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## Technical Specifications

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Product name : SI unit

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Model : EX240-SIB1

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(EX240-IE1)

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# Contents

1. SAFETY	.....	P2
2. Specification		
2-1. Network specification (EX240-SIB1)	.....	P5
2-2. General specification	.....	P5
2-3. Electric specification	.....	P5
2-4. Input specification (EX240-IE1)	.....	P5
2-5. Applicable solenoid valve and DI unit	.....	P6
2-6. Correspondence between output data and solenoid valve	.....	P6
3. Wiring and setting		
3-1. Communication wiring	.....	P7
3-2. Power supply wiring	.....	P8
3-3. Input wiring	.....	P10
3-4. Installation and Maintenance	.....	P12
3-5. Switch setting	.....	P14
3-6. Input circuit setting	.....	P14
4. LED display and appearance		
4-1. LED display	.....	P15
4-2. Dimensions	.....	P16



# 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, CAUTION and NOTE, will be followed by important safety information that must be carefully reviewed.	
 <b>WARNING</b>	Indicates a potentially hazardous situation which could result in death or serious injury if you do not follow instructions.
 <b>CAUTION</b>	Indicates a potentially hazardous situation which if not avoided, may result in minor injury or moderate injury.
<b>NOTE</b>	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\*<sup>1</sup>, 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\*<sup>2</sup> including equipment that concerns itself with the safety of persons or that seriously affects the public. This usage needs special consideration\*<sup>3</sup>.
  - \*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 as fool-proof, fail-safe, redundant and etc.
- ◆ Special consideration 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).

The 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.

## **▲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 operationOtherwise 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 maintenanceOtherwise 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.

## **NOTE**

### **\*Product specifications**

- Operate SI Unit with the specified voltage.  
Operation with a voltage beyond specifications can cause malfunction or damage of the unit.
- Reserve a space for maintenance  
Remember to leave space for maintenance when designing layout of the unit.
- Do not remove labels.  
Otherwise error while in maintenance or misreading of an operation manual can cause damage or malfunction. It may also result in nonconformity to safety standards.
- Instructions on handling

### **\*Installation**

- Do not drop, hit or apply excessive shock to the unit.  
Otherwise it can result in damage to the unit causing failure or malfunction.
- Follow the specified tightening torque.  
Excessive tightening torque can break screws.

#### **\*Wiring (including plugging in/out of connector)**

- Do not bend or apply tensile force to cables, or apply force by placing heavy load on them. Wiring with bending stress or tensile stress can cause breakage of the cables.
- Connect wires and cables correctly.  
Miswiring can break the SI Unit depending on the miswired circuit.
- Do not connect wires while the power is on.  
Otherwise it can break the SI Unit causing damage or malfunction.
- Do not lay wires or cables with power cable or high-voltage cable in the same wiring route.  
Otherwise the wires to the SI Unit can be contaminated with noise or induced surge voltage from power lines or high-voltage lines causing malfunction.  
Lay the wires to the SI Unit and each I/O device to a wire duct or in a protective tube other than those for power lines or high-voltage lines.
- Verify the insulation of wiring.  
Poor insulation (interference with other circuit, poor insulation between terminals and etc.) can introduce excess voltage or current to the SI Unit or each I/O device causing damage.
- Separate power lines for solenoid valves from power line for Input and control unit.  
Otherwise wires can be contaminated with noise or induced surge voltage causing malfunction.
- Take proper measurements against noise such as noise filter when the SI Unit is incorporated in equipment or devices.  
Otherwise contamination with noise can cause malfunction.

#### **\* Environment**

- Select the proper type of protection according to the environment of operation.  
IP65 protection is achieved when the following conditions are met.
  - (1) To connect units properly with communication line and power cable at the both end, and
  - (2) To connect SI Unit properly with manifold valves.  
Use cover or etc. when install in an environment where water always splashes on these units.
- Take sufficient shielding measures when install at a following place.  
Insufficient measures can cause malfunction or failure.  
Verify the effect of the measures after installation of the unit in equipment or devices:
  - (1) A place where noise due to static electricity is generated
  - (2) A place where electric field strength is high
  - (3) A place where there is radioactive irradiation
  - (4) A place near power line
  - (5) A place where water splashes on the product.

