ET-G9-5

Small SI unit for serial transmission

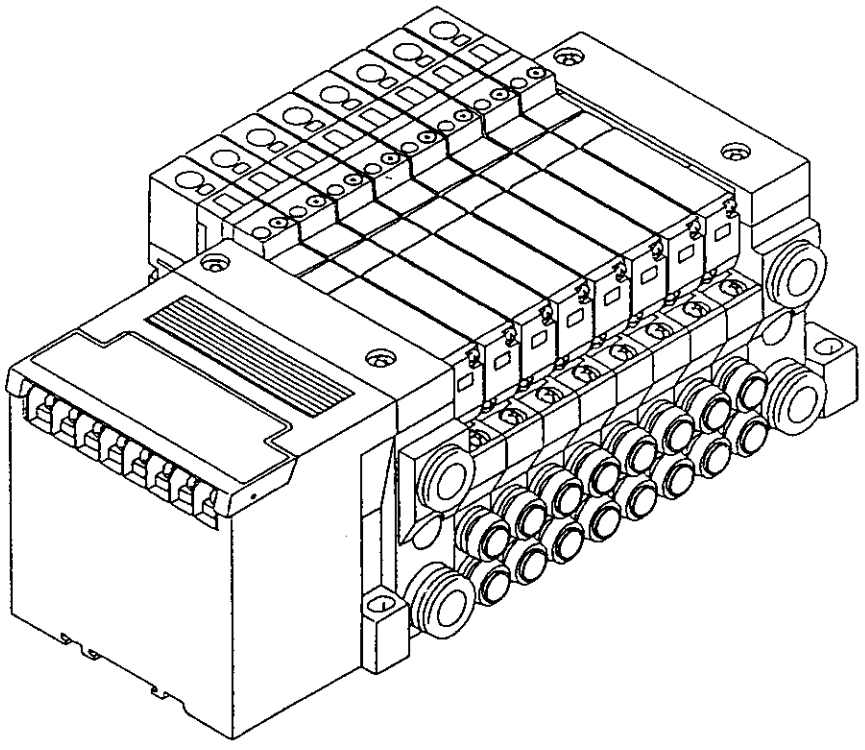
EX100 Series

AB Corporation PLC applicable

EX120-SAB1

EX121-SAB1

Technical Operating Information



SMC CORPORATION

INDEX

Outline:

The Remote I/O (RIO)System for Allen-Bradley PLC's refers to an Allen-Bradley communication network supporting high speed transfer of control information. An RIO network consists of a master device (Scanner) and multiple slave devices.
The scanner and slave devices are connected via a single twisted pair cable.
The scanner communicates with each slave device on the network in an exchange referred to as discrete I/O transfer. Data transferred on the network is organized as RIO racks. Each slave device is assigned a portion on an RIO rack for its I/O information.

The SMC Serial Interface(SI) unit EX120/121-SAB1 is an exclusive slave device for use within Allen-Bradley's "1771RIO" network.

Each SI unit occupies a quarter rack in the RIO network. The output portion of the quarter rack is utilized to discretely control up to 16 SMC solenoid valves. Each SI unit is mounted directly to the SMC valve manifold and is connected to the PLC network via a single twisted pair cable. This eliminates the large numbers of wires and the associated high labor costs of conventionally wired systems.

SI valve manifold systems manufactured by SMC have internally pre-wired solenoid connections. It is only necessary to make the communication and power wire connections to the SI unit and to set DIP switches on the SI unit itself at the time of installation.

*This product incorporates a communication link which is licensed by permission under the patents and proprietary technology of Allen-Bradley Co. Inc. Allen-Bradley does not warranty this product. All warranty and support services are the responsibility of and provided by SMC Corporation.

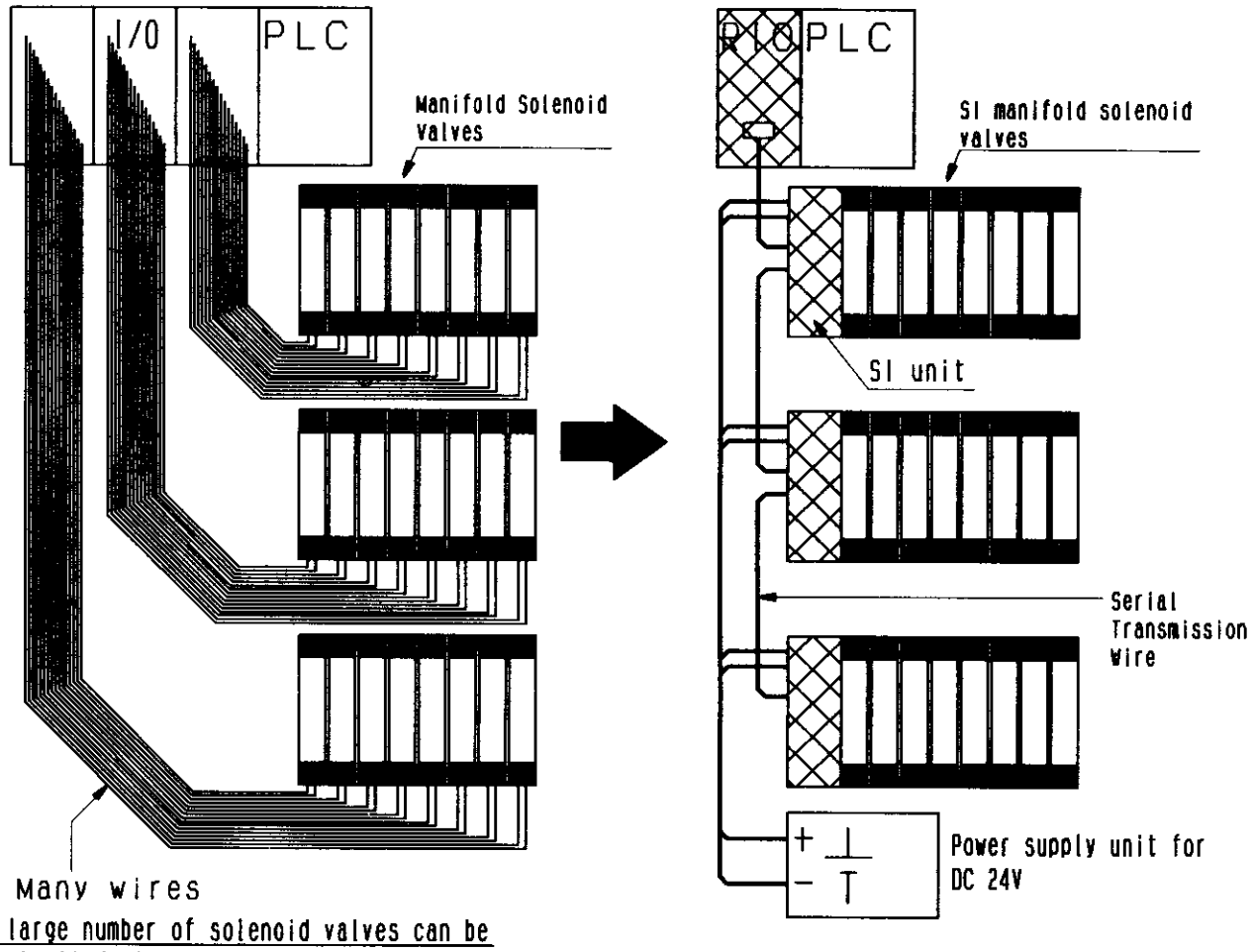
Chapter 1: CHARACTERISTICS AND SYSTEM COMPOSITION

1-1. Characteristics

The use of serial transmission systems elliminates wiring.

