NAiS

PROGRAMMABLE CONTROLLER

FP SERIES FP0 S–LINK Unit

Hardware Manual

BEFORE BEGINNING

LIMITED WARRANTY

Introduction

Thank you for purchasing the FP0 S–LINK control unit.

The FP0 S–LINK control unit is designed exclusively for the FP0 programmable controller, and is equipped with numerous functions that make it easy to use the S–LINK with the FP0.

This hardware manual describes the functions, installation, wiring, and operation of the FP0 S–LINK control unit.

For detailed information about the S–LINK, refer to the "S–LINK Design manual and Construction manual."

Please make sure you understand the material contained in this manual before using your equipment.

Important Symbols

The following symbols are used in this manual:

☞ **Note**

> **Contains important additional information or indicates that you should proceed with caution.**

✌ **Example:**

> **Contains an illustrative example of the previous text section.**

☛ next page

> **Indicates that the text will be continued on the next page.**

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Record of Changes

Chapter 1

Features and Restrictions

1.1   Features

By having fewer wiring and construction functions, the S–LINK with a T–branch enables a more compact control panel, with no modifications required. Control of S–LINK input/output devices with 64 inputs and 64 outputs is supported. Additionally, expansion units can be added to accommodate up to three units, enabling efficient I/O wiring.

1.2   Restrictions

1.2.1   Unit Combinations

FP0 S–LINK   **First**   **Second**   **Third**
control unit   **expansion unit**   **expansion unit**   **expansion unit**

Maximum possible expansion is with a total of 3 units

A maximum of three expansion I/O units can be connected to one FP0 S–LINK control unit.

There are no restrictions on the combinations of the type expansion units.

1.2.2   Controllable I/O Points

When expansion units are added, control of up to 224 points is possible by using the S–LINK section and expansion section in combination.

Controllable I/O points of S–LINK section	Max. 128 points
Controllable I/O points of expansion section	Max. 96 points

1.2.3   Current Consumption

The internal current consumption (5V power supply) for the FP0 S–LINK control unit is as shown below. When configuring the system, the usage conditions of other units should be taken into consideration and included in the capacity of the power supply unit.

Name	Model no.	Current consumption (5V power supply)
FP0 S–LINK control unit	FP0–SL1	150mA max.

☞ **Note**

> **For information on the internal current consumption of other units, ☛ FP0 Hardware Manual and the manual for the relevant unit.**

1.2　　　　Restrictions

Chapter 2

Parts and Specifications

2.1   Names and Functions
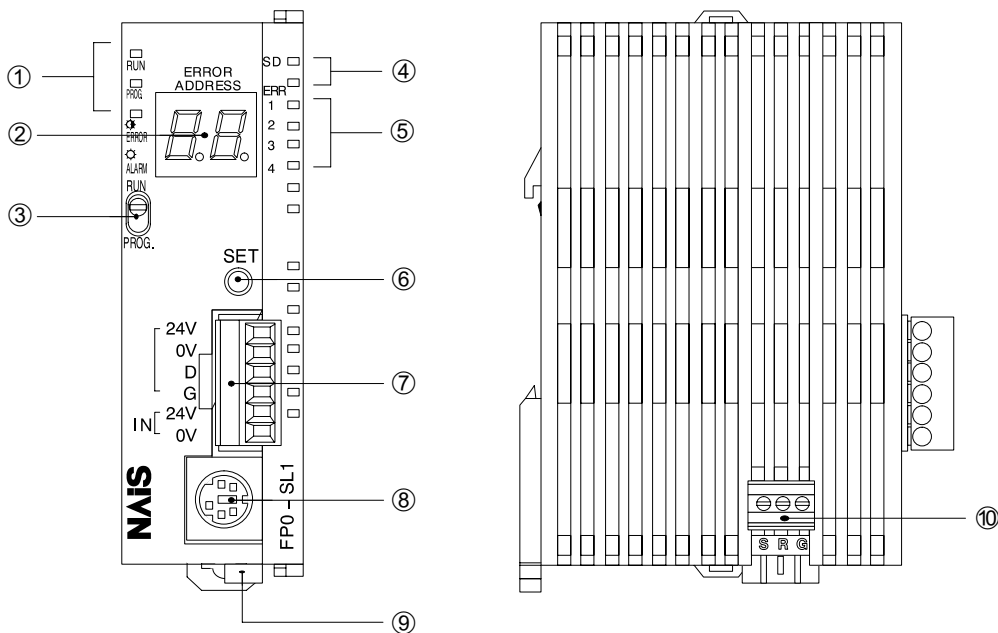
① **Status indicator LED**
The LED display the operation mode and error statuses.