#### **\*Maintenance**

- Before performing maintenance, make sure to turn of the power supply, stop supplied air, release the residual air in the piping into the atmosphere, and verify that the pneumatic system is open to the air.  
Otherwise an unexpected operation of a system component can occur.
- Perform maintenance and check regularly  
Otherwise an unexpected malfunction of the system can occur due to a malfunction of the unit.
- Perform a proper functional check.  
Stop operation when an abnormality is observed such that the device does not work properly.  
Otherwise an unexpected malfunction of the system component can occur.
- Do not use solvents such as benzene, thinner or other to clean the SI Unit.  
It can damage the surface of the body and erase the indication 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. Specification

### 2-1. Network specification (EX240-SIB1)

Protocol	INTERBUS ( EN50254 )	
Bus Interface	EIA RS-485	
Communication speed	500kbps	
Input	32 points	
Output	32 points	
Occupied byte	1, 2, 4 byte Settable	
ID code	DIO DI DO	03(HEX) 02(HEX) 01(HEX)

### 2-2. General specification

	EX240-SIB1	EX240-IE1
Dimension (W × H × D)	54 × 97.5 × 120 *1	54 × 69.6 × 120 *1
Weight	450g *1	370g *1
Ambient temperature	0 to +50°C	
Ambient humidity	30 to 95%RH ( No condensation )	
Vibration proof	10 to 57Hz 0.35mm (constant amplitude) 57 to 150Hz 50m/s <sup>2</sup> (constant speed)	
Impact proof	Peak value : 150m/s <sup>2</sup> /11ms, 3 times each in directions of ± X,Y and Z	
Enclosure	IP65	

\*1) Attachments excluded.

### 2-3. Electric specification

Rated voltage	24VDC
Power supply voltage	for SI units : 24VDC ± 10%
	for solenoid valve : 24VDC ± 10%
Current consumption	200mA or less (SI unit) + sensor supply current
Withstand voltage	1500VAC 50/60Hz 1min. (between terminal and case)
Noise resistance	1000Vp-p pulse width 1 μs leading1ns
Insulation resistance	10M Ω or more (500VDC mega, between terminal and case)
Applicable load	24VDC, Solenoid valve with lamp-surge voltage protection circuit of 2.1W or less
Residual voltage	0.3V or less
Driving circuit	P-ch MOS-FET open drain (PNP)

### 2-4. Input specification (EX240-IE1)

Standard	IEC1131-2
Corresponding sensor	Current source type(PNP output), Current sink type(NPN output)*2
Rated voltage Ue	24VDC *3
Logical "1" input voltage UH	11 to 30V
Logical "0" input voltage UL	-3 to 5V
Logical "1" input current IH	8mA Typ.
Connection of 2-wire type sensor	Possible
Logical "0" allowable current IL	2.5mA Max.
Input delay	3ms Typ.
Sensor supply current	500mA / DI unit ( 60mA Max. / sensor )
Short circuit suppressor	600mA Typ. for each DI unit ( supply power cut ) Cut power once and then supply it again for return.

\*2) Changed over by switch (for every DI unit)

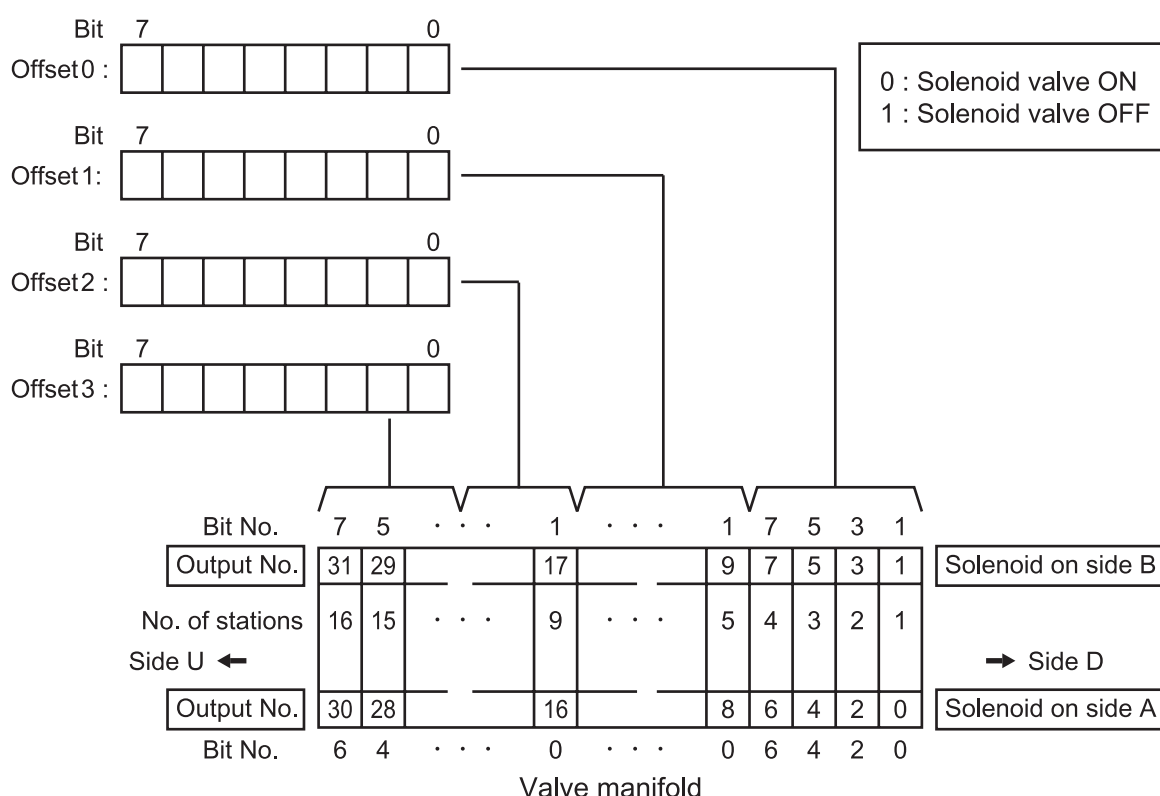
\*3) Approx. 2V of voltage drop for power supply voltage (power supply for SI/DI units)