<<Conventional Method>>

<<Serial transmission Method>>



A large number of solenoid valves can be controlled via a twisted pair cable using Serial Interface Technology.

The number of wires required are drastically reduced. A single twisted pair cable connects the RIO(Remote I/O) slave device to the RIO master device.

Space Saving

Due to the reduction of wiring and the use of miniaturized valve manifolds with SI unit considerable space reductions as compared to conventional valve manifolds are achieved.

Valves can be installed in different areas.

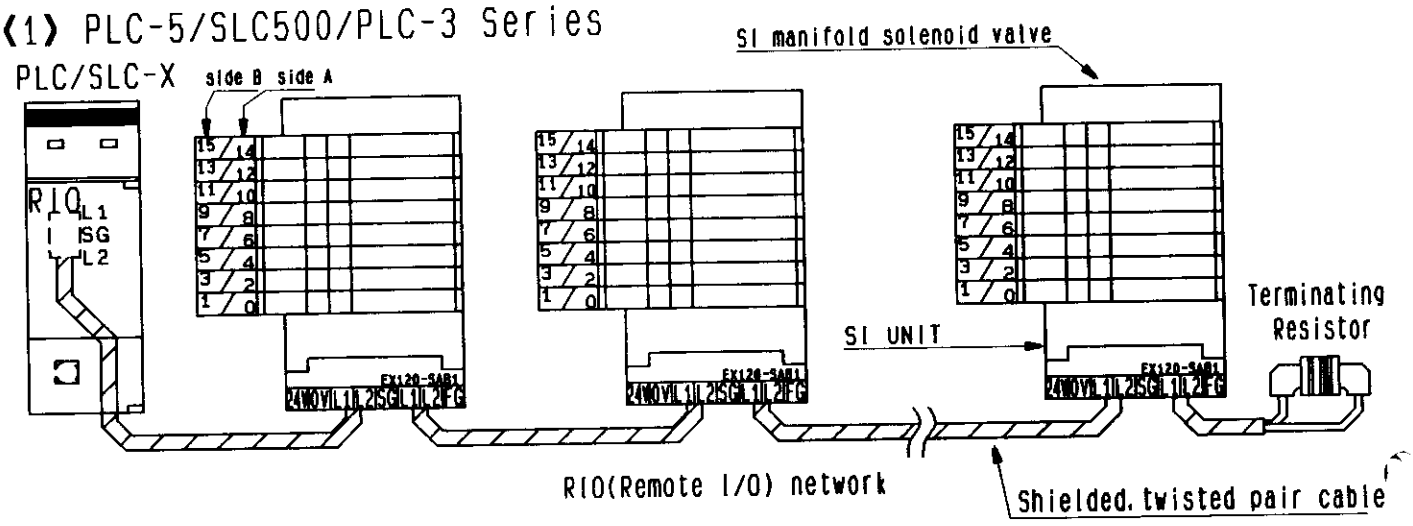
Utilizing Serial Interface Technology, valve manifolds with SI units can be located in different areas and still controlled by one PLC.

Easy Maintenance

Due to the wiring reduction the installation, troubleshooting and maintenance of a complete system is drastically reduced.

1-2. System Composition

⟨1⟩ PLC-5/SLC500/PLC-3 Series

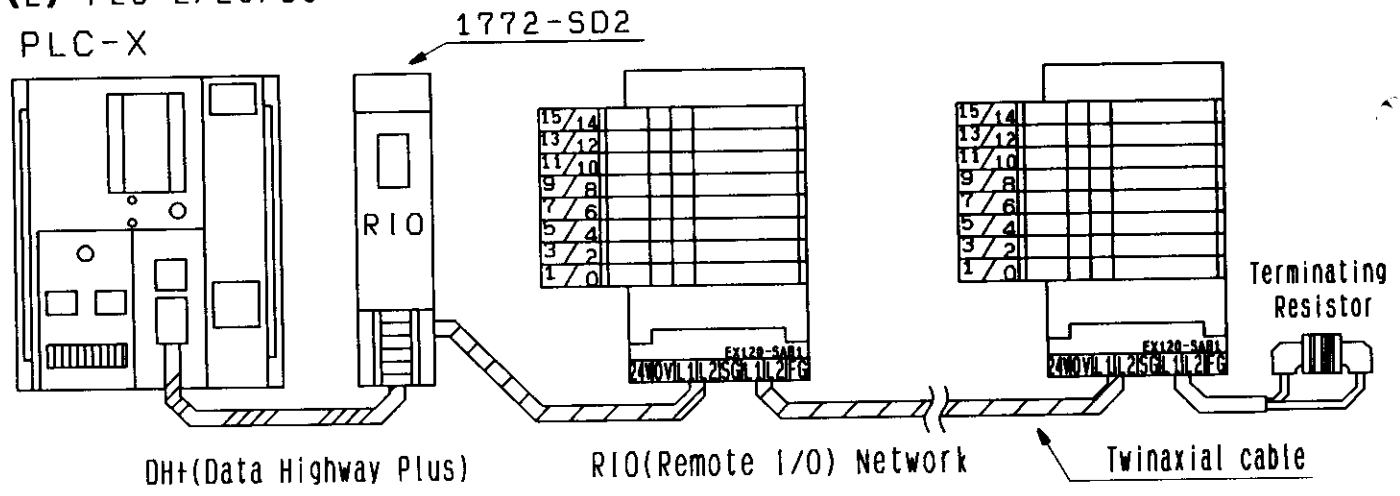


The communication terminal(L1, L2)of the SI unit is directly connected to the RIO terminal of each processor of the PLC-5, the SLC500, the PLC-3 series(some parts excluded)(See page 18)via the recommended cable.