② **ERROR ADDRESS display (2–digit hexadecimal display)**
The address at which the S–LINK system error occurred is displayed.

③ **Mode switch**
The mode switch changes the operation mode.

④ **Transmission indicator (SEND)**
This flashes when input or output data is transmitted between the various units of the S–LINK system.

⑤ **ERROR indicators**
These light if an error occurs in the S–LINK system.
ERR1 (Error 1): Short circuit between D – G line.
ERR2: Unused.
ERR3 (Error 3): Abnormal voltage level between D – G line.
ERR4 (Error 4): Broken wire or S–LINK I/O device error.

⑥ **System SET button**
Pressing the system SET button reads the connection status for the S–LINK system and stores it in the memory. In subsequent operation, the S–LINK unit checks for errors using the connection status registered at this time.
The output unit data effective at the time that the system SET button was pressed is retained.

☛ next page

2.1 Names and Functions

⑦ **S–LINK terminal block (6–pin)**
The power supply and signal wires of the S–LINK system are connected to the S–LINK terminal block.
The S–LINK terminal block can be detached from the FP0 S–LINK control unit for wiring operations.
For detailed information, ☛ section 4.1.2.

⑧ **Tool port (RS232C)**
The tool port (RS232C) is used to connect a programming tool.

⑨ **Power supply connector**
Supply 24V DC to the power supply connector. It is connected using the power supply cable (AFP0581) that comes with the unit.

⑩ **RS232C port**
Use this port to connect to devices with an RS232C port, such as an I.O.P., a bar code reader, or an image checker, enabling data input and output.

Tool port (RS232C) specifications

Pin assignment
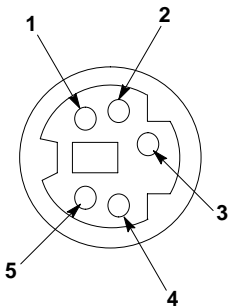
Pin no.	Abbreviation
1	–
2	SD (TXD)
3	SG
4	RD (RXD)
5	+5V

Settings when shipped from the factory

Default value	Baud rate: 9600bps
	Character bit: 8bits
	Parity check: Odd
	Stop bit: 1bit

2.2   Specifications

2.2.1   General Specifications

Item	Description
Rated operating voltage	24V DC
Operating voltage range	21.6V to 26.4V DC
Rated current consumption	150mA or less
Allowed momentary power off time	10ms at 21.6V, 10ms at 24V
Ambient temperature	0°C to +55°C/32°F to +131°F
Storage temperature	−20°C to +70°C/−4°F to +158°F
Ambient humidity	30% to 85% RH (non-condensing)
Storage humidity	30% to 85% RH (non-condensing)
Breakdown voltage	500V AC for 1 minute between S–LINK terminal block and power supply/ground terminals
Insulation resistance	min. 100MΩ (measured with a 500V DC megger) between S–LINK terminal block and power supply/ground terminals
Vibration resistance	10Hz to 55Hz, 1 cycle/min: double amplitude of 0.75mm/ 0.030in., 10 min on 3 axes
Shock resistance	Shock of 98m/s^2 or more, 4 times on 3 axes
Noise immunity	1,000 Vp-p with pulse widths 50ns and 1μs (based on in-house measurements) (at FP0 programmable controller section)
Operating condition	Free from corrosive gases and excessive dust