## 2-5. Applicable solenoid valve and DI unit

SI unit	Applicable solenoid valve	DI unit
EX240-SIB1	VQ2000,VQ4000,VQC4000	EX240-IE1

## 2-6. Correspondence between output data and solenoid valve

### Output data



- Output numbers are assigned to stations from side D to U of manifold in order (See manual of each manifold solenoid valve for the directions of side D and U.)
- Standard manifold is wired in double. Output numbers are assigned to side A and B alternatively. In case of single solenoid valve, output on side B is free.
- Mixed (single and double) wiring is available as long as wiring specifications designate it. This allows output numbers to be specified without having free output.
- Each bit of data sent from master (4 bytes) shows ON/OFF( 0: OFF 1: ON ) of solenoid valve. Starting from LSB of the first byte (Offset0), output numbers are assigned to all the bits in numeric order.

	No.	Station no.	No.
Double	4	3	5
Single	2	2	3
Double	0	1	1

Free

	No.	Station no.	No.
Double	3	3	4
Single	2	2	-
Double	0	1	1

## 3. Wiring and Setting

### 3-1. Communication wiring

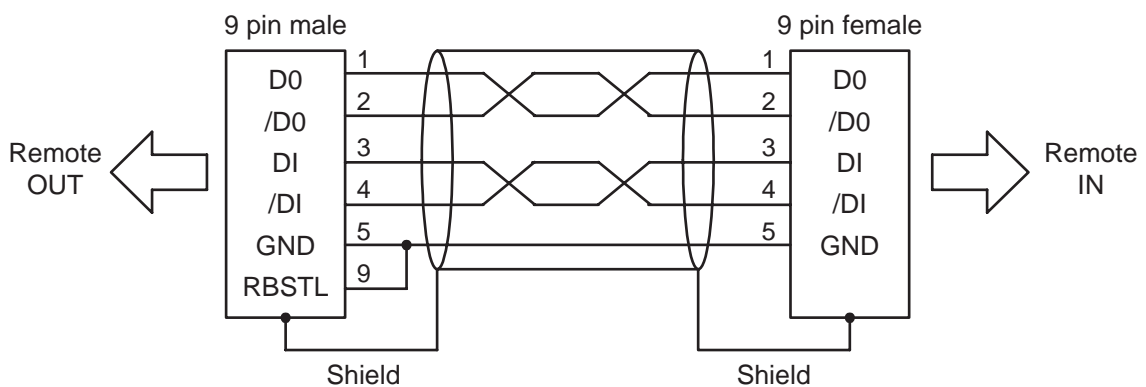
The SI unit presented in this operation manual can be connected to remote bust of INTERBUS system. One master unit has max. points for slave up to 4096 (512 slaves). Transmission distance between the slaves is 400m at longest and the total length of connection can be extended up to 12.8km.

The max. number of I/O of the salve is 32 for both of input and output. If DI unit (such as EX240-IE1) is connected, input signal of sensor which is either of on or off can be also received.

#### ⚠ CAUTION

The max. number of I/O (slave) is changed depending on the master unit. For the exact values of them, the operation manual available from the manufacturer of the master unit should be referred.