Use a shielded, twisted pair cable(2-core) for the cable of RIO network.
(See page 18)

Never fail to place a terminating resistor at a physical end link.
(See page 19)

⟨2⟩ PLC-2/20, 30



When the RIO system is constructed by each processor of the PLC-2/20, 30, through the RIO Scanner(1772-SD2), the communication terminal of the SI unit is connected to the RIO terminal of the RIO Scanner via the recommended cables.

1-3. Applicable PLC

It is applicable to the PLC which has the RIO(Remote I/O)System made by Allen-Bradley Co.

Allen-Bradley PLC	RIO	Max. # of SI Units
SLC500(5/02)	RIO Scanner(1747-SN)	16
PLC-5/11	Built-in	4
PLC-5/15	Built-in	12
PLC-5/20	Built-in	12
PLC-5/25	Built-in	16
PLC-5/40	Built-in	60
PLC-5/40L	Built-in	30
PLC-5/60	Built-in	64
PLC-5/60L	Built-in	32
PLC-5/250	Built-in	128
PLC-5/VME	Built-in	4
PLC-3/10	Built-in	128
PLC-3	Built-in	128
PLC-2/20	RIO Scanner(1772-SD2)	(32)
PLC-2/30	RIO Scanner(1772-SD2)	(32)

Note: The numbers of connection base is for one channel of Remote I/O main station respectively.
Please contact Allen-Bradley Co. for details on PLC's.

1-4. Applicable Series of Solenoid Valves

《1》 Applicable Series of solenoid valves for EX120 series

(1) VQ1000 Series (Base piping type plug-in unit)

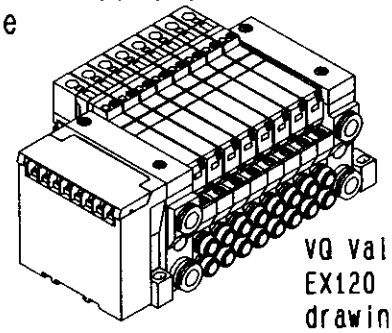
Valve type			Valve series	Cv factor [*1]	Response time (ms) [*2]	Weight (g)
2 positions	Single	Metal	VQ1100	0.2	12 Max.	64
		Rubber	VQ1101	0.3	15 Max.	
	Double	Metal	VQ1200	0.2	10 Max.	78
		Rubber	VQ1201	0.3	15 Max.	
3 positions	Closed Center	Metal	VQ1300	0.2	20 Max.	
		Rubber	VQ1301	0.3	25 Max.	
	Exhaust Center	Metal	VQ1400	0.2	20 Max.	
		Rubber	VQ1401	0.3	25 Max.	
	Pressure Center	Metal	VQ1500	0.2	20 Max.	
		Rubber	VQ1501	0.3	25 Max.	

(2) VQ2000 Series (Base piping type plug-in unit)

Valve type			Valve series	Cv factor [*1]	Response time (ms) [*2]	Weight (g)
2 positions	Single	Metal	VQ2100	0.8	20 Max.	90
		Rubber	VQ2101	0.9	20 Max.	
	Double	Metal	VQ2200	0.8	15 Max.	110
		Rubber	VQ2201	0.9	20 Max.	
3 positions	Closed Center	Metal	VQ2300	0.7	25 Max.	
		Rubber	VQ2301	0.8	30 Max.	
	Exhaust Center	Metal	VQ2400	0.7	25 Max.	
		Rubber	VQ2401	0.8	30 Max.	
	Pressure Center	Metal	VQ2500	0.7	25 Max.	
		Rubber	VQ2501	0.8	30 Max.	

*1: The value without a back pressure prevention valve for the cylinder port pipe connection bore C6:(VQ1000), C8:(VQ2000)

*2: According to JISB8375-1981(The value at supply pressure 0.5MPa [5.1Kgf/cm²] with a lamp surge voltage protection circuit. Should be in the clean air).



VQ valve used EX120 Series outline drawing

《2》 Applicable solenoid valves for EX121 series

(1) VQ0000 Series (Base piping type plug-lead unit)

Valve type			Valve series	Cv factor [*1]	Response time (ms) [*2]	Weight (g)
2 positions	Single	Metal	VQ0150	0.14	12 Max.	36
		Rubber	VQ0151	0.15	15 Max.	
	Double	Metal	VQ0250	0.14	10 Max.	50
		Rubber	VQ0251	0.15	15 Max.	
3 positions	Closed Center	Metal	VQ0350	0.11	20 Max.	
		Rubber	VQ0351	0.15	25 Max.	
	Exhaust Center	Metal	VQ0450	0.11	20 Max.	
		Rubber	VQ0451	0.15	25 Max.	

(2) VQ1000 Series (Base piping type plug-lead unit)

Valve type			Valve series	Cv factor [*1]	Response time (ms) [*2]	Weight (g)
2 positions	Single	Metal	VQ1110	0.2	12 Max.	64
		Rubber	VQ1111	0.3	15 Max.	
	Double	Metal	VQ1210	0.2	10 Max.	78
		Rubber	VQ1211	0.3	15 Max.	
3 positions	Closed Center	Metal	VQ1310	0.2	20 Max.	
		Rubber	VQ1311	0.3	25 Max.	
	Exhaust Center	Metal	VQ1410	0.2	20 Max.	
		Rubber	VQ1411	0.3	25 Max.	
	Pressure Center	Metal	VQ1510	0.2	20 Max.	
		Rubber	VQ1511	0.3	25 Max.	

*1: The value without a back pressure prevention valve for the cylinder port pipe connection bore C4:(VQ0000), C6:(VQ1000)

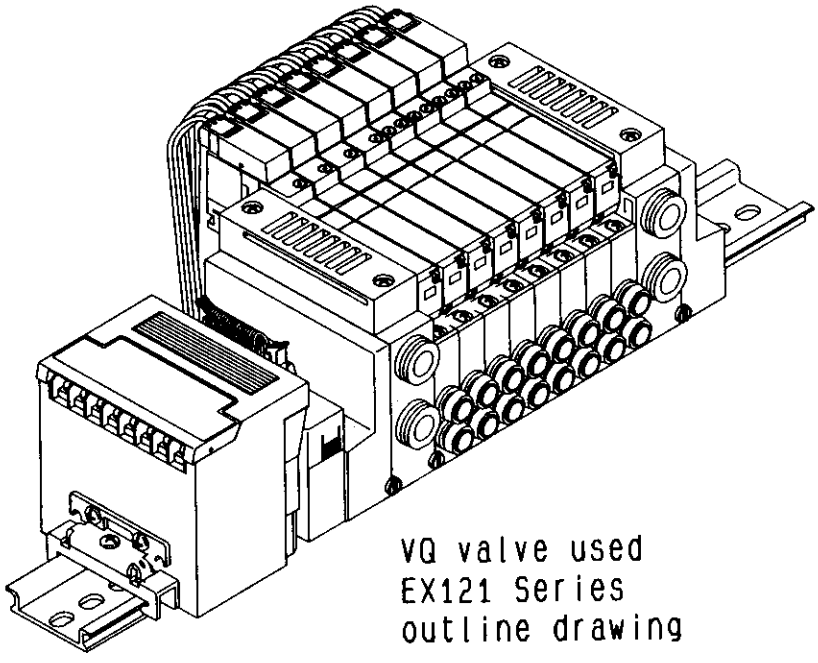
*2: According to JISB8375-1981(The value at supply pressure 0.5MPa [5.1Kgf/cm²] with a lamp surge voltage protection circuit. Should be in the clean air).