2.2   Specifications

2.2.2   Performance Specifications

Item			Description
Programming method/Control method			Relay symbol/Cyclic operation
Controllable I/O points	**Control unit only**		S–LINK section: max. 128 $\left(\begin{array}{l}\text{Input: 64}\\\text{Output: 64}\end{array}\right)$
	With expansion		Expansion section: max. 96
Program memory			Built in EEPROM (no back-up battery required)
Program capacity			5,000 steps
Numbers of instruction	**Basic instruction**		83 types
	High-level instruction		114 types
Operation speed			0.9μs/step (basic instruction)
I/O update time and Base time			Without expansion: 0.3ms With expansion: 0.3ms + (1 × Number of expansion unit) ms
Operation memory points	**Relays**	**Internal relay (R)**	1,008 points (R0 to R62F)
		Special internal relay (R)	64 points (R9000 to R903F)
		Timer/Counter (T/C)	144 points (initial setting is 100 timer points: T0 to T99 / 44 counter points: C100 to C143 (☞ note) Timer range: 1ms, 10ms, 100ms, 1s; selected by instruction
	Memory areas	**Data register (DT)**	6,144 words (DT0 to DT6143)
		Special data register (DT)	112 words (DT9000 to DT9111)b
		Index registers (IX, IY)	2 words
Differential points			Unlimited number of points
Master control relay points (MCR)			32 points
Number of labels (JP and LOOP)			64 labels
Number of step ladders			128 stages
Number of subroutines			16 subroutines
Number of interrupt programs			1 program (internal: 1)
Self-diagnostic function			Such as watchdog timer, program syntax check

☞   **Note**

The proportion of timer points to counter points can be changed using a system register 5. For detailed information,
☞ **"FP0 Programming Manual."**

Item			Description
Memory backup (☛ note 1)	**Timer**		Non-hold type: all points
	Counter	**Non-hold type**	From set value to C127
		Hold type	16 points (elapsed values) C128 to C143
	Internal relay	**Non-hold type**	880 points (R0 to R54F) 55 words (WR0 to WR54)
		Hold type	128 points (R550 to R62F) 8 words (WR55 to WR62)
	Data registers	**Non-hold type**	6112 words (DT0 to DT6111)
		Hold type	32 words (DT6112 to DT6143)
Special functions	**Pulse catch input**		Not available
	Interrupt input		Not available
	RS232C port (☛ note 2)		Baud rate: 300, 600, 1200, 2400. 4800, 9600, and 19200 bps
			Transmission distance: 3m/9.84ft.
			Terminal block: 3-pin, made by Phoenix Contact Co. (product number: MKDS 1/3-3.5)
			Communication method: half-duplex
	Periodical interrupt		0.5ms to 30s interval
	Constant scan		Available
	High-speed counter function		Not available
	Pulse output function		Not available
	PWM output function		Not available

☞ **Notes**

1) **The program, system registers and the hold type areas (internal relay, data register and counter) are backed up by the built in EEPROM.**

2) **When using the RS232C port for communication, retransmission is recommended.**
   The driver IC for the RS232C port conforms completely to EIA/TIA-232E and CCITT V. 28 standards.