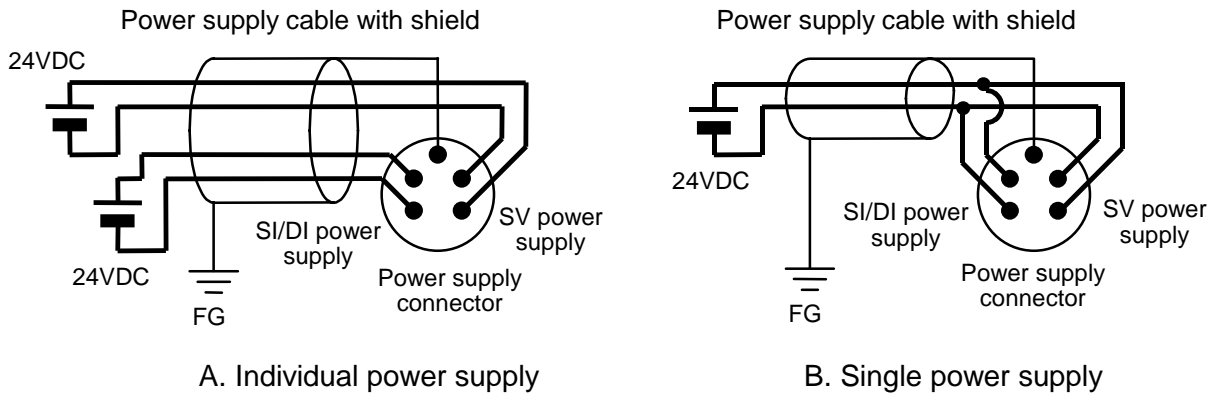
Cable : Remote Bus Cable IP65 circular connector PHOENIX CONTACT, etc.



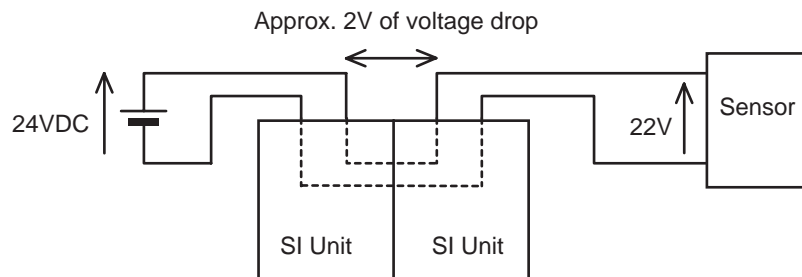
Characteristics (20°C)	Specification
Number of wire (twisted pair)	3×2, twisted pair
Sectional area	Min.0.2mm <sup>2</sup>
Conductor resistance	max. 9.6Ω/100m
Characteristic impedance	100Ω±20%, f = 0.064MHz 100Ω±15Ω, f > 1MHz
Insulation strength	
Between conductors	1000Vr.m.s, 1 min
Between conductor and shield	1000Vr.m.s, 1 min
Insulation resistance	Min.150MΩ, 1km cable
Max. transferring impedance	250mΩ/m, 30MHz
Conductor capacity	max. 60nF/1km
Cable length	max. 400m

### 3-2. Power supply wiring

Power supply line inside the unit has individual power supplies for solenoid valve actuation (SV power supply) and for SI/DI unit (SI/DI power supply). Supply DC24V for each of them. Either single or individual power supply is available.

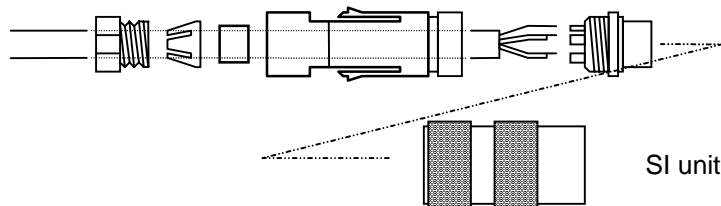


Power for SI/DI unit is supplied to sensor connected with DI unit. Select sensor concerning voltage drop up to approx. 2V inside the unit at this moment. If sensor requires 24V, it is necessary to lower power supply voltage for SI/DI unit slightly or secure power supply for sensor separately without going through SI unit so that sensor input voltage can be 24V with actual loading (allowable voltage of SI/DI unit power supply: 19.2V to 28.8V).



Select power supply cable sufficient for power consumption and number of stations of solenoid valves, and current consumption of SI unit and sensor.

Wire power supply cable to plug properly and then connect it to socket of SI unit.

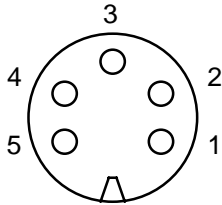


FRANZ BINDER 72309-0114-70-05

• Power supply Connector

Franz Binder Series 723 5 pins (72309-0115-80-05 )

Connector example for cable: Franz Binder 72309-0114-70-15 etc. \* DIN type 5 pins

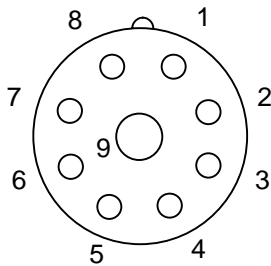


No.	Description	Function
1	SV24V	+24V for Solenoid valve
2	SV0V	0V for Solenoid valve
3	FG	Protection earth
4	SI/DI24V	+24V for SI/DI Unit
5	SI/DI0V	0V for SI/DI Unit

• Remote IN

CONINVERS Series RC 9 pins (8+1) male

Connector example for cable: Remote bus cable PHOENIX CONTACT etc.