(3) VQ1000 Series (Direct piping type cassette plug-lead unit)

Valve type			Valve series	Cv factor [*1]	Response time (ms) [*2]	Weight (g)
2 positions	Single	Metal	VQ1170	0.20	12 Max.	67
		Rubber	VQ1171	0.28	15 Max.	
	Double (Latching)	Metal	VQ1270	0.20	12 Max.	
		Rubber	VQ1271	0.28	15 Max.	
3 positions	Closed Center	Metal	VQ1370	0.20	20 Max.	
		Rubber	VQ1371	0.28	25 Max.	
	Exhaust Center	Metal	VQ1470	0.20	20 Max.	
		Rubber	VQ1471	0.28	25 Max.	
	Pressure Center	Metal	VQ1570	0.20	20 Max.	
		Rubber	VQ1571	0.28	25 Max.	

*1: Cylinder port size of C6 (VQ1000)

*2: According to JISB8375-1981(The value at supply pressure 0.5MPa [5.1Kgf/cm²] with a lamp surge voltage protection circuit. Should be in the clean air).



VQ valve used
EX121 Series
outline drawing

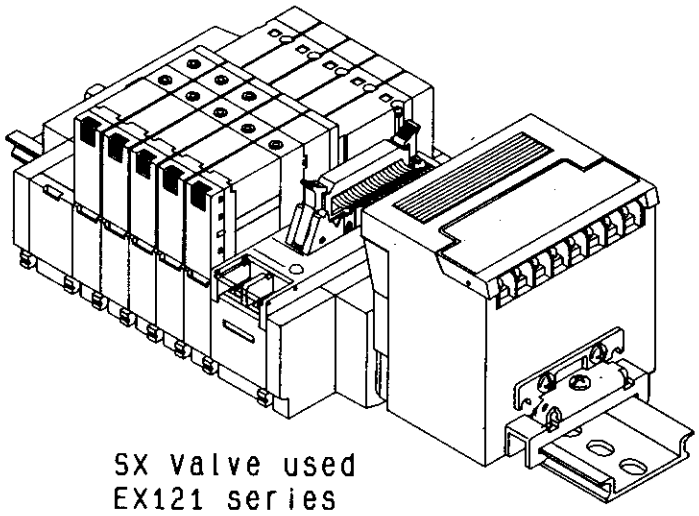
(4) SX3000 Series

Valve type		Valve series	Cv factor [*1]		Response time (ms) (*2)	Weight (g) (*3)
			P→A/B	A/B→EA/EB		
2 positions	Single	SX3140	0.27	0.3	10 Max.	101(67)
	Double	SX3240	0.27	0.3		110(75)
3 positions	Closed Center	SX3340	0.26	0.27	15 Max.	112(78)
	Exhaust Center	SX3440	0.27	0.33 (0.18)		
	Pressure Center	SX3540	0.37 (0.18)	0.29		

(5) SX5000 Series

Valve type		Valve series	Cv factor [*1]		Response time (ms) (*2)	Weight (g) (*3)
			P→A/B	A/B→EA/EB		
2 positions	Single	SX5140	0.71	0.7	15 Max.	137(75)
	Double	SX5240	0.71	0.7		145(83)
3 positions	Closed Center	SX5340	0.42	0.45	25 Max.	151(89)
	Exhaust Center	SX5440	0.44	0.8 (0.5)		
	Pressure Center	SX5540	0.88 (0.25)	0.48		

*1:The values inside of the parentheses are at the time of the nomal position.
*2:The value at supply pressure 0.5MPa[5.1Kgf/cm²]without a lamp surge voltage protection circuit.
*3:The values inside of the parentheses are the values without a subplate.



SX Valve used
EX121 series
outline drawing

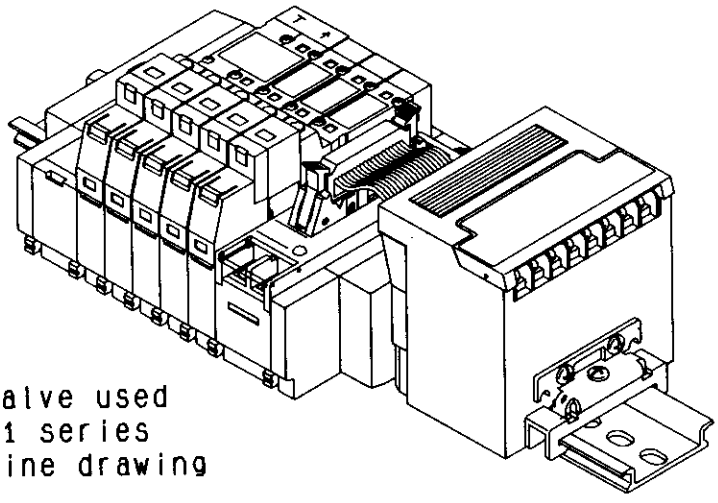
(6) SY3000 Series

Valve type		Valve series	Cv factor [*1]		Response time (ms) [*2]	Weight (g) [*3]
			P→A/B	A/B→EA/EB		
2 positions	Single	SX3140	0.27	0.3	10 Max.	85(51)
	Double	SX3240	0.27	0.3	8 Max.	103(69)
3 positions	Closed Center	SX3340	0.26	0.27	12 Max.	105(70)
	Exhaust Center	SX3440	0.27	0.33 (0.18)		
	Pressure Center	SX3540	0.37 (0.18)	0.29		

(7) SY5000 Series

Valve type		Valve series	Cv factor [*1]		Response time (ms) [*2]	Weight (g) [*3]
			P→A/B	A/B→EA/EB		
2 positions	Single	SX5140	0.71	0.7	14 Max.	121(59)
	Double	SX5240	0.71	0.7	12 Max.	140(77)
3 positions	Closed Center	SX5340	0.42	0.45	22 Max.	146(83)
	Exhaust Center	SX5440	0.44	0.8 (0.5)		
	Pressure Center	SX5540	0.88 (0.25)	0.48		

*1:The values inside of the parentheses are the values at the normal position.
*2:The value at supply pressure 0.5MPa[5.1kgf/cm²] without a lamp surge voltage protection circuit.
*3:The values inside of the parentheses are the values without a subplate.