2.2 Specifications

2.2.3 S–LINK Controller Specifications

Item		Description
Rated power supply voltage		24V DC ± 10% / Allowable ripple p – p ± 10% max. (Supplied from IN – 24V, IN – 0V of the S–LINK terminal block)
Current consumption (☛ note 1)		[S–LINK controller current consumption (including D – G line current consumption)] 24V DC 1.6A max.
		[Maximum current which can be supplied (supplied to S–LINK unit and I/O devices from 24V – 0V line)] + 24V DC 5A (fuse: 5A)
Transmission method		Bi–directional time–divided multiple signal transmission
Synchronization method		Bit synchronization, frame synchronization
Transmission protocol		S–LINK protocol
Transmission speed		28.5kbps
Transmission delay time		Max. 10.7ms
Transmission distance		Main signal wire: up to a distance to 200m max. (400m when a booster is used)
FAN–out (☛ note 2)		320
Connection method (☛ note 3)		'T'–branch multi–drop wiring
No. of input/output points		64 points input/64 points output Fixed
Display indicators	Transmission display (SEND)	Green LED blinks in response to synchronization signals
	Error indicator	Red LED light up depending on the error
	Error address display	If the system error occurs, the error address is displayed using the red 7–segment LED.

☞ **Notes**

1) **For detailed information on current consumption, ☛ "Determining the Power Supply" in the "S–LINK Design Manual".**

2) **The output capacitance for the D–G line of the S–LINK controller and booster is indicated by FAN–out, and the input capacitance from the D–G line of the S–LINK configuration unit is indicated by FAN–in. When configuring the S–LINK system, the configuration should be set up so that the FAN–out total $\geq$ the FAN–in total. For detailed information on calculating the FAN–in value and other values, ☛ "S–LINK Design Manual".**

3) **The FP0 S–LINK control unit does not have a loop wiring function.**

Chapter 3

I/O Allocation

# 3.1   How to Count the I/O Numbers

Specifying X and Y numbers
On the FP0, the same numbers are used for input and output.
Example: The same number "X80 and Y80" can be used for input and output

Expression of numbers for input/output relays
Since input relay (X) and output relay (Y) are handled in units of 16 points, they are
expressed as a combination of decimal and hexadecimal numbers as shown below.

✌ **Example: External input relay (X)**

Decimal number
1, 2, 3 . . . .

Hexadecimal number
0, 1, 2, 3 . . . . . . 9, A, B . . . . . F
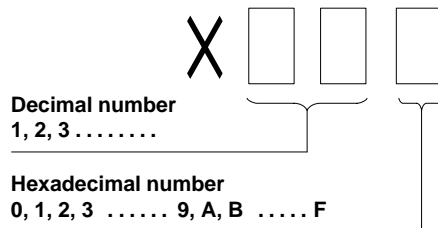
3.2   I/O Numbers of S–LINK Control Unit

The I/O allocation of the FP0 S–LINK control unit is fixed.

| Unit	FP0 I/O	S–LINK address
Input (64 points)	X80 to X8F	0 to 15
	X90 to X9F	16 to 31
	X100 to X10F	32 to 47
	X110 to X11F	48 to 63
Output (64 points)	Y80 to Y8F	64 to 79
	Y90 to Y9F	80 to 95
	Y100 to Y10F	96 to 111
	Y110 to Y11F	112 to 127

Chapter 4

Wiring

4.1   Wiring the Power Supply

With the FP0 S–LINK control unit, power must be supplied at two locations (power supply connector and S–LINK terminal block).

4.1.1   Wiring to Power Supply Connector

This is the power supply for the programmable controller section and the S–LINK controller in the S–LINK control unit (24V DC, 150mA).
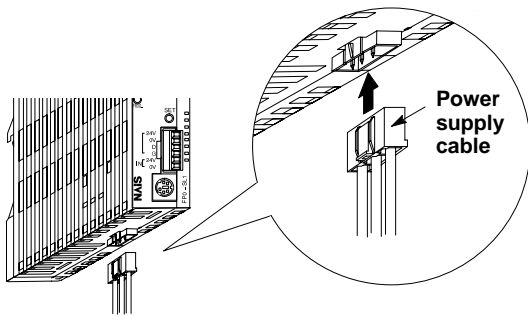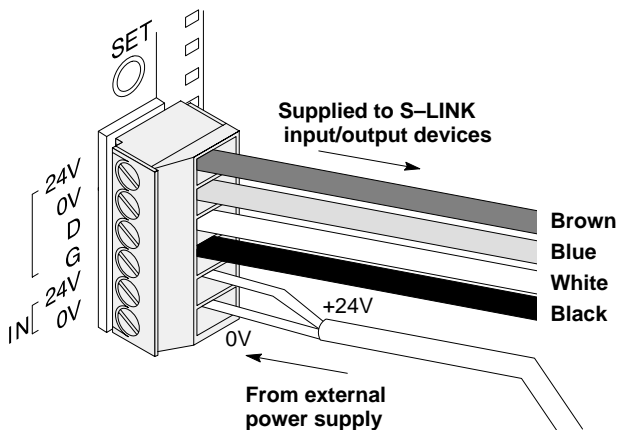