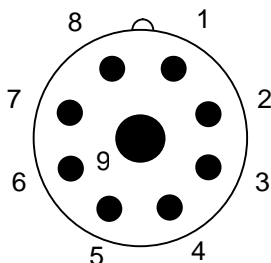
N.C. : No Connected

No.	Description	Function
1	DO	Receive data +
2	/DO	Receive data -
3	DI	Send data +
4	/DI	Send data -
5	GND	Ground
6	N.C.	-
7	N.C.	-
8	N.C.	-
9	N.C.	-
Housing	Shield	Shield

• Remote OUT

CONINVERS Series RC 9 pins (8+1) female

Connector example for cable: Remote bus cable PHOENIX CONTACT etc.



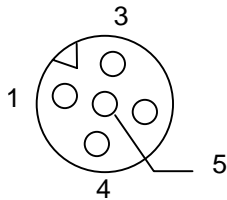
N.C. : No Connected

No.	Description	Function
1	DO	Send data +
2	/DO	Send data -
3	DI	Receive data +
4	/DI	Receive data -
5	GND	Ground
6	N.C.	-
7	N.C.	-
8	N.C.	-
9	RBSTL	Input for Bus connector
Housing	Shield	Shield

• Input Connector

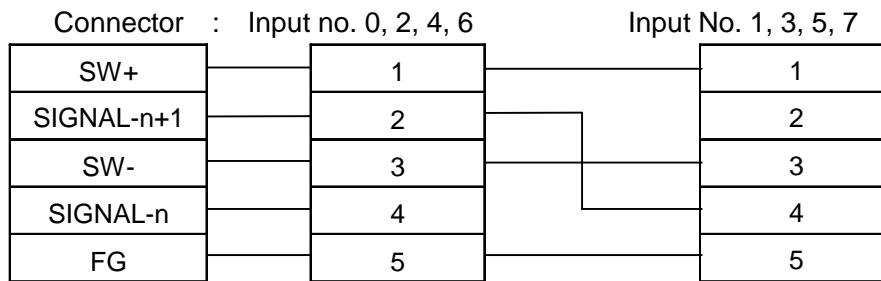
M12 5 pins (compatible with OMRON XS2F) × 8 pcs.

Connector example for cable: OMRON XS2G



No.	Description	Function
1	SW+	Supply power + for sensor
2	N.C.	Free *
3	SW -	Supply power - for sensor
4	SIGNAL	Sensor input signal
5	FG	Protection earth for sensor

\* No.2 pins of connectors with input No. 0, 2, 4, and 6 (connectors on the right side of each DI unit) are internally connected to No.4 pins of input No.1, 3, 5 and 7 (sensor input signals), respectively. This allows direct input for 2 points which are put in one cable with a collective connector.



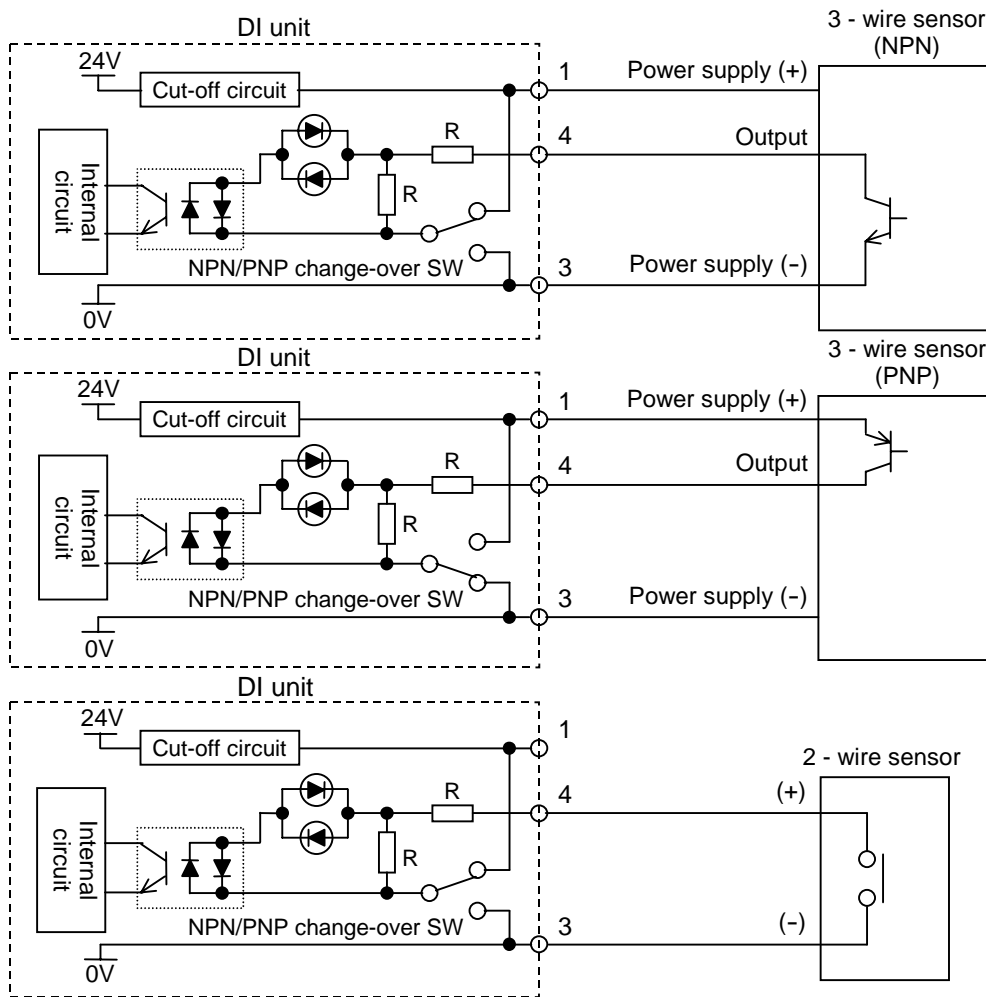
**NOTE :** Use water-proof cover on unused input connectors in case protection structure is necessary equivalent to IP65. Please order the water-proof cover separately.  
Ex: OMRON XS2Z-12