SY Valve used
EX121 series
outline drawing

1-5. Product Number System

The pre-wired (SI) manifold model numbers and valve model numbers are indicated in the following table:

Series	Manifold type display method	Valve type display method
Base piping plug-in unit type		
VQ1000	VV5Q11-[*1][*2]S[*3]-[*4]	VQ1[*5]0[*6][*7]-5[*8][*9]
VQ2000	VV5Q21-[*1][*2]S[*3]-[*4]	VQ2[*5]0[*6][*7]-5[*8][*9]
Base piping plug lead unit type		
VQ0000	VV5Q05-[*1][*2]S[*3]-[*4]	VQ0[*5]5[*6][*7]-5[*10][*9]
VQ1000	VV5Q12-[*1][*2]S[*3]-[*4]	VQ1[*5]1[*6][*7]-5[*10][*9]
Direct piping cassette plug lead unit type		
VQ1000	VV5Q17-[*1]S[*3]-[*4]	VQ1[*5]7[*6][*7]-5[*10][*9]-[*2]
Base piping plug-in type		
SX3000	SS5X3-45S1[*3][*11]-[*1][*12]-[*2][*4]	SX3[*5]40-5LOZ[*9]
SX5000	SS5X5-45S1[*3][*11]-[*1][*12]-[*2][*4]	SX5[*5]40-5LOZ[*9]
Base piping plug-in type		
SY3000	SS5Y3-45S1[*3][*11]-[*1][*12]-[*2][*4]	SY3[*5]4[*13]-5FU[*9]
SY5000	SS5Y5-45S1[*3][*11]-[*1][*12]-[*2][*4]	SY5[*5]4[*13]-5FU[*9]

* 1:Please insert number of stations.

* 2:Please indicate with symbol for the type of a cylinder port pipe connection bore.

* 3:Please indicate the SI unit type.(see in the following table)

Symbols	Types of SI unit
0	No SI unit
A	General purpose type with SI unit
B	Mitsubishi(MELSEC-A) applicable with SI unit
C	Omron(SYSMAC) applicable with SI unit
D	Sharp(New Satelite) applicable with SI unit
E	Matsushita(MEWNET-FP)applicable with SI unit
F1	NKE(Output-16bases) applicable with SI unit
F2	NKE(Output- 8bases) applicable with SI unit
G	AB(PLC.SLC) applicable with SI unit
H	
I	
J	

* 4:Please indicate the specificatios for each option.

* 5:Please indicate the type of switching method.

* 6:Please indicate the type of sealing method.

* 7:Please indicate the functions.

* 8:Please indicate the use of the lamp surge voltage protection circuit.

* 9:Please indicate the type of the manual operation method.

*10:Please indicate the type of taking out method for a lead wire.

*11:Please indicate the type of the assembled position for the SI unit.

*12:Please indicate the type of the assembled position for the air supply and exhaust block Ass'y.

*13:Please indicate the dual body type(double 3 positions).

For details, please use our catalog for the VQ and SX,SY series for a reference.

Chapter 2:Specifications[EX120/121-SAB1]

2-1. General Specifications

Item	Specification
Operating ambient temperature	32~131°F(0~+55℃)(Max 8 poins are ON) 32~122°F(0~+50℃)(All points are ON)
Operating ambient relative-humidity	35~85%RH(No condensation)
Vibration resistance	5G(According to JIS C0911:10Hz~55Hz. Duplex amplitude 0.5mm)
Impact resistance	10G(According to JIS C0912)
Noise resistance	1000Vp-p(pulse width 1μs leading 1ns pulse)
Dielectric strength	1000VAC 1 min.(between external terminal and case.)
Insulation resistance	10MΩ or more (@500VDC megger) (Between the lump-sum external terminal and the earth.)
Operating atmosphere	No corrosive gas and no heavy dust

2-2. Performance Specifications

Item	Specification
Applicable PLC	The PLC/SLC series made by Allen-Brandly Co.(Refer to Section 1-3)
Remote I/O master station	RIO/DIO built-in PLC.RIO/DIO scanner.(Refer to Section 1-3)
Number of connection terminal for a master station	(Refer to Section 1-3) (*1)
Number of CH for in connecting use of master station	(4)CH (*1)
Transmission speed	57.6/115.2/230.4Kbps
Transmission distance	10,000 feet about 3,050m in case of 57.6Kbps 5,000 feet about 1,525m in case of 115.2Kbps 2,500 feet about 750m in case of 230.4Kbps
Transmission path	Shielded twisted pair cable (Refer to Section 54)

*1) Spesification is different according to type of PLC.
Please contact Allen-Bradley Co. for further details.

2-3. SI unit Specifications

⟨1⟩ EX120-SAB1 SI unit Specifications

Item	Specification
Output points	16 points
Output type	Transister type(Open collector)
Load	24VDC, solenoid valve with lamp surge voltage protection circuit of 2.1W or less.
Residual voltage	0.4V or less
Source voltage	24VDC±10% (*1)
Current consumption	0.1A
Weight	0.33lbs(0.15kg) or less
Exterior dimension	2.52"×2.14"×2.39"(64mm×54.4mm×60.8mm)

*1) When using VQ, SX and SY valve, please set the power supply from -5% to +10% of 24VDC.

⟨2⟩ EX121-SAB1 SI unit Specifications

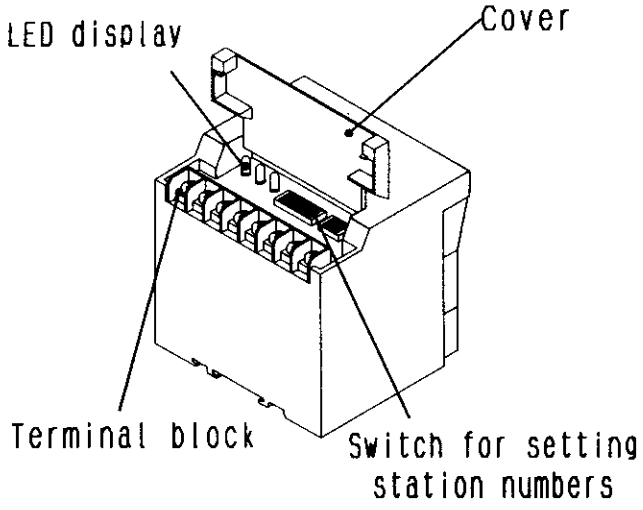
Item	Specification
Output points	16 points
Output type	Transister type(Open collector)
Load	24VDC, solenoid valve with lamp surge voltage protection circuit of 2.1W or less.
Residual voltage	0.4V or less
Source voltage	24VDC±10% (*1)
Current consumption	0.1A
Weight	0.40lbs(0.18kg) or less
Exterior dimension	2.52"×2.54"×2.39"(64mm×64.4mm×60.8mm)

*1) When using VQ, SX and SY valve, please set the power supply from -5% to +10% of 24VDC.