4.1.2   Wiring to S–LINK Terminal Block

This is the power supply for the S–LINK controller in the S–LINK control unit and other S–LINK input/output devices to which power is supplied through the 24V – 0V line of the S–LINK main cable.

The current consumption for the overall S–LINK system is calculated by referring to the section entitled "Determining the Power Supply" in the "S–LINK Design Manual." (For standard purposes, a power supply exceeding 24V DC, 1.6 A should be selected.)

Supply of power to S–LINK terminal block

4.1   Wiring the Power Supply

S–LINK terminal block: MC1.5/6–ST–3.5 (Made by Phoenix Contact Co.)

Terminal name	Color of connecting cable	Description
24V	Brown	Main wire (for S–LINK I/O devices)
0V	Blue	
D	White	
G	Black	
IN–24V	—	External power supply input for S–LINK
IN–0V	—	

Suitable wires (twisted wire)

Size	AWG#20 to 16
Normal cross–section surface area	0.5 to 1.25mm^2

☞ **Notes**

- **The S–LINK section is protected by a fuse, but if too many input/output devices are connected, or if the current consumption is heavy enough to cause the fuse to blow, we recommend providing a local power supply.**

- **A short–circuit between D–G, or between D–24V, triggers the protective circuit, but there is no protection against short–circuiting between G–24V or 0V–24V. Be aware that a short–circuit can cause a breakdown or malfunction.**
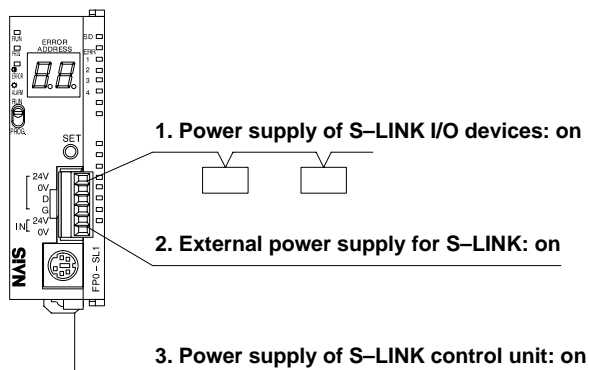
Chapter 5

Operation

5.1   Sequence of Turning on Power Supplies

When turning on the power supplies to the S–LINK control unit, follow the sequence outlined below.

Procedure:

1. **Turn on the power supply to the S–LINK I/O devices connected to the S–LINK system.**

2. **Turn on the external power supply to the S–LINK.**

3. **Last, turn on the power supply to the S–LINK control unit itself.**

If using the power supply of booster, start up the booster before the external power supply for S–LINK.

When turning off the power supplies, reverse the order of the sequence noted above.
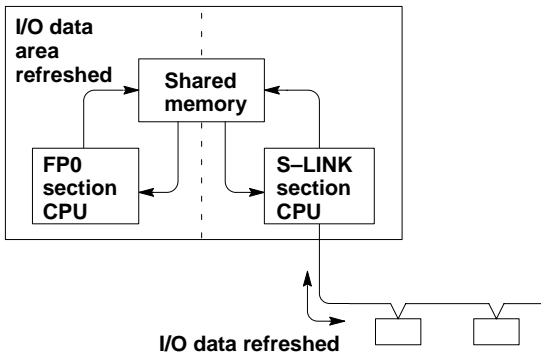
5.2   Operation When Power Supply is Turned On

**Refreshing S–LINK I/O data**

With the S–LINK control unit, I/O data is refreshed by the CPUs of both the FP0 section and the S–LINK section, through the memory shared between them.

S–LINK control unit

I/O data refreshed

The illustration below shows the time required until the first refreshing is completed by the S–LINK control unit after the power supply has been turned on. (The external power supply for the S–LINK is already on.)
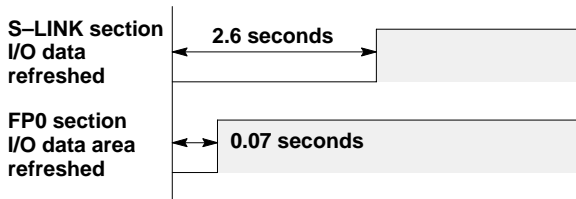
When the power supply to the S–LINK control unit is turned on, it takes approximately 2.6 seconds for the S–LINK I/O data to be verified by the FP0 section. Be particularly careful with regard to the FP0 sequence program, if using the S–LINK input at the b contact relay when the power supply is turned on.

For information on the S–LINK system as a whole, ☛ "S–LINK Construction Manual".

5.3 S–LINK System Address Recognition

5.3.1 Recognizing the Address

Before the S–LINK system is being operated for the first time, turn on the power supply and then press the system SET button.

When the system SET button is pressed, the number of connected devices recognized by S–LINK control unit blinks on the error address display in hexadecimal.

ERROR ADDRESS display
(Displaying in hexadecimal)

System SET button
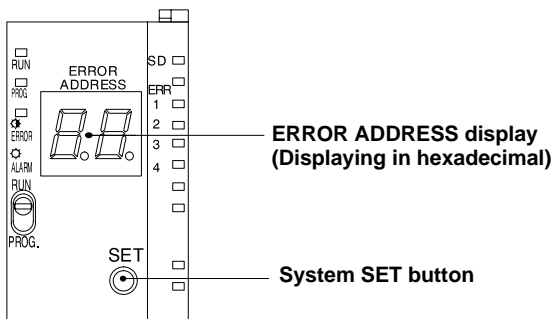
If the actual number of connected devices differs from the number displayed, since an unrecognized S–LINK device exists, check for address overlapping, improper connection, etc..

Subsequently, an error check is carried out based on this status. When an address is recognized, that status is stored in the EEPROM, so it is not necessary to press the system SET button after that point (each time the power supply is turned on).

When the power supply is switched on for the first time after completing the S–LINK system wiring, an arbitrary error display may appear. This does not indicate any abnormal operation. If the system SET button is pressed, this display is erased.

If an error address is displayed during operation, confirm the address, and then turn off the power supply, correct the address at the location where the error occurred, and turn the power supply on again. Check to make sure the error address display has disappeared. (Do not press the system SET button in this case.)

If the system SET button is pressed after an error has occurred and before it is canceled, the error will be canceled. If the cause of the error has not been corrected at that point, however, be aware that the I/O device for that address will be skipped during any subsequent checks.

☞ **Note**

> **If the system SET button is pressed without recovery having been made, that status will be recognized for that address, and any locations where recovery has not been made will not be recognized.**

5.3   S–LINK System Address Recognition

5.3.2   Address Setting of S–LINK I/O Device

Addresses can be set freely, regardless of the position of the I/O device connected to the system, but problems in the wiring of the main cable, such as broken or disconnected wires, can be detected more easily if I/O devices closer to the S–LINK control unit are given smaller addresses, and addresses increase in sequential order for I/O devices which are farther away from the S–LINK control unit.

Numeric values indicate the initial address for each I/O device.
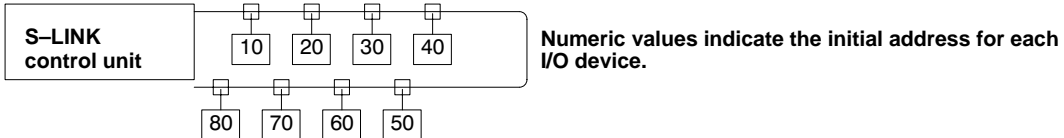
Up to two I/O devices can be assigned the same address within the system for any individual S–LINK control unit. Do not set the same address for three or more I/O devices.

Up to seven boosters can be connected to one system for any individual S–LINK control unit, but the actual number which can be connected varies depending on the units configuring the system and the wiring length.

☞ **Note**

> **The FP0 S–LINK control unit does not have a loop wiring function.**

Chapter 6

What to Do If an Error Occurs

6.1   Judging Errors from the Error Indicators

If an error occurs in the S–LINK system, the ERROR indicator indicated in the table below lights, depending on the content of the error.

| ERROR indicators				Description	Steps to take
ERR1	ERR2	ERR3	ERR4		
on	off	on	off	Short–circuit between D–G (☞ note 1)	If the ERR1 or ERR3 indicator lights, output of the signal being transmitted stops, and none of the S–LINK devices connected to the system will operate. Also, if a short–circuit occurs at a location far away, there may be times when ERR1 does not light. Check the S–LINK signal/power line.
off	off	on	off	Error in level of signal being transmitted	There is a possibility that the wiring length, the configuration, or the number of configuration devices connected to the system exceeds the rated limit. Check the system configuration once again.
off	off	off	on	Address has been changed/ D or G line is broken or disconnected/ Error in S–LINK unit for displayed address (☞ note 2)	Check to see if the S–LINK signal/power line is broken or disconnected, or if the address is incorrect. In this case, transmission signals are being output, so the S–LINK input/output devices operate normally.

☞ **Notes**

1) This ERROR indicator lights even if the external power supply to the S–LINK has not been turned on, but this does not indicate a breakdown in the S–LINK control unit itself. Check the external power supply to the S–LINK.

2) ERR4 is held, so to cancel it, one of the following is required: turn the power supply to the FP0 off and then on again, press the system SET button and enter the settings again, or turn the power supply on the S–LINK side off and then on again.
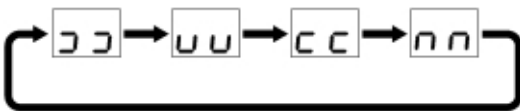
6.2   Judging Error Address Displays

The transmission line is monitored at all times, and if an error occurs, the address at which the error occurred is displayed as a hexadecimal value.
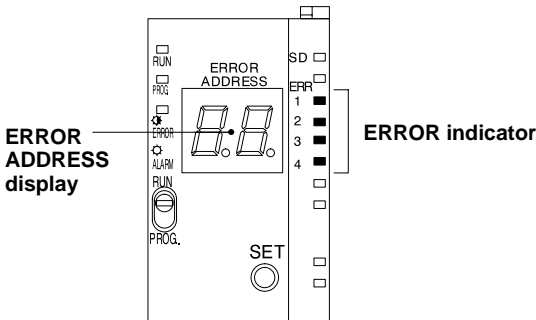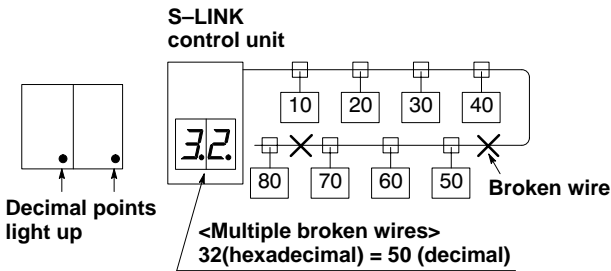

During normal transmission:
The "ㄱ ㄱ" shaped charactor rotates in the clockwise direction.