3-3. Input wiring

Input connector allows connection with plug for M12 sensor of the following specifications.

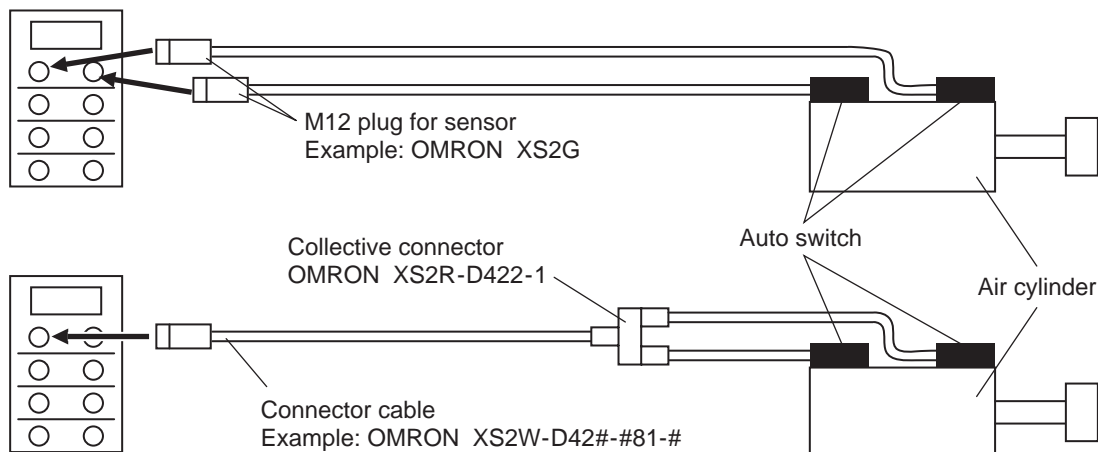
Number of pins	4 or 5 pins
AC / DC	DC

• Input circuit diagrams



\* Allowable supply current for sensor is 500mA per DI unit at the maximum. For DI unit to which 8 pieces of sensors are connected, approximately 60mA can be supplied per point. If excessive current flows into sensor power supply due to short circuit, power supply is stopped by cut-off circuit. In such a case, solve the problem, cut power once and then supply it again for return.

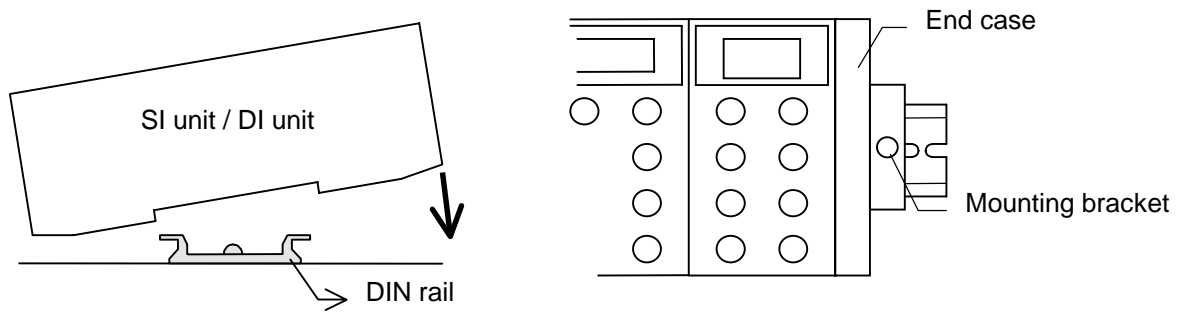
• Example of sensor connection



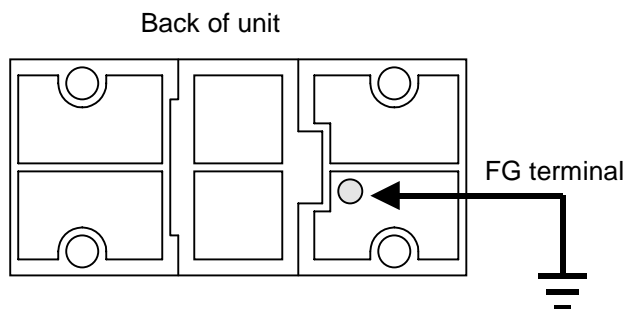
### 3-4. Installation and Maintenance

- Installation

- 1) Fix DIN rail for mounting SI/DI unit to the position where the unit is installed.
- 2) Set SI/DI units on DIN rail and fix them with mounting brackets.



- 3) Fix manifold solenoid valve with mounting screws.
- 4) Ground FG terminal.



- 5) Arrange wires (for power supply, communication and input) and pipes.

### 3-5. Switch setting

#### 1) Setting of input and output byte (DIO,BYTE setting)

It is set whether SI unit is used input and output(DIO), output(DO) or input(DI). Number of occupied bites (BYTE) can be selected either from 4 byte, 2 byte or 1 byte. 1 byte is 8 points. Setting should be done with power off. Open the cover and set DIP switch with minus driver and so on.

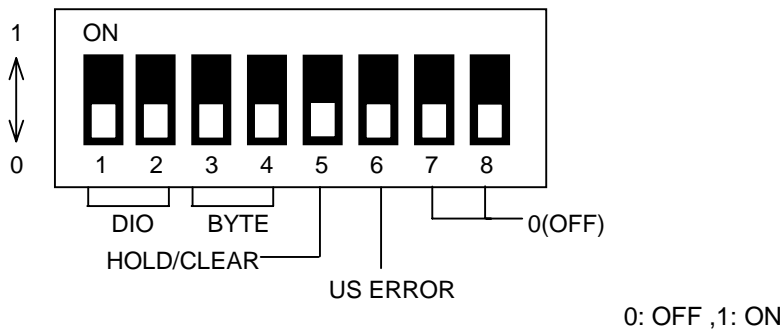
Address for SI unit is automatically layout by master unit. Please refer to manual or others of master unit for the details.

#### 2) Setting HOLD/CLEAR

When the communication abnormality occurs, if the output condition of SI unit solenoid valve should be maintained or all OFF is set.

#### 3) Setting of power source detection for solenoid valve (US ERROR setting)

When DIO setting is DIO or DO, it sets whether to use or not use the function detection if the power is supplied for output of solenoid valve. This function is invalid for DI as it does not need power source for solenoid valve.



DIO setting	SW1	SW2	BYTE setting	SW3	SW4
DIO	0	0	4 BYTE	0	0
DO	1	0	-	1	0
DI	0	1	2 BYTE	0	1
-	1	1	1 BYTE	1	1

HOLD/CLEAR setting	SW5	US ERROR setting	SW6
CLEAR	0	Use	0
HOLD	1	Not use	1

Keep 0(OFF) the SW7 and SW8.

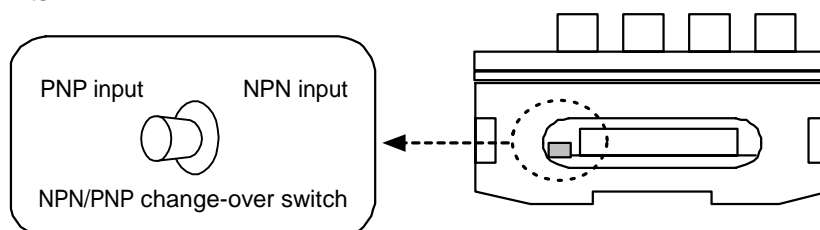
When shipped from factory, SW1 ~ 8 are all OFF.

### **CAUTION**

When BYTE setting is 1 byte, it needs firmware version of PHOENIX CONTACT Co.'s master is more than version 4.0. Please refer to the manual of each product manufacture for details.

### 3-6. Input circuit setting

It is possible to change input circuit setting (NPN / PNP sensor input) for every DI unit. Disconnect DI units each other and set them individually. See "3-4. Installation & Maintenance" for disconnection and connection of units.