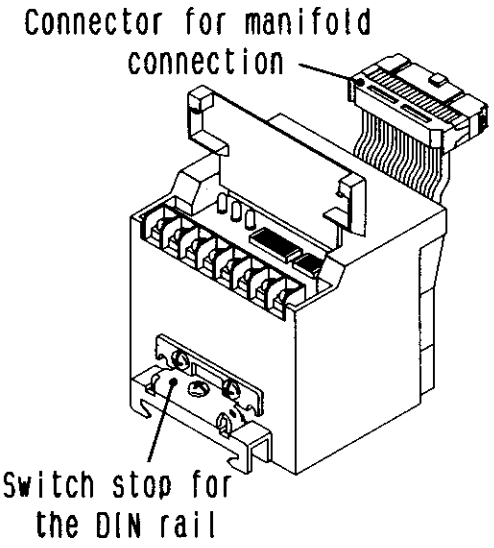
Chapter 3:STRUCTURE OF PARTS

3-1. Designation of each section

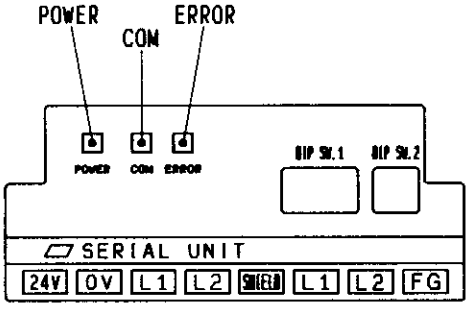
<<EX120-SAB1 unit>>



<<EX121-SAB1 unit>>

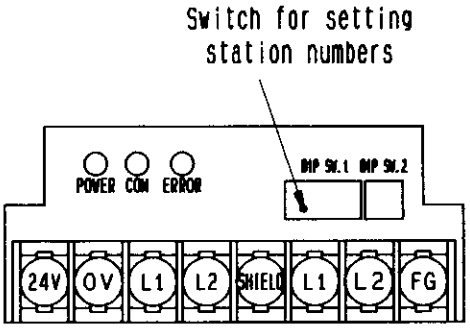


3-2. LED Indicators



Marking	Description
"POWER"	Light at ON of power supply
"COM"	Communication is normal·····LED is on Communication is initialized···LED is flashing Communication is abnormal·····LED is off
"ERROR"	Communication is abnormal·····LED is on

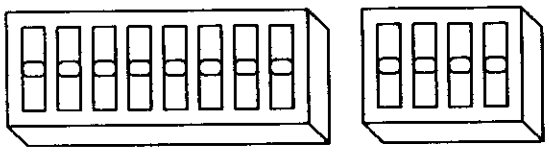
3-3. Terminal Block



Terminal Names	Connection to:
24V	Connect to the supply power 24VDC
0V	
L1	Connect to L1
L2	Connect to L2
SHIELD	Connect to the shield wire of the communication cable
FG	Connect Ground

*The terminal block L1 is connected to the other L1:
L2 is connected to the other L2 respectively in inside.
*For details of wiring method, see chapter 5.

Chapter 4:SWITCH SETTINGS



Note:At address setting, open the display cover of the SI unit and set the dip switch with a screwdriver.
*Never set address with the power is ON.

4-1. Rack Address and Starting Quarter

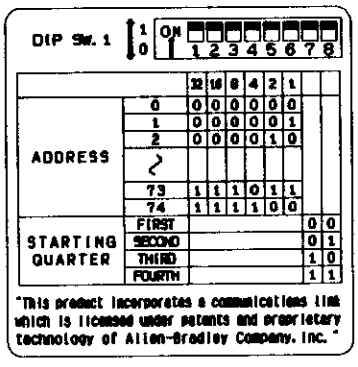
(1) Rack Address(bits 1-6)

As shown in the figure 4-1, the rack address setting establishes the SI unit's "identity" within the RIO network.
The setting range is 00~74 octal.(61 different settings)

(2) Starting Quarter(bits 7,8)

As shown in the figure 4-1, the starting quarter setting establishes the group number for a quarter rack device within a full rack address.
There are 4 possible settings.

Note:The label is displayed on the left side of the SI unit.



<Fig.4-1> Dip switch label 1

4-2. Data Rate(baud), Clear/Hold Mode, and Last Rack

(DIP SW2-Refer to Figure 4-2)

⟨1⟩ Data Rate(bits 1, 2)

With the power supply OFF, use a small screwdriver to set the 4 bit switch to set the data rate, mode, last rack indications.

Switch position	Data rate	Maximum I/O transmission distance
00	57.6Kbps	10,000ft(3,000m)
01	115.2Kbps	5,000ft(1,500m)
10	230.4Kbps	2,500ft(750m)
11	not used	

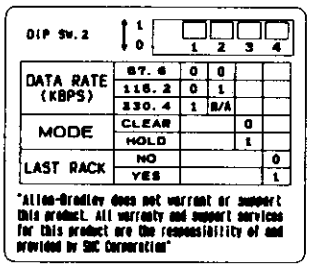
⟨2⟩ Clear/Hold Mode(bit 3)

Switch position	Mode of Operation
0 (Clear)	With switch in this position, if a communication error occurs the remote I/O clears the current output state and stops operation temporarity. When the signal becomes normal, the remote I/O automatically returns to normal operation.
1 (Hold)	With switch in this position, if a communication error occurs the remote I/O holds the last normal signal of the output and stops operation temporarity. When the signal becomes normal, the remote I/O automatically returns to normal operation.

⟨3⟩ Last Rack(bit 4)

Set this switch to position 1 if the unit is the last rack in the network. (Use in noisy environments to improve speed and performance).

Note: The label is displayed on the right side of SI unit.



<Fig. 4-2> Dip switch label 2

4-3. Correspondence of Output Address and Valve Solenoids

The Serial Interface unit(EX120-SAB1)has 16 outputs 0~F(hexidecimal). Each output point corresponds to a specific solenoid in the standard valve/manifold configuration.