If an error occurs:
The address is displayed. In case faults occur at several locations, the smallest error address is displayed and the decimal points light up simultaneously.
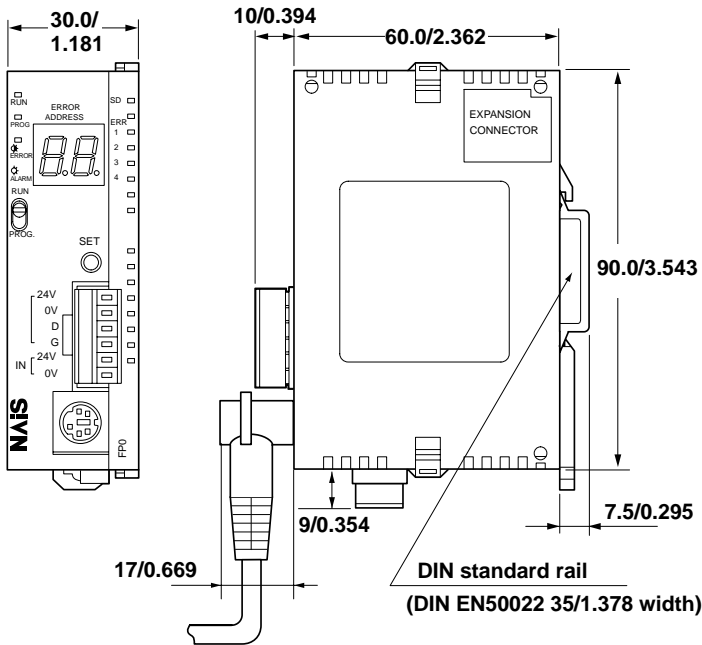
Chapter 7

Dimensions

7.1   FP0 S–LINK Control Unit

Reference measuring for wiring.

External dimensions (unit: mm/in.)

7.2   Mounting on DIN Rail

Top view (unit: mm/in.)

60.0/2.362   **67.5/2.657**
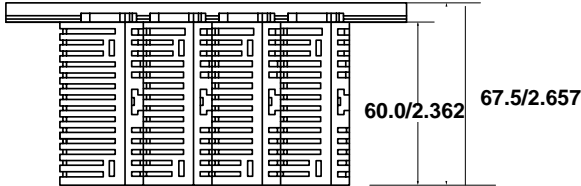
Front view (unit: mm/in.)

A   B   C   D

45/1.772

90.0/3.543

45/1.772
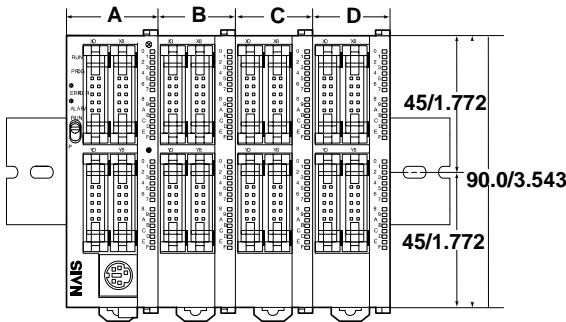
A+B+C+D dimensions (unit: mm/in.)

Control unit type	A (Control unit only)	A+B (1 expansion unit connected)	A+B+C (2 expansion units connected)	A+B+C+D (3 expansion units connected)
FP0 S–LINK control unit (FP0–SL1)	30/1.181	55/2.165	80/3.150	105/4.134

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Record of Changes

Manual No.	Date	Description of Changes
ARCT1F263END	January 2000	First edition

GLOBAL NETWORK

North America	Europe	Asia Pacific	China	Japan
Aromat Corporation	**Matsushita Electric Works Group**	**Matsushita Electric Works (Asia Pacific)**	**Matsushita Electric Works**	**Matsushita Electric Works Ltd. Automation Controls Group**

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