	1	1	1	1	1

<Setting of mode>

0	HW mode Setting of address and speed is done by SW.1~8.
1	SW mode Setting of address And speed is done via network. ※SW.1~8 isn't available.

<Setting of communication speed>

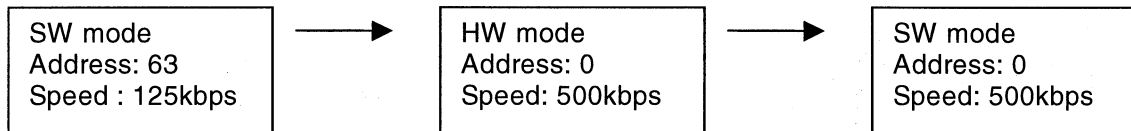
Setting		Communication speed (kbps)	Max. transmission distance (m)			
SW7	SW8		Length of trunk		Length of branch line	Total branch line
			Thick cable	Thin cable		
0	0	125	500	100	6	156
1	0	250	250			78
0	1	500	125			39
1	1	Not used	Not used			

<Setting of output when communication stops>

SW.9	Output condition of solenoid valve when communication stops (Time-out error of I/O connection) or Fault message is received. (Initial condition of solenoid valve)
1	All outputs are held. (Fault action = 1, Fault value = 0)
0	All outputs are cleared. (Fault state = 0, Fault value = 0)

⚠ CAUTION

- When shipped, node address of 63 and communication speed of 125kbps are set in advance (in both HW and SW mode).
- Address and communication speed set in SW mode are held even if the power supply of SI unit turns off. If re-application of power supply is done in HW mode, values are erased and address and communication speed set by switch are memorized.

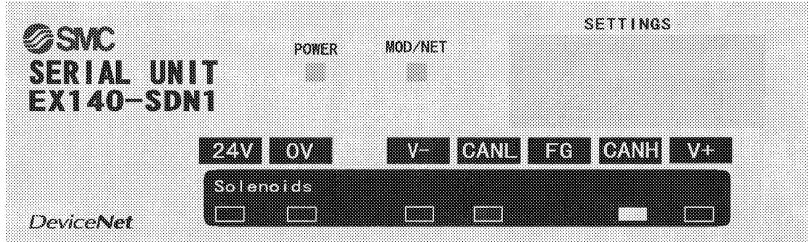


- When shipped and with communication stopped, output is set to 0 (cleared). And it is possible to change output setting with communication stopped by one point individually via network of DeviceNet. In this case, setting of SW. 9 become unavailable.

4.LED indicator and Physical dimensions

4-1 LED indication

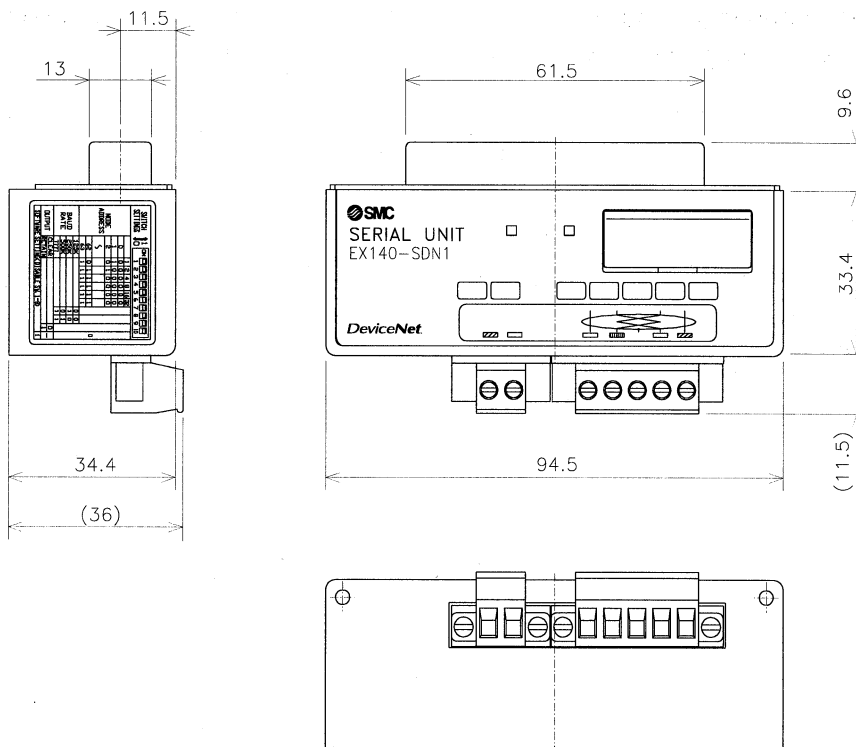
EX140-SDN1



Indication	Contents	
POWER	Green Lights up when power for DeviceNet line is supplied.	
MOD / NET	Lights off	SI unit isn't on line or power supply for communication line isn't turned on.
	Green flashing	Waiting for connection (ON line)
	Green lights up	Connection completed (ON line)
	Red flashing	Connection time out (Minor communication error)
	Red lights up	MAC ID duplication error or BUS OFF error (Major communication error)

4-2 Physical dimensions

SI unit (EX140-SDN1)



5. Trouble Shooting

MOD/NET LED	Cause & Countermeasure
Lights off	<p>POWER LED lights off <Countermeasure> Confirm that power for SI unit circuit is supplied. Confirm correct wiring. If above countermeasures do not improve status, please exchange SI unit.</p> <p>POWER LED lights up <Countermeasure> Confirm that baud rate is set correctly. If MOD/NET LED lights off in spite of baud rate is set correctly, change SI unit.</p>
Green flashing	<p>Connection waiting Shows communication waiting status between SI unit and master. <Countermeasure> Confirm master operate correctly. If using scan list, ensure slave is recorded to scan list correctly.</p>
Red flashing	<p>Communication wire disconnected error <Countermeasure> Confirm communication wire is not disconnected. <Remark> Red flashing if master power source is turned off during communication.</p>
Red lights up	<p>Node address overlapping error <Countermeasure> Confirm there is no overlapping on the node address.</p> <p>BUS OFF error Detects communication error. <Countermeasure> Case 1 Communication error due to noise. Confirm there is no component or high voltage cable that generate noise around communication wire. Make some distances between communication wire and noise source.</p> <p>Case2 Communication cable problem. Confirm terminal resistance (121ohm) connects to the both ends of communication wire that is main wire of communication wire.</p> <p>If red MOD/NET LED is still lights up in spite of above countermeasures, change SI unit.</p>

CAUTION

When red MOD/NET LED is lit, even if cause is solved, SI unit do not do auto-recovery. In this case, please reset the power to SI unit circuit (Communication/Internal power supply).

SI unit isn't available for monitoring of power supply for solved valve.

Revision history
A: Contents revised in several places.

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Note: Specifications are subject to change without prior notice and any obligation on the part of the manufacturer.
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