(1) In the case where 8 valve stations or less. (Standard)

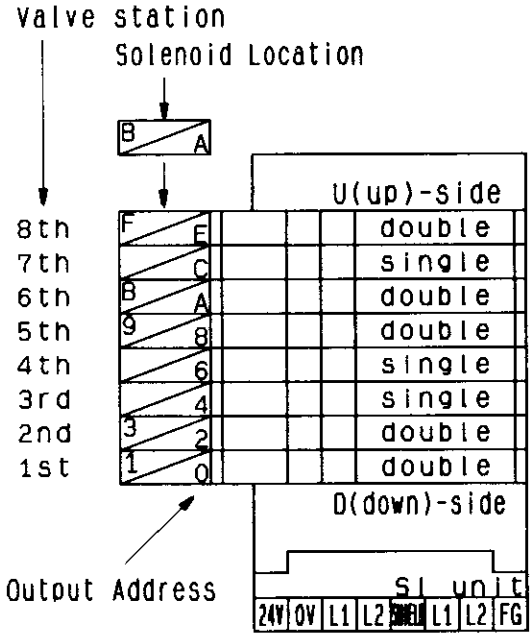
The manihold is pre-wired for double solenoid valve capability (2 points/ station). and the single solenoid type valves are used the B-side output would not be used.

The way of counting valve station is the 1, 2, ·····8th station from D-side of manifold.
The 0-output address corresponds to the A-side solenoid of the D(Down)-side, the B-side solenoid is 1-output address. The others are assigned in order from D-side of manihold.
For example, when sixth valve station of double solenoid type(2 points/ station) are connected, the outputs address will be "0" through "B"(11).

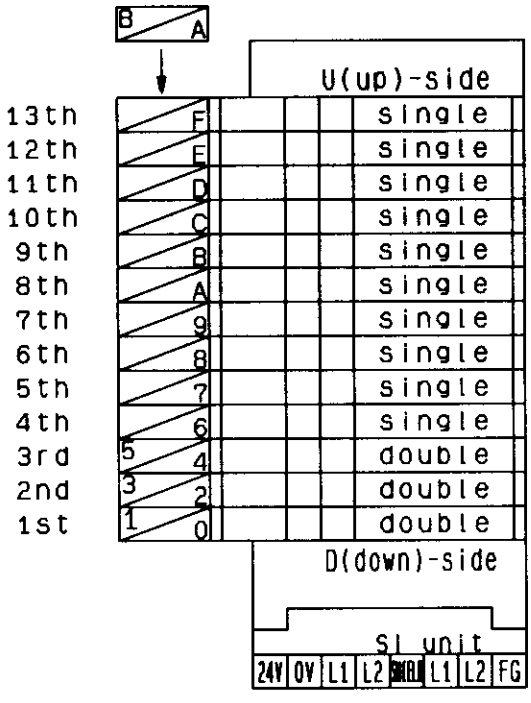
(2) In the case where 9~16 valves stations.

The specification by the customer of the exact location of single and double solenoid valves is required. In this case, some or all of the valve stations will have just one corresponding output point.

A special label is applied to these manifolds indicate the solenoid/output point specification.



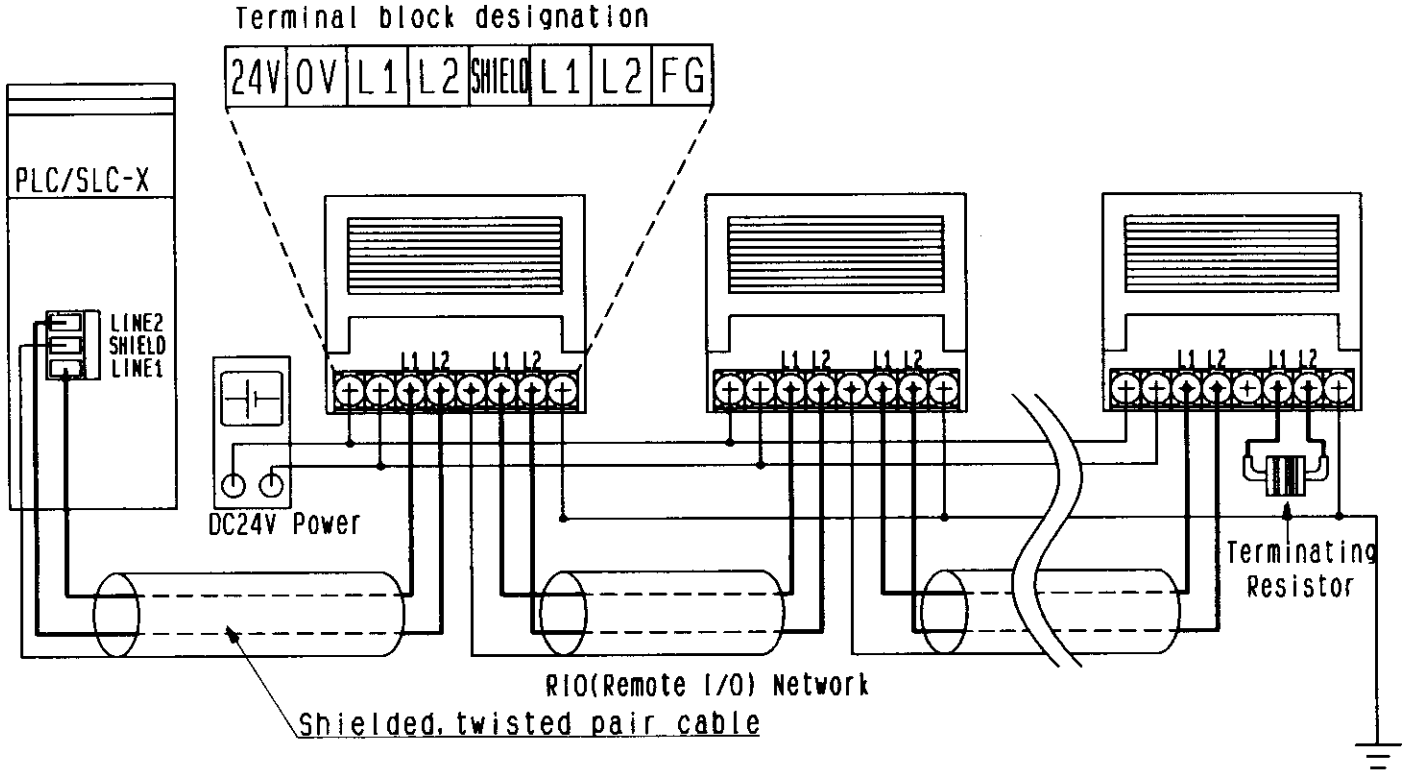
Example:The manifold of 8 valve stations



Example:The manihold of 13 valve stations

Chapter 5:WIRING

5-1. Wiring Type Drawing



5-2. Power Supply Wiring

(1) Power(24VDC) must be supplied to the SI unit and to the solenoid valves.
- 24VDC for solenoid valve(max. 1.5A)
- 24VDC for serial interface unit(max. 0.1A)

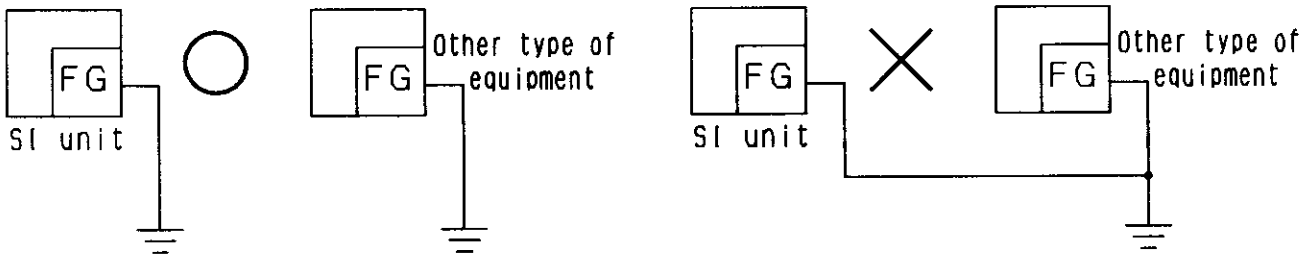
(2) Provide 24VDC +/-10% at the SI unit.