### 3-5. Switch setting

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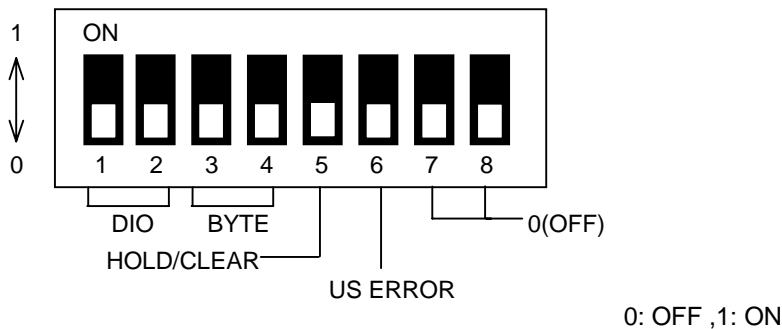
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DIO setting	SW1	SW2	BYTE setting	SW3	SW4
DIO	0	0	4 BYTE	0	0
DO	1	0	-	1	0
DI	0	1	2 BYTE	0	1
-	1	1	1 BYTE	1	1

HOLD/CLEAR setting	SW5	US ERROR setting	SW6
CLEAR	0	Use	0
HOLD	1	Not use	1

0: OFF ,1: ON

Keep 0(OFF) the SW7 and SW8.

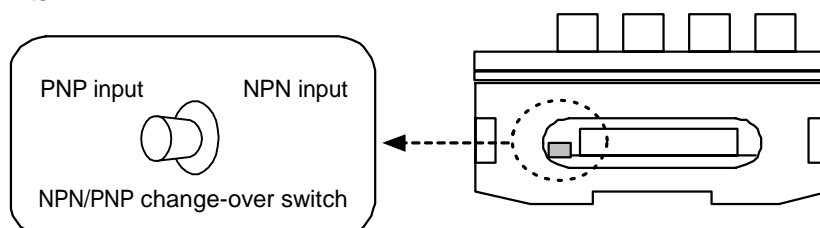
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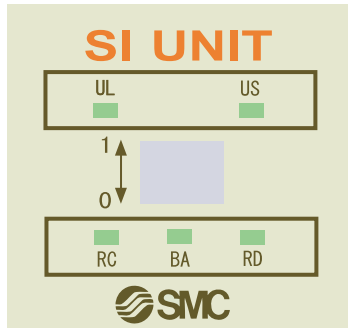
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## 4. LED display and appearance

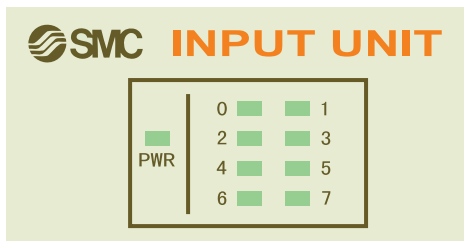
### 4-1. LED Display

- EX240-SIB1



LED name	Color	Contents
UL	Green	Lights up when power for SI/DI unit turned ON.
US	Green	Lights up when power for solenoid valve is turned ON.
RC	Green	Lights up when bus is normal.
BA	Green	Lights up when transmission is normal.
RD	Red	Lights up when transmission is abnormal.

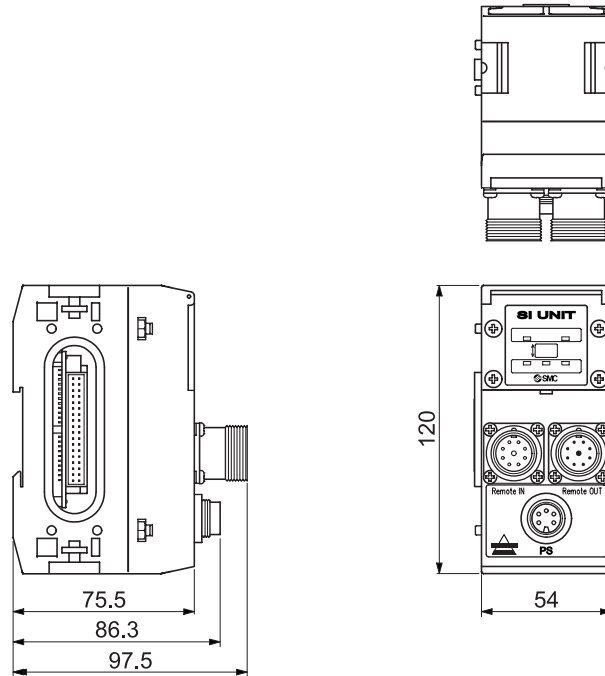
- EX240-IE1



LED name	Color	Contents
PWR	Green	Lights up when power for sensor is supplied. Lights off when short-circuit suppressor works.
0 to 7	Orange	Lights up when each sensor input turns on.

## 4-2. Dimension

- EX240-SIB1



- Manifold

