Technical Specifications

SI Unit

EX150-SDN1-X97

SMC Corporation

Contents

1. SAFETY

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, CATION 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 SI Unit.

♦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 asfool-proof, fail-safe, redundant and etc.
- Special consideration*4 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).
  *4: 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 SI unit for interlock, adopt a double interlocking method such as equipping the mechanical protection function in order to deal with SI unit failure.
  Check the SI unit 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 product beyond specification range.
  Operation at a range that exceeds the specifications can cause a fire, malfunction, or damage to SI unit.
  Verify the specifications before use.

- Do not use the product in an atmosphere containing combustible, explosive or corrosive gas.
  It can cause a fire, explosion or corrosion.
  This SI unit is not designed to be explosion-proof.

- These instructions must be followed when using the product in an interlocking circuit:
  - Provide double interlocking by another system such as mechanical protection
  - Check the product regularly to ensure proper operation

  Otherwise malfunction can cause an accident.

- These instructions must be followed while in maintenance:
  - Turn off the power supply
  - Stop the supplied air, exhaust the residual pressure and verify the release of air before performing maintenance
  - Release all energy stored in equipment or devices (hydraulic pressure, mechanical springs, electric capacitors or gravity force), verify the energy is reset to zero, and then perform maintenance work.

  Otherwise it can cause injury.

⚠CAUTION

- Perform proper functional checks after maintenance.
  Stop operation when an abnormality is observed such that the SI unit does not work properly.
  Safety is not be assured due to unexpected malfunction.

Design·Selection

1. See the specification.
   Keep all requirements in the specification (Voltage, operating ambient temperature, impact) to avoid damage, malfunction and fire.
2. Specified maintenance space is necessary. Design must consider the space necessary for maintenance.

Installation·Adjustment·Wiring

1. Don't drop nor hit the unit.
   Don't apply impact more than 100m/s^2. Internal parts of SI unit may be damaged and malfunction.
2. Wire properly. SI unit may damage by improper wiring.
3. Don't wire power supply line and high power line together.
   Wire SI unit wiring (piping) and power line/high power line separately to avoid interference of noise and surge from high power line to the signal line.
4. Ensure the insulation of wiring.
   Insulation failure (mixture with other circuit, insulation between terminals etc.) may cause excessive voltage or current to SI unit, which leads to damage the SI unit.
5. Keep the tightening torque. The screw should be tightening with the specified torque, otherwise IP67 protection cannot be guaranteed.
6. Don't apply repeated bend and tensile force. Wiring applying repeated bending stress and tensile force lead to cause disconnection.

Operating Condition

1. Never use in explosive environment.
   SI unit is not explosion proof. Operation in explosive environment may cause explosion accident.
2. Don't apply temperature cycle.
   Temperature cycle other than normal temperature change do harm to the internal part of SI unit.
3. Don't use where exposed to surge source.
   Device and instrument, which generate big surge (Electromagnetic lifter, High frequency induction furnace, motor etc.) adjacent to the manifold solenoid valve with SI unit lead to cause the deterioration or damage of the switch internal circuit element. Consider the solution against surge and do not to mix lines.
4. Bits of wire and other foreign materials should not enter the product.
   Bits of wire and other foreign materials in SI unit may cause fire, failure or malfunction.
5. Mounting of SI unit on manifold and wiring from the conduit shall be treated as specified. Otherwise IP67 rating cannot be attained.

Maintenance

1. Periodic maintenance is recommended to avoid unexpected failure and malfunction.
2. Don't touch the terminal and internal board during energization to avoid malfunction, unit damage, and electric shock.

Safety instructions for power supply

1. User must supply power to input and solenoid separately single or dual power supplies can be used.
2. Choose UL recognized product for direct current power source to be mounted.
   (1) Limited voltage current circuit complying with UL508
   The power supply circuit made with secondary side coil of isolation transformer, which satisfies the following condition
   Max. voltage (No load) : 30Vrms (42.4V peak) or less, and
   Max. current : 8A or less (Include when short), and restricted by the circuit protecting device (fuse) with rate in the table below

Voltage with no load (V peak)	Max. current rate
0 to 20 [V]	5.0
Exceeding 20 [V] up to 30 [V]	$\frac{100}{\text{Peak voltage}}$

   (2) Max. 30Vrms (42.4V peak) or less circuit (Class 2 circuit) which sources class 2 source unit complying with UL1310 or class 2 transformer complying with UL1585.

2. Specification

2-1. General specifications

Item	Specifications
Operating ambient temp.	0 to +55°C(with 8 points of valve ON) 0 to +50°C (with 16 points of valve ON)
Operating ambient humidity	35 to 85%RH (No dew condensation)
Storage ambient temp.	-20 to +60°C
Vibration proof	50m/s^2 (comply with JIS C 0911)
Impact proof	100m/s^2 (comply with JIS C 0912)
Noise immunity	Normal mode ±1500V Pulse 1μs Common mode ±1500V Pulse 1μs Radiation ±1000 V Pulse 1μs
Withstand voltage	1500VAC for 1 min. between FG and external terminal package.
Insulation resistance	500VDC, 2MΩ between FG and external terminal package.
Operating environment	No corrosive gas and no dust

2-2. Electrical and network specifications

Item		Specifications
Applicable system		DeviceNet Release 2.0
Power supply voltage for communication		11 to 25V DC (supplied by communication connector)
Power supply voltage for solenoid valve		24V DC +10% -5%
Consumption current	Communication and Internal power supply	100mA or less (24V DC)
	Power supply for Solenoid valve	1.5A or less (24V DC)
Solenoid valve Connection spec.	Output style	PNP output (Open collector)
	Connected load	24V DC, Solenoid valve with lamp-surge voltage protection circuit of 1.5W or less. (made by SMC)
	Insulation type	Opt-coupler insulation type
Residual voltage		1.0V DC or less
Network connection spec.	Applicable DeviceNet	Volume Ⅰ - Release 1.2 Volume Ⅱ - Release 1.1
	MAC ID setting range	0~63 (Set by Dip switch)
	Baud Rate (Transmission speed)	500kbps, 250kbps, 125kbps (Set by Dip switch)
	Slave (branch station) type	Group 2 only server
	Connection type	T branch type, Multi drop type
	Device type	27
	Product code	1202
	Revision	Referred to EDS file.
	Vendor ID	7
	Corresponding message	Polled command (I/O message), Explicit message

2-3. 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	

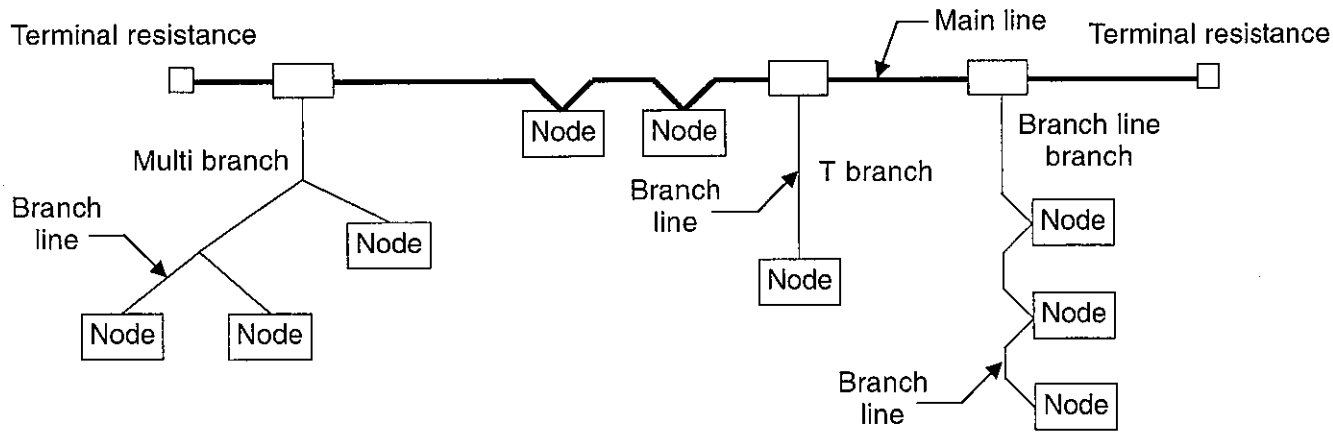
*) Mapping method of sending / receiving data is different by PLC.
For further information, refer to the manual for PLC master (scanner)

	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

2-4. Applicable solenoid valve series
VQC1000, 2000, 4000 Series
SV1000, 2000, 3000 Series

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)		

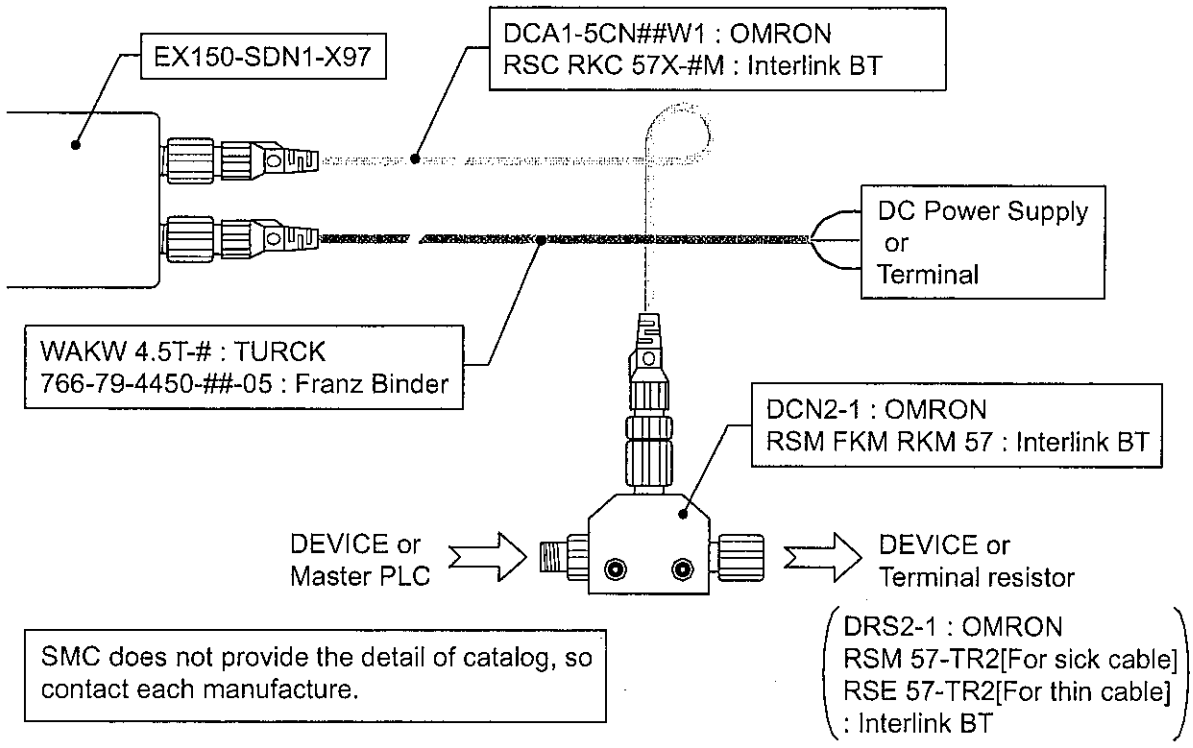
Cable specification

Item	For Power supply		For Solenoid valve	
	Thick cable		Thin cable	
	Communication Signal	Power upply	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	120Ω ±10%	—	120Ω ±10%	—
Propagation delay	1.36ns / ft	—	1.36ns / ft	—
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	6.9Ω/1000ft	3.6Ω/1000ft	28Ω/1000ft	17.5Ω/1000ft

⚠ CAUTION

· For Multi drop connection, prepare plug connector for T branch separately.
· Use DeviceNet special cable for communication cable.
· Be sure to connect DeviceNet special terminal resistor with both ends of trunk.

Example of connection



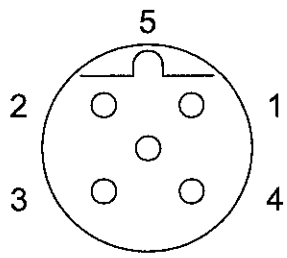
⚠ CAUTION

· Before wiring, be sure to turn off power supply off.
· 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.

Power supply connector

M12 5pin (Plug)

Example of connector on cable side : TURCK WAKW4.5T-# etc.

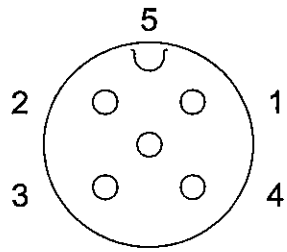


No.	Description	Function
1	SV 24V	For solenoid valve +24V
2	SV 0V	For solenoid valve 0V
3	-	N.C.
4	-	N.C.
5	E	Earth

Communication connector

M12 5pin [Special for DeviceNet] (Plug)

Example of connector on cable side : OMRON DCA1-5CN##F1
KARL LUMBERG RKT5-56
Interlink BT RSC RKC 57X-#M etc.

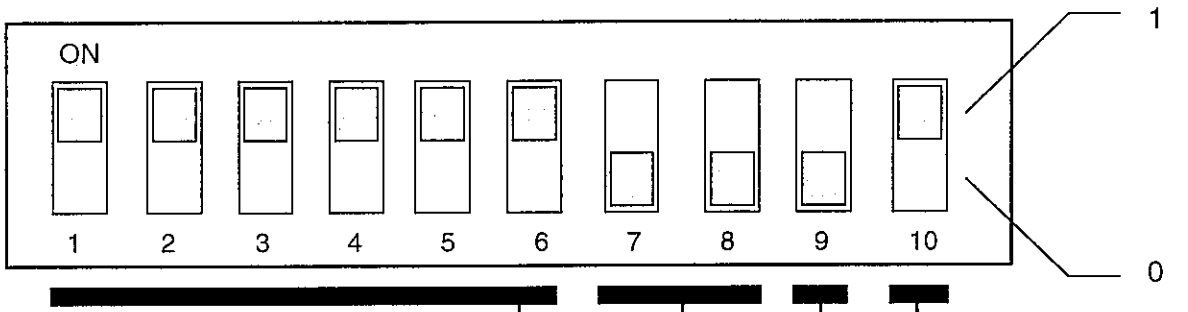


No.	Description	Function
1	Drain	Drain / Shield
2	V +	Power supply + for circuit
3	V -	Power supply - for circuit
4	CAN_H	Signal wire H
5	CAN_L	Signal wire L

Applicable to Micro Style connector with DeviceNet specification

3-2. DIP switch setting

When DIP switch is set, turn power supply of SI unit to OFF.



Setting of node address (MAC ID)

Node address	SW1	SW2	SW3	SW4	SW5	SW6
	2^0 (1)	2^1 (2)	2^2 (4)	2^3 (8)	2^4 (16)	2^5 (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 communication speed

Communication speed	SW7	SW8
125 kbps	0	0
250 kbps	1	0
500 kbps	0	1
Not used	1	1

Setting of output state in communication fault

Output state : Communication stops (I/O connection·Time out), fault message is received.

SW9	Output state (initial value)	
0	CLEAR	All outputs are reset to zero. (Fault state=0·Fault value=0)
1	HOLD	All outputs are hold before communication fault. (Fault action=1·Fault value=0)

Mode setting

SW10	Mode
0	HW Mode
	Set MAC ID·Baud rate by SW1 to 8
1	SW Mode
	Set MAC ID·Baud rate by network. SW1 to 8 are invalid.

⚠ CAUTION

- MAC ID and baud rate are preset to 63, 125kbps respectively at the shipment (SW mode).
- In SW mode, setting value of MAC ID and baud rate are retained even after power supply is off. In HW mode, once power supply is turned off and turned on again, then setting value of MAC ID and baud rate in SW mode are erased. Setting switch can newly set MAC ID and baud rate.

SW mode	⇒	HW mode	⇒	SW mode
MAC ID : 63 Baud rate : 125kbps		MAC ID: 0 Baud rate : 500kbps		MAC ID: 0 Baud rate : 500kbps

- Output with communication stopped is set to 0 (full output clear mode) at shipment from factory. It is possible to change setting of single output when communication stopped. In this case, setting of SW9 gets invalid.

3-3. Maintenance

Exchange of SI unit

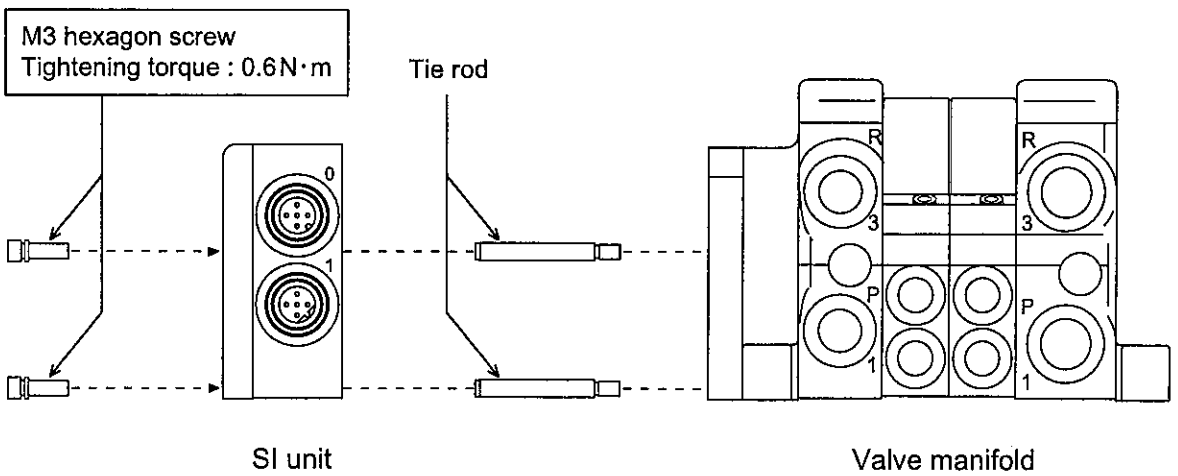
1.Remove screws from End Plate and release connection of each unit.
2.Replace old SI unit with new one. (Tie rod does not need to be removed.)
3.Connect End Plate and tighten removed screws by specified tightening torque. (0.6N·m)

⚠ Caution for maintenance

(1) Be sure to turn-off all power supplies.
(2) Be sure that there is no foreign object in any of units.
(3) Be sure that gasket is lined properly.
(4) Be sure that tightening torque is according to specification.

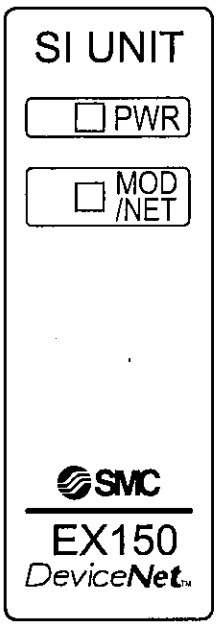
If these items are not kept, it may lead to the breakage of substrate or intrusion of liquid or dust into the units.

Assembly and disconnection of unit



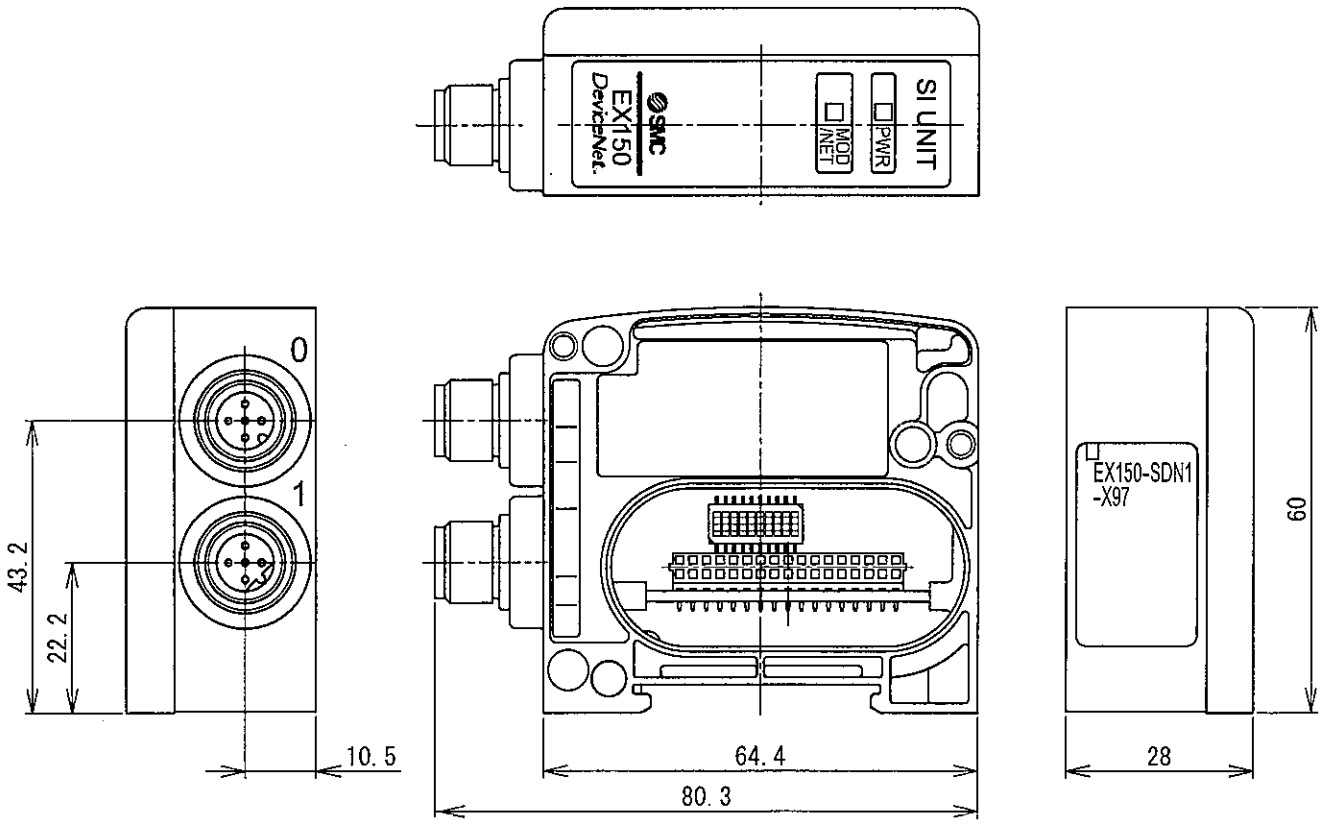
4. LED indicator and Dimensions

4-1. LED indication



Indication	Contents	
PWR	Green Lights up when power for DeviceNet line is supplied.	
MOD /NET	Lights off	Power off,off line or Duplicate MAC ID.
	Green flashing	Waiting for I/O connection (ON line)
	Green lights up	I/O Connection completed (ON line)
	Red flashing	I/O Connection time out (Minor communication error)
	Red lights up	MAC ID duplication error or BUS OFF error (Major communication error)

4-2. Dimensions



5. Trouble shooting

MOD/NET LED	Cause & Countermeasure
Lights off	PWR LED lights off <Countermeasure> Confirm that power for SI unit circuit is supplied. Confirm correct wiring for circuit. If above countermeasures do not improve status, please exchange SI unit. PWR 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.
Green flashing	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.
Red flashing	Communication wire disconnected error <Countermeasure> Confirm communication wire is not disconnected. <Remark> Red flashing if master power source is turned off during communication.
Red lights up	MAC ID overlapping error <Countermeasure> Confirm there is no overlapping on the MAC ID. BUS OFF error Detects communication error. <Countermeasure> 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. Communication cable problem Confirm terminal resistance (121ohm) connects to the both ends of communication wire that is main wire of communication wire. If red MOD/NET LED still lights up in spite of above countermeasures, change SI unit.

⚠ 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). However, the interval of five seconds or more is needed when turning it on again.
- SI unit isn't available for monitoring of power supply for solved valve.