(3) Avoid close proximity of the power supply wire to high voltage wires and strong electrical fields.

5-3. Grounding

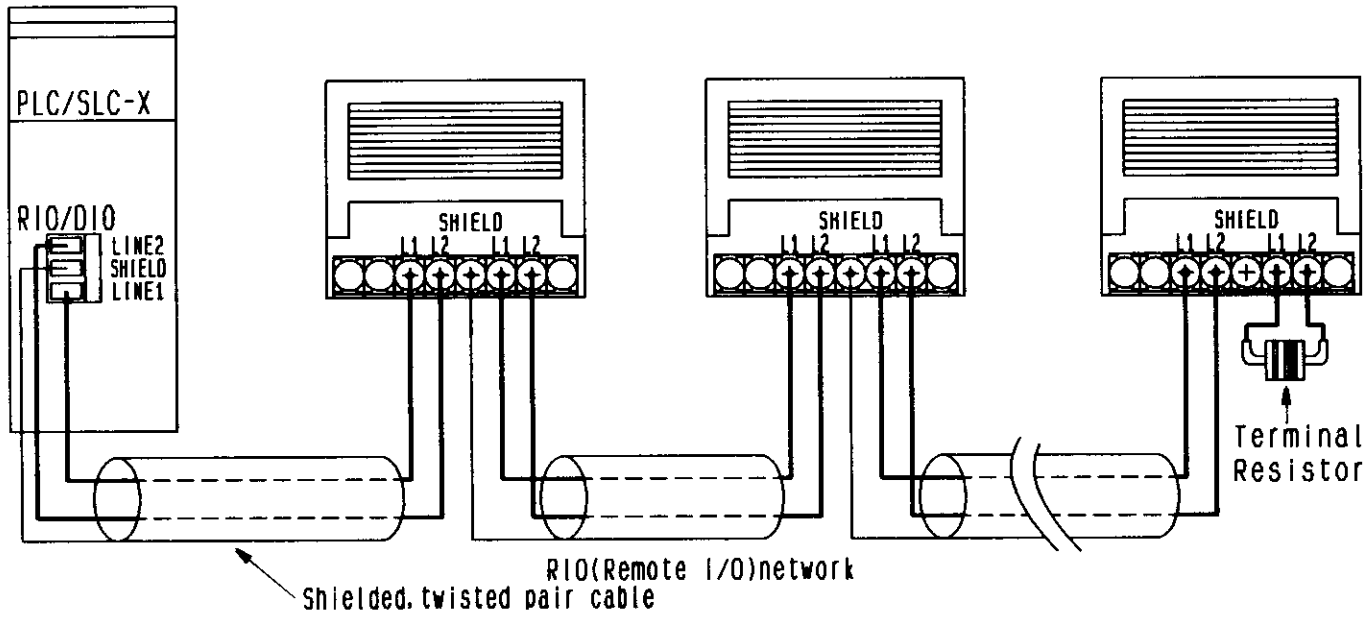
(1) The FG terminal of SI unit is the ground terminal. The third type grounding (earthing resistance is less than 100Ω) should be done with the earthing conductor of electrical wire greater than 2mm².

(2) Don't use it with earthing conductor of other equipment.



5-4. Wiring of the Communication Cable

The connection of the cable should be as shown below.



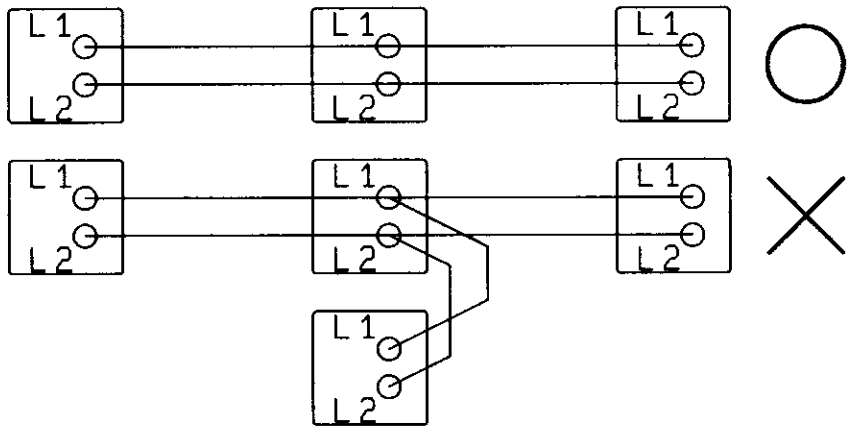
(1) Make all connections with power OFF, and the LINE1(L1) of the RIO/DIO terminal of the PLC/SLC is connected to L1 terminal of SI unit; the LINE2(L2) is to L2.

(2) Avoid proximity of cable to high voltage lines and equipment.

(3) Use appropriate style cable:

Type of Cable	Recommended Cable
shielded, twisted pair(2-core)	Allen-Bradley no. 1770-CD("blue hose") Belden Co., Type9463

(4) There is no restriction as to the spacing between each device(or SI unit), as long as the maximum cable distance is not exceeded. However, no two devices may connect to the same point on the RIO network.



(5) Wiring of the Shield terminal of SI unit should be done by connecting it to the shield line of recommended cable.

(6) Connect terminating resistors at the end of each link.(Termination kits are normally included with your A-B scanner).The type of resistor used is dependent on the baud rate.(Power rating of resistor:1/4W.)

	Number of link stations	
DATA RATE(Kbps)	~16	17~32
57.6	82Ω	150Ω
115.2	82Ω	150Ω
230.4	150Ω	150Ω

Chapter 6: TROUBLESHOOTING

The flowchart below refers to the SI valve manifold only.
Refer to the operating manual for the Allen-Bradley PLC as necessary.

Troubleshooting: