Panasonic

PROGRAMMABLE CONTROLLER

FP SERIES FP-X

Hardware Manual

Panasonic

FP–X Hardware Manual

Panasonic Electric Works Europe AG

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BEFORE BEGINNING

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- When physical defects are due to defective equipment other than the distributed product.
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Important Symbols

One or more of the following symbols may be used in this manual:

Warning.
The warning triangle indicates especially important safety instructions. If they are not adhered to, the results could be:

- **fatal or critical injury and/or**
- **significant damage to instruments or their contents, e.g. data**

NOTE

Contains important additional information.

EXAMPLE

Contains an illustrative example of the previous text section.

PROCEDURE

Indicates that a step-by-step procedure follows.

REFERENCE

Indicates where you can find additional information on the subject at hand.

CAUTION

Indicates that you should proceed with caution.

KEYPOINTS

Summarizes key points in a concise manner.

SHORTCUTS

Provides helpful keyboard shortcuts.

EXPLANATION

Provides brief explanation of a function, e.g. why or when you should use it.

☛ next page

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

The manual uses the following conventions to indicate elements from the user interface or the keyboard:

"Data Field"	Data field entries and option names are rendered in quotation marks.
[Button]	Buttons are indicated by square brackets.
<Key>	Keys are indicated by pointed brackets

Before You Start

Installation environment

Do not use the FP-X unit where it will be exposed to the following:

- Direct sunlight and ambient temperatures outside the range of 0°C to 55°C /32°F to 131°F.
- Ambient humidity outside the range of 10% to 90% RH (at 25°C, non-condensing) and sudden temperature changes causing condensation.
- Inflammable or corrosive gas.
- Excessive vibration or shock.
- Excessive airborne dust, metal particles or salts.
- Water, oil or chemicals in any form including spray or mist.
- Benzine, paint thinner, alcohol or other organic solvents or strong alkaline solutions such as ammonia or caustic soda.
- Influence from power transmission lines, high voltage equipment, power cables, power equipment, radio transmitters, or any other equipment that would generate high switching surges.

Static electricity

Before touching the unit, always touch a grounded piece of metal in order to discharge static electricity.

In dry locations, excessive static electricity can cause problems.

Cleaning

Do not use thinner based cleaners because they deform the unit case and fade colors.

Power supplies

Use an insulated power supply with an internal protective circuit for resistance to noise.

If you use a power supply without a protective circuit, power should be supplied through a protective element such as a fuse.

Power supply sequence

Arrange the power supply sequence such that the power supply of the control unit turns off before the power supply for the inputs and outputs.

If the power supply for the inputs and outputs is turned off before the power supply of the control unit, the control unit will detect input fluctuations and may begin an unscheduled operation.

Before turning on the power

When turning on the power for the first time, be sure to follow the precautions given below:

- When performing installation, check to make sure that there are no scraps of wiring,

particularly conductive fragments, adhering to the unit.

- Verify that the power supply wiring, I/O wiring, and power supply voltage are all correct.
- Sufficiently tighten the installation screws and terminal screws.
- Set the mode selector to PROG. Mode.

Before entering a program

Be sure to clear any existing program before entering a new program.

Request concerning program storage

To prevent the accidental loss of programs, the user should consider the following measures:

- Backing up programs. To avoid accidentally losing programs, destroying files, or overwriting the contents of a file, documents should be printed out and then saved.
- Specifying the password carefully. The password setting is designed to avoid programs being accidentally overwritten. If the password is forgotten, however, it will be impossible to overwrite the program even if you want to. Also, if a password is forcibly bypassed, the program is deleted. Therefore, please note the password in a safe location.
- Upload protection. When the upload protection setting is specified, programs will be disalbed to be read out. If the setting is cancelled forcibly, all programs and system registers will be deleted. Therefore, note that managing programs and system registers are your own responsibility.

Backup battery

Do not install the battery if it is not used as it may leak if it remains discharged.

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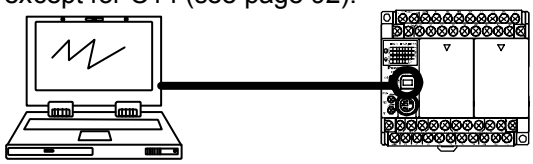
Chapter 1

Features, Functions and Restrictions

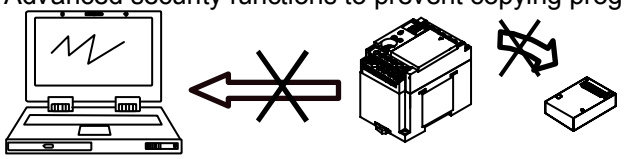
1.1 Features and Functions

The FP-X is a compact, general-purpose PLC suitable for small-scale facility control and includes the following features:

- Can be directly connected to a personal computer using the USB communication port, except for C14 (see page 92).



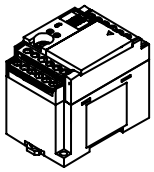
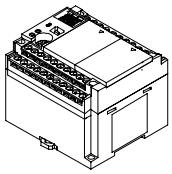
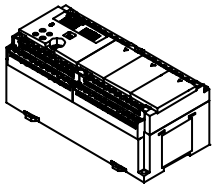
- Advanced security functions to prevent copying programs illicitly (see page 181).



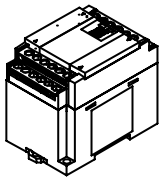
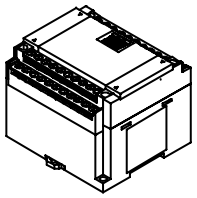
- Supports Modbus RTU communication (see page 152).
- Supports analog control and includes analog potentiometers, e.g. to control analog timers without needing a programming tool.
- A variety of optional communication (see page 35) and application cassettes (see page 40).
- FP0 expansion units (see page 31) can be added.
- AC power supply.
- Screw terminal block.
- Relay output.
- 32k-step program capacity.
- 0.32μs command processing speed.
- Max. 382-points I/O control.
- The CPU is equipped with single-phase 8-channel and 2-phase 4-channel high-speed counter functions.

1.2 Unit Types

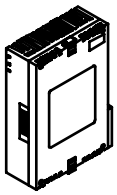
1.2.1 FP-X Control Units

Type	Name	No. of I/O points	Power supply	Product no.
	FP-X C14 control unit	14 points 8-point DC input 6-point relay output	100 - 240V AC	AFPX-C14R
	FP-X C30 control unit	30 points 16-point DC input 14-point relay output	100 - 240V AC	AFPX-C30R
	FP-X C60 control unit	60 points 32-point DC input 28-point relay output	100 - 240V AC	AFPX-C60R

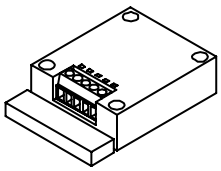
1.2.2 FP-X Expansion I/O Units

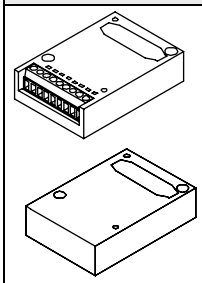
Type	Name	No. of I/O points	Power supply	Product no.
	FP-X E16 expansion I/O unit (with expansion cable)	16 points 8-point DC input 8-point relay output	Supplied from control unit or AFPX-E30R	AFPX-E16R
	FP-X E30 expansion I/O unit (with expansion cable)	30 points 16-point DC input 14-point relay output	100 - 240V AC	AFPX-E30R

1.2.3 FP-X Expansion FP0 Adapter

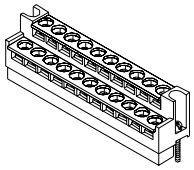
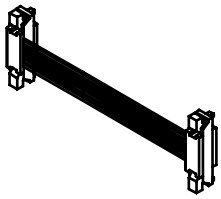
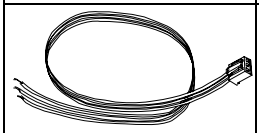
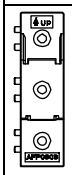
Type	Name	Specifications	Product no.
	FP-X expansion FP0 adapter (with expansion cable, power supply cable)	For connecting FP0 expansion units	AFPX-EFP0

1.2.4 Add-On Cassettes

Communication cassette	Name	Specifications	Product no.
	FP-X communication cassette	5-wire, 1-channel RS232C	AFPX-COM1
	FP-X communication cassette	3-wire, 2-channel RS232C	AFPX-COM2
	FP-X communication cassette	1-channel RS485 / RS422 (insulated)	AFPX-COM3
	FP-X communication cassette	1-channel RS485 (insulated) 3-wire, 1-channel RS232C	AFPX-COM4

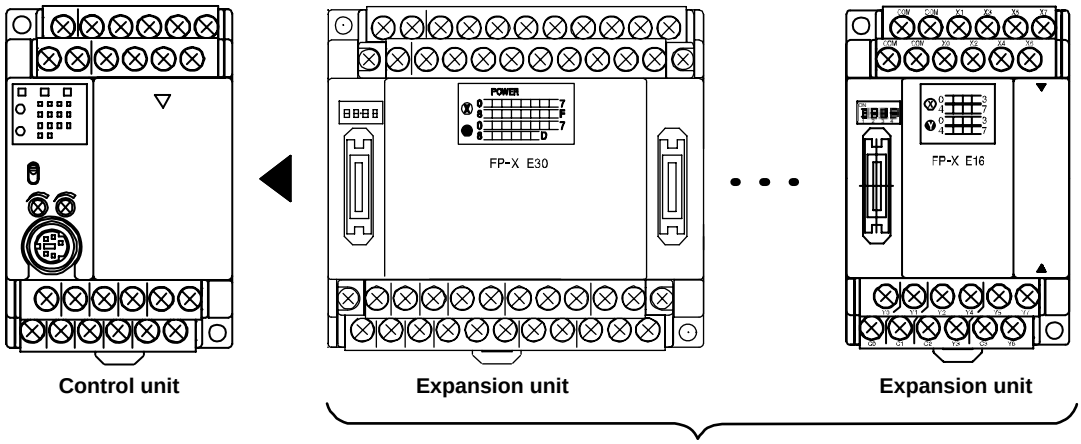
Application cassettte	Name	Specifications	Product no.
	FP-X analog input cassette	2-channel analog input (non-insulated)	AFPX-AD2
	FP-X input cassette	8-point DC input	AFPX-IN8
	FP-X output cassette	8-point transistor output (NPN)	AFPX-TR8
		6-point transistor output (PNP)	AFPX-TR6P
	FP-X pulse I/O cassette	2-ch high-speed counter + 1 ch pulse output	AFPX-PLS
	FP-X master memory cassette	Master memory + realtime clock	AFPX-MRTC

1.2.5 Related Parts

Type	Name	Specifications	Product no.
	FP-X backup battery	Necessary for backing up data registers, etc. or for using the realtime clock function.	AFPX-BATT
	FP-X terminal block (C30/C60)	For C30/C60 control unit with 21-pin cover (no printing), 5 pcs/pack.	AFPX-TAN1
	FP-X expansion cable	8cm	AFPX-ECO8
	FP0 power supply cable	For FP0 expansion adapter Length: 1m	AFP0581
	FP0 mounting plate (slim type)	Used for FP0 expansion unit, 10 pcs/pack	AFP0803

1.3 Restrictions on Unit Combinations

1.3.1 Restrictions, FP-X Expansion Units



Controllable I/O points

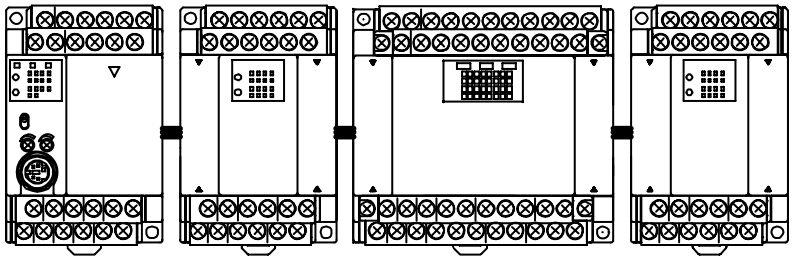
Control unit	Control unit I/O points	Total I/O points possible using 8 AFPX-E30R units
FP-X C14	14	254
FP-X C30	30	270
FP-X C60	60	300

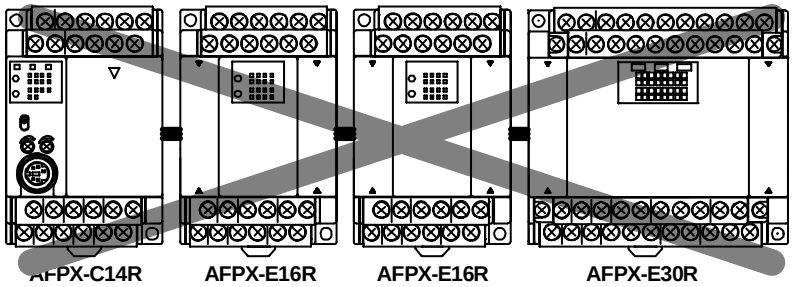
◆ NOTES

- **Since the AFPX-E16R expansion unit gets its power from a unit with a power supply, i.e. the control or AFPX-E30R unit, you cannot connect more than**

one in a row.

OK:



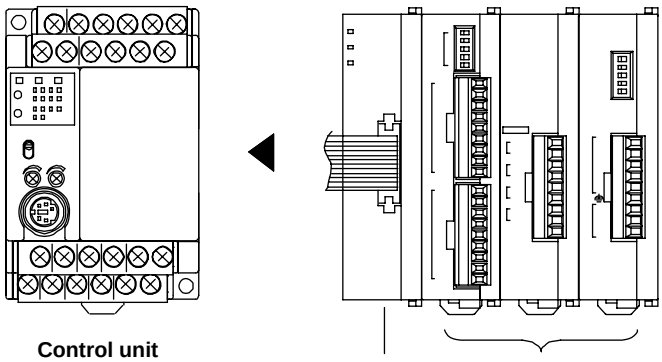


- **The total length of the expansion cable should not exceed 160cm.**

1.3.2 Restrictions, FP0 Expansion Units

Up to three dedicated FP0 expansion units can be added using the expansion FP0 adapter.

The relay output type and the transistor output type can be used in combination.



Controllable I/O points

Control unit	Control unit I/O points	Total I/O points, control unit + FP0 expansion unit
FP-X C14	14	110
FP-X C30	30	126
FP-X C60	60	156

◆ NOTES

- **The FP-X expansion I/O unit can also be installed between the control unit and the expansion FP0 adapter.**
- **Only one expansion FP0 adapter can be installed at the last position of the FP-X expansion bus.**
- **Install the FP0 thermocouple unit to the right of other expansion units. If it is installed on the left side, overall precision will deteriorate. For details, refer to the FP0 thermocouple unit manual.**
- **Install the FP0 CC-Link slave unit to the right of the other expansion units because it has no expansion connector on the right side. For details, refer to the FP0 CC-link slave unit manual.**

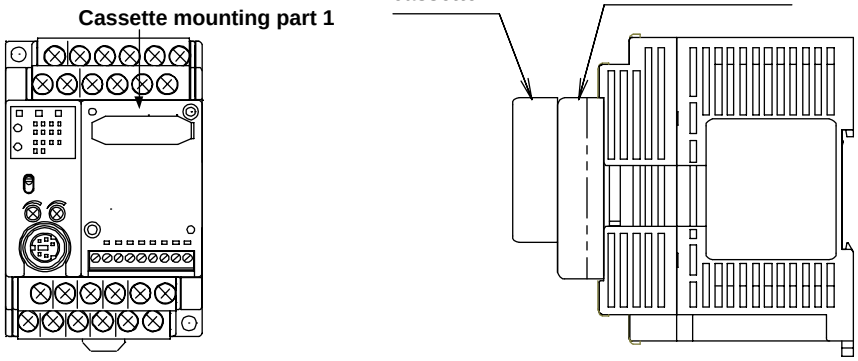
1.3.3 Restrictions, FP-X Add-On Cassettes

Add-on cassettes are installed in cassette mounting parts 1 and 2 of the control unit. For C14, only cassette mounting part 1 is available.

Top view **Side view**

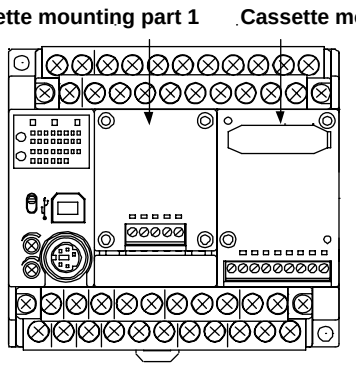
■ FP-X C14

1 application cassette installed



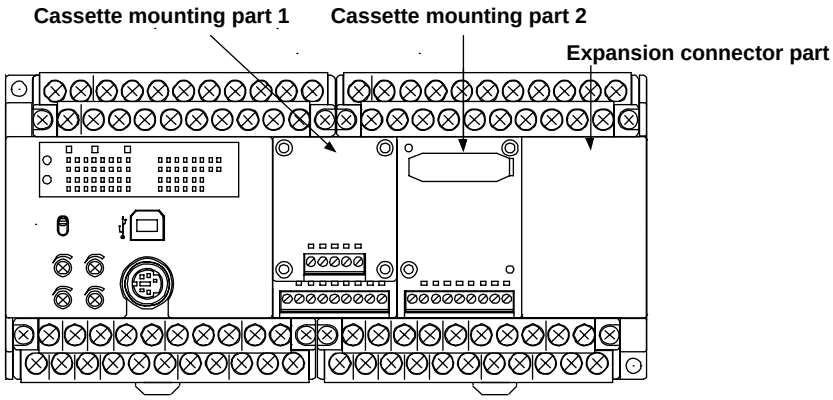
■ FP-X C30

1 application cassette and 1 communication cassette installed



■ FP-X C60

2 application cassettes and 1 communication cassette installed



A: Available, NA: Not Available

Restrictions on control unit			**FP-X C14 FP-X C30 FP-X C60**	**FP-X C30 FP-X C60**	**FP-X C60**
Type of FP-X add-on cassette			**Cassette mounting part 1**	**Cassette mounting part 2**	**Expansion connector part**
Communication cassette	Communication cassette	AFPX-COM1	A	N/A	The add-on cassette cannot be installed
	Communication cassette	AFPX-COM2	A	N/A	
	Communication cassette	AFPX-COM3	A	N/A	
	Communication cassette	AFPX-COM4	A	N/A	
Application cassette	Analog input cassette	AFPX-AD2	A	A	
	Input cassette	AFPX-IN8	A	A	
	Output cassette	AFPX-TR8	A	A	
	Output cassette	AFPX-TR6P	A	A	
	Pulse I/O cassette	AFPX-PLS	A	A	
	Master memory cassette	AFPX-MTRC	A(see note 1)	A(see note 1)	

◆ NOTES

1. **Only one FP-X master memory cassette AFPX-MRTC can be installed. If 2 units are installed, E26 (user ROM error) will occur.**

2. **Application cassettes can be installed in cassette mounting part 1 and 2 of C30/C60.**

3. **Only one communication cassette can be installed, in cassette mounting part 1. If an application cassette is installed in mounting part 1, mount the communication cassette on top of it.**

4. **An add-on cassette installed in the expansion connector part of C60 will not work.**

1.4 Programming Tools

You can use the following programming software to program the FP-X:

- FPWIN Pro Version 5.1 or later
- FPWIN GR Version 2.5 or later
- FP memory loader, to transfer programs and system registers

You can connect your PC to the FP-X with an RS232C programming cable. For the FP-X C30 and C60, you can also connect them via the USB port.

RS232C programming cable

PC side	PLC side	Specifications	Product no.
D-sub 9-pin	female mini DIN round 5-pin	L type (3m)	AFC8503
		Straight type (3m)	AFC8503S

Commercial USB cable

Cable type	Length
USB 2.0 (or 1.1) AB type	Max. 5m

◆ NOTE

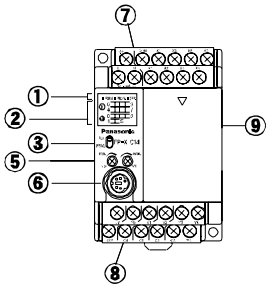
Due to slight terminological differences between the programming tools, there are some slight inconsistencies between the manual and the FPWIN Pro user interface, especially regarding communication modes.

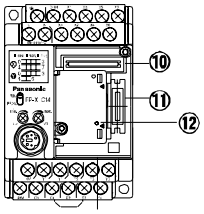
Chapter 2

Control Units

2.1 Parts and Functions

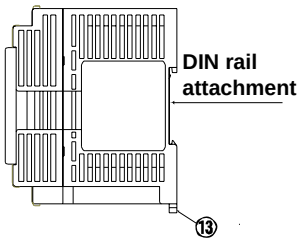
FP-X C14



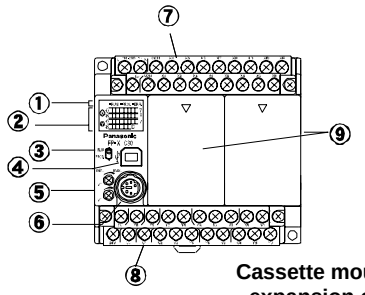


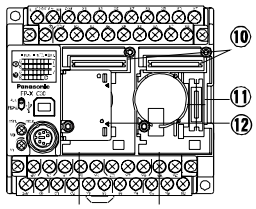
Cassette mounting part 1
- expansion cover removed.

Right side view (same for all control units)



FP-X C30

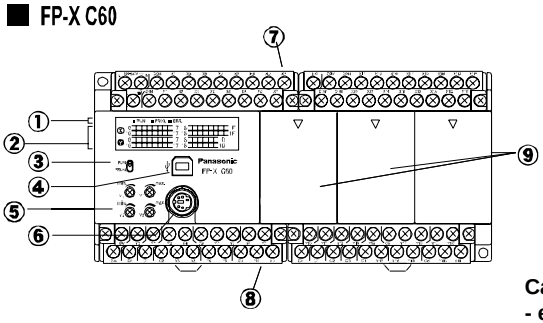


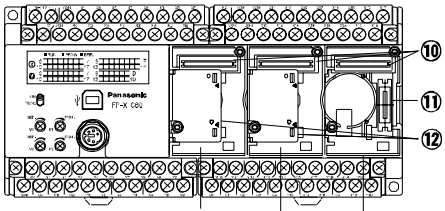


Cassette mounting part 1
- expansion cover removed.

Cassette mounting part 2
- expansion and battery cover removed.

FP-X C60





Cassette mounting part 1
- expansion cover removed.

Cassette mounting part 2
- expansion cover removed.

Expansion connector part 2
- expansion and battery cover removed.

① Status indicator LEDs

These LEDs display the current operation status or the occurrence of an error.

LED	Color	Operation status
RUN	Green	Lights when in the RUN mode and indicates that the program is being executed.
		Flashes during forced input/output. (The RUN and PROG. LEDs flash alternately.)
PROG.	Green	Lights when in PROG. mode and indicates that operation has stopped. Lights when in PROG. mode during forced input/output.
		Flashes during forced input/output. (The RUN and PROG. LEDs flash alternately.)
ERR. (ALARM)	Red	Flashes when an error is detected during the self-diagnostic function. (ERROR)
		Lights if a hardware error occurs, or if operation slows because of the program and the watchdog timer is activated. (ALARM)

② Input/output indicator LEDs

Indicates the on/off status of the input and output.

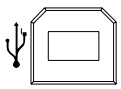
③ RUN/PROG. mode switch

This switch is used to change the operation mode of the PLC.

Switch position	Operation mode
RUN (upward)	This sets RUN mode. The program is executed and operation begins.
PROG. (downward)	This sets PROG. mode. Operation stops.

- The programming tool can perform remote switching.
- When performing remote switching from the programming tool, the setting of the mode switch and the actual mode of operation may differ. Verify the mode with the status indicator LED.
- Restart FP-X to operate in the mode set with the RUN/PROG. mode switch.

④ USB connector (B type) (see page 92)



You can connect your PC to the FP-X via the USB port for programming. Commercial USB cables (AB type) can be used, max. length 5m.

The baud rate with the USB is 115.2 kbps (fixed).

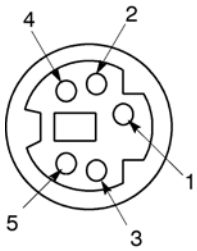
⑤ Analog potentiometer (analog dial) (see page 193)

Turning this dial changes the values of special data registers DT90040 to DT90043 within the range of K0 to K1000. It can be used for analog timers and other applications.
C14R and C30R is equipped with 2 dials. C60R is equipped with 4.

⑥ Tool port (RS232C)

This port is used to connect a programming tool.

A commercial mini-DIN 5-pin connector is used for the Tool port on the control unit.



Pin no.	Signal name	Abbreviation	Signal direction
1	Signal Ground	SG	-
2	Send Data	SD	Unit → External device
3	Receive Data	RD	Unit ← External device
4	Not used.		
5	+5V	+5V	Unit → External device

The followings are the factory default settings. Use the system registers for the tool port to change these settings or the unit station numbers.

- Baud rate: 9600 bps
- Character bit: 8 bits
- Parity check: Odd parity
- Stop bit length: 1 bit

⑦ Power supply and input terminal block

⑧ Service power supply for input and output terminal block

⑨ Expansion cover

It is used after the expansion cable or the battery has been installed.

⑩ Add-on cassette connector

⑪ For connecting expansion I/O unit and expansion FP0 adapter

An exclusive expansion cable is inserted.

⑫ Battery cover

Remove this battery cover when you install the optional backup battery. The backup battery enables the realtime clock and data registers to be backed up.

⑬ DIN rail attachment lever

2.2 Power Supply Specifications

AC Power Supply

Item	Specifications	
	C14R	C30R/C60R
Rated voltage	100 to 240V AC	
Voltage regulation range	85 to 264V AC	
Consumption current	0.3A or less (at 100V AC)	0.7A or less (at 100V AC)
Surge current	40A or less (at 240V AC, 25°C)	45A or less (at 240V AC, 25°C)
Momentary power off time	10ms (when using 100V AC)	
Frequency	50/60 Hz (47 to 63 Hz)	
Leakage current	0.75mA or less between input and protective earth terminals	
Internal power supply part Guaranteed life	20,000 hours (at 55°C)	
Fuse	Built-in (Cannot be replaced)	
Insulation system	Transformer insulation	
Terminal screw	M3	

Service Power Supply for Inputs and Outputs

Item	Specifications	
	C14R	C30R/C60R
Rated output voltage	24V DC	
Voltage regulation range	21.6 to 26.4V DC	
Rated output current	0.15A	0.4A
Overcurrent protection function Note)	Available	
Terminal screw	M3	

◆ NOTE

This function is meant to protect against overcurrent temporarily**. A current load that is beyond the specifications may cause damage.**

2.3 Input Specifications

Item		Description
Insulation method		Optical coupler
Rated input voltage		24V DC
Operating voltage range		21.6 to 26.4V DC
Rated input current		Approx. 4.7mA (for control units X0 to X7) Approx. 4.3mA (from control unit X8)
Input points per common		8 points/common (C14R) 16 points/common (C30R/C60R) (Either the positive or negative wire of the input power supply can be connected to the common terminal.)
Min. on voltage/Min. on current		19.2V DC/3mA
Min. off voltage/Min. off current		2.4V DC/1mA
Input impedance		Approx. 5.1 kΩ (for control units X0 to X7) Approx. 5.6 kΩ (from control unit X8)
Response time	off → on on → off	**For control units X0 to X7:** • 0.6ms or less: normal input • 50μs or less: high-speed counter, pulse catch, interrupt input settings (see note) **From control unit X8:** • 0.6ms or less (see note)
Operating mode indicator		LED display
Applicable type		Conforms to IEC61131-2 TYPE 3 (according to the above specifications)

◆ NOTE

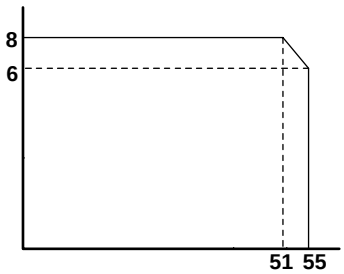
This specification applies when the rated input voltage is 24V DC and the temperature is 25°C.

Limitations on the number of input points that are ON simultaneously

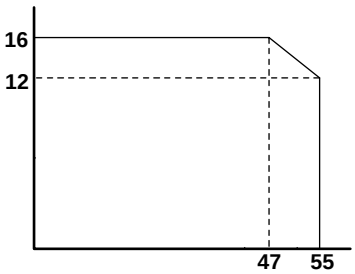
Keep the number of input points per common which are simultaneously on within the following range as determined by the ambient temperature.

Vertical axis: Number of points per common simultaneously ON.

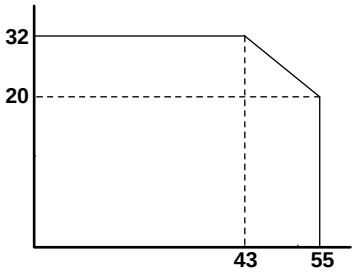
[C14R]



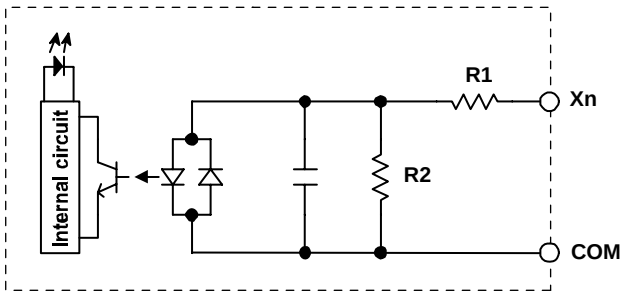
[C30R]



[C60R]



Internal circuit diagram C14R/C30R/C60R



For X0 to X7: R1=5.1kΩ, R2 = 3kΩ

From X8 on: R1=5.6kΩ, R2 = 1kΩ

2.4 Relay Output Specifications

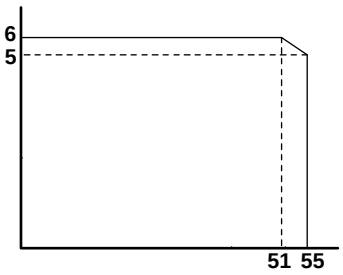
Item		Description
Insulation method		Relay insulation
Output type		1a output (Relay cannot be replaced)
Rated control capacity (Resistance load)		2A/point 250V AC 2A/point 30V DC (8 A or less/common)
Output points per common		1 point/common, 2 points/common, 3 points/common, 4 points/common
Response time	off → on	Approx. 10ms
	on → off	Approx. 8ms
Lifetime	Mechanical	≥ 20,000,000 times (frequency of switching: 180 times/min.)
	Electrical	≥ 100,000 times (frequency of switching at the rated control capacity: 20 times/min.)
Surge absorber		None
Operating mode indicator		LED display

Limitations on the number of output points that are ON simultaneously

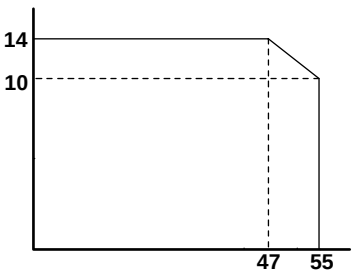
Keep the number of output points per common which are simultaneously on within the following range as determined by the ambient temperature.

Vertical axis: Number of points per common simultaneously ON.

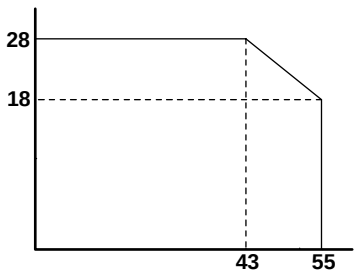
[C14R]



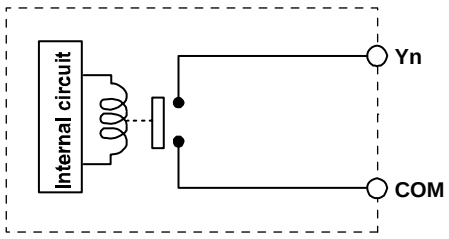
[C30R]



[C60R]



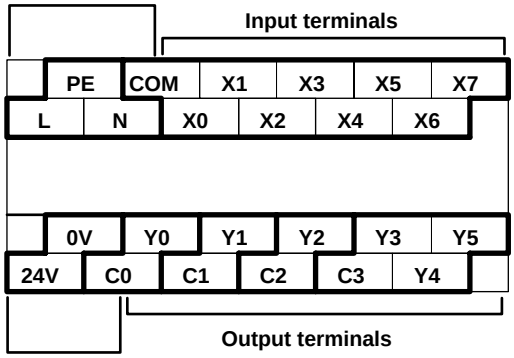
Internal circuit



2.5 Terminal Layout

C14R control unit

Power supply terminals (Input)



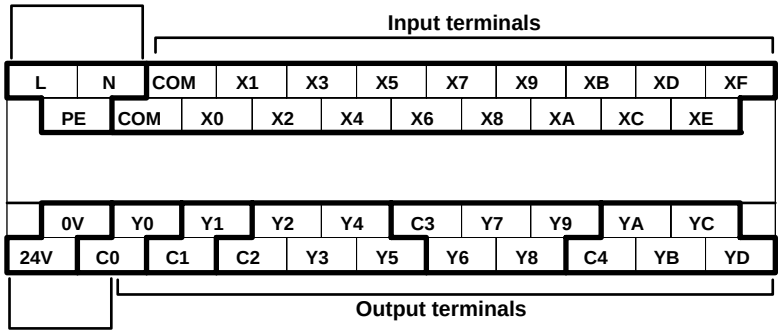
Service power supply terminals for input (output)

● **Relation between output and COM terminals**

Y0	——	C0
Y1	——	C1
Y2	——	C2
Y3, Y4, Y5	——	C3

C30R control unit

Power supply terminals (Input)

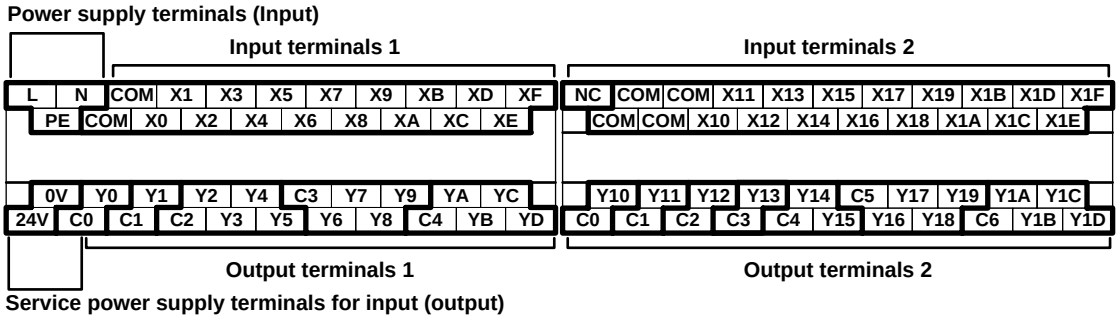


Service power supply terminals for input (output)

● **Relation between output and COM terminals**

Y0	——	C0
Y1	——	C1
Y2 - Y5	——	C2
Y7 - Y9	——	C3
YA - YD	——	C4

C60R control unit



● **Relation between output and COM terminals**

Y0	C0	Y10	C0
Y1	C1	Y11	C1
Y2 to Y5	C2	Y12	C2
Y6 to Y9	C3	Y13	C3
YA to YD	C4	Y14 to Y15	C4
		Y16 to Y19	C5
		Y1A to Y1D	C6

◆ KEYPOINTS

Input terminals:

Each COM terminal in the same terminal block is connected within the unit.
However, the COM terminals of the input terminals 1 and 2 for C60 are isolated. (They are not connected internally.)

Output terminals:

Each COM port (CO, C1 …) is separate. Use them as indicated in the area surrounded by the bold black lines.

Chapter 3

Expansion Units and Add-On Cassettes

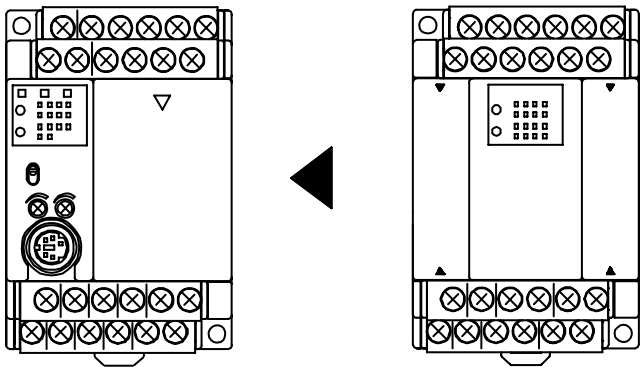
3.1 Expansion Methods

You can expand the FP-X in two ways:

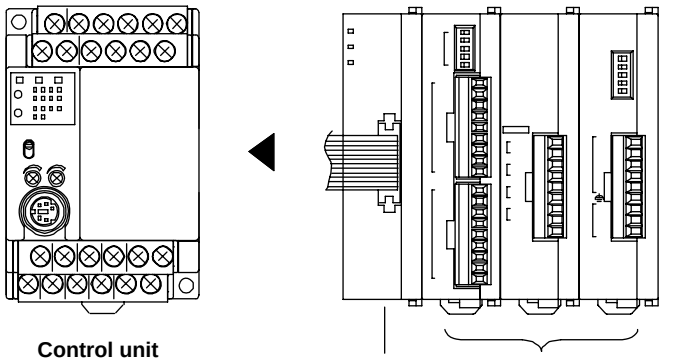
- By adding an expansion unit
- By installing add-on cassettes

Adding an expansion unit, connected by an expansion cable

Add the FP-X expansion unit or FP0 expansion units (expansion FP0 adapter AFPX-EFP0 is necessary) by using the exclusive expansion cable.



Control unit **Expansion unit**



Control unit

Expansion FP0 adapter **Expansion units 1, 2, 3**

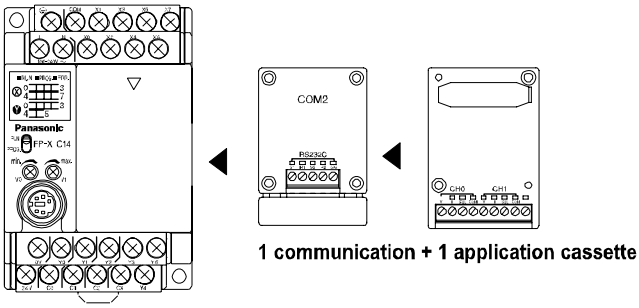
NOTE

You can install the FP-X expansion unit between the control unit and the expansion FP0 adapter. Only one expansion FP0 adapter can be installed, at the last position.

Add-on cassettes

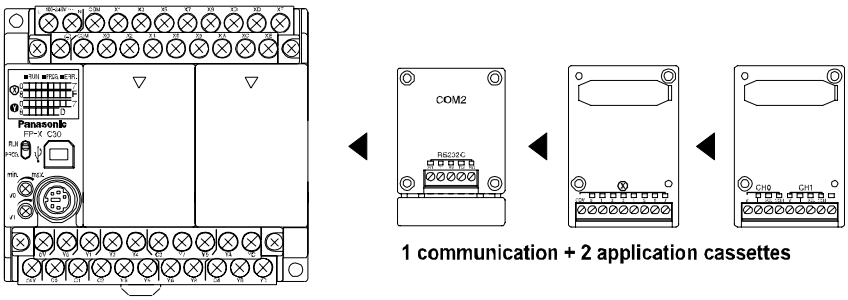
Add-on cassettes can be installed on the FP-X control unit. The number of cassettes that can be installed depends on the type of control unit.

FP-X C14



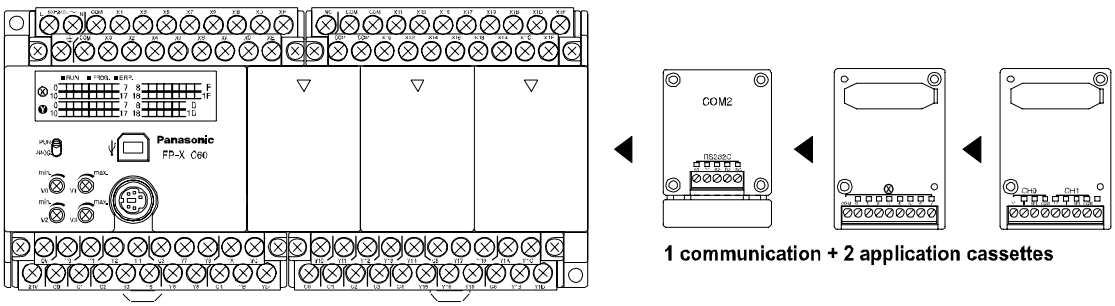
1 communication + 1 application cassette

FP-X C30



1 communication + 2 application cassettes

FP-X C60

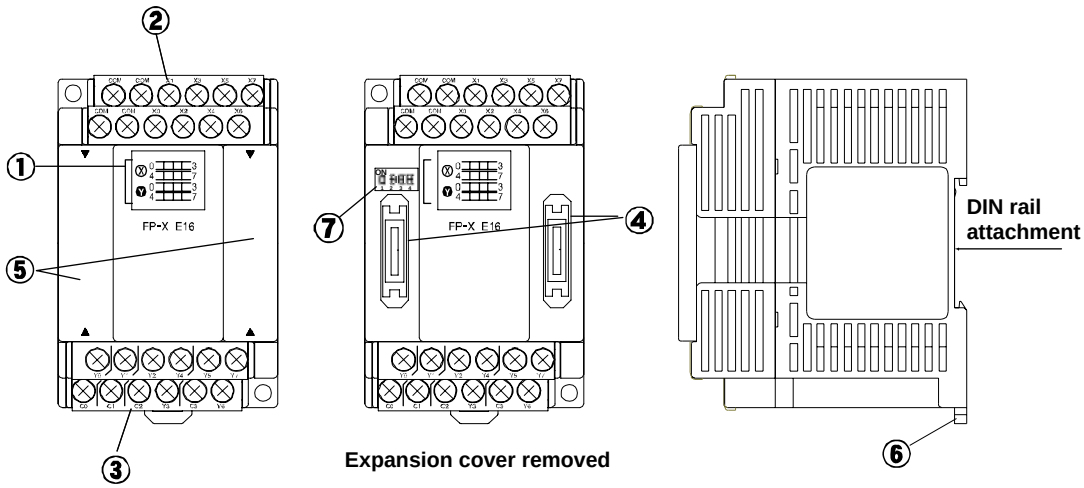


1 communication + 2 application cassettes

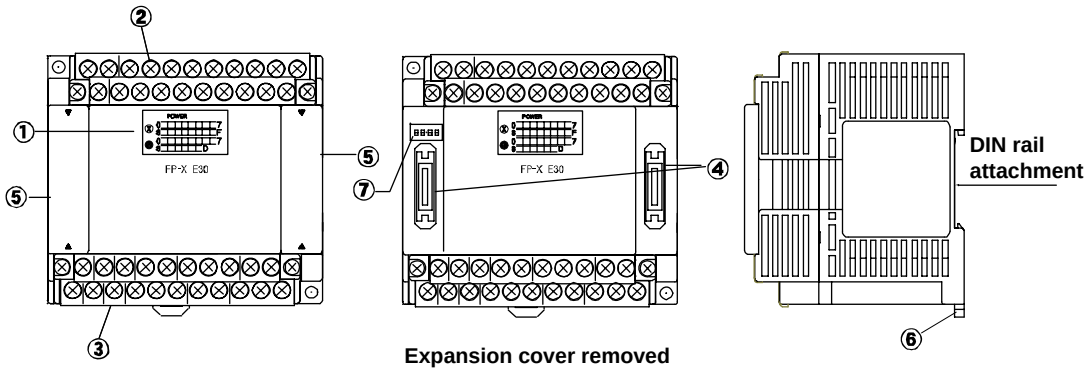
3.2 FP-X Expansion I/O Units

Part names and functions

AFPX-E16R



AFPX-E30R



① Input and Output indicator LEDs

Indicate the on/off status of the inputs and outputs.

② Input terminal block

③ Output terminal block

④ Expansion connector

Connects the expansion unit to the control unit or the expansion FP0 adapter via the exclusive expansion cable.

⑤ Expansion cover

You can reattach it after connecting the expansion cable.

⑥ DIN rail attachment lever

This lever enables the expansion unit to attach to a DIN rail at a touch. The lever is also used for installation on the mounting plate (slim 30 type) (Product No.:AFP0811).

⑦ DIP switches

All switches should be turned on for the expansion I/O unit installed at the last position.

3.2.1 Power Supply Specifications for AFPX-E30R

AC power supply

Item	Specifications, AFPX-E30R
Rated voltage	100 to 240V AC
Voltage regulation range	85 to 264V AC
Consumption current	0.4A or less (at 100V AC)
Surge current	40A or less (at 240V AC, 25°C)
Momentary power off time	10ms (when using 100V AC)
Frequency	50/60Hz (47 to 63Hz)
Leakage current	0.75mA or less between input and protective earth terminals
Internal power supply part, guaranteed life	20,000 hours (at 55°C)
Fuse	Built-in (cannot be replaced)
Insulation system	Transformer insulation
Terminal screw	M3

Service power supply for input (output)

Item	Specifications, AFPX-E30R
Rated output voltage	24V DC
Voltage regulation range	21.6 to 26.4V DC
Rated output current	0.4A
Overcurrent protection function	Available (see note)
Terminal screw	M3

◆ NOTE

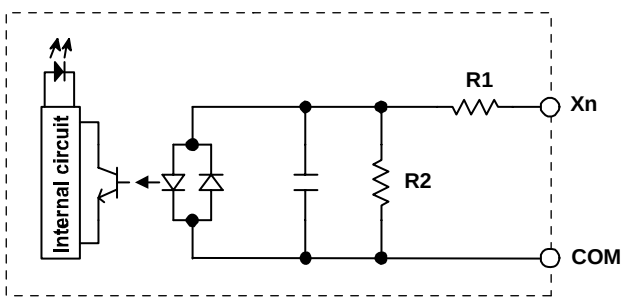
This function is meant to protect against overcurrent temporarily**. A current load that is beyond the specifications may cause damage.**

3.2.2 Input and Output Specifications

Input specifications

Item		Description	
		E16R	E30R
Insulation method		Optical coupler	
Rated input voltage		24V DC	
Operating voltage range		21.6 to 26.4V DC	
Rated input current		Approx. 4.3mA	
Input points per common (Either the positive or negative wire of the input power supply can be connected to the common terminal.)		8 points/common	16 points/common
Min. on voltage/Min. on current		19.2V DC/3mA	
Max. off voltage/Max. off current		2.4V DC/1mA	
Input impedance		Approx. 5.6kΩ	
Response time	off → on	0.6ms or less	
	on → off	0.6ms or less	
Operating mode indicator		LED display	
Applicable type		Conforms to IEC61131-2 TYPE 3 (according to the above specifications)	

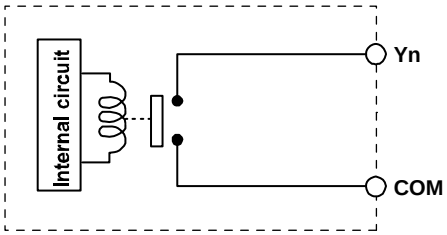
Internal circuit



Relay output specifications

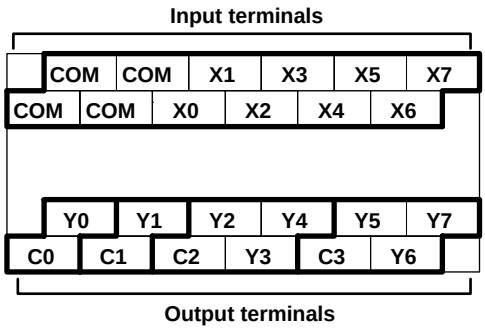
Item		Description	
		E16R	E30R
Insulation method		Relay insulation	
Output type		1a output (Relay cannot be replaced.)	
Rated control capacity (Resistance load)		2A 250 VAC, 2A 30V DC	
		(6A or less/common)	(8A or less/common)
Output points per common		1 point/common, 3 points/common	1 point/common, 4 points/common
Response time	off → on	Approx. 10ms	
	on → off	Approx. 8ms	
Lifetime	Mechanical	≥ 20,000,000 times (frequency of switching: 180 times/min.)	
	Electrical	≥ 100,000 times (frequency of switching at the rated control capacity: 20 times/min.)	
Surge absorber		None	
Operating mode indicator		LED display	

Internal circuit



3.2.3 Terminal Layout

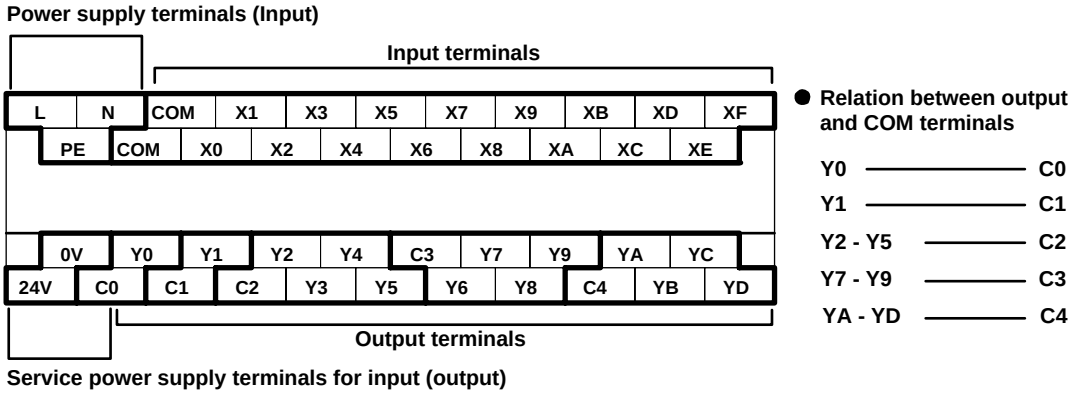
E16R expansion I/O unit



● **Relation between output and COM terminals**

Y0 —— C0
Y1 —— C1
Y2 to Y4 —— C2
Y5 to Y7 —— C3

E30R expansion I/O unit



KEYPOINTS

Input terminal:

Each COM terminal in the same terminal block is connected within the unit.

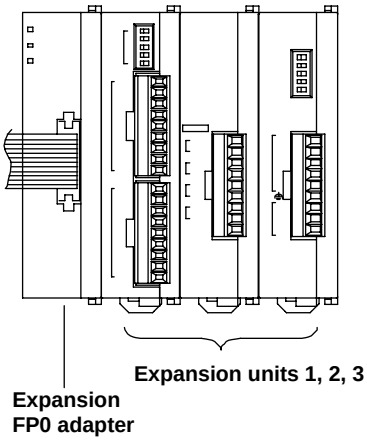
Output terminal:

Each COM port (CO, C1 …) is separate. Use them as indicated in the area surrounded by the bold black lines.

3.3 FP-X Expansion FP0 Adapter

A maximum of 3 FP0 expansion units can be used with the expansion FP0 adapter. All FP0 expansion units can be used.

Be aware of the restrictions regarding installation (see page 7).



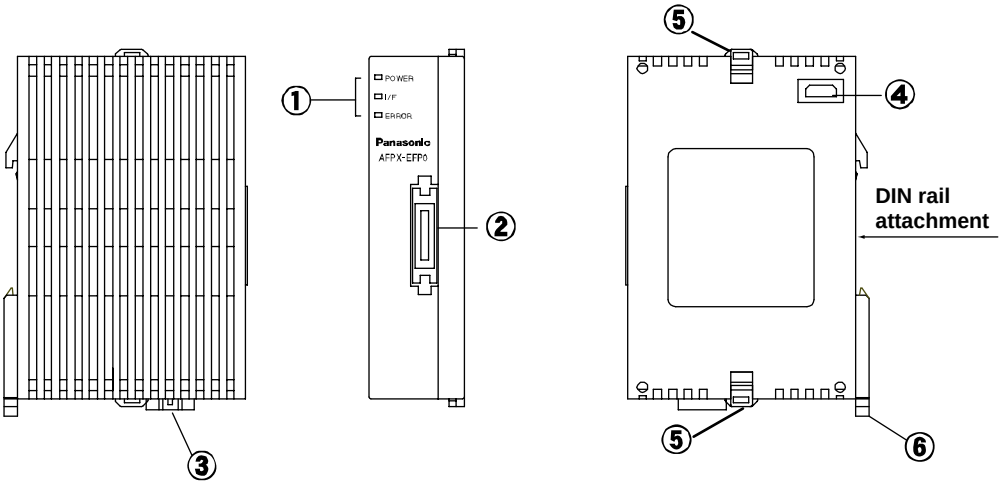
◆ NOTE

The expansion FP0 adapter does not function by itself. Always connect an FP0 expansion unit to it.

◆ REFERENCE

For details on FP0 expansion units, please refer to the FP0 hardware manual or the individual manuals on the expansion units.

Parts and functions of the FP-X expansion FP0 adapter (AFPX-EFP0)



① Status indicator LEDs

LED	Color	Operation status
RUN	Green	Lights when 24V DC is supplied and communication with the control unit starts. If communication cannot be carried out, it goes out.
I/F	Green	Lights when communication with the control unit starts. If communication cannot be carried out, it goes out. Flashes if the FP0 expansion unit is not connected.
ERROR	Red	Flashes when an error occurs with the connection to the FP0 expansion unit.

② FP-X expansion bus connector

Connects the FP-X control or expansion unit. Use the provided expansion cable (AFPX-EC08). Do not specify a TERM (terminal) setting for the expansion FP0 adapter.

③ Power supply connector (24V DC)

Use the power supply cable (AFP0581) provided.

④ FP0 expansion connector

Connects the FP0 expansion unit.

⑤ Expansion hook

This hook is used to secure the FP0 expansion unit.

⑥ DIN rail attachment lever

General specifications

Item	Specifications
Rated voltage	24V DC
Voltage regulation	21.6 to 26.4V DC
Surge current	20A or less (24V DC, at 25°C)
Fuse	Built-in (replacement is not available)
Insulation system	Non-isolated
Power supply connector	3-pin connector (power supply cable AFP0581 is provided)

◆ NOTE

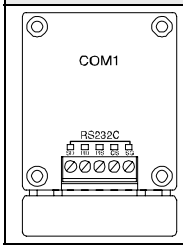
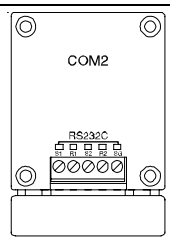
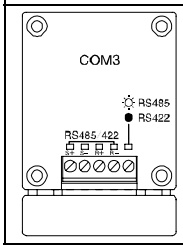
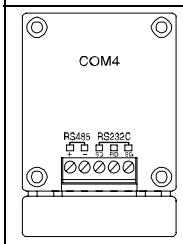
Be sure to consider current consumption when installing your units (see page 206).

3.4 Types of Expansion Cassettes

There are two types of expansion cassettes:

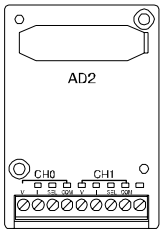
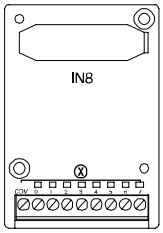
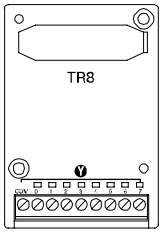
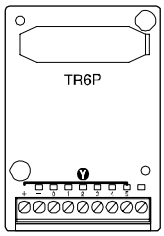
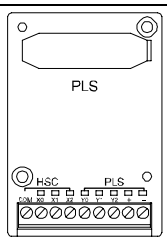
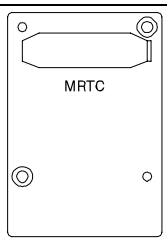
- Communication cassettes (see page 35)
- Application cassettes (see page 40)

Communication cassettes

Unit	Name	Specifications	I/O no.	Product no.
	FP-X communication cassette	5-wire typ 1-channel RS232C	–	AFPX-COM1
	FP-X communication cassette	3-wire type 2-channel RS232C	–	AFPX-COM2
	FP-X communication cassette	1-channel RS485/RS422 (isolated)	–	AFPX-COM3
	FP-X communication cassette	• 1-channel RS485 (isolated) • 3-wire type 1-channel RS232C	–	AFPX-COM4

Application cassettes

The I/O numbers for cassette mounting part one begin at X100/Y100 and for cassette mounting part 2 X200/Y200.

Unit	Name	Specifications	I/O no.	Product no.
	FP-X analog input cassette	2-channel analog input (non-isolated)	From X100 From X200	AFPX-AD2
	FP-X input cassette	8-point DC input	From X100 From X200	AFPX-IN8
	FP-X output cassette	8-point transistor output (NPN)	From Y100 From Y200	AFPX-TR8
	FP-X output cassette	6-point transistor output (PNP)	From Y100 From Y200	AFPX-TR6P
	FP-X pulse I/O cassette	2-channel high-speed counter + 1-channel pulse output	From X100 From Y100 From X200 From Y200	AFPX-PLS
	FP-X master memory cassette	Master memory + realtime clock	–	AFPX-MRTC

3.5 Communication Cassettes

There are several types of communication cassettes.

Type	Product no.
1-channel RS232C type	AFPX-COM1
2-channel RS232C type	AFPX-COM2
1-channel RS485/RS422 type	AFPX-COM3
1-channel RS485 and 1-channel RS232C combination type	AFPX-COM4

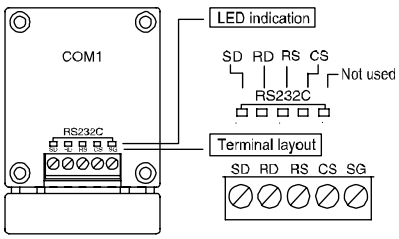
3.5.1 1-Channel RS232C Type

This communication cassette is a 1-channel unit with a non-isolated RS232C port. It supports the following types of communication:

- 1:1 computer link
- General-purpose serial
- PLC (PC) link between two units
- 1:1 Modbus RTU

RS/CS control is possible

LED indication / Terminal layout



Pin	Signal name	Signal direction	Port
SD	Send Data	FP-X → external device	COM 1
RD	Receive Data	FP-X ← external device	
RS	Request to Send	FP-X → external device	
CS	Clear to Send	FP-X ← external device	
SG	Signal Ground	–	–

NOTES

- **RS (Request to Send) can be controlled by the SYS1 instruction.**
- **Data cannot be sent without the pin CS (Clear to Send). When using with a three-wire port, short-circuit the RS and CS pins.**

3.5.2 2-Channel RS232C Type

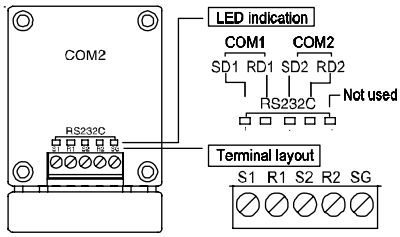
This communication cassette is a 2-channel unit with a non-isolated three-wire RS232C port. It supports the following types of communication:

- 1:1 computer link
- General-purpose serial

- PLC (PC) link between two units (channel 1 only)
- 1:1 Modbus RTU

Communication with two external devices is possible.

LED indication / Terminal layout



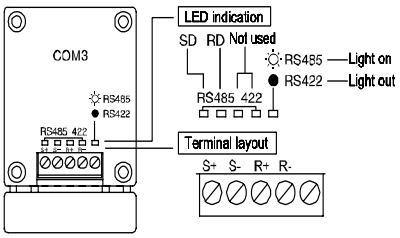
Pin	Signal name	Signal direction	Port
S1	Send Data 1	FP-X → external device	COM 1
R1	Receive Data 1	FP-X ← external device	
S2	Send Data 2	FP-X → external device	COM 2
R2	Receive Data 2	FP-X ← external device	
SG	Signal Ground	–	–

3.5.3 1-Channel RS485/RS422 Type

This communication cassette is a 1-channel unit with an isolated two-wire RS485/four-wire RS422 port. It supports the following types of communication:

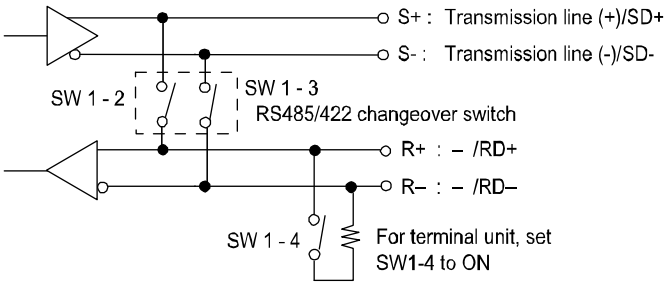
- 1:1 or 1:N computer link
- General-purpose serial
- PLC (PC) link
- Modbus RTU

LED indication / Terminal layout



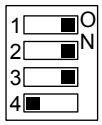
Pin	Name		Signal direction	Port
	RS485	**RS422**		
S+	Transmission line (+)	Send Data (+)	–	COM 1
S-	Transmission line (+)	Send Data (-)	–	
R+	–	Receive Data (+)	–	
R-	–	Receive Data (-)	–	
	–	–	–	

Circuit diagram



Switches

The switches are located on the rear of the cassette.



SW	RS485	RS422
1 2 3	ON	OFF
4	ON for terminal unit	

3.5.4 1-Channel RS485 and 1-Channel RS232C Combination Type

This communication cassette is a 1-channel unit with an isolated two-wire RS485 port and 1-channel unit with an isolated three-wire RS232C port.

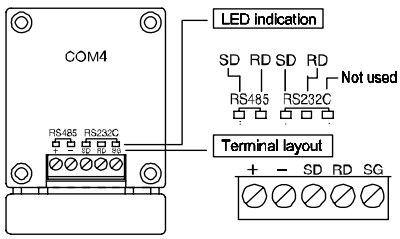
The RS485 port supports the following types of communication:

- 1:N computer link
- General-purpose serial
- PLC (PC) link
- Modbus RTU

The RS232C port supports the following types of communication:

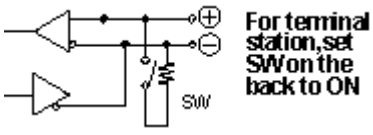
- 1:1 computer link
- General-purpose serial
- Modbus RTU

LED indication / Terminal layout



Pin	Signal name	Signal direction	Port
+	Transmission line (+)	–	RS485 (COM 1)
-	Transmission line (-)	–	
SD	Send Data	FP-X → external device	RS232 (COM 2)
RD	Receive Data	FP-X ← external device	
SG	Signal Ground	–	

Circuit diagram



3.5.5 Connection Examples

AFPX-COM1: 1-channel 5-wire RS232C

COM1

Pin name	Signal name	Abbr.
SD	Send Data	SD
RD	Receive Data	RD
RS	Request to Send	RS
CS	Clear to Send	CS
SG	Signal Ground	SG

Destination device

Abbr.	Signal name
RD	Receive Data
SD	Send Data
CS	Clear to Send
RS	Request to Send
SG	Signal Ground

◆ NOTE

If the external device is a three-wire type, COM 1's RS terminal should be connected to the external device's RS terminal.

AFPX-COM2: 2-channel 3-wire RS232C

COM 2

Pin name	Signal name	Abbr.
S1	Send Data 1	SD
R1	Receive Data 1	RD
S2	Send Data 2	SD
R2	Receive Data 2	RD
SG	Signal Ground	SG

Destination device 1

Abbr.	Signal name
RD	Receive Data
SD	Send Data
SG	Signal Ground

Destination device 2

Abbr.	Signal name
RD	Receive Data
SD	Send Data
SG	Signal Ground

AFPX-COM3: 1-channel RS485/RS422

Using RS485

COM 3

Pin name	Signal name	Abbr.
S+	Transmission line (+)	S+
S-	Transmission line (-)	S-
	Not used	
	Not used	
	Not used	

Destination device

Abbr.	Signal name
+	Transmission line (+)
-	Transmission line (-)

(To other device)

Using RS422

COM 3

Pin name	Signal name	Abbr.
S+	Send Data (+)	SD+
S-	Send Data (-)	SD-
R+	Receive Data (+)	RD+
R-	Receive Data (-)	RD-
	Not used	

Destination device

Abbr.	Signal name
RD+	Receive Data (+)
RD-	Receive Data (-)
SD+	Send Data (+)
SD-	Send Data (-)

◆ NOTE

There are several names for the signal names of RS422. Confirm them using the instruction manuals for each device.

AFPX-COM4: 1-channel RS485 and 1-channel 3-wire RS232C

COM 4

Pin name	Signal name	Abbr.
+	Transmission line (+)	+
-	Transmission line (-)	-
SD	Send Data	SD
RD	Receive Data	RD
SG	Signal Ground	SG

Destination device 1

Abbr.	Signal name
+	Transmission line (+)
-	Transmission line (-)

(To other device)

Destination device 2

Abbr.	Signal name
RD	Receive Data
SD	Send Data
SG	Signal Ground

3.6 Application Cassettes

There are several types of application cassettes.

Type	Product no.
Analog input	AFPX-AD2
Input	AFPX-IN8
Output	AFPX-TR8
Output	AFPX-TR6P
Pulse I/O	AFPX-PLS
Master Memory and Realtime Clock	AFPX-MRTC

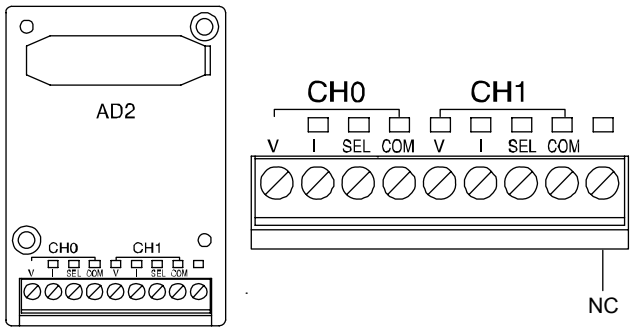
3.6.1 FP-X Analog Input Cassette

Item		Specifications
No. of input points		2 channels/cassette
Input range	Voltage	0 to 10V
	Current	0 to 20mA
Digital conversion value		K0 to K4000 (see note)
Resolution		1/4000 (12 bits)
Conversion speed		1ms/channel (self-scan type)
Total accuracy		±1% F.S. or less (0 to 55°C)
Input impedance	Voltage	40kΩ
	Current	125Ω
Absolute max. rating	Voltage	-0.3 to +15V
	Current	-2 to +30mA
Input protection		Diode
No. of input points		32

◆ NOTE

When the analog input values exceed the upper and lower limits, the digital values will equal the limit values.

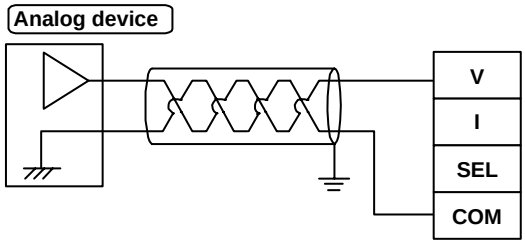
Terminal layout



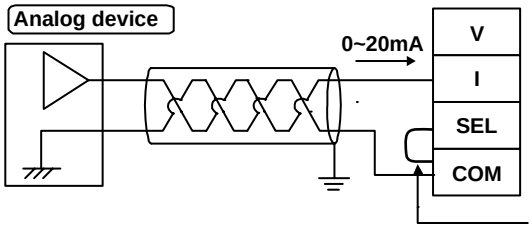
Channel	LED label	Description
CH0	**V***	Voltage input
	I	Current input
	SEL	Voltage/current select
	COM	Common
CH1	**V**	Voltage input
	I	Current input
	SEL	Voltage/current select
	COM	Common
NC		Not used
*No LED indication		

Connection method

With voltage input (0 to 10V)



With current input (0 to 20 mA



Short-circuit the SEL and COM terminals.

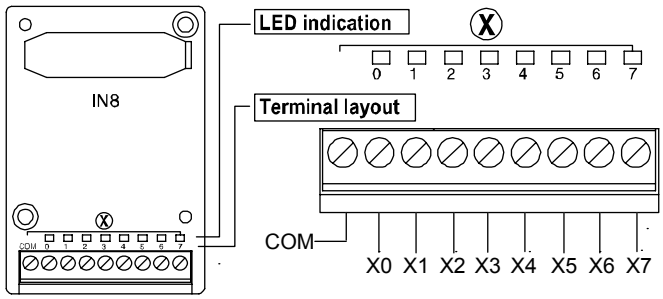
NOTES

- **Use double-core twisted-pair shielded wires. We recommend grounding them. However, depending on the conditions of the external noise, it may be better not to ground the shielding.**
- **Do not have the analog input wiring close to AC wires, power wires, or load.**

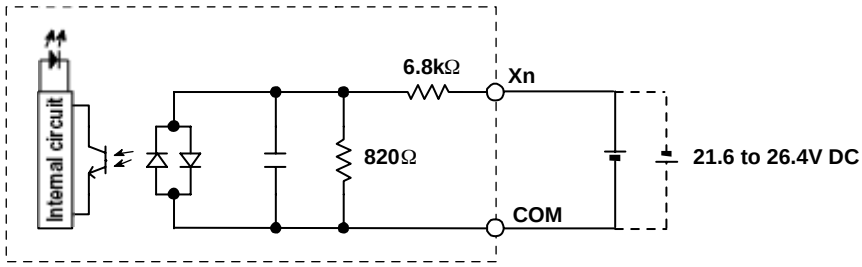
3.6.2 FP-X Input Cassette

Item		Description
Insulation method		Optical coupler
Rated input voltage		24V DC
Operating voltage range		21.6 to 26.4V DC
Rated input current		Approx. 3.5mA
Input points per common		8 points/common (Either the positive or negative of input power supply can be connected to common terminal.)
Min. on voltage/Min. on current		19.2V DC/3mA
Max. off voltage/Max. off current		2.4V DC/1mA
Input impedance		Approx. 6.8kΩ
Response time	off → on	1.0ms or less
	on → off	1.0ms or less
Operating mode indicator		LED display
Applicable type		Conforms to IEC61131-2 TYPE3 (according to the above specifications)

Location/Terminal layout



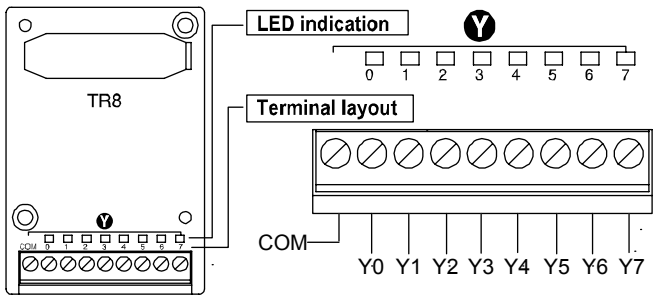
Internal circuit



3.6.3 FP-X Output Cassette (AFPX-TR8)

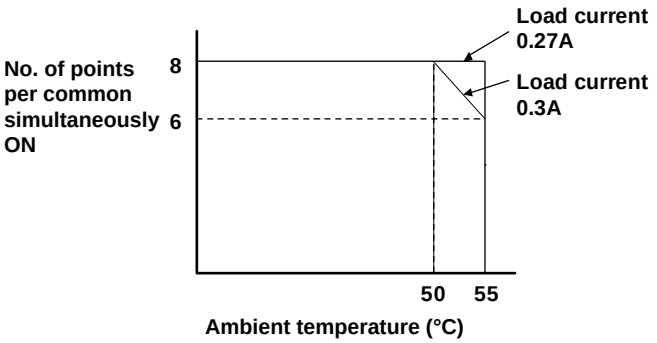
Item		Description
Insulation method		Optical coupler
Output type		Open collector (NPN)
Rated load voltage		24V DC
Operating load voltage range		21.6 to 26.4V DC
Max. load current		0.3A
Max. surge current		1.5A
Output points per common		8 points/common
Off state leakage current		1μA or less
On state voltage drop		1.5V DC or less
Response time	off → on	0.1ms or less
	on → off	0.8ms or less
Surge absorber		Zener diode
Operating mode indicator		LED display

LED indication/Terminal layout

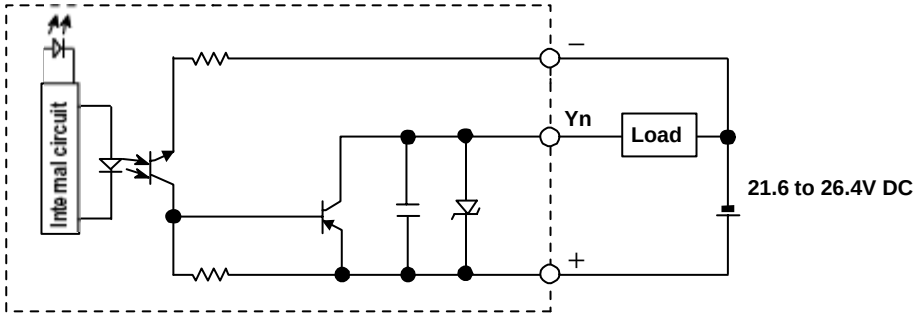


Limitations on the number of points that are on simultaneously

Keep the number of points which are simultaneously on within the following range as determined by the ambient temperature.



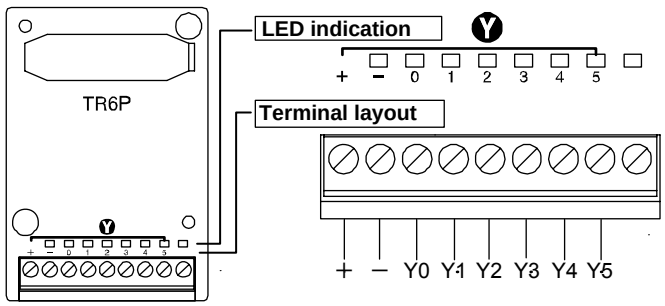
Internal circuit



3.6.4 FP-X Output Cassette (AFPX-TR6P)

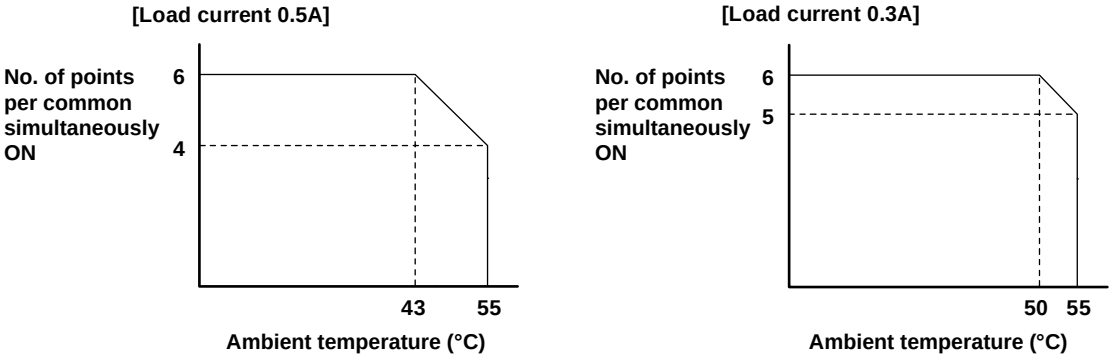
Item		Description
No. of I/O points		6-point transistor output (PNP) I/O allocation, slot 0: from Y100, slot 1: from Y200
Weight		25g
Increase in current consumption by the control unit		100V AC: 10mA or less 200V AC: 5mA or less
Insulation method		Optical coupler
Output type		Open collector (PNP)
Rated load voltage		24V DC
Operating load voltage range		21.6 to 26.4V DC
Max. load current		0.5A
Max. surge current		1.5A
Output points per common		8 points/common
Off state leakage current		1μA or less
On state voltage drop		1.5V DC or less
Response time	off → on	0.1ms or less
	on → off	0.8ms or less
Surge absorber		Zener diode
Operating mode indicator		LED display

LED indication/Terminal layout

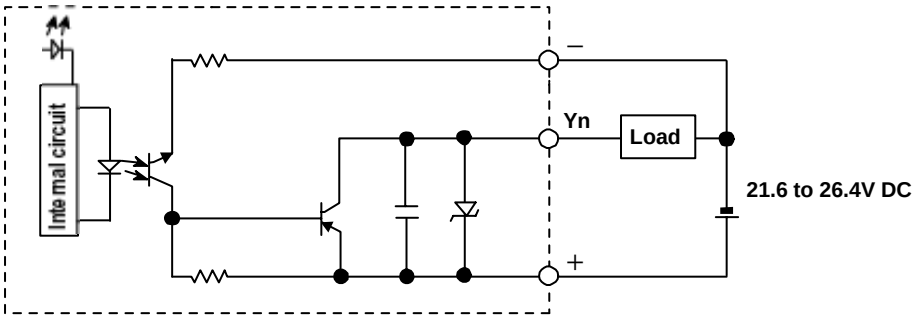


Limitations on the number of points that are on simultaneously

Keep the number of points which are simultaneously on within the following range as determined by the ambient temperature.



Internal circuit



3.6.5 FP-X Pulse I/O Cassette

High-speed counter part

Item		Specifications
No. of input points	For high-speed counter	Single-phase 2 channels, 2-phase 1 channel
	For Pulse catch	3 points
	For interrupt input	3 points
Rated input voltage		24V DC
Operating voltage range		21.6 to 26.4V DC
Rated input current		Approx. 8mA
Input points per common		3 points/common
Min. on voltage/Min. on current		19.2V DC/6mA
Max. off voltage/Max. off current		2.4V DC/1.3mA
Input impedance		Approx. 3kΩ

Item		Specifications
Response time	off → on	5μs or less (see note)
	on → off	5μs or less (see note)
Operating mode indicator		LED display
Applicable type		Conforms to IEC61131-2 TYPE3 (however, according to the above specifications)

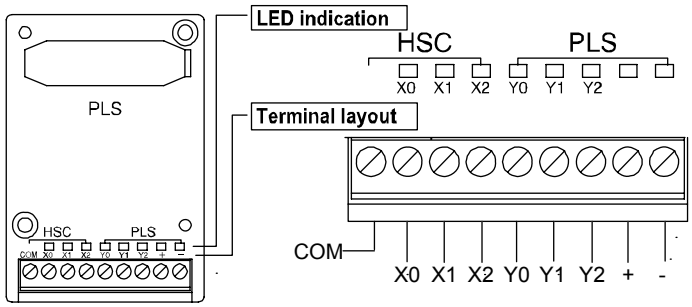
◆ NOTE

This is the specification when the rated input voltage is 24 V DC at 25°C. As the input of the pulse I/O cassette is for the counter input, the response time is quick. Therefore, if it is used as a normal input, we recommend adding a timer using the programming tool to prevent chattering or noise interpreted as input signals.

Pulse output part

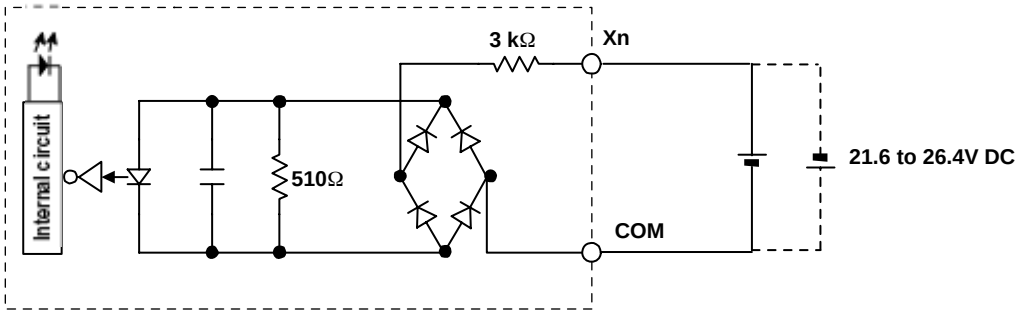
Item			Description
Output type			Open collector (NPN)
Rated load voltage			5 to 24V DC
Operating load voltage range			4.75 to 26.4V DC
Max. load current			0.3A
Max. surge current			1.5A
Output points per common			3 points/common
Off state leakage current			1mA or less
On state voltage drop			0.2V DC or less
Response time	Y0 Y1	off → on	5μs or less (when the load current is 15mA or more)
		on → off	5μs or less (when the load current is 15mA or more)
	Y2	off → on	1ms or less
		on → off	1ms or less
External power supply (+, - terminals)			21.6 to 26.4V DC
Surge absorber			Zener diode
Operating mode indicator			LED display

LED indication/Terminal layout

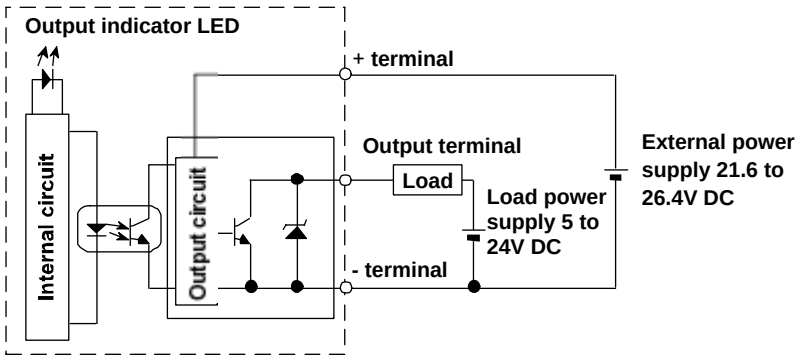


Internal circuit

■ High-speed counter part



■ Pulse output part



3.6.6 FP-X Master Memory Cassette

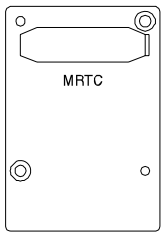
Item		Specifications
Realtime clock	Setting items	Year, month, day hour (24-hour display), minute, second and day of week
	Accuracy	At 0°C: less than 104 seconds per month At 25°C: less than 51 seconds per month At 55°C: less than 155 seconds per month
Master memory function	Memory capacity	Flash ROM (512kB)
	Storable data	System registers
		Programs
		Comment data (328kB)
		F-ROM data area
		Security function

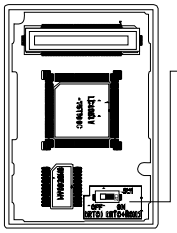
◆ NOTE

Only the realtime clock function is valid at the factory setting. Install a backup battery (see page 83) in the control unit to use the realtime clock function. If the battery is not installed, the realtime clock will not function.

Function changeover switch (between the realtime clock and the realtime clock + master memory)

Use the switch on the back of the cassette to switch between the realtime clock and realtime clock + master memory functions (see page 190).





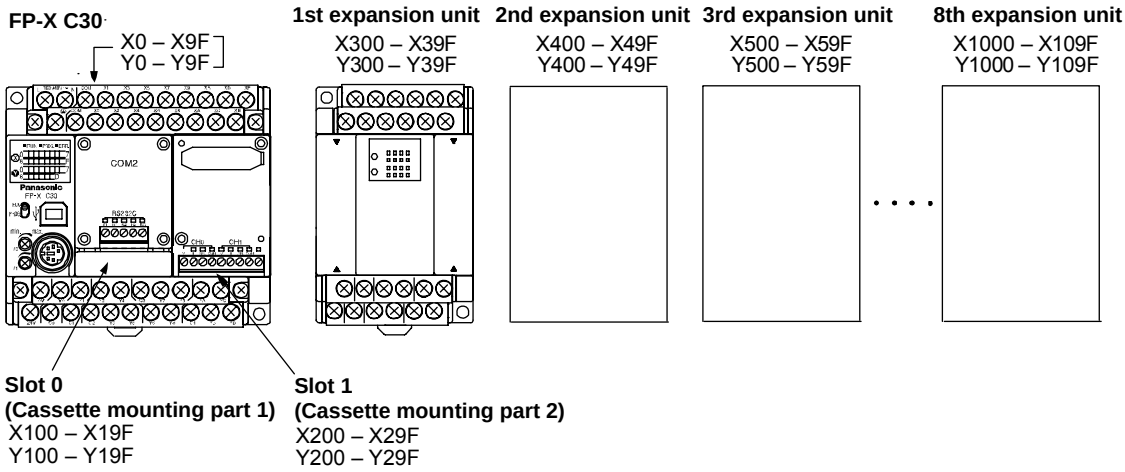
Changeover switch (backside)

OFF	**Realtime clock (RTC) (Factory default setting)**
ON	**Realtime clock & master memory (RTC & ROM)**

Chapter 4

I/O Allocation

4.1 I/O Allocation Overview



Unit	Input	Output
Control unit	X0 to X9F (WX0 to WX9)	Y0 to Y9F (WY0 to WY9)
Cassette mounting part 1 (Slot 0)	X100 to X19F (WX10 to WX19)	Y100 to Y19F (WY10 to WY19)
Cassette mounting part 2 (Slot 1)	X200 to X29F (WX20 to WX29)	Y200 to Y29F (WY20 to WY29)
Expansion 1st unit	X300 to X39F (WX30 to WX39)	Y300 to Y39F (WY30 to WY39)
Expansion 2nd unit	X400 to X49F (WX40 to WX49)	Y400 to Y49F (WY40 to WY49)
Expansion 3rd unit	X500 to X59F (WX50 to WX59)	Y500 to Y59F (WY50 to WY59)
Expansion 4th unit	X600 to X69F (WX60 to WX69)	Y600 to Y69F (WY60 to WY69)
Expansion 5th unit	X700 to X79F (WX70 to WX79)	Y700 to Y79F (WY70 to WY79)
Expansion 6th unit	X800 to X89F (WX80 to WX89)	Y800 to Y89F (WY80 to WY89)
Expansion 7th unit	X900 to X99F (WX90 to WX99)	Y900 to Y99F (WY90 to WY99)
Expansion 8th unit	X1000 to X109F (WX100 to WX109)	Y1000 to Y109F (WY100 to WY109)

◆ NOTE

The ranges of the I/O numbers which are actually used differ depending on the cassettes and units.

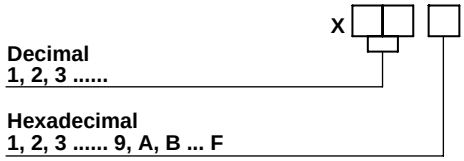
4.1.1 I/O Numbering

Specifying X (input) and Y (output) numbers

On the FP-X and the FP0, the same numbers are used for inputs and outputs, e.g. X**20**, Y**20**.

Expression of numbers for input/output relays

The input relay “X” and output relay “Y” are expressed as a combination of decimal and hexadecimal numbers as shown below.



Slot no.

The slot number indicates the installion position of the cassette, which is used to generate programs by the add-on cassette.

4.2 FP-X Control and Expansion Unit I/O Allocation

FP-X control unit

The I/O allocation of FP-X control unit is fixed.

I/O numbers

Type of control unit		Number of allocation	I/O number
FP-X C14 control unit	AFPX-C14R	Input (8 points)	X0 to X7
		Output (6 points)	Y0 to Y5
FP-X C30 control unit	AFPX-C30R	Input (16 points)	X0 to XF
		Output (14 points)	Y0 to YD
FP-X C60 control unit	AFPX-C60R	Input (32 points)	X0 to XF X10 to X1F
		Output (28 points)	Y0 to YD Y10 to Y1D

FP-X expansion unit

The FP-X expansion units are installed on the right side of the FP-X control unit.

I/O numbers (when installed as the first expansion unit)

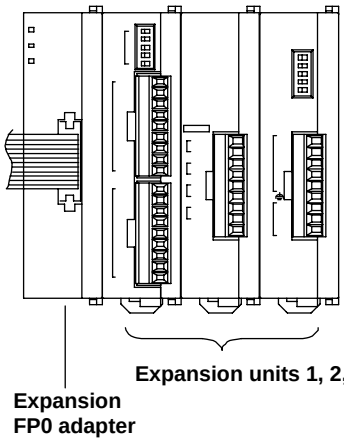
Type of expansion unit		Number of allocation	I/O number
FP-X E16 expansion I/O unit	AFPX-E16R	Input (8 points)	X300 to X307
		Output (8 points)	Y300 to Y307
FP-X E30 expansion I/O unit	AFPX-E30R	Input (16 points)	X300 to X30F
		Output (14 points)	Y300 to Y30D

◆ NOTE

Since the AFPX-E16R expansion unit gets its power from a unit with a power supply, i.e. the control or AFPX-E30R unit, you cannot connect more than one in a row.

4.3 FP0 Expansion Unit I/O Allocation

The FP0 expansion units are installed on the right of the FP0 expansion adapter. The I/O numbers are allocated from the unit nearest to the control unit in ascending order.



4.3.1 Number of Expansion Units and I/O Allocation

Only one expansion FP0 adapter can be connected at the last position of the FP-X expansion bus. The I/O allocation varies depending on the installation location of the expansion FP0 adapter.

Expansion location	Expansion unit 1	Expansion unit 2	Expansion unit 3
Expansion 1st unit	X300 to X31F	X320 to X33F	X340 to X35F
	Y300 to Y31F	Y320 to Y33F	Y340 to Y35F
Expansion 2nd unit	X400 to X41F	X420 to X43F	X440 to X45F
	Y400 to Y41F	Y420 to Y43F	Y440 to Y45F
Expansion 3rd unit	X500 to X51F	X520 to X53F	X540 to X55F
	Y500 to Y51F	Y520 to Y53F	Y540 to Y55F
Expansion 4th unit	X600 to X61F	X620 to X63F	X640 to X65F
	Y600 to Y61F	Y620 to Y63F	X640 to X65F
Expansion 5th unit	X700 to X71F	X720 to X73F	X740 to X75F
	Y700 to Y71F	Y720 to Y73F	Y740 to Y75F
Expansion 6th unit	X800 to X81F	X820 to X83F	X840 to X85F
	Y800 to Y81F	Y820 to Y83F	Y840 to Y85F
Expansion 7th unit	X900 to X91F	X920 to X93F	X940 to X95F
	Y900 to Y91F	Y920 to Y93F	Y940 to Y95F
Expansion 8th unit	X1000 to X101F	X1020 to X103F	X1040 to X105F
	Y1000 to Y101F	Y1020 to Y103F	Y1040 to Y105F

◆ NOTE

The ranges of the I/O numbers which are actually used differ depending on the units.

4.3.2 I/O Allocation of FP0 Expansion Units

I/O allocation is performed automatically when an expansion unit is added and is determined by the installation location.

I/O numbers when installed as the first expansion unit

Add 100, 200, etc. to the number depending on the expansion location (see page 53).

Type of unit		Number of allocation	Expansion unit 1	Expansion unit 2	Expansion unit 3
FP0 expansion unit	FP0-E8X	Input (8 points)	X300 to X307	X320 to X327	X340 to X347
	FP0-E8R	Input (4 points)	X300 to X303	X320 to X323	X340 to X343
		Output (4 points)	Y300 to Y303	Y320 to Y323	Y340 to Y343
	FP0-E8YT/P FP0-E8YR	Output (8 points)	Y300 to Y307	Y320 to Y327	Y340 to Y347
	FP0-E16X	Input (16 points)	X300 to X30F	X320 to X32F	X340 to X34F
	FP0-E16R FP0-E16T/P	Input (8 points)	X300 to X307	X320 to X327	X340 to X347
		Output (8 points)	Y300 to Y307	Y320 to Y327	Y340 to Y347
	FP0-E16YT/P	Output (16 points)	Y300 to Y30F	Y320 to Y32F	Y340 to Y34F
	FP0-E32T/P	Input (16 points)	X300 to X30F	X320 to X32F	X340 to X34F
		Output (16 points)	Y300 to Y30F	Y320 to Y32F	Y340 to Y34F
FP0 analog I/O unit	FP0-A21	Input (16 points) CH0	WX30 (X300 to X30F)	WX32 (X320 to X32F)	WX34 (X340 to X34F)
		Input (16 points) CH1	WX31 (X310 to X31F)	WX33 (X330 to X33F)	WX35 (X350 to X35F)
		Output (16 points)	WY30 (Y300 to Y30F)	WY32 (Y320 to Y32F)	WY34 (Y340 to Y34F)
FP0 A/D conversion unit FP0 thermo-couple unit	FP0-A80 FP0-TC4 FP0-TC8	Input (16 points) CH0, 2, 4, 6	WX30 (X300 to X30F)	WX32 (X320 to X32F)	WX34 (X340 to X34F)
		Input (16 points) CH1, 3, 5, 7	WX31 (X310 to X31F)	WX33 (X330 to X33F)	WX35 (X350 to X35F)
FP0 D/A conversion unit	FP0-A04V FP0-A04I	Input (16 points)	WX30 (X300 to X30F)	WX32 (X320 to X32F)	WX34 (X340 to X34F)
		Output (16 points) CH0, 2	WY30 (Y300 to Y30F)	WY32 (Y320 to Y32F)	WY34 (Y340 to Y34F)
		Output (16 points) CH1, 3	WY31 (Y310 to Y31F)	WY33 (Y330 to Y33F)	WY35 (Y350 to Y35F)
FP0 I/O link unit	FP0-IOL	Input 32 points	X300 to X31F	X320 to X33F	X340 to X35F
		Output 32 points	Y300 to Y31F	Y320 to Y33F	Y340 to Y35F

◆ NOTES

- **The data for each channel of the FP0 A/D conversion unit (FP0-A80), FP0 thermocouple unit (FP0-TC4/FP0-TC8) and FP0 D/A conversion unit (FP0-A04V/FP0-A04I) is converted and loaded with a user program that includes a switching flag to save the data in 16-bit words.**

- **Regarding I/O allocation for the FP0 CC-Link slave unit, please refer to the manual for that unit.**

4.4 FP-X Add-On Cassette I/O Allocation

There are no I/O numbers for communication cassettes or the master memory cassette.

Application cassette	Product no.	I/O no.	
		Mounting part 1, slot 0	Mounting part 2, slot 1
FP-X analog input cassette (see note)	AFPX-AD2	CH0 WX10 CH1 WX11	CH0 WX20 CH1 WX21
FP-X input cassette	AFPX-IN8	From X100	From X200
FP-X output cassette	AFPX-TR8	From Y100	From Y200
FP-X output cassette	AFPX-TR6P	From Y100	From Y200
FP-X pulse I/O cassette	AFPX-PLS	From X100 From Y100	From X200 From Y200
FP-X master memory cassette	AFPX-MRTC	–	–

◆ NOTE

Digital conversion values are K0 to 4000. As the resolution is 12 bits, the upper 4 bits are always 0.

Chapter 5

Installation and Wiring

5.1 Installation

Please follow the installation instructions carefully to prevent failure or malfunctions.

5.1.1 Installation Environment and Space

Avoid installing the unit in the following locations:

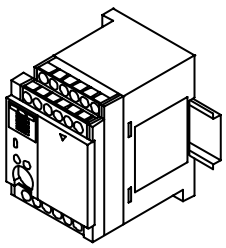
- Ambient temperatures outside the range of 0 °C to 55 °C/32 °F to 131 °F
- Ambient humidity outside the range of 30% to 85% RH
- Sudden temperature changes causing condensation
- Inflammable or corrosive gases
- Excessive airborne dust, metal particles or salts
- Benzine, paint thinner, alcohol or other organic solvents or strong alkaline solutions such as ammonia or caustic soda
- Excessive vibration or shock
- Direct sunlight
- Water or oil in any form including spray or mist

Avoid noise interference from the following sources:

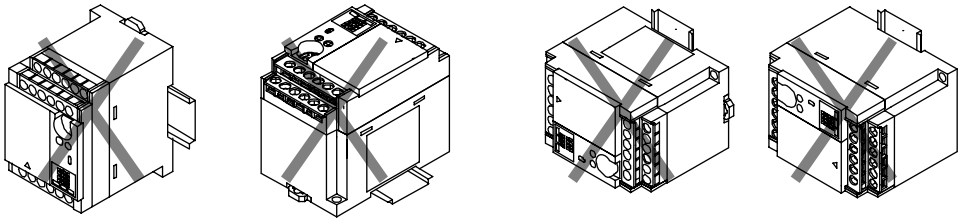
- Influence from power transmission lines, high voltage equipment, power cables, power equipment, radio transmitters, or any other equipment that would generate high switching surges.
- If noise occurs in the power supply line even after the above countermeasures are taken, it is recommended to supply power through an insulation transformer, noise filter, or the like.

Measures regarding heat discharge

Always install the unit orientated with the tool port facing outward on the bottom in order to prevent the generation of heat.



Do **NOT** install the FP-X control unit as shown below.

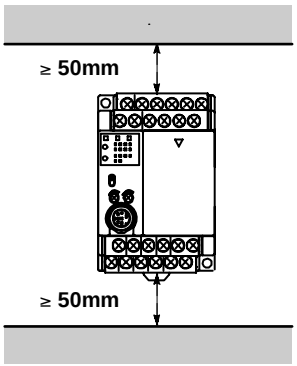


Upside-down **CPU horizontal** **DIN rail vertical**

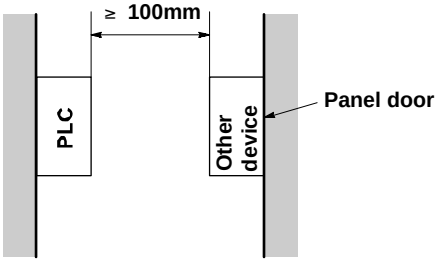
Do not install the unit above devices which generate heat such as heaters, transformers or large scale resistors.

Installation space

Leave at least 50 mm/1.97 in. of space between the wiring ducts of the unit and other devices to allow heat radiation and unit replacement.



Maintain a minimum of 100 mm/3.937 in. between devices to avoid adverse affects from noise and heat when installing a device or panel door to the front of the PLC unit.



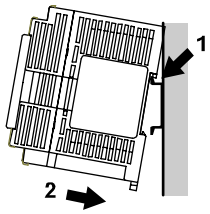
Keep the first 100 mm/3.937 in. from the front surface of the control unit open in order to allow room for programming tool connections and wiring.

5.1.2 Installation and Removal

Attachment to and removal from DIN rails

The FP-X can easily be attached to DIN rails.

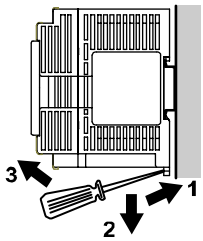
PROCEDURE



1. **Fit upper hook of unit onto DIN rail**
2. **Without moving upper hook, press on the lower hook to fit unit into position**

Removal is simple, too:

PROCEDURE



1. **Insert slotted screwdriver into DIN rail attachment lever**
2. **Pull attachment lever downwards**
3. **Lift up unit and remove from rail**

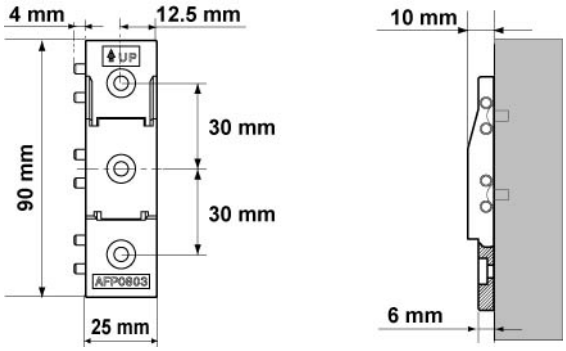
Installation and removal of the expansion FP0 adapter/FP0 expansion units

This procedure is the same as for the FP-X described previously.

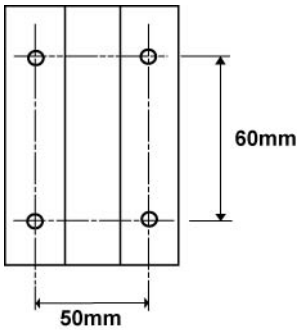
Installation using the optional slim type mounting plate (AFP0803, for mounting the FP0)

Use M4 size pan-head screws for attaching the mounting plate to the mounting panel. The diagrams below show the dimensions of the mounting plates.

Installation and removal of the unit is similar to the procedure using DIN rails described previously.



When combining several mounting plates, tighten the screws after joining all of the mounting plates to be connected. Tighten all corner screws.



5.2 Installation Using the Expansion Cable

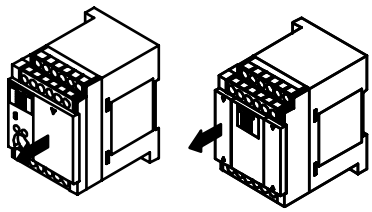
The FP-X expansion unit and the FP-X expansion FP0 adapter are connected to the control unit or each other using the exclusive expansion cable.

The expansion cable (AFPX-EC08) is packaged with the expansion unit and expansion FP0 adapter. It can also be purchased separately.

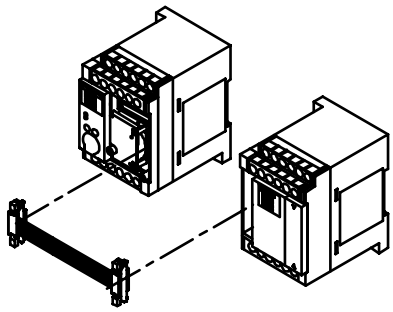
5.2.1 Connecting the FP-X Expansion Unit

PROCEDURE

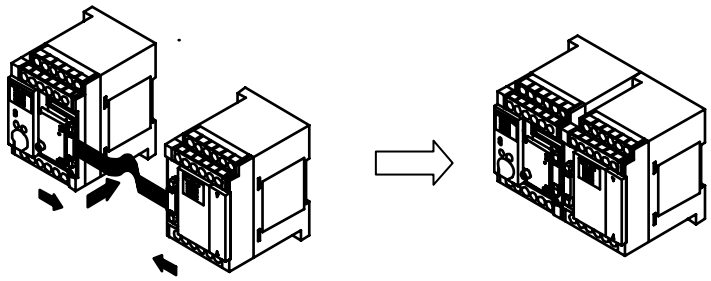
1. **Remove the expansion cover.**



2. **Attach the expansion connector cable to the control unit's expansion connector part and the expansion I/O unit's left expansion connector part.**

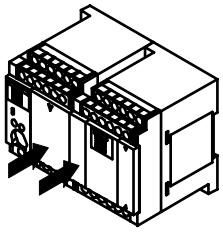


3. **Push the expansion connector cable in between the units.**



4. **For the expansion unit installed in the last position, turn on all DIP switches (see page 26).**

5. Reattach the expansion cover.

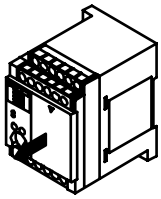


5.2.2 Connecting the Expansion FP0 Adapter

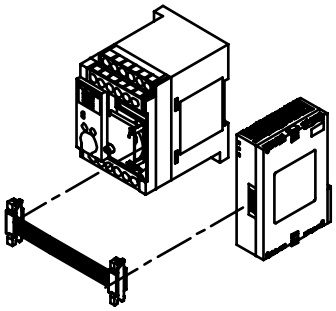
◆PROCEDURE

1. Remove the expansion cover.

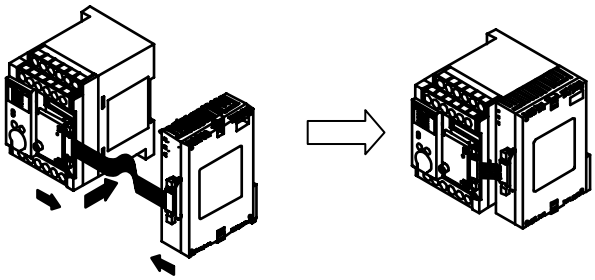
There is no expansion cover for the expansion FP0 adapter.



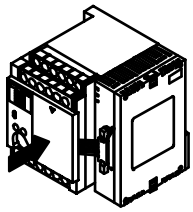
2. Attach the expansion connector cable to the units' expansion connector parts.



3. Push the expansion connector cable in between the units.



4. Reattach the expansion cover.

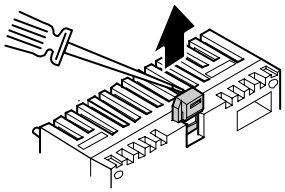


5.3 Adding FP0 Expansion Units to the Adapter

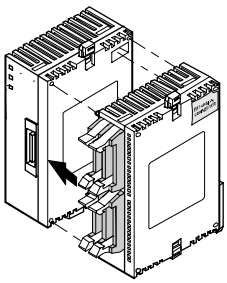
You can add up to 3 FP0 expansion units to the right of the expansion FP0 adapter.

◆PROCEDURE

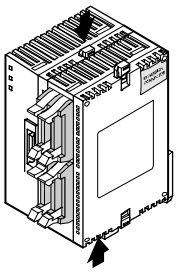
1. **Raise the expansion hooks on the top and bottom of the unit with a screwdriver.**



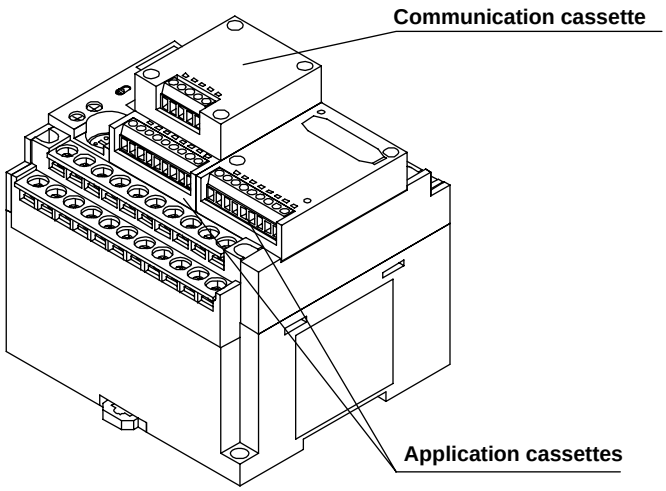
2. **Align the pins and holes in the four corners of the control unit and expansion unit, and insert the pins into the holes so that there is no gap between the units.**



3. **Press down the expansion hooks to secure the unit.**



5.4 How to Install Add-On Cassettes



FP-X C30 with 2 application cassettes and 1 communication cassette installed

◆ NOTES

1. **Do not touch the back side of the add-on cassette or connector as the parts, e.g. the IC, etc., may be damaged by static electricity.**
2. **The add-on cassettes must be secured to the control unit using the screws provided.**
3. **Install the backup battery (optional) before installing add-on cassettes.**
4. **The installation must be carried out when the power supply is off. If the power supply is on, it may cause faults.**

Recommended screw

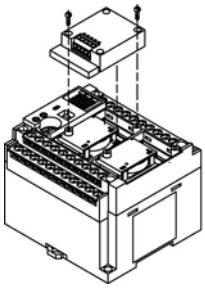
Recommended screw	Size and other conditions	Quantity
Tapping screw	Material: SW pan head (+) P-tight 2.6-16 galvanization, trivalent chromate (black)	2 pcs/1 cassette

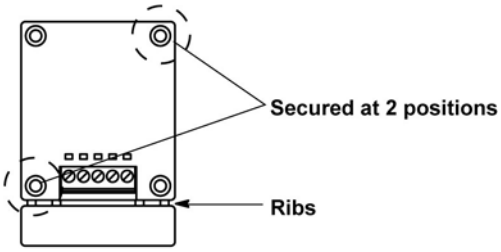
5.4.1 Installing the Communication Cassette

◆ NOTE

The communication cassette can only be installed in cassette mounting part 1 of the control unit.

Installation on the control unit



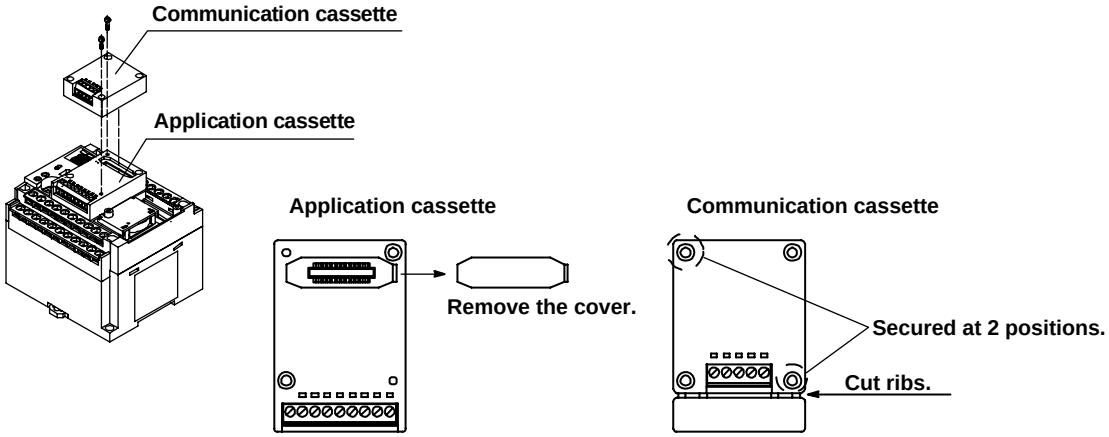


PROCEDURE

1. **Gently insert the connector.**
2. **Securely fasten the cassette to the control unit with the screws provided.**

   The screw's tightening torque should be 0.3 to 0.5 N•m. It is no problem if the ribs remain.

Installation on the application cassette



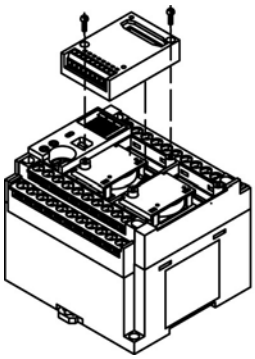
PROCEDURE

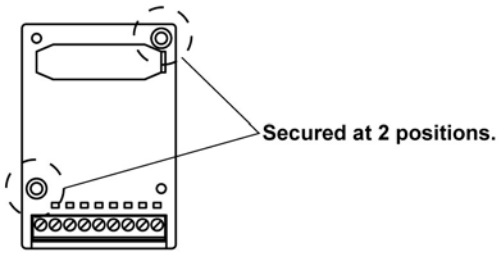
1. **Remove the expansion cover of the application cassette.**
2. **Cut the ribs on the communication cassette.**
3. **Gently insert the connector.**
4. **Securely fasten the communication cassette to the application cassette with the screws provided.**

   The screw's tightening torque should be 0.3 to 0.5 N•m.

5.4.2 Installing the Application Cassette

The application cassette can be installed in cassette mounting part 1 and 2 of the control unit.





PROCEDURE

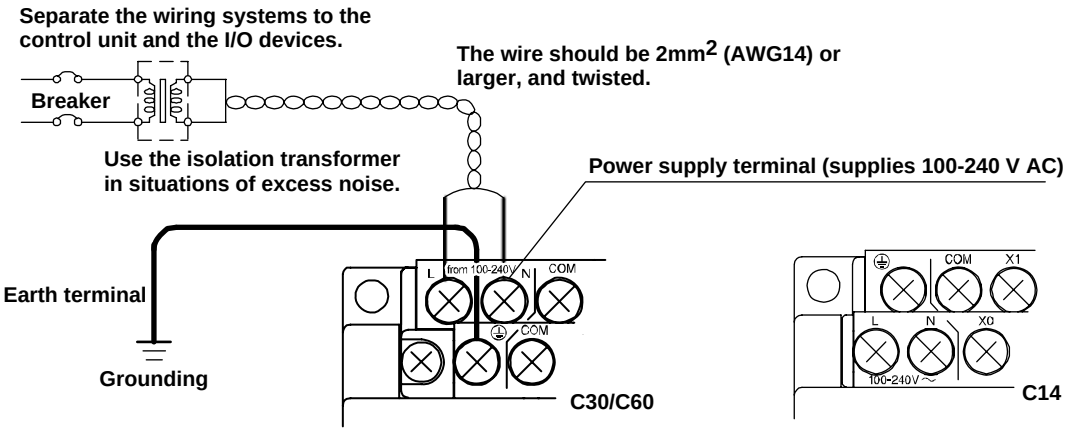
1. **Gently insert the application cassette, making sure the connector is secure.**
2. **Securely fasten the cassette to the control unit with the screws provided.**

   The screw's tightening torque should be 0.3 to 0.5 N•m.

5.5 Power Supply

5.5.1 Power Supply for the Control Unit

Wiring of power supply



Confirm that the power supply voltage is within the allowable range.

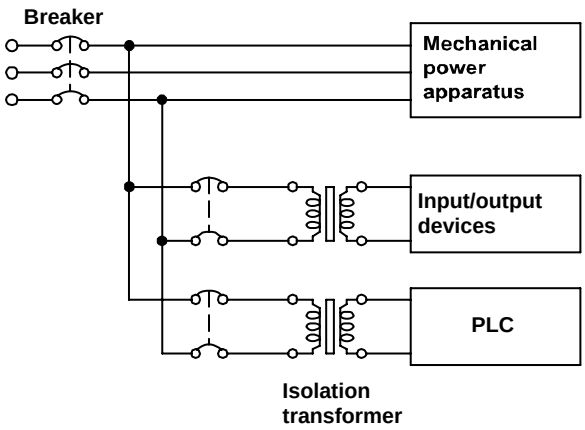
Rated input voltage	Operating voltage range	Rated frequnecy	Allowable frequency range
100 to 240V AC	85 to 264V AC	50/60Hz	47 to 63Hz

◆ NOTE

Using the power supply of the outlying voltage and frequency, or using inappropriate wires may cause the fault of the power supply of the PLC.

Isolation of power supply systems

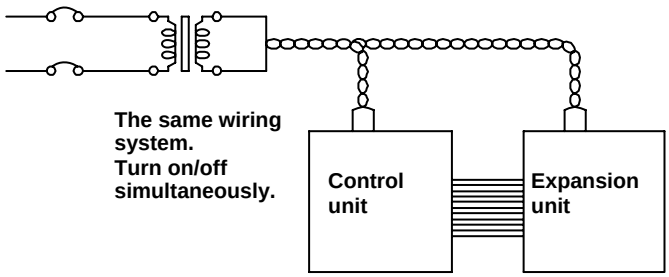
Isolate the wiring systems to the FP-X, output devices and mechanical power apparatus.



Power supply of the FP-X expansion units

◆ NOTE

Be sure to supply power to the FP-X expansion units and the control unit from the same power supply, and turn the power on and off simultaneously for both.

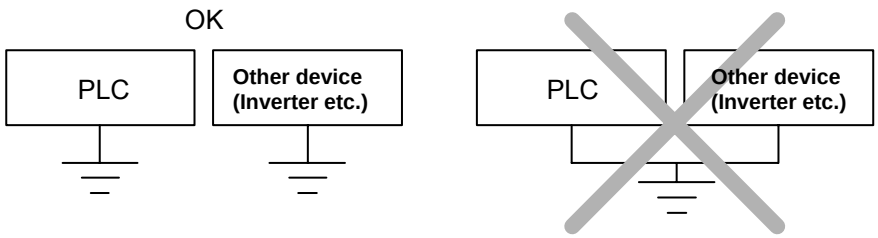


Grounding

If necessary, ground the instrument to reduce noise.

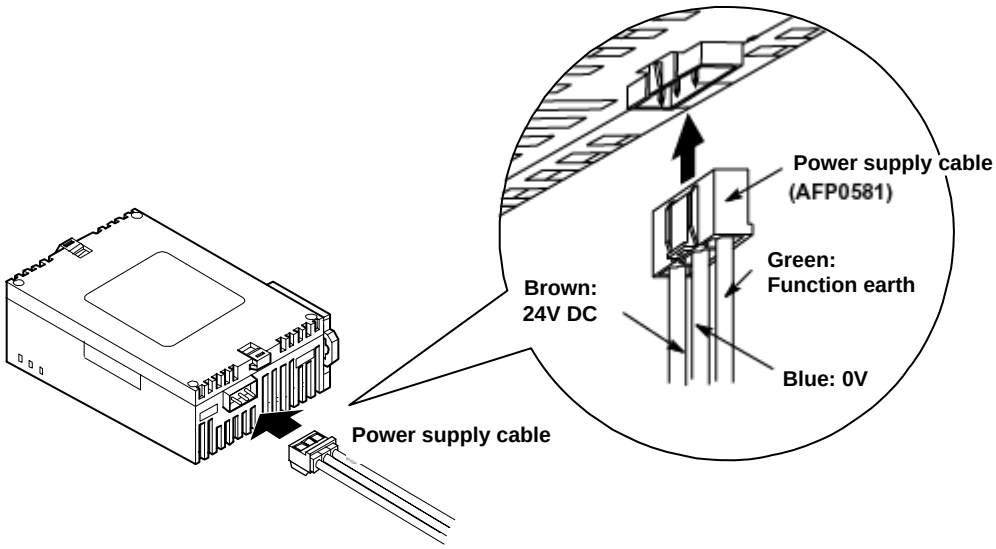
Exclusive grounding

- For gounding purposes, use wiring with a minimum of 2mm^2. The grounding connection should have a resistance of less than 100Ω.
- The point of grounding should be as close to the PLC unit as possible. The ground wire should be as short as possible.
- If two devices share a single ground point, it may produce an adverse effect. Always use an exclusive ground for each device.



5.5.2 Power Supply for the Expansion FP0 Adapter

Use the power supply cable provided (part no. AFP0581). Attach as shown.



Power supply wire

To minimize adverse effects from noise, twist the brown and blue wires of the power supply cable.

Power supply from the servicing power supply for the input of the FP-X control unit

- To protect the system against erroneous voltage from the power supply line, use an insulated power supply with an internal protective circuit.
- The regulator on the unit is a non-insulated type.
- To turn on the power supplies simultaneously, supply the power for the expansion FP0 adapter from the servicing power supply for the input of the FP-X control unit.

Power supply start-up sequence

- To ensure and ease the power supply sequence of the expansion FP0 adapter, supply the power for the expansion FP0 adapter from the servicing power supply for the input of the FP-X control unit.
- The power supply sequence should be set up so that power to the FP0 expansion unit is turned on before the FP-X system power supply.
- The power supply sequence should be set up so that power to the FP-X system and FP0 expansion unit is turned off before the input/output power supplies. If the input/output power supplies are turned off before the power to the expansion FP0 adapter, the control unit will detect the input fluctuations and may begin an unscheduled operation.

When turning on:

Power supply for FP0 → Power supply for FP-X, Expansion FP0 adapter → Power supplies for I/O devices.

When turning off:

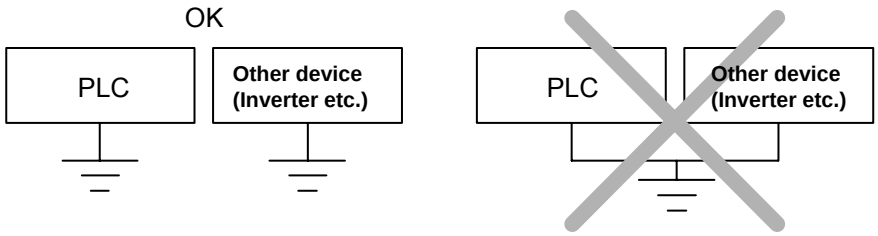
Power supply for FP-X, Expansion FP0 adapter → Power supply for FP0 → Power supplies for I/O devices

Grounding

If necessary, ground the instrument to reduce noise.

Exclusive grounding

- For gounding purposes, use wiring with a minimum of 2mm^2. The grounding connection should have a resistance of less than 100Ω.
- The point of grounding should be as close to the PLC unit as possible. The ground wire should be as short as possible.
- If two devices share a single ground point, it may produce an adverse effect. Always use an exclusive ground for each device.

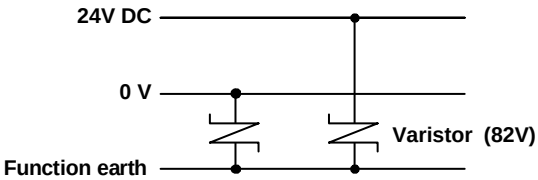


◆ NOTE

Depending on the surroundings in which the equipment is used, grounding may cause problems.

◆ EXAMPLE

Since the power supply line of the expansion FP0 adapter power supply connector is connected to the function earth through a varistor, if there is an irregular potential between the power supply line and earth, the varistor may be shorted.



Expansion FP0 adapter power supply line

5.6 Input and Output Wiring

Precautions Regarding Input and Output Wirings

Incorrect wiring or wiring that does not conform to the specifications may lead to a fault or malfunction.

◆ NOTES

- **Do not apply a voltage to the input terminal that exceeds the rated input voltage.**
- **Isolate input/output/power lines**
  - **Be sure to select the thickness (dia.) of the input and output wires while taking into consideration the required current capacity.**
  - **Arrange the wiring so that the input and output wiring are separated and so that these wirings are separated from the power wiring as much as possible. Do not route them through the same duct or wrap them up together.**
  - **Separate the input/output wires from the power and high voltage wires by at least 100mm.**
- **Wiring should be carried out after the power supply to the PLC has been turned off.**
- **Also turn off the power supply when the control unit, expansion units and various cassettes are connected. If they are connected while the power supply is on, it may cause a fault or malfunction.**

5.6.1 Input Wiring

For connecting input devices see the diagrams and recommendations given below.

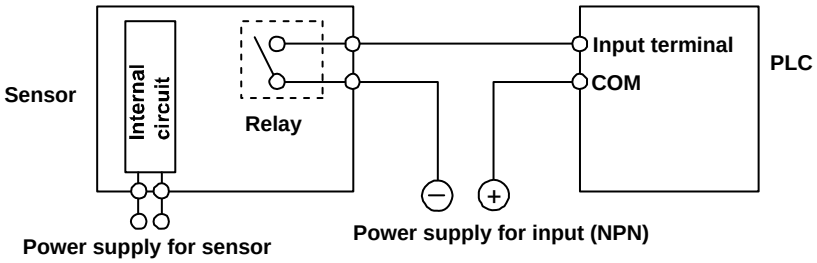
Power supply for the input

◆ NOTE

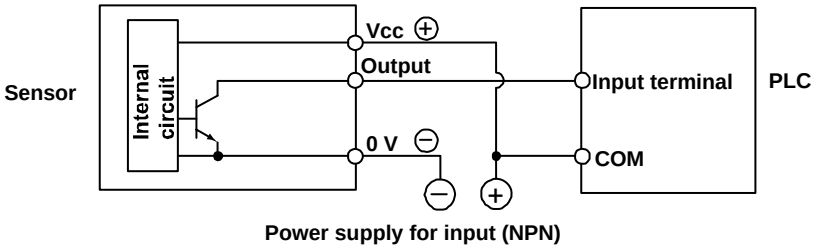
If you connect the power supply to another device besides the input, confirm the consumption current of the device side beforehand. If excess current is supplied for a long time, the power supply may be damaged.

5.6.1.1 Photoelectric and Proximity Sensors

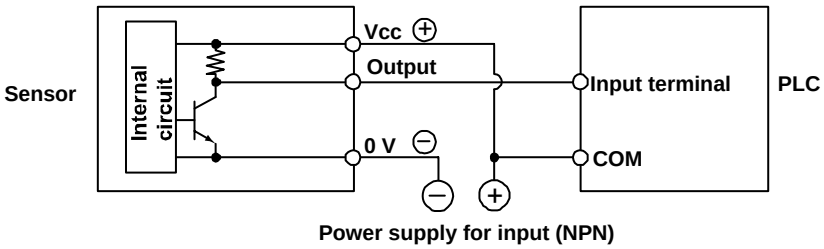
Relay output type (NPN input)



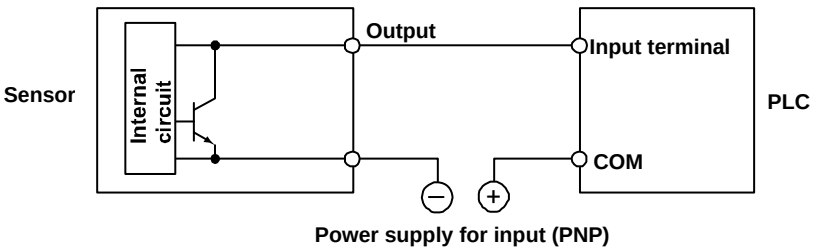
NPN open collector output type



Voltage output (universal output) type

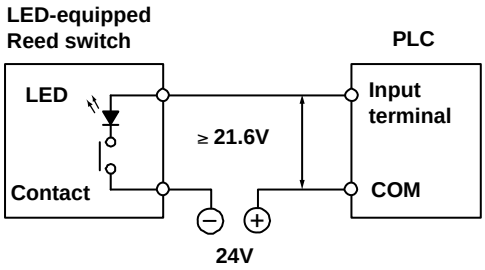


Two-wire output type



Precaution when using an LED-equipped Reed switch

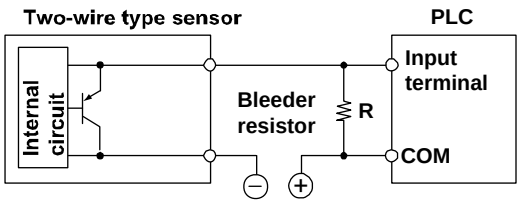
When an LED is connected in series to an input contact such as an LED-equipped Reed switch, make sure that the ON voltage applied to the PLC input terminal is greater than 21.6V DC. In particular, take care when connecting a number of switches in series.



NPN circuit

Precaution when using a two-wire type sensor

If the input of the PLC does not turn off because of leakage current from the two-wire type sensor (photoelectric sensor or proximity sensor), the use of a bleeder resistor is recommended, as shown below.



NPN circuit

The off voltage of the input is 2.4V. Therefore, select a bleeder resistor value R so that the voltage between the COM terminal and the input terminal will be less than 2.4V.

With an input impedance of 5.6kΩ, the sensor's leakage current I (mA) and

$$I \times 5.6R \frac{5.6R}{5.6R + R} \leq 2.4[V]$$

the resistance R of the bleeder resistor should be:

$$R \leq \frac{2.4 \times 5.6}{5.6 \times I - 2.4}[k\Omega]$$

The input impedance varies depending on the input terminal number.

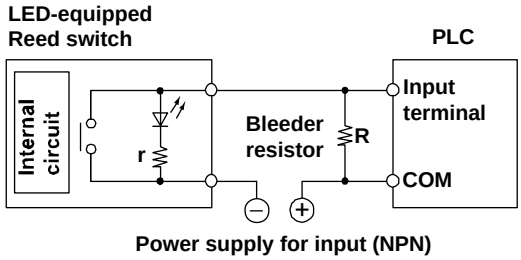
The wattage W of the resistor is:

$$W = \frac{(\text{Power supply voltage})^2}{R}[W]$$

In the actual selection, use a value that is 3 to 5 times the value of W.

Precaution when using an LED-equipped limit switch

If the input of the PLC does not turn off because of the leakage current from the LED-equipped limit switch, the use of a bleeder resistor is recommended, as shown below.



r: Internal resistor of limit switch (kΩ)

R: Bleeder resistor (kΩ)

The OFF voltage of the input is 2.4V. Therefore, when the power supply is 24V, select the bleeder resistor "R" so that the current will be greater than

$$I = \frac{24 - 2.4}{r}[A]$$

With an imput impedance of 5.6kΩ, the resistance R of the bleeder resistor should be:

$$R \leq \frac{2.4 \times 5.6}{5.6 \times I - 2.4}[k\Omega]$$

The input impedance varies depending on the input terminal number.

The wattage W of the resistor is:

$$W = \frac{(\text{Power supply voltage})^2}{R}[W]$$

In the actual selection, use a value that is 3 to 5 times the value of W.

5.6.2 Output Wiring

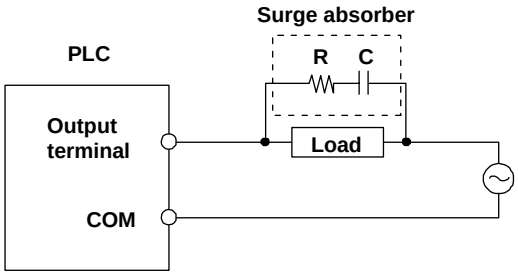
Do not connect a load that exceeds the maximum swiching ability to the output terminal.

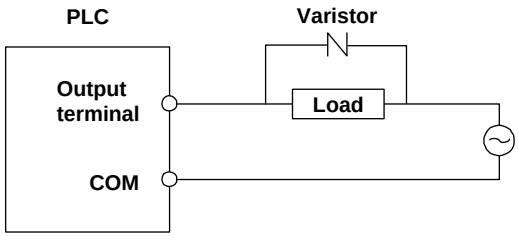
5.6.2.1 Protective Circuit for Inductive Loads

With an inductive load, a protective circuit should be installed in parallel with the load.

When switching DC inductive loads with the relay output type, be sure to connect a diode across the ends of the load.

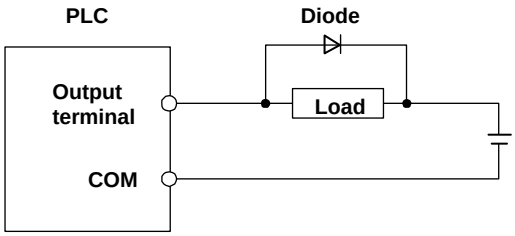
When using an AC inductive load





Example of surge absorber:
Resistance (R): 50Ω
Capacity (C): 0.47μF

When using a DC inductive load

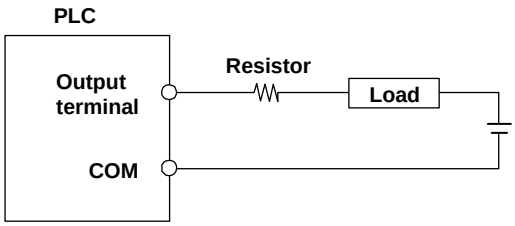


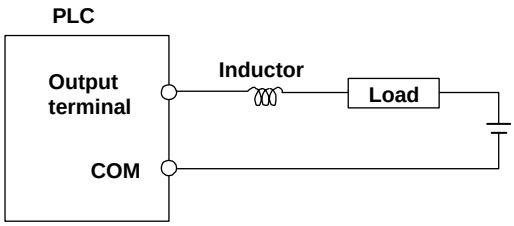
NPN circuit

Diode:
Reverse voltage (V_R): 3 times the load voltage
Average rectified forward current (I_0): Load current or more

5.6.2.2 Protective Circuit for Capacitive Loads

When connecting loads with large in-rush currents, connect a protection circuit as shown below to minimize their effect.

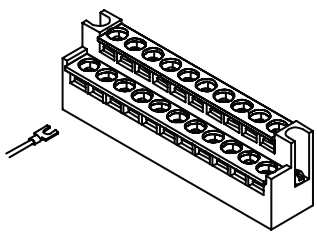


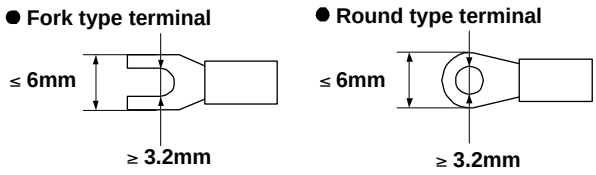


5.7 Wiring of Terminal Block

Supplied terminal block/Suitable wires

M3 terminal screws are used to secure the terminal. The following suitable solderless terminals are recommended.





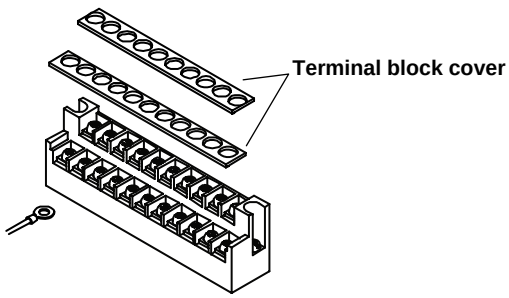
Suitable wires

Suitable wires	Nominal cross-sectional area
AWG22 to 14	0.3 to 2.0mm^2

The tightening torque should be 0.5 to 0.6 N· m

Connection to the terminal block

When using the round type terminal, remove the terminal cover.



◆ NOTE

Reattach the terminal block cover after wiring to prevent electric shock.

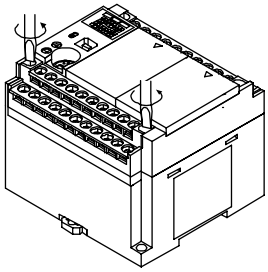
How to remove the terminal block

The terminal blocks for C30/C60 can be removed to facilitate wiring. The terminal block for C14 cannot be removed.

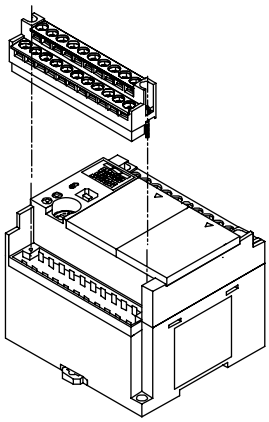
PROCEDURE

1. Loosen the mounting screws on both sides

The terminal block will rise gradually until released.

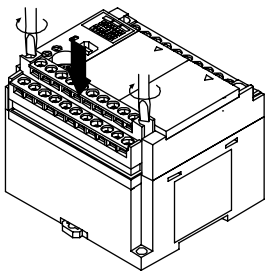


The mounting screws are fixed to the terminal block so they will not get lost.



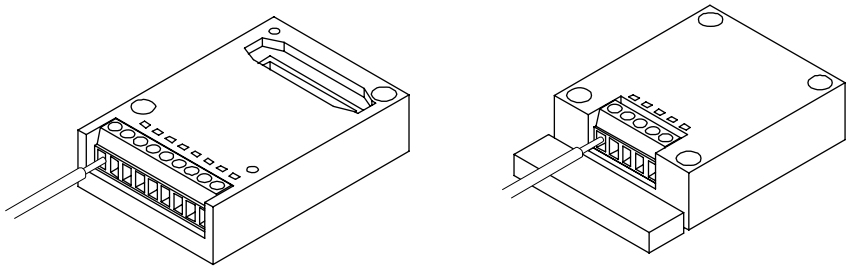
2. To reattach the terminal block, tighten the screws until the terminal block lowers into place

The tightening torque should be 0.25 to 0.35 N•m.



5.8 Wiring of Add-On Cassette Terminal Block

A screw-down connection type terminal block is used. Suitable wires are given below.



Application cassette (left) and communication cassette (right) with wire inserted

Suitable wires (twisted) (see page 82)

Size	Nominal cross-sectional area
AWG #24 to 16	0.2 to 1.25mm2

Pole terminal with compatible insulation sleeve

For pole terminals, please consider the following specifications.

Cross-sectional area (mm^2)	Size
0.25	AWG #24
0.50	AWG #20
0.75	AWG #18
1.00	AWG #18
0.5x2	AWG #20 (for 2 pcs)

The tightening torque should be 0.22 to 0.25 N•m.

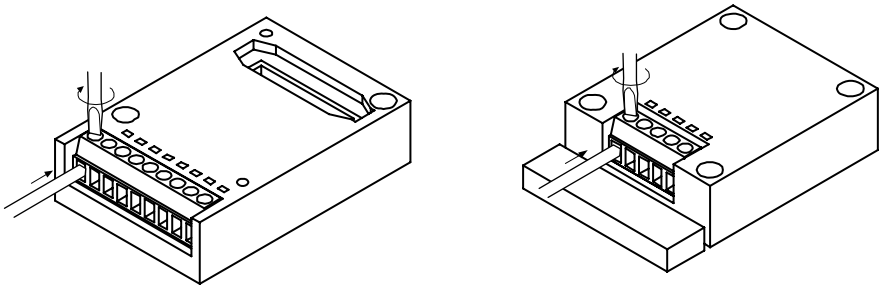
Wiring method

◆PROCEDURE

1. **Remove a portion of the wire's insulation**

2. **Insert the wire into the terminal block until it contacts the back of the block socket**

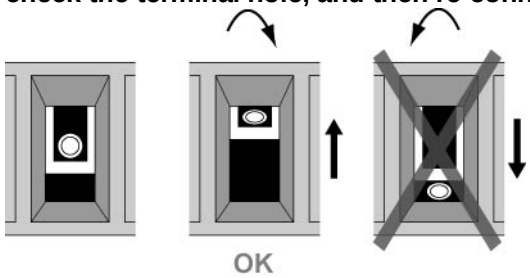
3. Turn the screw clockwise to fix the wire in place.



Tightening torque: 0.22 to 0.25N•m.

◆ **NOTES**

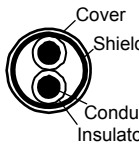
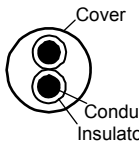
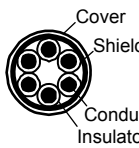
- **When removing the wire's insulation, be careful not to scratch the core wire.**
- **Do not twist the wires to connect them.**
- **Do not solder the wires to connect them. The solder may break due to vibration.**
- **After wiring, make sure stress is not applied to the wire.**
- **In the terminal block socket construction, if the wire closes upon counter-clockwise rotation, the connection is faulty. Disconnect the wire, check the terminal hole, and then re-connect the wire.**



- **If two wires are connected to the plus terminal and minus terminal of the RS485, use wires of the same cross-sectional area: 0.5 to 0.75 mm^2.**

5.8.1 Transmission Cables

Please use the following cables for systems using the communication cassette.

Type	Cross-sectional view	Conductor		Insulator		Cable diam.
		Size	Resistance (at 20°C)	Material	Thickness	
Shielded twisted pair		≥ 1.25mm^2 (AWG16)	Max. 16.8Ω/km	Polye-thyl ene	Max. 0.5mm	Approx. 8.5mm
		≥ 0.5 mm^2 (AWG20)	Max. 33.4Ω/km	Polye-thyl ene	Max. 0.5mm	Approx. 8.5mm
VCTF		≥ 0.75 mm^2 (AWG18)	Max. 25.1Ω/km	Polychlo-r inated biphenyl	Max. 0.6mm	Approx. 6.6mm
Shielded multicore cable		≥ 0.3 mm^2 (AWG22)	Max. 58.8Ω/km	Vinyl chloride	Max. 0.3mm	Approx. 6.6mm

◆ NOTES

- **Use shielded twisted pair cables.**
- **Use only one type of transmission cable.**
- **Twisted pair cables are recommended in noisy environments.**
- **When using shielded cable with crossover wiring for the RS485 transmission line, grounded one end.**
- **If two wires are connected to the plus terminal and minus terminal of the RS485, use the wires of the same cross-sectional area which is 0.5 to 0.75 mm2.**

5.9 Backup Battery

Installing a backup battery in the FP-X makes it possible to:

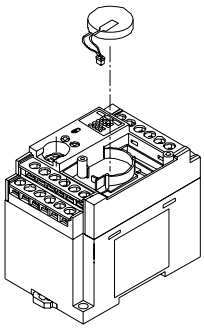
- access the realtime clock function when the master memory cassette AFPX-MRTC is installed
- back up data registers and other data

Battery (Option)

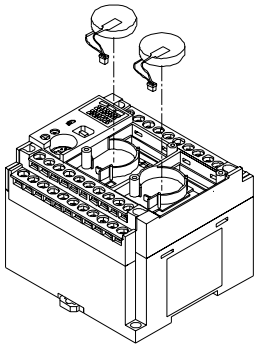
Name	Part no.	Quantity that can be installed		
		C14	C30	C60
Backup battery for FP-X	AFPX-BATT	1 pc	Max. 2 pcs	Max. 3 pcs

The battery can be installed in cassette mounting parts 1, 2 and the expansion connector part.

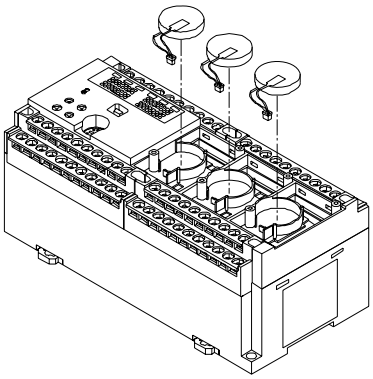
■ **C14R**



■ **C30R**



■ **C60R**



5.9.1 Installing the Backup Battery

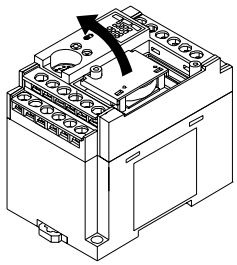
◆ NOTE

When replacing the battery, turn off the power after power has been supplied for more than 5 min. Replace the battery within 2 minutes.

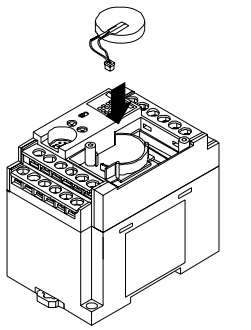
The procedure shown below begins after the expansion cover has been removed.

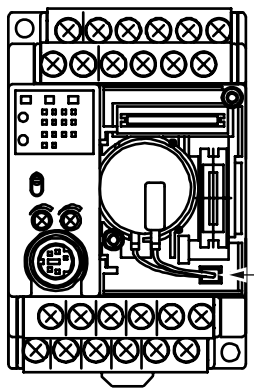
◆ PROCEDURE

1. **Remove the battery cover.**

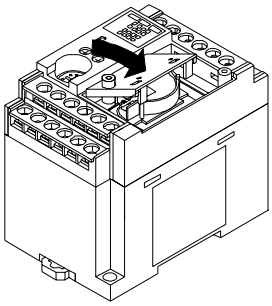


2. **Insert the battery and connect the connector to the unit.**





3. **Reattach the battery cover.**



5.9.2 System Register Setting

Settings for the battery error alarm

By default, system register 4 for the alarm battery error is set to “Off” (disabled). When using the battery, turn on (enable) system register 4 of the control unit.

◆ REFERENCE

Please refer to the online help of your programming tool for information on the battery error alarm settings.

Specifying the hold area

In order to use backup functions such as data registers, settings must be entered for system registers 6 to 14.

◆ NOTES

- **The setting of the system registers 6 to 14 is effective only when a backup battery is installed.**
- **Without the battery, use the default settings. If you change the settings, the “Hold/Non-hold” operation becomes unstable.**
- **Without the settings, data may be lost as the result of a battery shutoff.**

5.9.3 Time to Replace the Backup Battery

If system register 4 is set to “On” (enabled), you will be informed when it is time to replace the backup battery.

- Special internal relays R9005 and R9006 will go on if the battery voltage drops.
- ERROR/ALARM LED will flash.

The battery remains effective for about a week after the alarm is issued, but in some cases the problem is not detected immediately. The battery should be replaced as soon as possible.

◆ NOTE

When replacing the battery, turn off the power after power has been supplied for more than 5 min. Replace the battery within 2 minutes.

5.9.4 Lifetime of the Backup Battery

The backup battery will eventually die. Therefore it is important to replace it periodically. Refer to the table below as a guide for when to replace the battery.

◆ NOTES

- **The battery lifetime is the value when no power at all is supplied.**
- **The actual lifetime may be shorter than the typical lifetime depending on the conditions.**

Battery lifetime: when the master memory cassette (AFPX-MRTC) is installed

Control unit	Quantity used	Battery lifetime	Suggested replacement interval	Typical lifetime in actual use (25°C)
C14	1	≥ 2.1 years	3 years	10 years
C30	1	≥ 1.8 years	3 years	10 years
	2	≥ 3.7 years	5 years	20 years
C60	1	≥ 1.8 years	3 years	10 years
	2	≥ 3.7 years	5 years	20 years
	3	≥ 5.6 years	8 years	20 years

Battery lifetime: when the master memory cassette (AFPX-MRTC) is not installed

Control unit	Quantity used	Battery lifetime	Suggested replacement interval	Typical lifetime in actual use (25°C)
C14	1	≥ 3.3 years	5 years	20 years
C30	1	≥ 2.7 years	4 years	20 years
	2	≥ 5.4 years	8 years	20 years
C60	1	≥ 2.7 years	4 years	20 years
	2	≥ 5.4 years	8 years	20 years
	3	≥ 8.1 years	12 years	20 years

5.10 Safety Measures

Precautions regarding th system design

In certain applications, malfunctions may occur for the following reasons:

- Power-on timing differences between the PLC system and inputs/outputs or mechanical power apparatus.
- Response time lag when a momentary power drop occurs.
- Abnormality in the PLC unit, external power supply, or other devices.

In order to prevent a malfunction resulting in system shutdown, choose adequate safety measures listed as follows.

Interlock circuit

When a motor's clockwise/counter-clockwise operation is controlled, provide an external interlock circuit.

Emergency stop circuit

Provide an emergency stop circuit to the PLC externally to turn off the power supply of the output device.

Start-up sequence

The PLC should be operated after all outside devices are energized. To ensure this sequence, the following measures are recommended:

- Turn on the PLC with the mode selector set to PROG. mode. Then switch to RUN mode.
- Program the PLC to disregard inputs and outputs until the outside devices are energized.

◆ NOTE

When stopping PLC operation, also make sure the input/output devices turn off after the PLC has stopped operating.

Grounding

When installing the PLC next to devices that generate high switching voltages, e.g. inverters, do not ground them together. Use an exclusive ground for each device.

The terminal block cover must be used to prevent electric shock.

5.10.1 Momentary Power Failures

If a power failure lasts less than 10ms, the FP-X continues to operate. If power is off for 10ms or longer, operation changes depending on the combination of units, the power supply voltage, etc. In some cases, operation may be the same as that for a power supply reset.

Although the duration of the power failure for the expansion FP0 adapter is 10ms, judge the permissible time as a system after confirming the permissible duration of the power failure for the DC power supply that supplies power to the expansion FP0 apapter.

5.10.2 Protection of Output Sections

If current exceeding the rated control capacity is being supplied in the form of a motor lock current or a coil shorting in an electromagnetic device, a protective element such as a fuse should be attached externally.

Chapter 6

Communication Ports and Cassettes

6.1 Names and Principle Applications of the Ports

Port name	Port type		Communication function
	USB used	USB not used	
Tool port	Standard equipment (mini-DIN 5-pin connector)		• Computer link • General-purpose serial communication
COM1 port	Communication cassette (see note)	Communication cassette	• Computer link • General-purpose serial communication • PC (PLC) link • MODBUS RTU
COM2 port	USB port (for C30/C60 only)		• Computer link • General-purpose serial communication • MODBUS RTU

◆ NOTE

Please note the restrictions on communication cassettes when using the USB port (see page 97).

6.2 Tool Port

The tool port (see page 14) offers two different communication modes:

- Computer link (see page 103)
- General-purpose serial communication (see page 115)

◆ NOTE

General-purpose serial communication is only available in RUN mode. Computer link is automatically selected in PROG mode so that the programming tool, etc. can be connected.

◆ REFERENCE

Please refer to your programming tool's online help for information on the tool port settings.

6.3 USB Port

◆ NOTE

Install the programming tool before connecting the FP-X with a PC.

If you connect the FP-X to a PC with the USB cable before the programming tool is installed or during installation, the USB driver will not be installed correctly.

The USB port (see page 14) offers three different communication modes:

- Computer link (see page 103)
- General-purpose serial communication (see page 115)
- Modbus RTU (see page 152)

USB port settings

You must select the system registers for COM2 to make settings for communication via the USB port. Please refer to your programming tool's online help for information on the COM port settings.

6.3.1 USB Connection

The FP-X C30 and C60 control units are equipped with a USB port. Connecting the units with a personal computer using a USB cable enables communication with our programming software. The FP-X C14 control unit is not equipped with the USB connector.

This communication method uses the USB as a virtual serial port, i.e. the FP-X connected via USB is treated by the PC as if connected via the COM port.

Necessary items for the connection

- A PC with the following OS is necessary to connect the FP-X via the USB:
  - Windows®98 Second Edition
  - Windows®Me
  - Windows®2000
  - Windows®XP
- FPWIN Pro version 5.1 or later, or FPWIN GR version 2.50 or later
  - These versions include a USB driver. However, you will need the following 2 items if you install it separately: 1) USB driver, 2) USB-COM conversion driver
- USB cable (see page 14)

6.3.2 USB Connection Procedure

You need only perform the connection procedure the first time you establish the USB connection.

However, you must change the communication setting when switching between the USB and tool port connection.

6.3.3 Installation of USB Driver

The following 2 USB drivers must be installed to recognize the USB:

- USB driver
- USB-COM conversion driver

The installation procedure may differ depending on the PC's OS.

◆ NOTE

For a PC with more than one connector, you may be requested to reinstall these 2 drivers if the USB connectors' positions have changed.

Under Windows

◆ PROCEDURE

1. **Turn on the power suuply of the FP-X**
2. **Connect the FP-X with a PC using a USB cable**

The PC recognizes the USB driver automatically.

3. **Follow the wizard's instructions**

6.3.4 Confirming COM Ports

The USB connected to the FP-X is recognized by the PC as a COM port. It depends on your PC environment to which COM port the USB is allocated. Therefore, it is necessary to confirm the COM port number allocated.

A COM port no. is necessary for communication to take place with the programming tool.

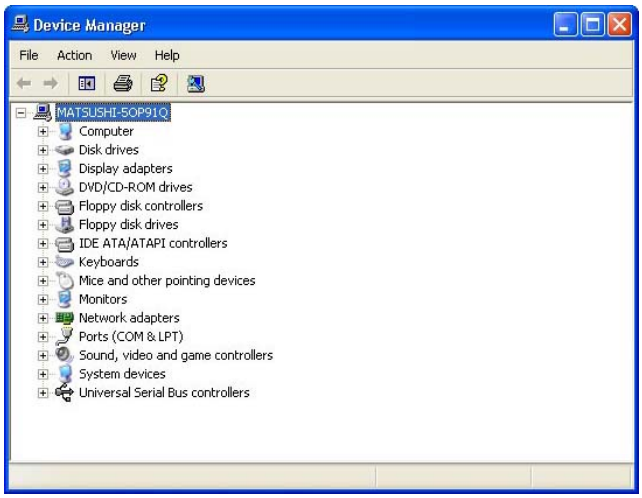
PROCEDURE

1. **Display Device Manager**

   For **Windows®XP**: My computer → View system information → Hardware tab → Device Manager.

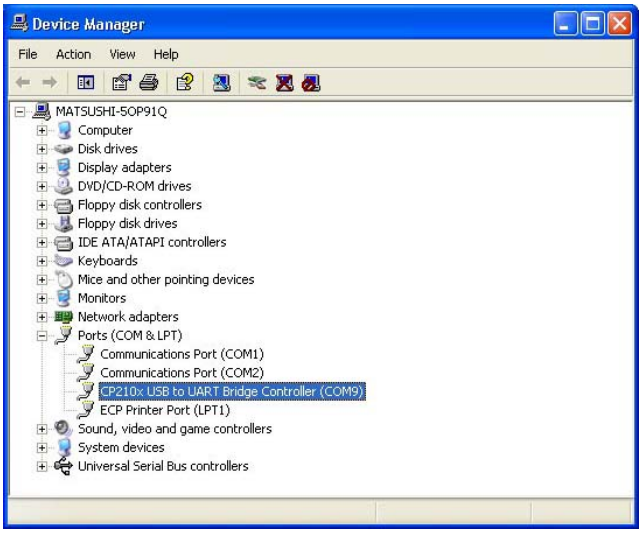
   For **Windows®2000**: My computer → Control panel → System → Hardware tab → Device manager → View → Device by type.

   For **Windows®98 Second Edition/Windows®Me**: My computer → Control panel → System → Device manager tab → View devices by type.



2. **Double-click "Ports (COM & LPT)"**
3. **Confim the COM port no.**

"CP210x USB to UART Bridge Controller (COM n)" is the COM port allocated. COM9 is allocated in the following display.



◆ NOTE

If "? CP210x USB to UART Bridge Controller" appears in "Other devices" or "Unknown device" is indicated, the installation has failed. Reinstall the USB driver (see page 96).

6.3.5 Communication with the Programming Tool

The following settings are necessary.

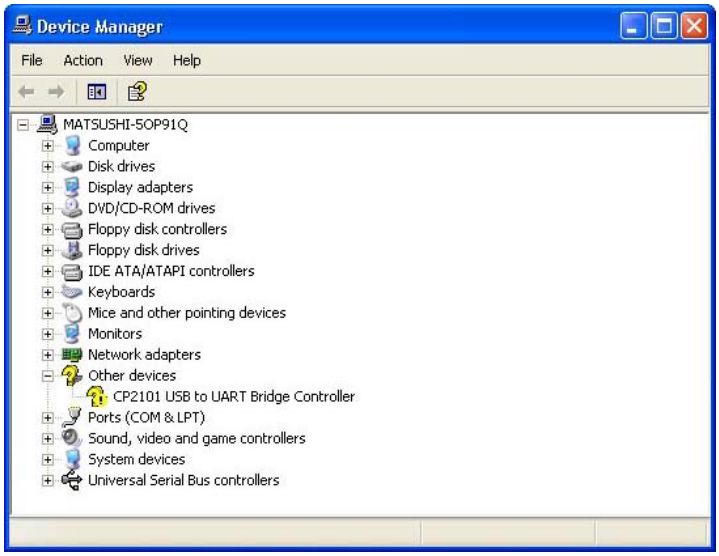
Parameter	Setting
Network type	C-NET (RS232C)
Port no..	COM port no. allocated for the USB
Baud rate	Specify 115200 bps. (Communicates with 115200 bps when the USB is connected)
Data length	8 bits
Stop bit	1 bit
Parity	Odd

◆ REFERENCE

Please refer to your programming tool's online help for information on the COM port settings.

6.3.6 Reinstalling the USB Driver

The USB driver must be installed again if the installation failed. If "? CP210x USB to UART Bridge Controller" appears in "Other devices" or "Unknown device" is indicated, the installation has failed.



Also, reinstall the driver if the USB connection does not work well.

Reinstalling the USB driver

PROCEDURE

1. **Right-click "? CP210X USB to UART Bridge Controller"**
2. **Select "Delete"**
3. **Reinstall the USB driver (see page 93)**

6.4 Communication Cassettes

Communication modes

With the communication cassettes, the FP-X offers four different communication modes (see "Terminology in FPWIN Pro and FPWIN GR" on page 102):

- Computer link (see page 103)
- General-purpose serial communication (see page 115)
- PC (PLC) link (see page 128)
- Modbus RTU (see page 152)

Types (see "Connection Examples" on page 38)

- 1-channel RS232C type (see page 35)
- 2-channel RS232C type (see page 35)
- 1-channel RS485/RS422 type (see page 36)
- 1-channel RS485 and 1-channel RS232C combination type (see page 37)

6.4.1 Communication Cassettes and the USB Port

The USB port is allocated to the COM2 port, and the functions of the communication cassette are restricted as below when the USB port is used.

The USB port is available as the default setting or when the system registers are initialized.

Cassette	USB port not used	USB port used
AFPX-COM1	5-wire 1-channel RS232C	3-wire 1-channel RS232C (RS and CS control is not available.)
AFPX-COM2	3-wire 2-channel RS232C	3-wire 1-channel RS232C (The 2nd channel cannot be used.)
AFPX-COM3	No restrictions, 1-channel RS485/RS422	
AFPX-COM4	1-channel RS485 1-channel RS232C	1-channel RS485 (RS232C cannot be used.)

6.4.2 Communication Specifications and Modes

Overview of modes, interfaces, communication cassettes and communication methods

Mode	Computer link (see note)			General-purpose serial communication (see note)			PC (PLC) link	Modbus RTU (see note)		
	1:1		1:N	1:1		1:N		1:1		1:N
Interface	RS232C	**RS422**	**RS485**	RS232C	**RS422**	**RS485**	RS232C RS422 RS485	RS232C	**RS422**	**RS485**
Cassette	APFX -COM1 -COM2 -COM4	APFX^{L} -COM3	APFX -COM3 -COM4	APFX -COM1 -COM2 -COM4	APFX^{L} -COM3	APFX -COM3 -COM4	APFX -COM1 -COM2 -COM3 -COM4	APFX -COM1 -COM2 -COM4	APFX^{L} -COM3	APFX -COM3 -COM4
Comm. method	Half-duplex		2-wire, half-duplex	Half-duplex		2-wire, half-duplex	Token bus (floating master)	Half-duplex		2-wire, half-duplex

◆ NOTE

We recommend that you program the FP-X to retransmit data if a communication error occurs to ensure reliability.

Communication specifications

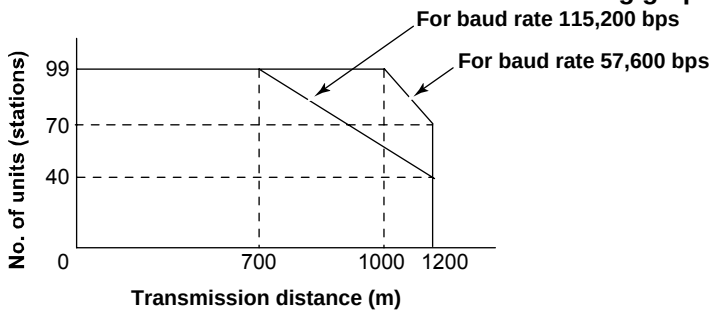
Item		Specifications		
Interface		RS232C (non-isolated)	RS422 (isolated) (note 1)	RS485 (isolated) (note 1, 2)
Communication mode		1:1 communicaion		1:N communication
Communication method		Half-duplex communication		Two-wire half-duplex communication
Synchronous method		Start stop synchronous system		
Transmission line		Multicore shielded line		Shielded twisted-pair cable or VCTF
Transmission distance		15 m	Max. 1200 m (note 1)	Max. 1200 m (note 1, 2)
Baud rate (note 3) (set by system register)		2400, 4800, 9600, 19200, 38400, 57600, 115200 bps		
Trans-mission code	Computer link	ASCII, JIS7, JIS8		
	General-purpose serial communication	ASCII, JIS7, JIS8, Binary		
	MODBUS RTU	Binary		
Communication	Data length	7 bits/8 bits		

Item		Specifications	
format (set by system register) (note 4)	Parity	None/Even/Odd	
	Stop bit	1 bit/2 bits	
	Start code	STX/No STX	
	End code	CR/CR+LF/None/ETX	
No. of connected units (note 5, 6, 7)		2 units	Max. 99 units (max. 32 units when C-NET adapter is connected.)

◆ NOTES

1. **When connecting a commercially available device that has an RS485 interface, please confirm operation using the actual device. In some cases, the number of units, transmission distance, and baud rate vary depending on the device connected.**

2. **The values for the transmission distance, baud rate and number of units should be within the values noted in the following graph.**



When using a baud rate of 9600 bps or 19200 bps, you can set up to a maximum of 99 units (stations). The maximum transmission distance is 1200 m.

3. **When a C-NET adapter is connected to the RS485 interface, you can only specify 9600 bps or 19200 bps for the baud rate.**

4. **The start and end code can only be used in general-purpose serial communication.**

5. **If necessary, adjust the response time for the FP-X's RS485 interface using the SYS1 instruction.**

6. **Unit numbers should be registered via the system registers.**

7. **Set the terminal resistance for the RS485/RS422 of COM3 and COM4 using the dip switch on the back of the cassette. There is no terminal resistance for the RS232C port.**

6.4.3 Precaution When Using the RS485 Port

AFPX-COM3, AFPX-COM4

The SYS1 instruction is available for FP-X, which allows you to control the response time via RS485 if necessary.

◆REFERENCE

Please refer to your programming tool's online help for information on the SYS1 instruction.

Chapter 7

Communication Modes

7.1 Terminology in FPWIN Pro and FPWIN GR

Although similar, FPWIN Pro and FPWIN GR use slightly different terminology to describe communication modes. The following table provides the terminological equivalents for FPWIN Pro.

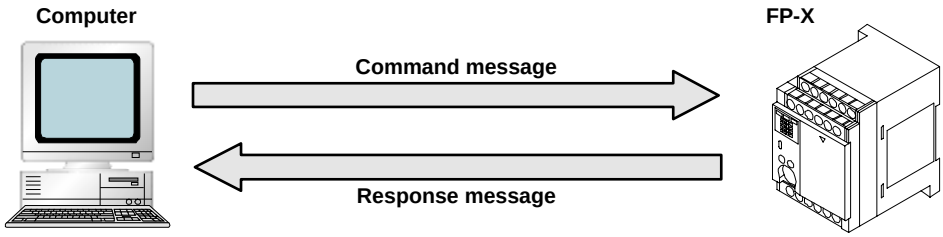
Names of the communication modes

FPWIN GR	FPWIN Pro
Computer link	MEWTOCOL-COM Slave [Computer Link]
General-purpose serial communication	Program controlled [General Purpose]
MODBUS RTU	Modbus RTU Master/Slave
PC (PLC) link	PLC Link [MEWNET-W0]

Other programming conventions

Indication	FPWIN GR	FPWIN Pro
Hexadecimal values	H	16#
Constants	K	no prefix required

7.2 Computer Link



What is computer link?

- A computer link is a communication connection between a computer and a PLC, which allows the PC to monitor and control the PLC's operating status.
- The computer and the PLC communicate via instructions (commands) from the computer to the PLC and response messages from the PLC to the computer.
- A proprietary MEWNET protocol called MEWTOCOL-COM is used to exchange data between the computer and the PLC.

Program for computer link

- For a computer link, a program must be written (e.g. in BASIC or C language) that enables the computer to send command messages and receive response messages. No communication program is required on the PLC side.
- Programs for the computer side must be based on the MEWTOCOL-COM format. MEWTOCOL-COM contains the commands (see page 252) used to monitor and control PLC operation.

KEYPOINTS

- Our software "Control CommX" enables communication using Visual Basic.
- Our add-in software "PCWAY" can be used with "Excel" to collect data.

7.2.1 Outline of Computer Link Operation

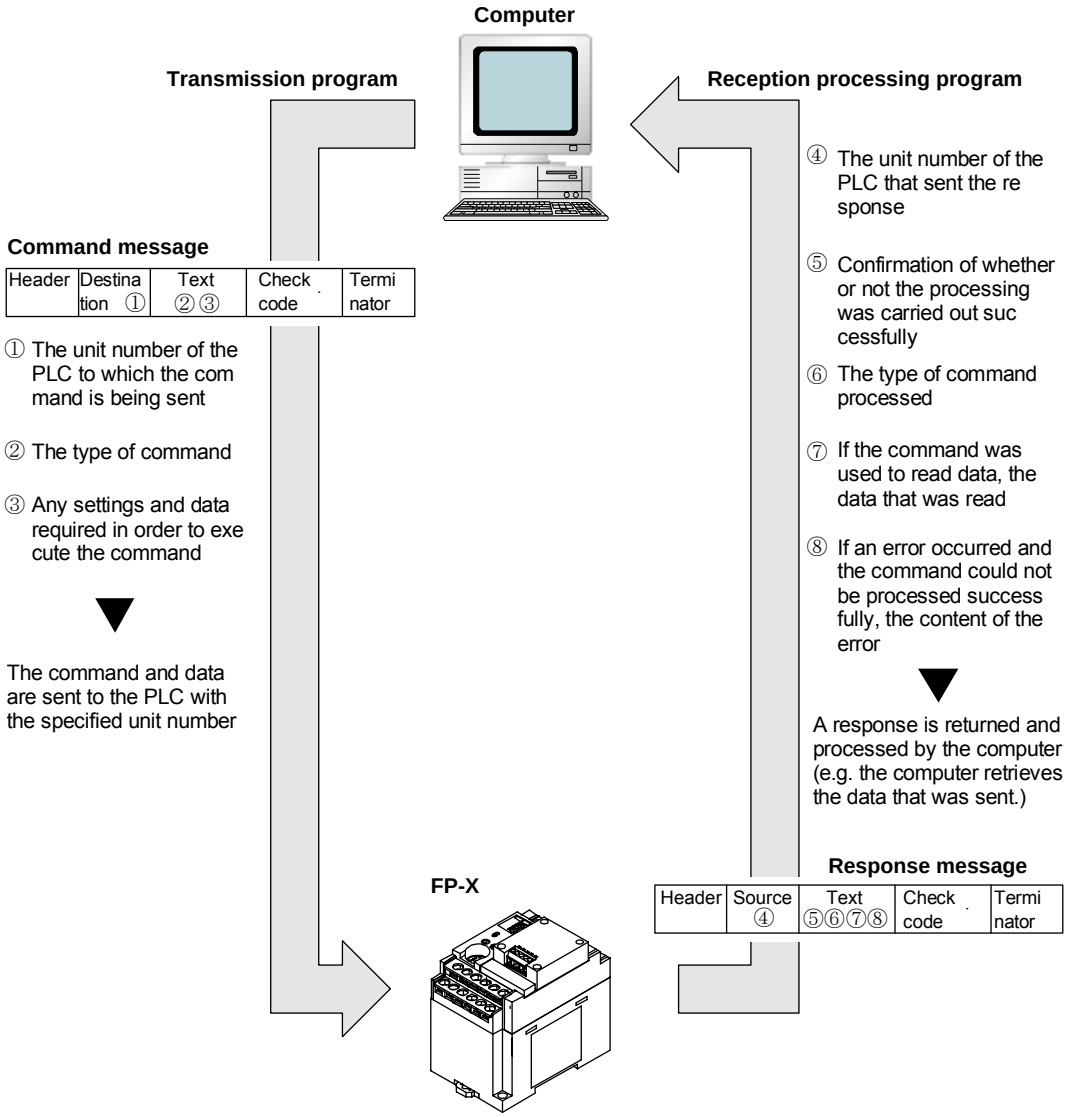
Command and response

Instructions issued by the computer to the PLC are called commands. Messages sent back to the computer from the PLC are called responses. When the PLC receives a command, it processes the command regardless of the sequence program, and sends a response back to the computer.

MEWTOCOL-COM sketch

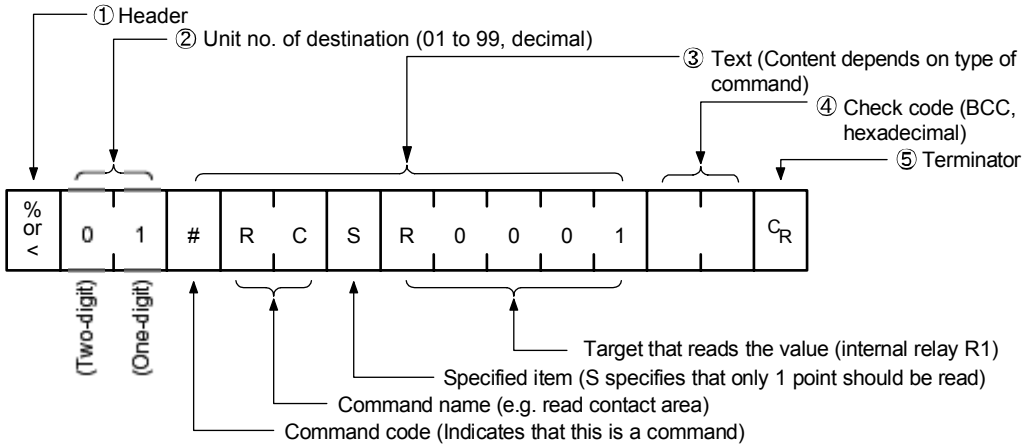
- Communication is carried out in a conversational format, based on the MEWTOCOL-COM communication procedures.
- Data is sent in ASCII format.

- The computer has the first right of transmission. The right of transmission shifts back and forth between the computer and the PLC each time a message is sent.



7.2.2 Command Messages

All command-related items should be noted in the text segment. The unit number must be specified before sending the command.



① Header (start code)

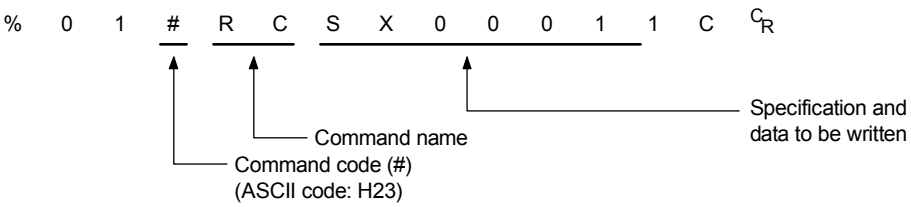
Commands must always have a "%" (ASCII code: H25) or a "<" (ASCII code: H3C) at the beginning of a message.

② Unit number

The unit number of the PLC to which you want to send the command must be specified. In 1:1 communication, the unit number "01" (ASCII code: H3031) should be specified. The unit no. of the PLC is specified by the system register.

③ Text

The content differs depending on the command. The content should be noted in all upper-case characters, following the fixed formula for the particular command.



④ Check code

BCC (block check code) for error detection using horizontal parity. The BCC should be created so that it targets all of the text data from the header to the last text character. The BCC starts from the header and checks each character in sequence, using the exclusive OR operation, and replaces the final result with character text. It is normally part of the calculation program and is created automatically.

The parity check can be skipped by entering "**" (ASCII code: H2A2A) instead of the BCC.

⑤ Terminator (end code)

Messages must always end with a "$^{C}_{R}$" (ASCII code: H0D).

◆ NOTES

- **The method for writing text segments in the message varies depending on the type of command.**
- **If there is a large number of characters to be written, they may be divided and sent as several commands. If there is a large number of characters in the value that was loaded, they may be divided and several responses sent.**

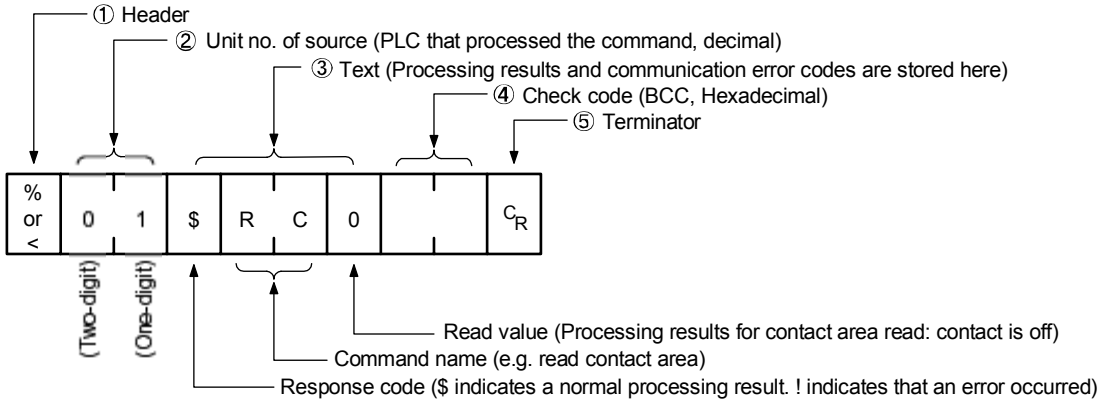
◆ KEYPOINTS

With the FP-X, an expansion header "<" is supported to send single frames of up to 2048 characters as well as a general "%".

Type of header	No. of characters that can be sent in 1 frame
%	Max. 118 characters
<	Max. 2048 characters

7.2.3 Response Messages

The PLC that received the previous command (see page 105) sends the processing results to the computer.



① Header (start code)

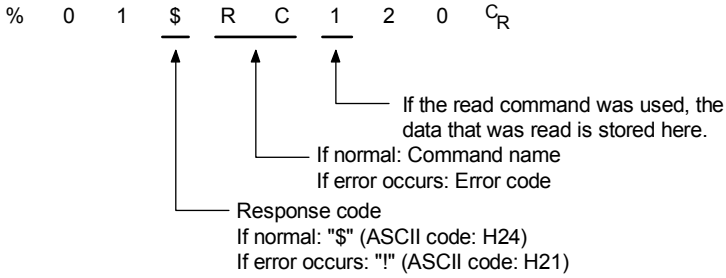
A "%" (ASCII code: H25) or "<" (ASCII code: H3C) must be at the beginning of a message. The response must start with the same header that was at the beginning of the command.

② Unit number

The unit number of the PLC that processed the command is stored here.

③ Text

The content of this varies depending on the type of command. The value should be read based on the content. If the processing is not completed successfully, an error code will be stored here, so that the content of the error can be checked.



④ Check code

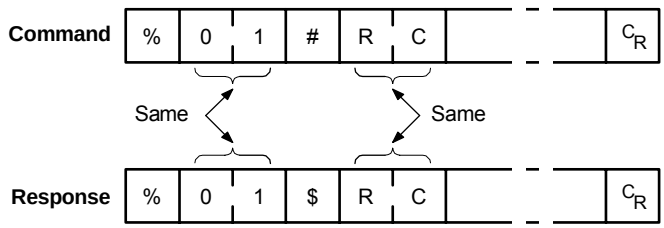
BCC (block check code) for error detection using horizontal parity. The BCC starts from the header and checks each character in sequence, using the exclusive OR operation, and replaces the final result with character text.

⑤ Terminator (end code)

Messages must always end with a "$^{C}_{R}$" (ASCII code: H0D).

◆ NOTES

- **If no response is returned, the communication format may not be correct, or the command may not have arrived at the PLC, or the PLC may not be functioning. Check to make sure all of the communication specifications (e.g. baud rate, data length, and parity) match between the computer and the PLC.**
- **If the response contains an "!" instead of a "$", the command was not processed successfully. The response will contain a communication error code. Check the meaning of the error code.**
- **Unit number and command name are always identical in a command and its corresponding response (see below). This makes the correspondence between a command and a response clear.**



7.2.4 Computer Link Communication Parameters

Use the programming tool to enter settings for the COM port. The COM port of the communication cassette supports all MEWTOCOL-COM commands, i.e. there are no restrictions.

The COM1 port is supported by communication cassettes AFPX-COM1, AFPX-COM2 and AFPX-COM3.

The COM2 port is supported by communication cassettes AFPX-COM2 and AFPX-COM4.

System register settings

System register	Function	Settings
410 (COM1), 411 (COM2)	Unit number	1-99
412 (see note 1)	Communication mode	Computer link
413 (COM1), 414 (COM2)	Communication format	Default settings (see note 2) • Data length: 8 bits • Parity: Odd • Stop bit: 1 • Terminator: CR • Header: No STX
415 (see note 1)	Baud rate	Any (default 9600bps) (see note 2)

◆ NOTES

1. **The communication mode and baud rate settings occupy different bit positions of the same system register, so different settings for COM port 1 and COM port 2 are possible.**

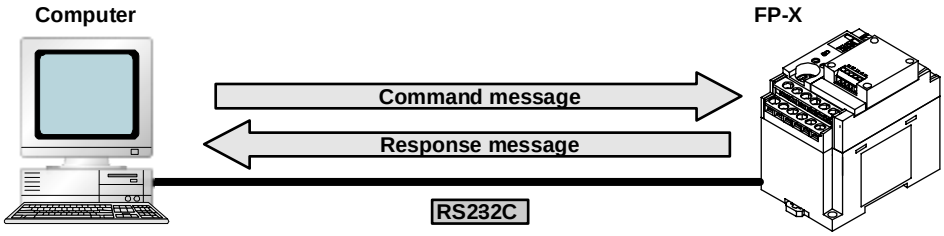
2. **Change the values to match the external device connected to the COM port.**

Terminal unit

Set the dip switch on the back of the cassettes AFPX-COM3 (see page 36) or AFPX-COM4 (see page 37) to designate them as the terminal unit in 1:N commnication.

7.2.5 1:1 Communication with a Computer

For a 1:1 computer link between the FP-X and a computer, an RS232C cable is needed. Communication is performed via commands from the computer and responses from the PLC.



Using 1-channel RS232C type communication cassette (AFPX-COM1)

Computer side (9-pin Sub-D)

Symbol	Pin no.
CD	1
RD	2
SD	3
ER	4
SG	5
DR	6
RS	7
CS	8
RI	9

AFPX-COM1

Pin name	Signal name	Abbr.
SD	Send Data	SD
RD	Receive Data	RD
RS	Request to Send	RS
CS	Clear to Send	CS
SG	Signal Ground	SG

Using 2-channel RS232C type communication cassette (AFPX-COM2)

Computer side (9-pin Sub-D)

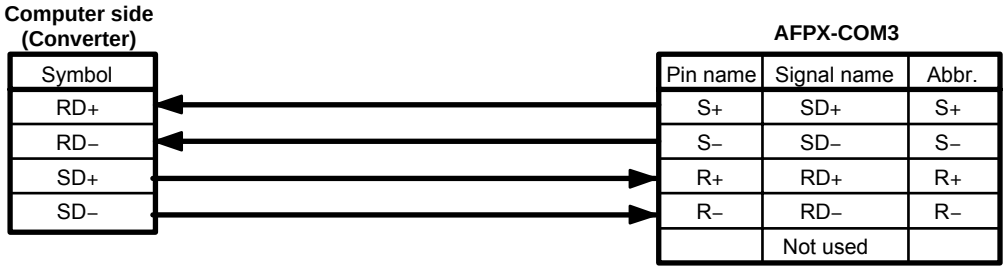
Symbol	Pin no.
CD	1
RD	2
SD	3
ER	4
SG	5
DR	6
RS	7
CS	8
RI	9

AFPX-COM2

Pin name	Signal name	Abbr.
S1	Send Data 1	SD
R1	Receive Data 1	RD
S2	Send Data 2	SD
R2	Receive Data 2	RD
SG	Signal Ground	SG

(To other device)

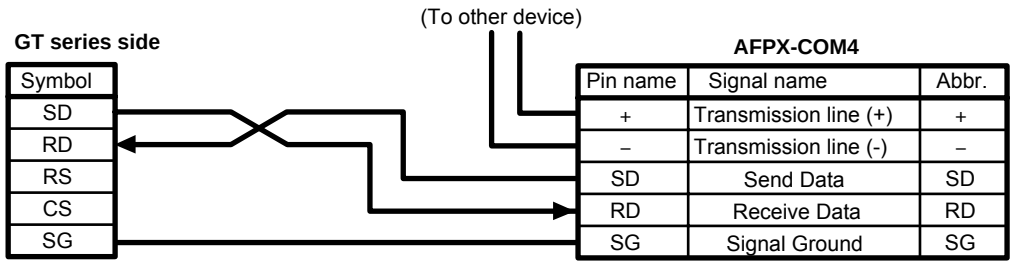
Using 1-channel RS485/RS422 type (RS422 setting), (AFPX-COM3)



◆ NOTE

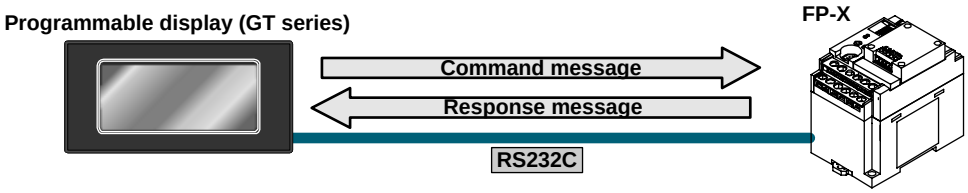
There are several names for the signal names of RS422. Confirm them using the instruction manuals for each device.

Using 1-channel RS485/1-channel RS232C type communication cassette (AFPX-COM4)



7.2.6 1:1 Communication with a GT Panel

A 1:1 computer link with a programmable display connects the FP-X and the programmable display using an RS232C cable. Communication is performed via commands from the programmable display and responses from the PLC.

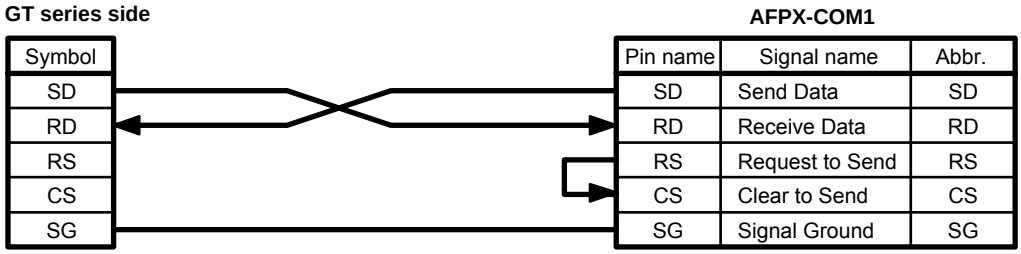


No program is required for communication. Simply set the mutual communications settings to operate the PLC via the programmable display.

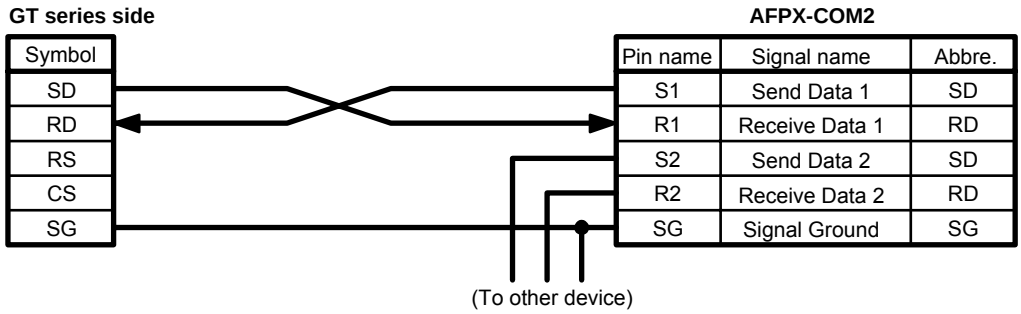
◆ NOTE

For the GT01 5V type, you can use the same cable (AIGT8142) via the tool port for communication and the power supply.

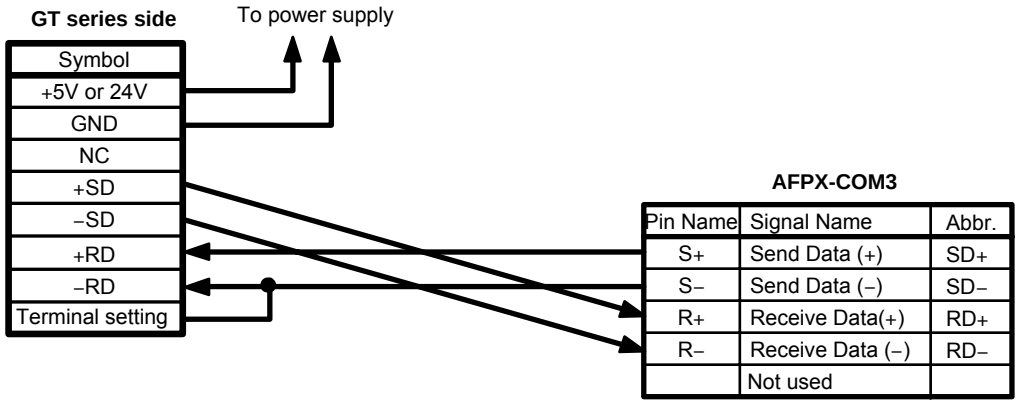
Using 1-channel RS232C type communication cassette (AFPX-COM1)



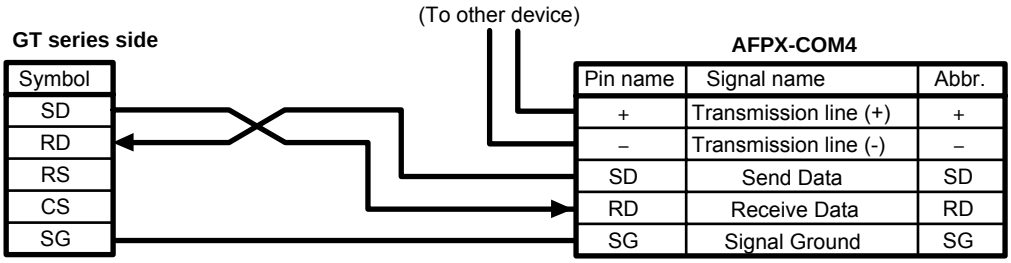
Using 2-channel RS232C type communication cassette (AFPX-COM2)



Using 1-channel RS485/RS422 type (RS422 setting), (AFPX-COM3)



Using 1-channel RS485/1-channel RS232C type communication cassette (AFPX-COM4)



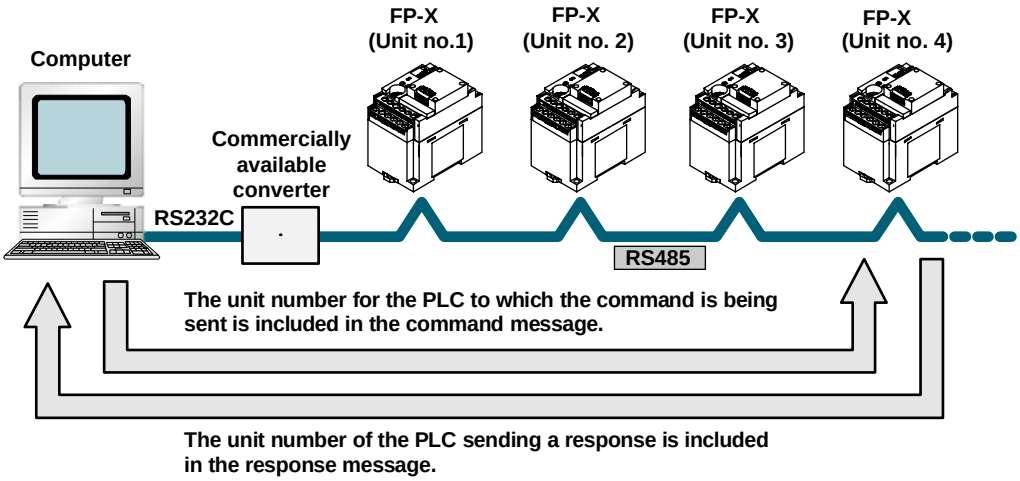
◆REFERENCE

Please refer to the "GT Series Technical Manual" for more information.

7.2.7 1:N Computer Link Communication

For a 1:N computer link, the computer and the FP-X are connected through a commercially available RS232C-RS485 converter, and the respective PLCs are wired using an RS485 cable.

The computer and the PLC communicate via commands and responses: The computer sends a command specifying the unit number, and the PLC with that unit number sends a response back to the computer.



Setting unit number in the system register (see page 108)

By default, the unit number for each communication port is set to 1 in the system register settings. There is no need to change this for 1:1 communication, but if 1:N communication is used to connect multiple PLCs to the transmission line (e.g. in a C-NET), the unit number must be specified in the system register so that the destination of the command can be identified.

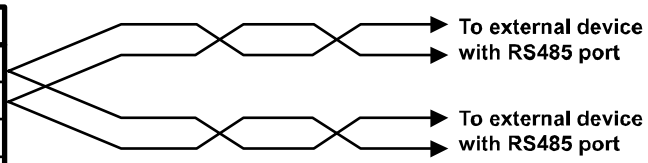
◆ NOTE

With a C-NET adapter, a maximum of 32 units (stations) can be specified.

AFPX-COM3 (RS485 setting) connection diagram

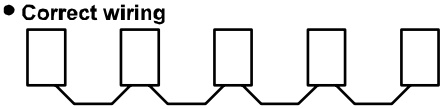
AFPX-COM3

Pin name	Signal name	Abbr.
S+	Transmission line 1 (+)	S+
S–	Transmission line 1 (-)	S–
R+	–	–
R–	–	–
–	–	–

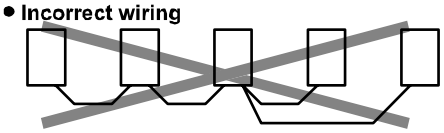


Wiring should extend from one unit to the next.
Never run two wires from a single unit to two other units.

- **Correct wiring**



- **Incorrect wiring**

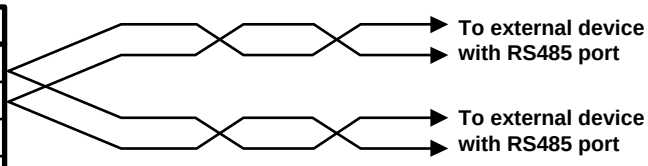


With 1:N communication, the various RS485 devices are connected using twisted pair cables. Use only one (+) and (-) terminal.

AFPX-COM4 connection diagram

AFPX-COM4

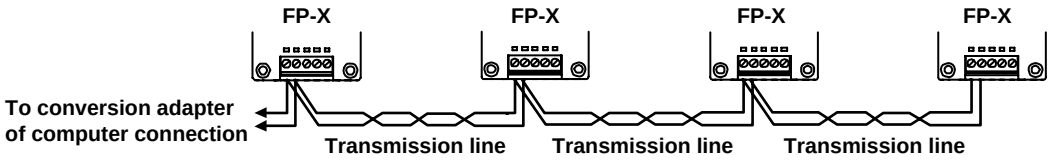
Pin name	Signal name	Abbr.
+	Transmission line 1 (+)	+
–	Transmission line 1 (-)	–
SD	Send Data	SD
RD	Receive Data	RD
SG	Signal Ground	SG



When using AFPX-COM4, connect two cables each to the (+) and (-) terminals. Use wires with the same cross-sectional area (0.5 to 0.75 mm^2).

Terminal unit

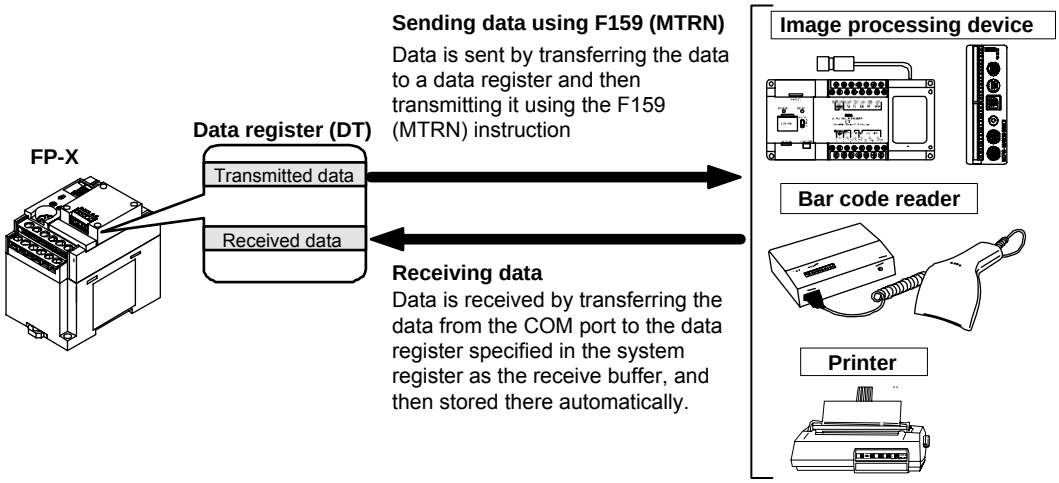
Set the dip switch on the back of the cassettes AFPX-COM3 (see page 36) or AFPX-COM4 (see page 37) to designate them as the terminal unit.



7.3 General Purpose Serial Communication

In general-purpose serial communication (see "Terminology in FPWIN Pro and FPWIN GR" on page 102), data is sent and received over the COM ports to and from an external device such as an image processing device or a bar code reader.

Data is read from and written to an external device connected to the COM port by means of an FP-X program and the FP-X data registers.

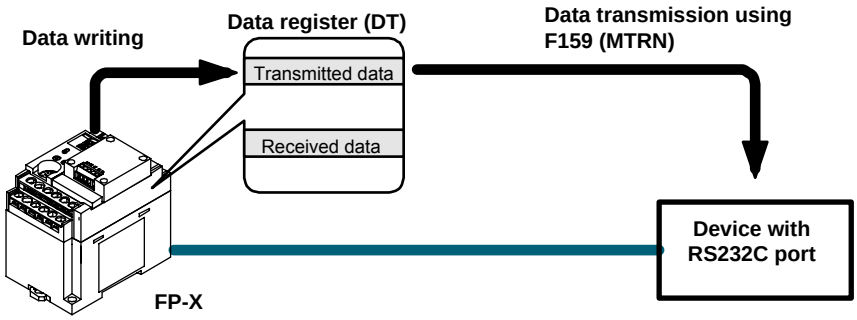


Outline of operation

To send data to and receive it from an external device using the general-purpose serial communication function, the data transmission and data reception functions described below are used. The F159 (MTRN) instruction and the "reception done" flag are used in these operations to transfer data between the FP-X and an external device.

Sending data

Data to be transmitted from the PLC is stored in the data register used as the send buffer (DT). When F159 (MTRN) is executed, the data is output from the COM port.

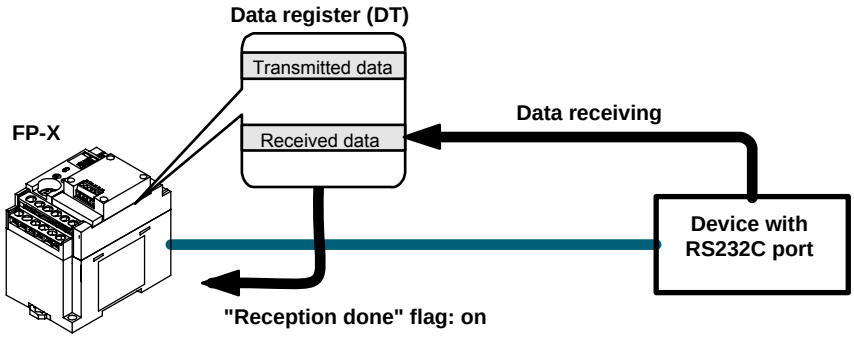


The terminator specified in the system register is automatically added to the data that has been sent.

The maximum volume of data that can be sent is 2048 bytes.

Receiving data

Data received from the COM port is stored in the receive buffer specified in the system register, and the "reception done" flag goes on. Data can be received whenever the "reception done" flag is off.



When data is being received, the "reception done" flag is controlled by the F159 (MTRN) instruction.

No terminator is included in the stored data.

The maximum volume of data that can be received is 4096 bytes.

7.3.1 General Purpose Communication Parameters

Use the programming tool to enter settings for the COM port. By default, the COM port is set to "Computer link". Change it to "General purpose".

The COM1 port is supported by communication cassettes AFPX-COM1, AFPX-COM2 and AFPX-COM3.

The COM2 port is supported by communication cassettes AFPX-COM2 and AFPX-COM4.

System register settings

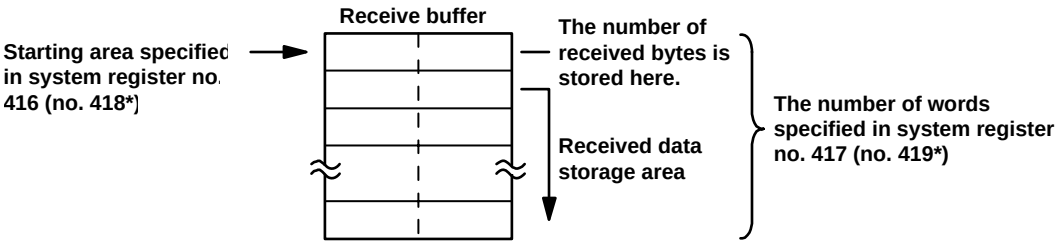
System register	Function	Settings
412 (see note 1)	Communication mode	General purpose
413 (COM1), 414 (COM2)	Communication format	Default settings (see note 2) • Data length: 8 bits • Parity: Odd • Stop bit: 1 • Terminator: CR • Header: No STX
415 (see note 1)	Baud rate	Any (default 9600bps) (see note 2)
416	COM1: starting address for data received	DT0 to DT32764 (initial value: DT0)
417	COM1: buffer capacity for data received	0 to 2048 words (initial value: 2048 words)

System register	Function	Settings
418	COM2: starting address for data received	DT0 to DT32764 (initial value: DT2048) (see note 3)
419	COM2: buffer capacity for data received	0 to 2048 words (initial value: 2048 words)

◆ NOTES

1. **The communication mode and baud rate settings occupy different bit positions of the same system register, so different settings for COM port 1 and COM port 2 are possible.**
2. **Change the values to match the external device connected to the COM port.**
3. **When using C14, the values are DT0 to DT12285.**

Receive buffer layout



(*The system register in parentheses refer to COM2.

7.3.2 Communication with External Devices

The F159 (MTRN) instruction is used to send and receive data via the specified COM port. The F144 (TRNS) instruction is not available for the FP-X.

◆ REFERENCE

For an explanation and programming examples for F159 (MTRN), please refer to the online help or the FPΣ User's Manual.

7.3.3 Data Format

Remember the following when accessing data in the FP-X send and receive buffers:

- If a header has been chosen in the transmission format settings, the code STX (FPWIN GR: H02, FPWIN Pro: 16#02 (see "Terminology in FPWIN Pro and FPWIN GR" on page 102)) will automatically be added at the beginning of the data being sent.
- Data received without STX code is stored in the receive buffer, and the "reception done"

flag turns on when the terminator (end code) is received.

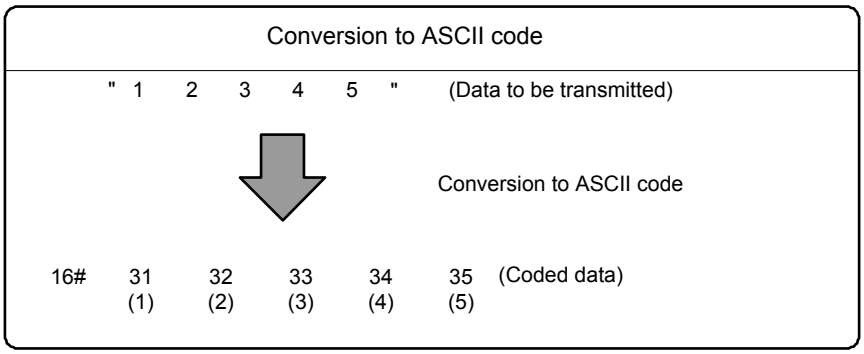
- A terminator is automatically added to the end of the data being sent.
- There is no terminator on the data stored in the receive buffer.

Sending data

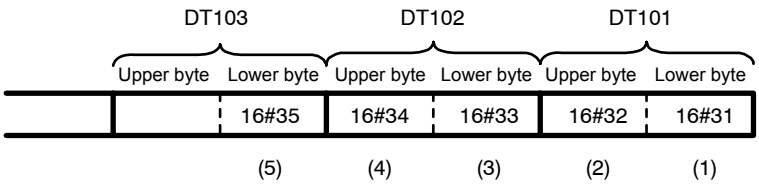
Data written to the send buffer will be sent just as it is.

◆EXAMPLE

Data sent using the F95_ASC instruction should be converted to ASCII code data.



If DT100 is being used as the send buffer, data will be stored in sequential order in the data registers starting from the next register (DT101), in two-byte units consisting of the upper and the lower byte.

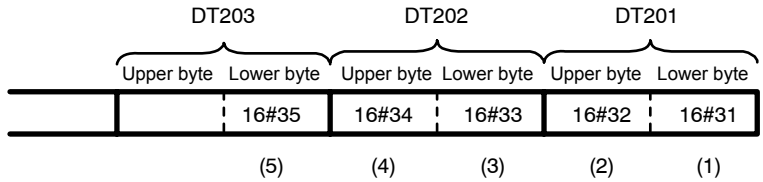


Receiving data

The data of the receive area being read is ASCII code data.

◆ **EXAMPLE**

If DT200 is being used as the receive buffer, received data will be stored in the registers starting from DT201, in sequential order of first the lower byte and then the upper byte.



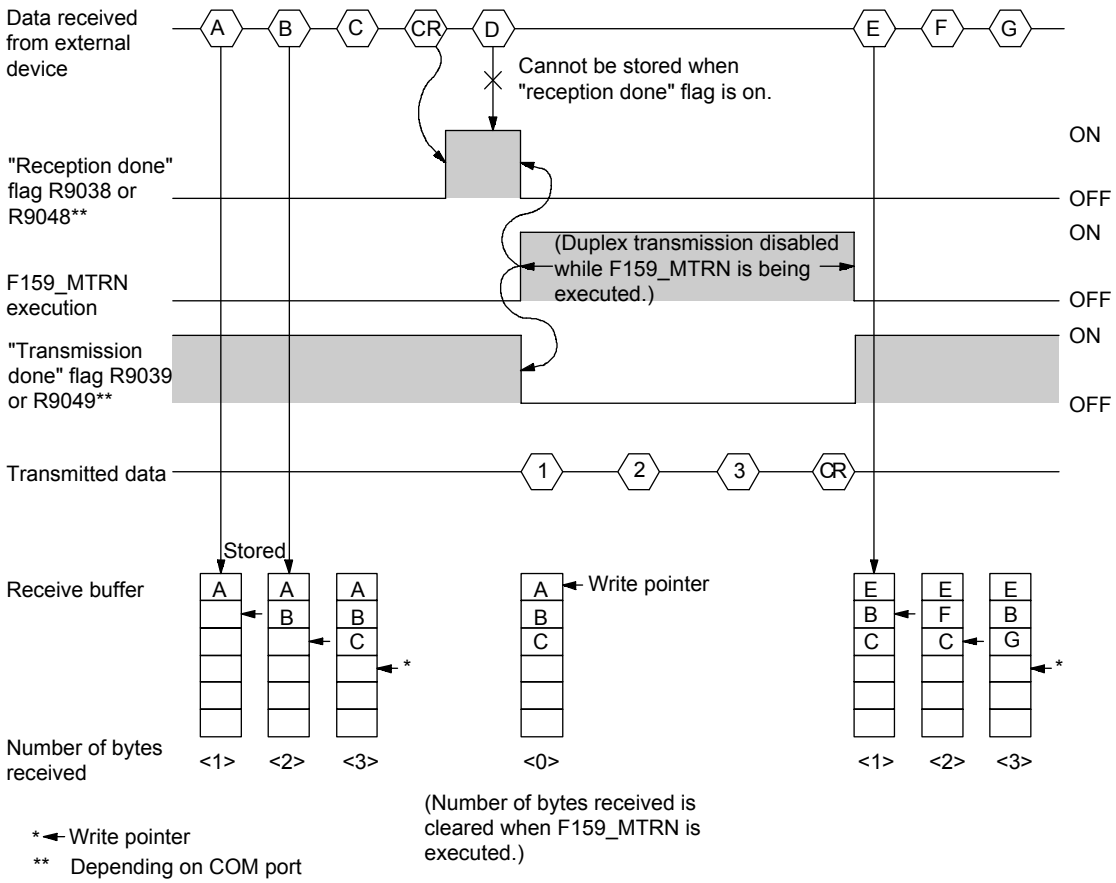
7.3.4 Flag Operation in Serial Communication

This section explains the operation of the "reception done" and the "transmission done" flag in serial communication.

7.3.4.1 Header: No-STX, Terminator: CR

Receiving data:

The "reception done" flag, the "transmission done" flag, and the F159_MTRN instruction are related as follows:



For general-purpose serial communication, half-duplex transmission must be used.

Reception is disabled when the "reception done" flag R9038 or R9048 is on.

When **F159_MTRN** is executed, the number of bytes received is cleared, and the address (write pointer) in the receive buffer is reset to the initial address.

Also, when **F159_MTRN** is executed, the error flag R9037 or R9047, the "reception done" flag R9038 or R9048 and the "transmission done" flag R9039 or R9049 go off.

Duplex transmission is disabled while **F159_MTRN** is being executed. The "transmission done" flag R9039 or R9049 must be observed.

Reception stops if the error flag R9037 or R9047 goes on. To resume reception, execute the **F159_MTRN** instruction, which turns off the error flag.

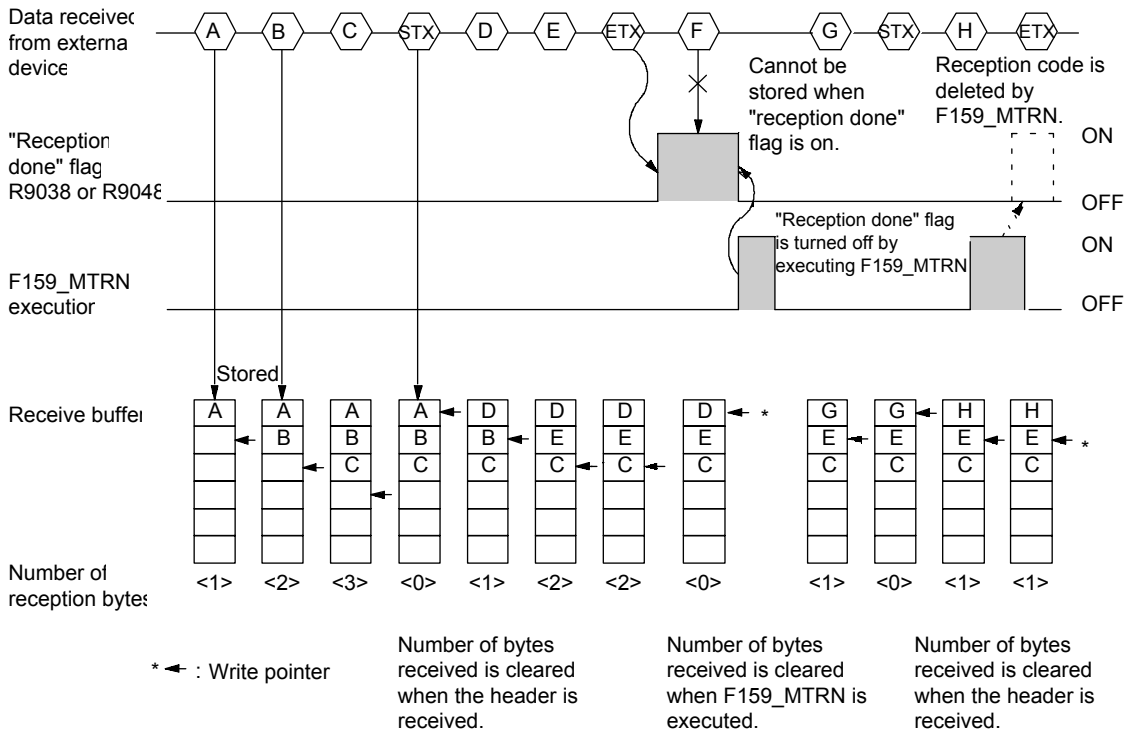
◆ NOTE

Be aware that the "reception done" flag R9038 or R9048 changes even while a scan is in progress (e.g., if the "reception done" flag is used multiple times as an input condition, there is a possibility of different statuses existing within the same scan). To prevent multiple read access to the special internal relay you should generate a copy of it at the beginning of the program.

7.3.4.2 Header: STX, Terminator: ETX

Receiving data:

The "reception done" flag, the "transmission done" flag, and the F159_MTRN instruction are related as follows:



The data is stored in the receive buffer in sequential order. When the header is received, the number of bytes received is cleared, and the address (write pointer) in the receive buffer is reset to the initial address.

Reception is disabled while the "reception done" flag R9038 or R9048 is on.

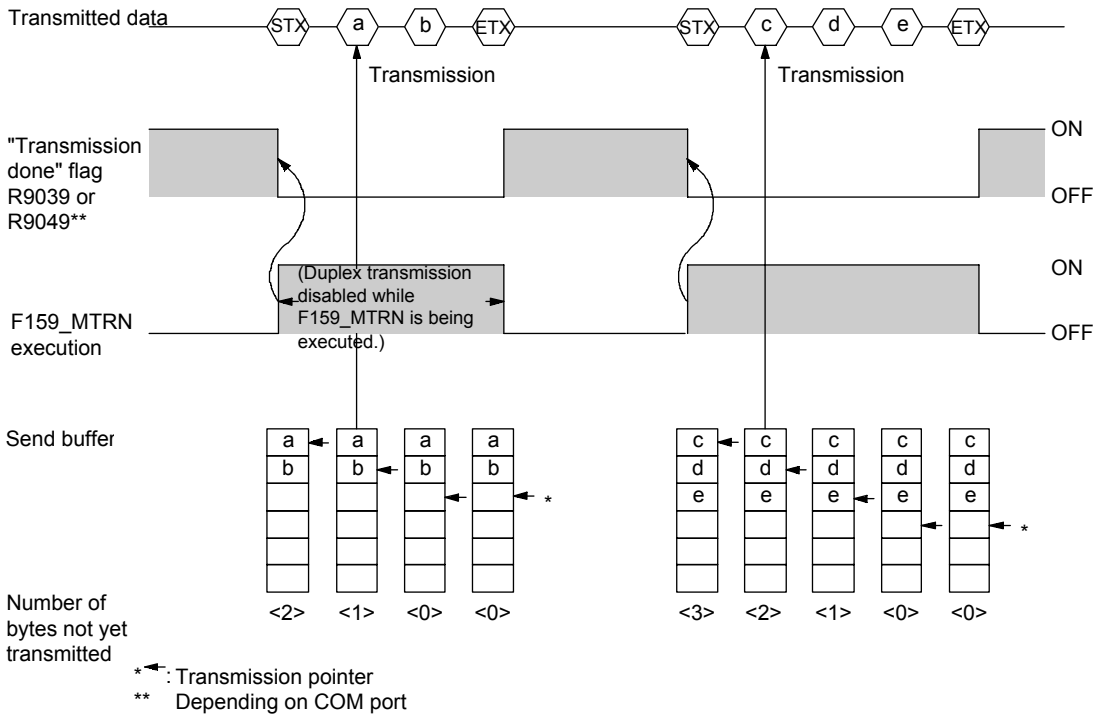
Also, when **F159_MTRN** is executed, the number of bytes received is cleared, and the address (write pointer) in the receive buffer is reset to the initial address.

If there are two headers, data following the second header overwrites the data in the receive buffer.

The "reception done" flag R9038 or R9048 is turned off by the **F159_MTRN** instruction. Therefore, if **F159_MTRN** is executed at the same time the terminator is received, the "reception done" flag will not be detected.

Sending data:

The "reception done" flag, the "transmission done" flag, and the F159_MTRN instruction are related as follows:



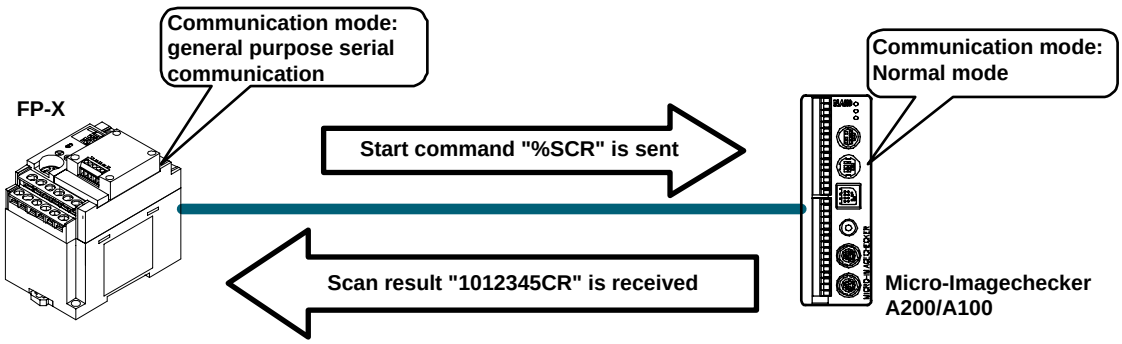
Header (STX) and terminator (ETX) are automatically added to the data being transmitted. The data is transmitted to an external device.

When the **F159_MTRN** instruction is executed, the "transmission done" flag R9039 or R9049 goes off.

Duplex transmission is disabled while **F159_MTRN** is being executed. The "transmission done" flag R9039 or R9049 must be observed.

7.3.5 1:1 Communication With Micro-Imagechecker

The FP-X and Micro-Imagechecker A100/A200 are connected using an RS232C cable. The results of the scan are stored in the data registers of the FP-X.



After the scan start code "%S^{C}_{R}" has been sent from the FP-X side, the scan result is returned from the Micro-Imagechecker as the response.

Communication format settings for Micro-Imagechecker A100/A200

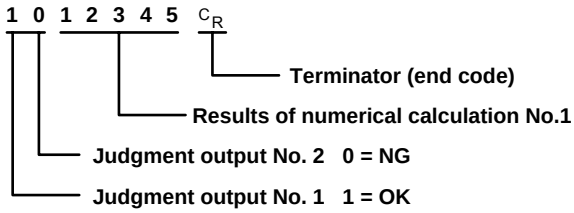
To set the communication mode and transmission format settings for the Micro-Imagechecker, select "5: Communication" under "5: ENVIRONMENT" on the main menu, and set the following items.

No.	Name	Set value	
No. 51	Communication mode	Normal Mode	
No. 52	RS232C	Baud rate (bps)	9600 bit/s
		Length	8
		Stop bit	1
		Parity	Odd
		Flow Control	None
No. 53	Serial Output	Output	5 Column
		Invalid Digit	Repl. 0
		Read End	None
		Process End	None
		Numerical Calculation	Output
		Judgment	Output

◆ NOTES

- **If "Del" is specified for the invalid processing parameter, zero suppression processing will be carried out on the output data, and the output format will be changed. Always make sure "Repl. 0" is specified.**
- **When outputting data to an external device, numerical calculation is required, so "Out" should be specified for the "Numerical calculation" parameter.**

With the above settings, the following data will be output from the Micro-Imagechecker:



Connection to Micro-Imagechecker A100/A200

◆ NOTE

Please make the connection using a special RS232C cable available for the Micro-Imagechecker (order no. ANM81303).

Using 1-channel RS232C type communication cassette (AFPX-COM1)

AFPX-COM1

Pin name	Signal name	Abbr.
SD	Send Data	SD
RD	Receive Data	RD
RS	Request to Send	RS
CS	Clear to Send	CS
SG	Signal Ground	SG

ANM81303

Micro-Imagechecker side

ANM81303 Cable color	Symbol	Pin No.
Red	SD	1
White	RD	2
Black	RS	3
Yellow	CS	4
Blue	DR	5
Green	SG	6
Brown	CD	7
Gray	ER	8
	Shield	Cover

Using 2-channel RS232C type communication cassette (AFPX-COM2)

AFPX-COM2

Pin name	Signal name	Abbr.
S1	Send Data 1	SD
R1	Receive Data 1	RD
S2	Send Data 2	SD
R2	Receive Data 2	RD
SG	Signal Ground	SG

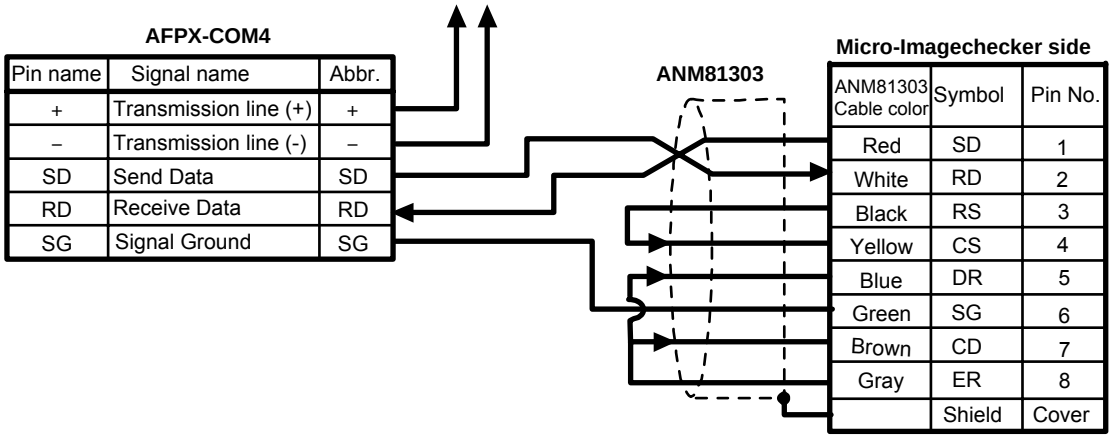
ANM81303

Micro-Imagechecker side

ANM81303 Cable color	Symbol	Pin No.
Red	SD	1
White	RD	2
Black	RS	3
Yellow	CS	4
Blue	DR	5
Green	SG	6
Brown	CD	7
Gray	ER	8
	Shield	Cover

(To other device)

Using 1-channel RS485/1-channel RS232C type communication cassette (AFPX-COM4)



Pin name	Signal name	Abbr.
+	Transmission line (+)	+
–	Transmission line (-)	–
SD	Send Data	SD
RD	Receive Data	RD
SG	Signal Ground	SG

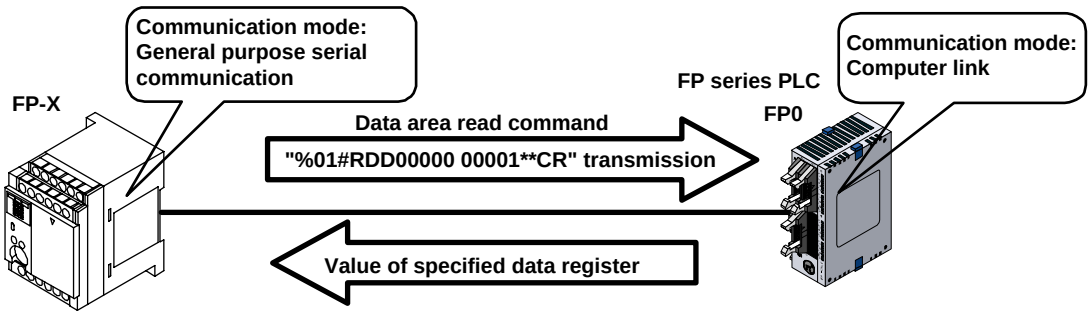
ANM81303 Cable color	Symbol	Pin No.
Red	SD	1
White	RD	2
Black	RS	3
Yellow	CS	4
Blue	DR	5
Green	SG	6
Brown	CD	7
Gray	ER	8
	Shield	Cover

◆ REFERENCE

You can find a programming example in the the FPWIN Pro online help or the FPΣ User's Manual. You can download the PDF file for this and other manuals from our website free of charge.

7.3.6 1:1 Communication With FP Series PLC

Connect the FP-X and another FP series PLC using the RS232C interface and the MEWTOCOL-COM communication protocol.



When the data area read command "%01#RDD00000 00001** $^{C}_{R}$" is sent from the FP-X side, the values of the data register of the PLC connected to the system are sent as a response. For example, if the value 100 is stored in DT0 and the value 200 is stored in DT1 of the PLC, "%01$RD6400C8006F$^{C}_{R}$" is sent as a response to the command. If there is an error, "%01! OO ** $^{C}_{R}$" is returned (OO is the error code).

In addition to data area read and write commands, MEWTOCOL-COM also provides contact area read and write as well as many other commands.

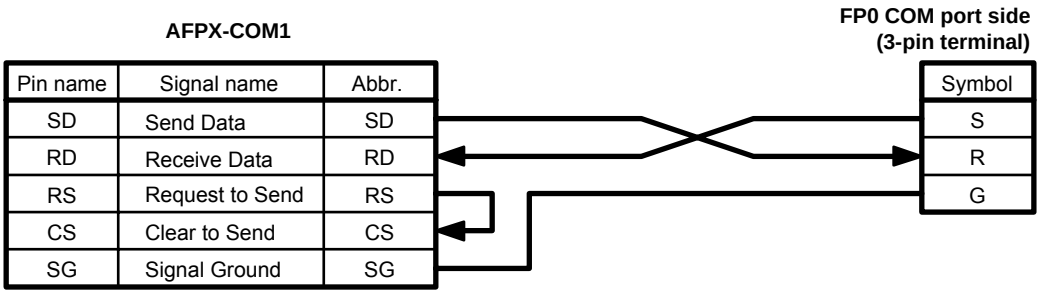
System register settings for FP series PLC (FP0)

No.	Name	Set value
No. 412	Communication mode for COM port	Computer link
No. 413*	Communication format for COM port	Data length: 8 bits Parity: Odd Stop bit: 1 bit Terminator: CR Header: No STX
No. 414*	Baud rate for COM port	19200 bps

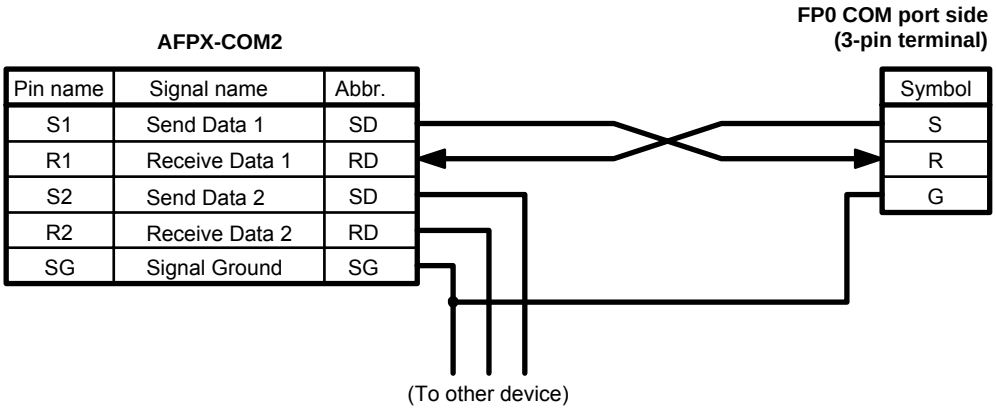
* These settings should be the same as the settings of the connected FP-X.

Connection to FP series PLCs (FP0)

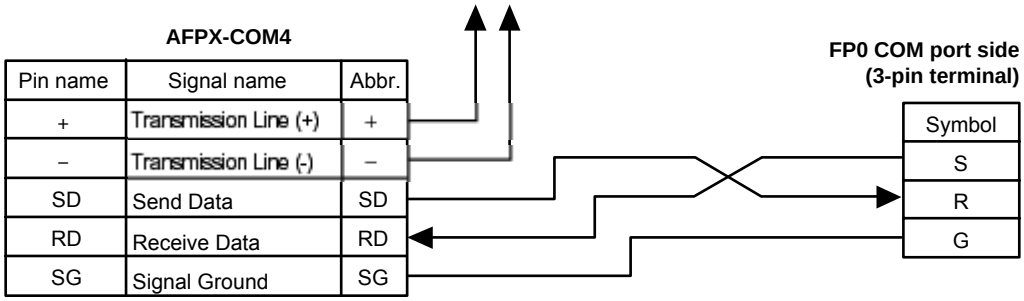
Using 1-channel RS232C type communication cassette (AFPX-COM1)



Using 2-channel RS232C type communication cassette (AFPX-COM2)



Using 1-channel RS485/1-channel RS232C type communication cassette (AFPX-COM4)

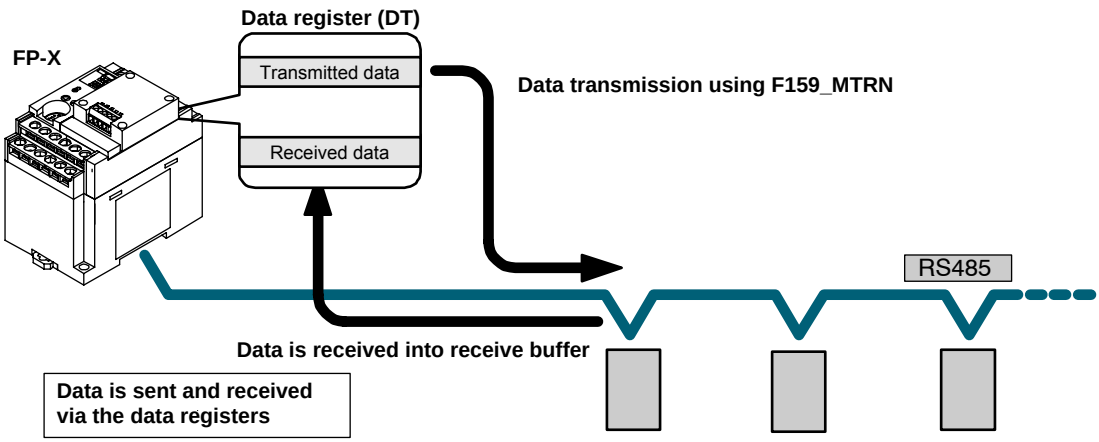


◆ REFERENCE

You can find a programming example in the the FPWIN Pro online help or the FPΣ User's Manual. You can download the PDF file for this and other manuals from our website free of charge.

7.3.7 1:N General Purpose Serial Communication

The FP-X and the external units are connected using an RS485 cable (see "Precaution When Using the RS485 Port" on page 100). Using the protocol that matches the external units, the F159 (MTRN) instruction is used to send and receive data.



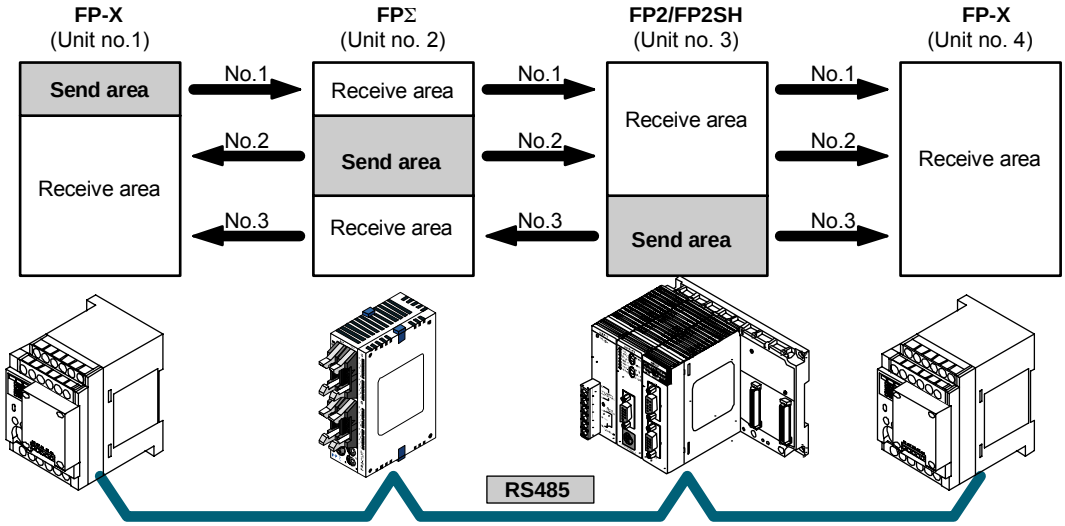
System register settings for COM1 port (see page 116)

7.4 PC (PLC) Link

The PLC link (see "Terminology in FPWIN Pro and FPWIN GR" on page 102) is an economic way of linking PLCs using a twisted-pair cable. Data is shared between the PLCs using link relays (L) and link registers (LD). The statuses of the link relays and link registers of one PLC are automatically fed back to the other PLCs on the same network. In other words, turning on a link relay contact in one PLC turns on the same link relay in all other PLCs on the same network. Likewise, if the contents of a link register in one PLC are changed, the values of the same link register are changed in all PLCs on the same network.

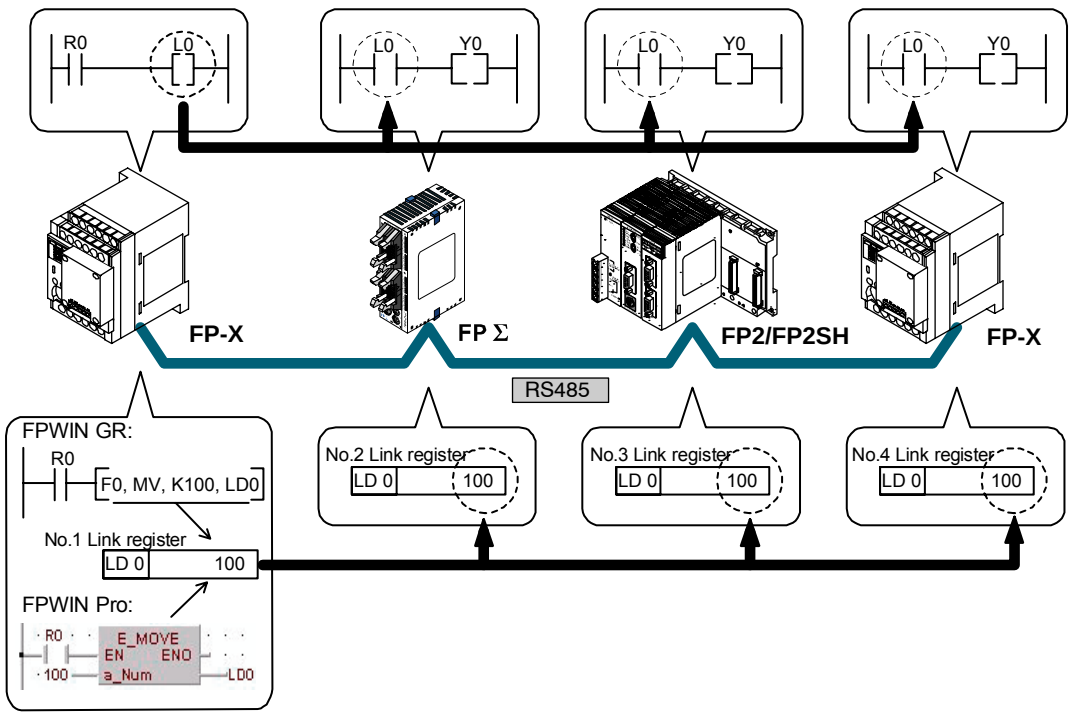
PLC link is not the default setting. You must change system register no. 412 setting to "PLC link" in order to use this function. It is available with the COM1 port only.

Unit numbers and link areas are allocated using the system registers.



◆EXAMPLE

Link relay L0 for unit no. 1 is turned on. The status change is fed back to the programs of the other units, and Y0 of the other units is set to TRUE. A constant of 100 is written to link register LD0 of unit no. 1. The contents of LD0 in the other units are also changed to a constant of 100.



7.4.1 PLC Link Communication Parameters

Use the programming tool to enter settings for the COM port. By default, the COM port is set to "Computer link". Change it to "PLC link".

PLC link is available for the COM1 port only.

System register settings

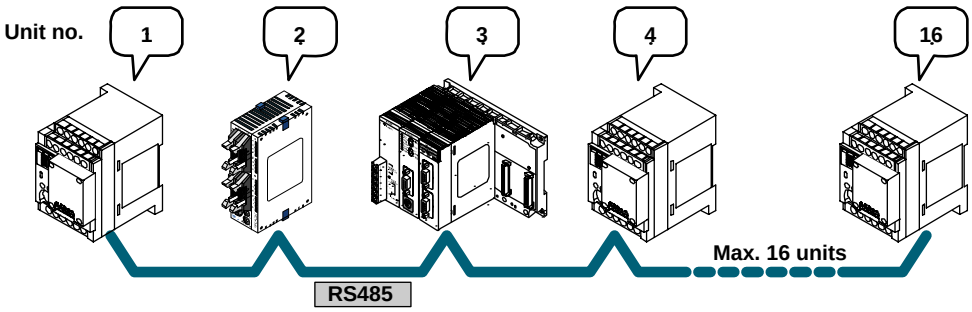
System register	Function	Set Value	
413	Communication format, COM1	Data length:	8 bits
		Parity check:	Odd
		Stop bit:	1 bit
		Terminator:	CR
		Header:	No STX
415	Baud rate, COM1	115200 bps	

Terminal unit

Set the dip switch on the back of the cassettes AFPX-COM3 (see page 36) or AFPX-COM4 (see page 37) to designate them as the terminal unit.

Setting unit numbers

In a PLC link that connects multiple PLCs on the same transmission line, the unit number must be set in order to identify the different PLCs. The same number must not be used for more than one PLC on the same network.



By default, the unit number for the communication port is set to 1 in the system registers. Specify the unit number either by using the SYS1 instruction or the system register.

◆ NOTES

- **The priority order for unit number settings is as follows:**
  1. SYS1 instruction
  2. System registers
- **Unit numbers should be set sequentially and consecutively, starting from 1, with no breaks between them. If there is a missing unit number, the transmission time will be longer.**
- **If fewer than 16 units are linked, the transmission time can be shortened by setting the largest unit number in system register no. 47.**

- **When using PLC link with RS232C/RS422 communication, the maximum number of units is 2.**

7.4.2 Link Area Allocation

The link relays and link registers to be used in the PLC link are allocated in the link area of the CPU unit. Specify the link area allocations by using the system registers of the CPU unit.

System registers

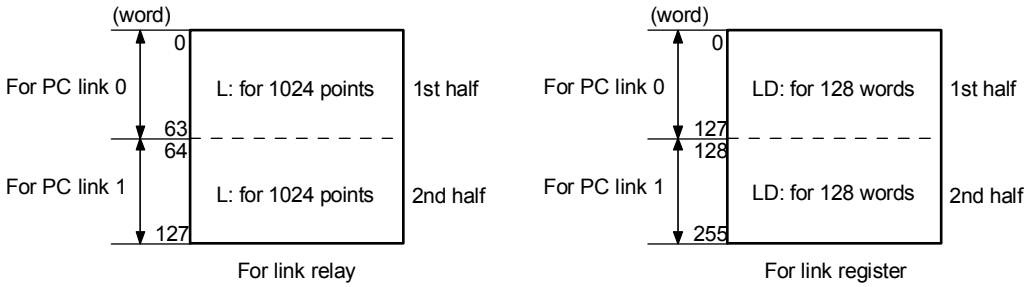
No.		Name	Default value	Set value
For PLC link 0	40	Range of link relays used for PLC link	0	0 to 64 words
	41	Range of link data registers used for PLC link	0	0 to 128 words
	42	Starting number for link relay transmission	0	0 to 63
	43	Link relay transmission size	0	0 to 64 words
	44	Starting number for link data register tranmission	0	0 to 127
	45	Link data register transmission size	0	0 to 128 words
	46	PLC link switch flag	Normal	Normal: 1st half Reverse: 2nd half
	47	Maximum unit number setting for MEWNET-W0 PLC link	16	1 to 16 (see note)
For PLC link 1	46	PLC link switch flag	Normal	Normal: 1st half Reverse: 2nd half
	50	Range of link relays used for PLC link	0	0 to 64 words
	51	Range of link data registers used for PLC link	0	0 to 128 words
	52	Starting number for link relay transmission	64	64 to 127
	53	Link relay transmission size	0	0 to 64 words
	54	Starting number for link data register tranmission	128	128 to 255
	55	Link data register transmission size	0	0 to 128 words
	57	Maximum unit number setting for MEWNET-W0 PLC link	0	0 to 16 (see note)

◆ NOTE

The same maximum unit number should be specified for all the PLCs connected in the PLC link.

Link area configuration

Link areas consist of link relays and link registers, and are divided into areas for PLC link 0 and PLC link 1. A maximum of 1024 link relays (points) and 128 link registers (words) can be used in the PLC link areas.



PLC link 1 can be used, for example, to connect with the second PLC link W0 of the FP2 Multi-Communication Unit (MCU). Then the link relay number (from WL64) and link register number (from LD128) for the PLC link can have the same values as the FP2 .

◆ **REFERENCE**

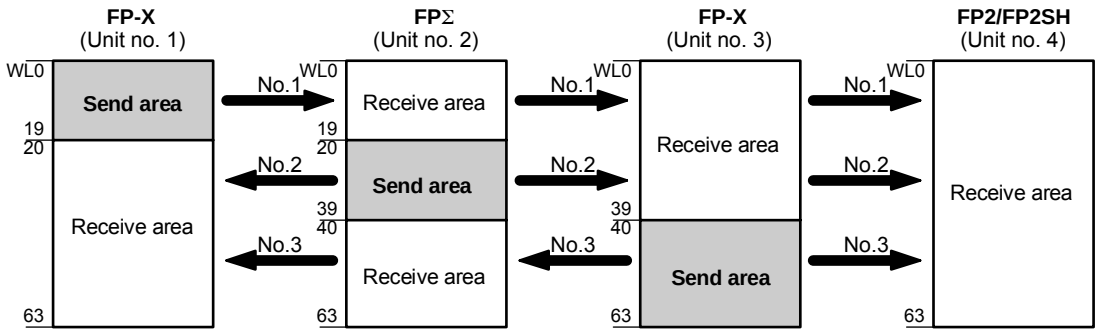
Please refer to the FP2 Multi-Communication Unit Technical Manual for more details.

7.4.3 PLC Link Area Allocation Examples

The areas for PLC link are divided into send areas and receive areas. The link relays and link registers are sent from the send area to the receive area of a different PLC. Link relays and link registers with the same numbers as those on the transmission side must exist in the receive area on the receiving side.

For PLC link 0

Link relay allocation



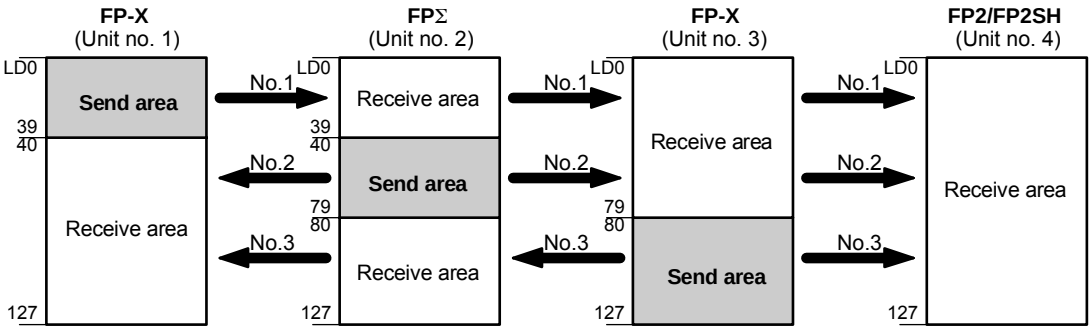
System registers

No.	Name	Setting for various units			
		No. 1	No. 2	No. 3	No. 4
40	Range of link relays used	64	64	64	64
42	Starting No. of word for link relay transmission	0	20	40	0
43	Link relay transmission size	20	20	24	0

◆ NOTE

System register no. 40 (range of link relays used) must be set to the same range for all units.

Link register allocation



System registers

No.	Name	Setting for various units			
		No. 1	No. 2	No. 3	No. 4
41	Range of link registers used	128	128	128	128
44	Starting No. for link register transmission	0	40	80	0
45	Link register transmission size	40	40	48	0

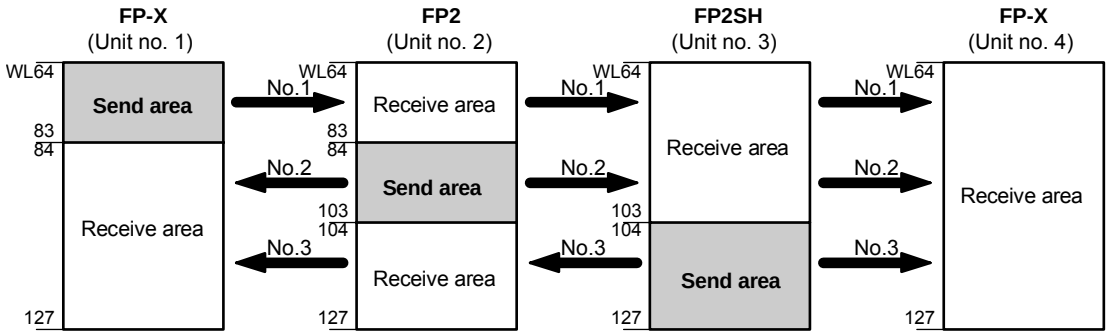
◆ NOTE

System register no. 41 (range of link relays used) must be set to the same range for all units.

When link areas are allocated as shown above, the No. 1 send area can be sent to the No. 2, No. 3 and No. 4 receive areas. Also, the No. 1 receive area can receive data from the No. 2 and No. 3 send areas. No. 4 is allocated as a receive area only, and can receive data from No. 1, No. 2 and No. 3, but cannot transmit it to other stations.

For PLC link 1

Link relay allocation



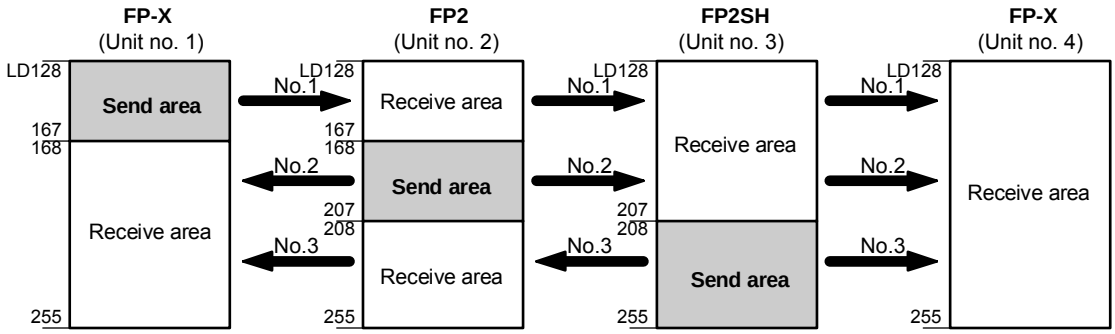
System registers

No.	Name	Setting for various units			
		No. 1	No. 2	No. 3	No. 4
50	Range of link relays used	64	64	64	64
52	Starting No. of word for link relay transmission	64	84	104	64
53	Link relay transmission size	20	20	24	0

◆ NOTE

System register no. 50 (range of link relays used) must be set to the same range for all units.

Link register allocation



System registers

No.	Name	Setting for various units			
		No. 1	No. 2	No. 3	No. 4
51	Range of link registers used	128	128	128	128
54	Starting No. for link register transmission	128	128	208	128
55	Link register transmission size	40	40	48	0

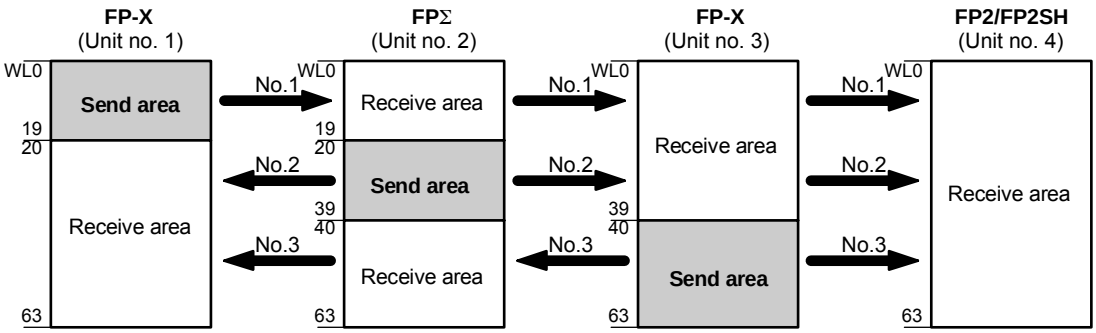
◆ NOTE

System register no. 50 (range of link relays used) must be set to the same range for all units.

When link areas are allocated as shown above, the No. 1 send area can be sent to the No. 2, No. 3 and No. 4 receive areas. Also, the No. 1 receive area can receive data from the No. 2 and No. 3 send areas. No. 4 is allocated as a receive area only, and can receive data from No. 1, No. 2 and No. 3, but cannot transmit it to other stations.

7.4.3.1 PLC Link Area 0 Allocation Example

Link relay allocation



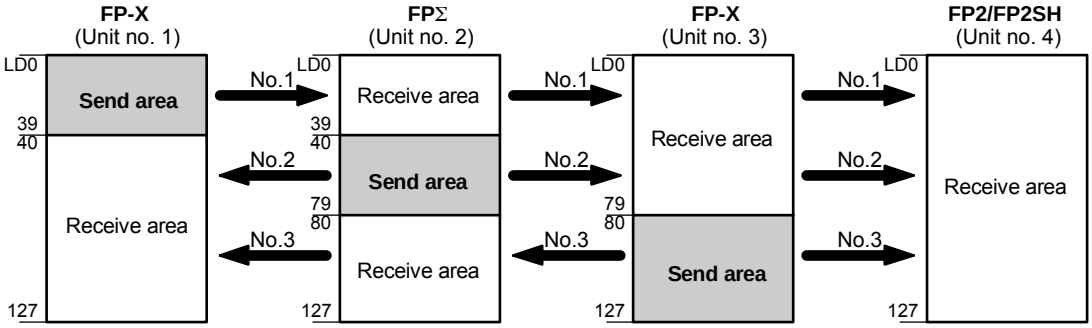
System registers

No.	Name	Setting for various units			
		No. 1	No. 2	No. 3	No. 4
40	Range of link relays used	64	64	64	64
42	Starting No. of word for link relay transmission	0	20	40	0
43	Link relay transmission size	20	20	24	0

◆ NOTE

System register no. 40 (range of link relays used) must be set to the same range for all units.

Link register allocation



System registers

No.	Name	Setting for various units			
		No. 1	No. 2	No. 3	No. 4
41	Range of link registers used	128	128	128	128
44	Starting No. for link register transmission	0	40	80	0
45	Link register transmission size	40	40	48	0

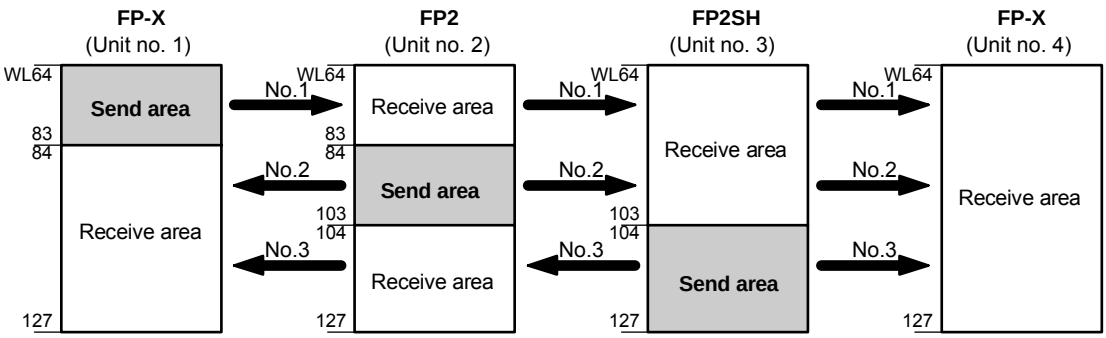
◆ NOTE

System register no. 41 (range of link relays used) must be set to the same range for all units.

When link areas are allocated as shown above, the No. 1 send area can be sent to the No. 2, No. 3 and No. 4 receive areas. Also, the No. 1 receive area can receive data from the No. 2 and No. 3 send areas. No. 4 is allocated as a receive area only, and can receive data from No. 1, No. 2 and No. 3, but cannot transmit it to other stations.

7.4.3.2 PLC Link Area 1 Allocation Example

Link relay allocation



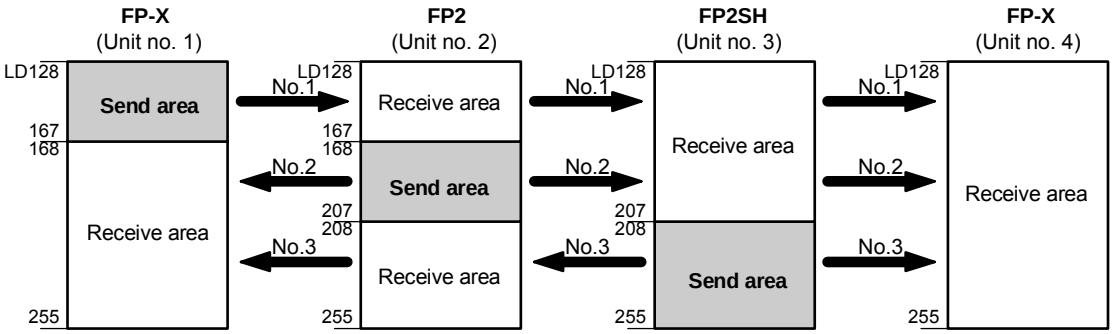
System registers

No.	Name	Setting for various units			
		No. 1	No. 2	No. 3	No. 4
50	Range of link relays used	64	64	64	64
52	Starting No. of word for link relay transmission	64	84	104	64
53	Link relay transmission size	20	20	24	0

◆ NOTE

System register no. 50 (range of link relays used) must be set to the same range for all units.

Link register allocation



System registers

No.	Name	Setting for various units			
		No. 1	No. 2	No. 3	No. 4
51	Range of link registers used	128	128	128	128
54	Starting No. for link register transmission	128	128	208	128
55	Link register transmission size	40	40	48	0

◆ NOTE

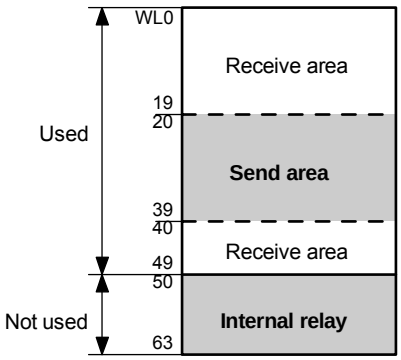
System register no. 50 (range of link registers used) must be set to the same range for all units.

When link areas are allocated as shown above, the No. 1 send area can be sent to the No. 2, No. 3 and No. 4 receive areas. Also, the No. 1 receive area can receive data from the No. 2 and No. 3 send areas. No. 4 is allocated as a receive area only, and can receive data from No. 1, No. 2 and No. 3, but cannot transmit it to other stations.

7.4.4 Partial Use of Link Areas

In the link areas available for PLC link, link relays with a total of 1,024 points (64 words) and link registers with a total of 128 words can be used. This does not mean, however, that it is necessary to reserve the entire area. Parts of the area which have not been reserved can be used as internal relays and internal registers.

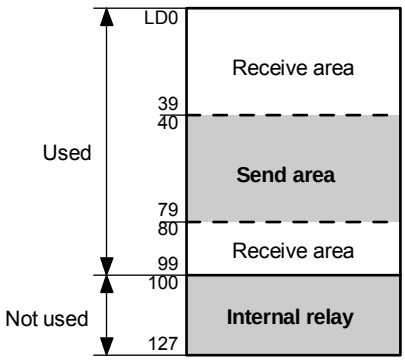
Link relay allocation



No.	Name	No. 1
No. 40	Range of link relays used for PLC link	50
No. 42	Start address of link relay send area	20
No. 43	Size of link relay send area	20

With the above settings, the 14 words (224 points) consisting of WL50 to WL63 can be used as internal relays.

Link register allocation



No.	Name	No. 1
No. 41	Range of link registers used for PLC link	100
No. 44	Start address of link register send area	40
No. 45	Size of link register send area	40

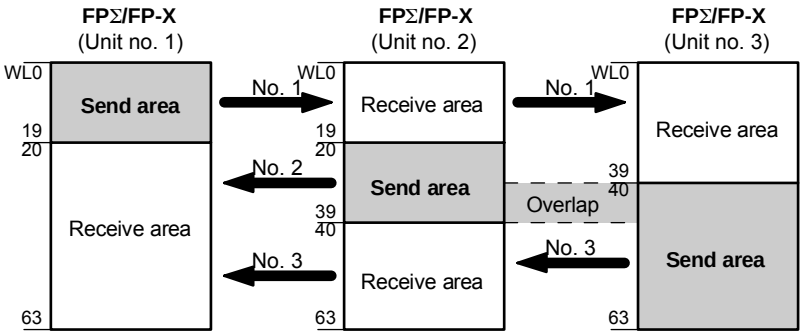
With the above settings, the 28 words consisting of LD100 to LD127 can be used as internal registers.

7.4.5 Precautions When Allocating Link Areas

A mistake in the link area allocation will cause an error, and communication will be disabled.

Avoid overlapping send areas

When sending data from the send area to the receive area of another PLC, send and receive areas must match. In the example shown below, there is an overlapping area between units no. 2 and 3, and this will cause an error, so that communication cannot be carried out.

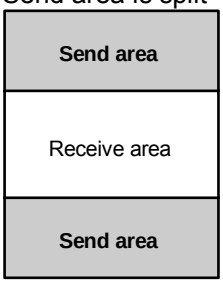


System register no.	Name	Set value of various control units		
		No. 1	No. 2	No. 3
No. 40	Range of link relays used for PLC link	64	64	64
No. 42	Start address of link relay send area	0	20	30
No. 43	Size of link relay send area	20	20	34

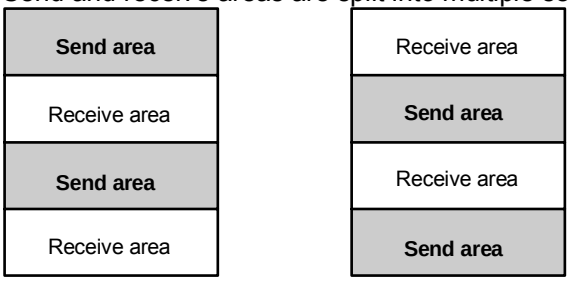
Invalid allocations

The allocations shown below are not possible, neither for link relays nor for link registers:

- Send area is split



- Send and receive areas are split into multiple segments



7.4.6 Setting the Largest Unit Number for a PLC Link

The largest station number can be set using system register no. 47.

Sample settings

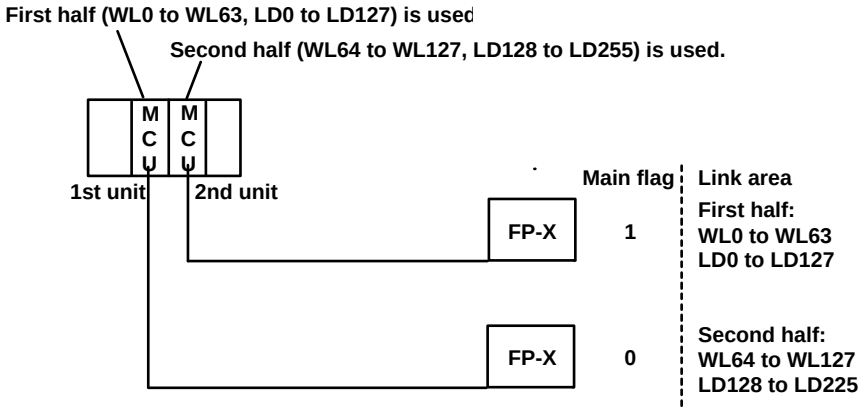
No. of units linked	Setting contents
2	1st unit: station no. 1 is set 2nd unit: station no. 2 is set A largest station no. of 2 is set for each.
4	1st unit: station no. 1 is set 2nd unit: station no. 2 is set 3rd unit: station no. 3 is set 4th unit: station no. 4 is set A largest station no. of 4 is set for each.
n	Nth unit: station no. n is set A largest station no. of N is set for each.

◆ NOTES

- **Station numbers should be set sequentially and consecutively, starting from 1, with no breaks between them. If there is a missing station number, the transmission time will be longer.**
- **If fewer than 16 units are linked, the transmission time can be shortened by setting the largest station number in system register no. 47 for PLC link 0 or system register no. 57 for PLC Link 1.**
- **For all PLCs which are linked, the same value should be set for the largest station number.**
- **If there are fewer than 16 units linked and the largest station number has not been set (default = 16), or the largest station number has been set but the station number settings are not consecutive, or the station number settings are consecutive but there is a station for which the power supply has not been turned on, the response time for the PLC link (the link transmission cycle) will be longer (see "PLC Link Response Time" on page 148).**

7.4.7 Setting the PLC Link Switching Flag

Set the PLC link switching flag with system register no. 46. If it is set to 0 (default value), the first half of the link relays and registers are used. If it is set to 1, the second half of the link relays and registers are used.



7.4.8 Monitoring

When using a PLC link, the operation status of the links can be monitored using the following relays.

Transmission assurance relays

- For PLC link 0: R9060 to R906F (correspond to station nos. 1 to 16)
- For PLC link 1: R9070 to R907F (correspond to station nos. 1 to 16)

If the transmission data from a different station is being used with the various PLCs, check to make sure the transmission assurance relay for the target station is on before using the data.

Relay no.	Station no.	Conditions for on/off
R9060	1	ON: • if the PLC link is normal OFF: • if transmission has been stopped, or • if a problem has occurred, or • if a PLC link is not being used
R9061	2	
R9062	3	
R9063	4	
R9064	5	
R9065	6	
R9066	7	
R9067	8	
R9068	9	
R9069	10	
R906A	11	
R906B	12	
R906C	13	
R906D	14	
R906E	15	
R906F	16	

Operation mode relays

- For PLC link 0: R9070 to R907F (correspond to station nos. 1 to 16)
- For PLC link 1: R9080 to R908F (correspond to station nos. 1 to 16)

The operation modes (RUN/PROG.) can be checked for any given PLC.

Relay no.	Station no.	Conditions for on/off
R9070	1	ON: • if the unit is in RUN mode OFF: • if the unit is in PROG mode
R9071	2	
R9072	3	
R9073	4	
R9074	5	
R9075	6	
R9076	7	
R9077	8	
R9078	9	
R9079	10	
R907A	11	
R907B	12	
R907C	13	
R907D	14	
R907E	15	
R907F	16	

PLC link transmission error relay R9050 (link 1)

This relay goes on if a problem is detected during transmission.

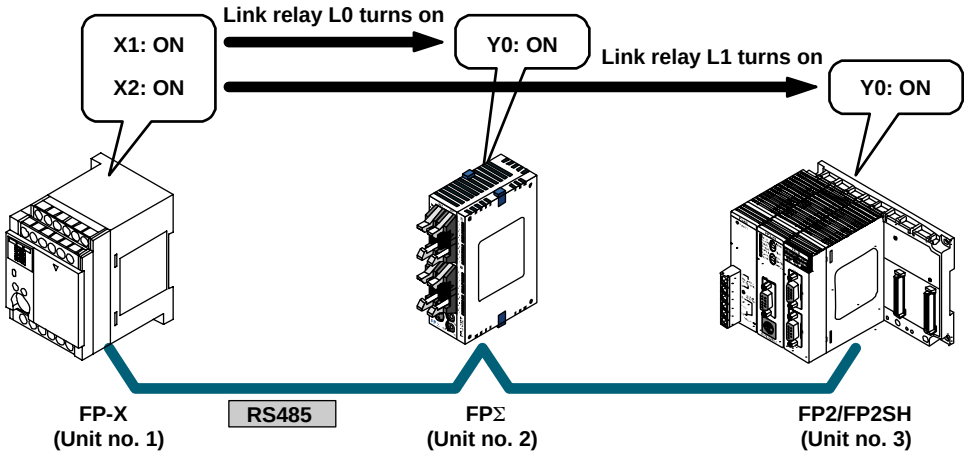
Relay no.	Station no.	Conditions for on/off
R9050	1	ON: • if a transmission error has occurred in the PLC link, or • if an error has occurred in the setting of the PLC link area OFF: • if there are no transmission errors
	2	
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	10	
	11	
	12	
	13	
	14	
	15	
	16	

◆ NOTES

- **Use your programming tool's monitoring function to monitor PLC link status items, such as the transmission cycle time and the number of times that errors have occurred.**
- **Remote programming of other linked PLCs is not possible.**

7.4.9 PLC Link Connection Example

The following example demonstrates how the PLC can be connected to two other PLCs using a PLC link connection. In the example shown here, link relays are used. When X1 of control unit no. 1 turns on, Y1 of unit no. 2 turns on. When X2 of unit no. 1 turns on, Y1 of unit no. 3 turns on.



System register settings for transmission format and baud rate (see page 130)

Set communication mode and unit numbers using the system registers:

Settings for unit no. 1

No.	Name	Set value
No. 410	COM port 1 unit no.	1
No. 412	COM port 1 selection of communication mode	PLC link

Settings for unit no. 2

No.	Name	Set value
No. 410	COM port 1 unit no.	2
No. 412	COM port 1 selection of communication mode	PLC link

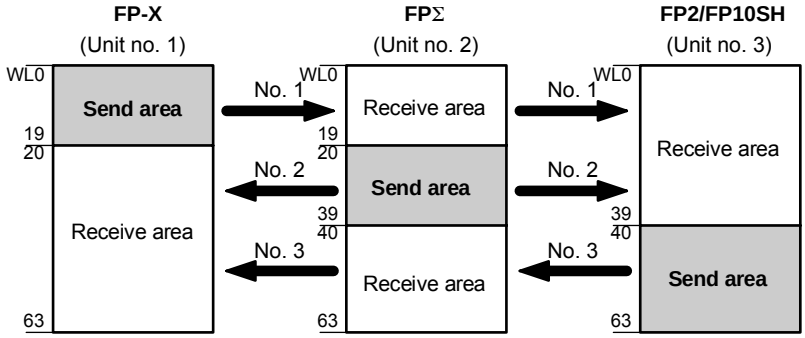
Settings for unit no. 3

Name	Set value
COM port 1 unit no.	3 (Set using the unit no. setting switch)
COM port 1 selection of communication mode	PLC link (Set using the mode speed setting switch)

◆ NOTES

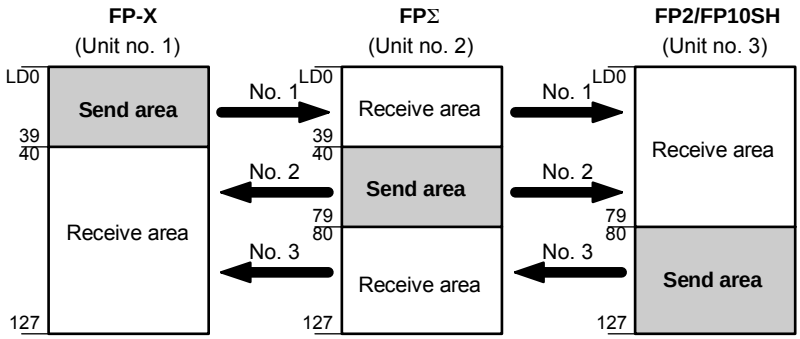
- **Make sure the same unit number is not used for more than one of the PLCs connected via the PLC link function.**
- **Specify consecutive numbers.**

Link area allocation



System register no.	Name	Set value of various control units		
		No. 1	No. 2	No. 3
No. 40	Range of link relays used for PLC link	64	64	64
No. 42	Start address of link relay send area	0	20	40
No. 43	Size of link relay send area	20	20	24

Link register allocation



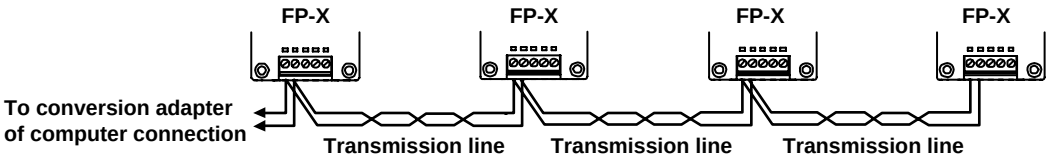
System register no.	Name	Set value of various control units		
		No. 1	No. 2	No. 3
No. 41	Range of link registers used for PLC link	128	128	128
No. 44	Start address of link register send area	0	40	80
No. 45	Size of link register send area	40	40	48

Setting the largest station number

No.	Name	Set value of various control unit		
		No. 1	No. 2	No. 3
No. 47	Largest station number setting for PLC link	3	3	3

Terminal unit

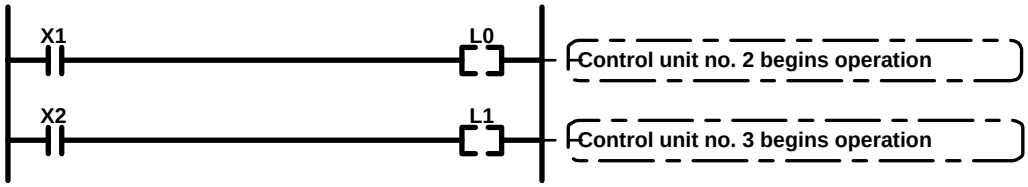
Set the dip switch on the back of the cassettes AFPX-COM3 (see page 36) or AFPX-COM4 (see page 37) to designate them as the terminal unit.



Programs

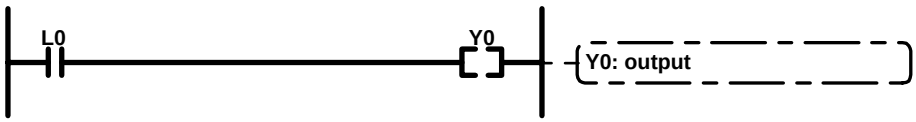
Unit no. 1

When X1 is input, L0 of the link relay goes on, and when X2 is input, L1 of the link relay goes on.



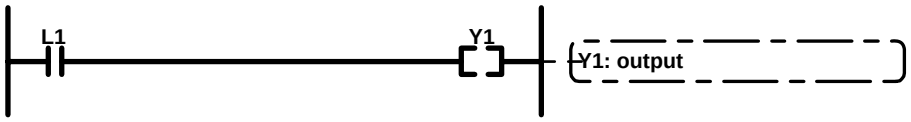
Unit no. 2

When L0 of the link relay goes on, Y0 is output.



Unit no. 3

When L1 of the link relay goes on, Y1 is output.



◆ NOTE

If you are using FPWIN Pro Ver. 4.1 or higher and wish to use the addresses LD or LE, please enter "L0D" or "L0E" to avoid error messages during compilation. The errors arise due to hexadecimal conflicts with the commands Load (LD) or Less Than or Equal To (LE).

7.4.10 PLC Link Response Time

The maximum value for the transmission time (T) of one cycle can be calculated using the following formula.

$$T\ max. = \underbrace{Ts1 + Ts2 + \cdots + Tsn}_{①} + \underline{Tlt} + \underline{Tso} + \underline{Tlk}$$

② ③ ④

① Ts (transmission time per station)

② Tlt (link table sending time)

③ Tso (master station scan time)

④ Tlk (link addition processing time)

① Ts (transmission time per station)

Ts = scan time + Tpc (PLC link sending time)
Tpc = Ttx (sending time per byte) x Pcm (PLC link sending size)
Ttx = 1 / transmission speed x 1000 x 11 ms --- approx. 0.096 ms at 115.2 kbps
Pcm = 23 + (number of relay words + number of register words) x 4

② Tlt (link table sending time)

Tlt = Ttx (sending time per byte) x Ltm (link table sending size)
Ttx = 1 / transmission speed x 1000 x 11 ms --- approx. 0.096 ms at 115.2 kbps
Ltm = 13 + 2 x n (n = number of stations being added)

③ Tso (master station scan time)

This should be confirmed using the programming tool.

④ Tlk (link addition processing time) --- If no stations are being added, Tlk = 0.

Tlk = Tlc (link addition command sending time) + Twt (addition waiting time) + Tls (sending time for command to stop transmission if link error occurs) + Tso (master station scan time)
Tlc = 10 x Ttx (sending time per byte)
Ttx = 1 / transmission speed x 1000 x 11 ms --- approx. 0.096 ms at 115.2 kbps
Twt = Initial value 400 ms (can be changed using SYS1 system register instruction)
Tls = 7 x Ttx (sending time per byte)
Ttx = 1 / transmission speed x 1000 x 11 ms --- approx. 0.096 ms at 115.2 kbps
Tso = Master station scan time

Calculation example 1

When all stations have been added to a 16-unit link, the largest station number is 16, relays and registers have been evenly allocated, and the scan time for each PLC is 1 ms

Ttx = 0.096 Each Pcm = 23 + (4 + 8) x 4 = 71 Tpc = Ttx x Pcm = 0.096 x 71 ≈ 6.82 ms

Each Ts = 1 + 6.82 = 7.82 ms Tlt = 0.096 x (13 + 2 x 16) = 4.32 ms

Given the above conditions, the maximum value for the transmission time (T) of one cycle will be:

T max. = 7.82 x 16 + 4.32 + 1 = 130.44 ms

Calculation example 2

When all stations have been added to a 16-unit link, the largest station number is 16, relays and registers have been evenly allocated, and the scan time for each PLC is 5 ms

Ttx = 0.096 Each Pcm = 23 + (4 + 8) x 4 = 71 Tpc = Ttx x Pcm = 0.096 x 71 ≈ 6.82 ms

Each Ts = 5 + 6.82 = 11.82 ms Tlt = 0.096 x (13 + 2 x 16) = 4.32 ms

Given the above conditions, the maximum value for the transmission time (T) of one cycle will be:

T max. = 11.82 x 16 + 4.32 + 5 = 198.44 ms

Calculation example 3

When all but one station have been added to a 16-unit link, the largest station number is 16, relays and registers have been allocated evenly, and the scan time for each PLC is 5 ms

Ttx = 0.096 Each Ts = 5 + 6.82 = 11.82 ms Tlt = 0.096 x (13 + 2 x 15) ≈ 4.31 ms

Tlk = 0.96 + 400 + 0.67 + 5 ≈ 407 ms

Note: The default value for the addition waiting time is 400 ms.

Given the above conditions, the maximum value for the transmission time (T) of one cycle will be:

T max. = 11.82 x 15 + 4.13 + 5 + 407 = 593.43 ms

Calculation example 4

When all stations have been added to an 8-unit link, the largest station number is 8, relays and registers have been evenly allocated, and the scan time for each PLC is 5 ms

Ttx = 0.096 Each Pcm = 23 + (8 + 16) x 4 = 119 Tpc = Ttx x Pcm = 0.096 x 119 ≈ 11.43 ms

Each Ts = 5 + 11.43 = 16.43 ms Tlt = 0.096 x (13 + 2 x 8) ≈ 2.79 ms

Given the above conditions, the maximum value for the transmission time (T) of one cycle will be:

T max. = 16.43 x 8 + 2.79 + 5 = 139.23 ms

Calculation example 5

When all stations have been added to a 2-unit link, the largest station number is 2, relays and registers have been evenly allocated, and the scan time for each PLC is 5 ms

Ttx = 0.096 Each Pcm = 23 + (32 + 64) x 4 = 407 Tpc = Ttx x Pcm = 0.096 x 407 ≈ 39.072 ms

Each Ts = 5 + 39.072 = 44.072 ms Tlt = 0.096 x (13 + 2 x 2) ≈ 1.632 ms

Given the above conditions, the maximum value for the transmission time (T) of one cycle will be:

T max. = 44.072 x 2 + 1.632 + 5 = 94.776 ms

Calculation example 6

When all stations have been added to a 2-unit link, the largest station number is 2, 32 relays and 2 register words have been evenly allocated, and the scan time for each PLC is 1 ms

Ttx = 0.096 Each Pcm = 23 + (1 + 1) x 4 = 31 Tpc = Ttx x Pcm = 0.096 x 31 ≈ 2.976 ms

Each Ts = 1 + 2.976 = 3.976 ms Tlt = 0.096 x (13 + 2 x 2) ≈ 1.632 ms

Given the above conditions, the maximum value for the transmission time (T) of one cycle will be:

T max. = 3.976 x 2 + 1.632 + 1 = 10.584 ms

◆ NOTES

- **In the description, "stations that have been added" refers to stations which are connected between station no. 1 and the largest station number and for which the power supply has been turned on.**
- **Comparing examples 2 and 3, the transmission cycle time is longer if there is one station that has not been added to the link. As a result the PLC link response time is longer.**
- **The SYS1 instruction can be used to minimize the transmission cycle time even if there are one or more stations that have not been added to the link.**

7.4.10.1 Reducing the Transmission Cycle Time

If there are stations that have not been added to the link, the Tlk time (link addition processing time) and with this the transmission cycle time will be longer.

T max. = Ts1 + Ts2 +• • • • • • • + Tsn + Tlt + Tso + Tlk

Tlk = Tlc (link addition command sending time) + Twt (addition waiting time) +
Tls (link error stop command sending time) + Tso (master station scan time)

With the SYS1 instruction, the link addition waiting time Twt in the above formula can be reduced. Thus, SYS1 can be used to minimize the increase in the transmission cycle time.

◆ REFERENCE

You can find a programming example in the the FPWIN Pro online help or the FPΣ User's Manual. You can download the PDF file for this and other manuals from our website free of charge.

◆ NOTES

- **If there are any stations that have not been added to the link, the setting should not be changed as long as a longer link transmission cycle time does not cause any problems.**
- **The SYS1 instruction should be executed at the beginning of the program, at the rise of R9014. The same waiting time should be set for all linked PLCs.**
- **The waiting time should be set to a value of at least twice the maximum scan time for any of the PLCs connected to the link.**
- **If a short waiting time has been set, there may be PLCs that cannot be added to the link even if their power supply is on. (The shortest time that can be set is 10 ms.)**

7.4.10.2 Error Detection Time for Transmission Assurance Relays

If the power supply of any given PLC fails or is turned off, it takes (as a default value) 6.4 seconds for the transmission assurance relay of that PLC to be turned off at the other stations. This time period can be shortened using the SYS1 instruction.

◆ REFERENCE

You can find a programming example in the the FPWIN Pro online help or the FPΣ User's Manual. You can download the PDF file for this and other manuals from our website free of charge.

◆ NOTES

- **The setting should not be changed as long as a longer transmission assurance relay detection time does not cause any problems.**
- **The SYS1 instruction should be executed at the beginning of the program, at the rise of R9014. The same time should be set for all linked PLCs.**
- **The time should be set to a value of at least twice the maximum transmission cycle time when all of the PLCs are connected to the link.**
- **If a short time has been set, the transmission assurance relay may not function properly. (The shortest time that can be set is 100 ms.)**

7.5 Modbus RTU Communication

The Modbus RTU protocol enables:

- communication between the FP-X and other devices, e.g. our FP-e, GT series programmable display units and KT temperature control units.
- conversations if the master unit sends instructions (command messages) to slave units and the slave units respond (response messages) according to the instructions.
- communication among up to 99 units.

The communication cassette and the USB port can be used.

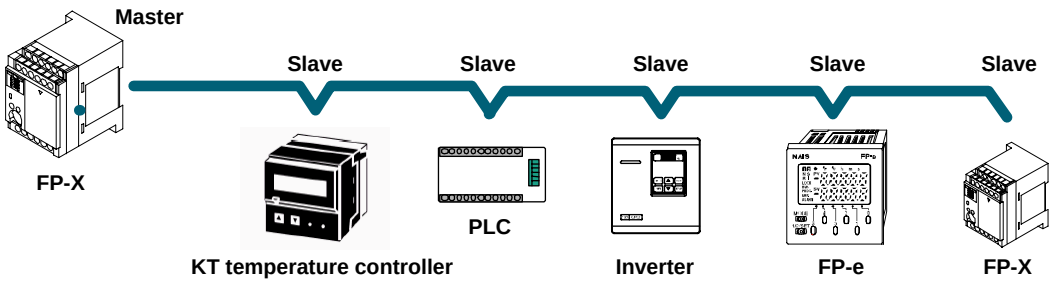
Modbus RTU communication allows a master unit to read data from and write data to slave units.

◆ NOTE

FP-X only supports the RTU binary mode, even though Modbus protocol supports both ASCII mode and RTU binary mode.

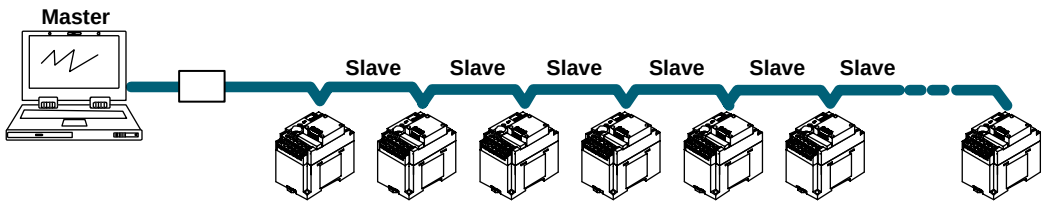
Master function

Writing and reading data for various slaves is available using the F145 (SEND) and F146 (RECV) instructions. The master can access each slave individually; global transmission is also possible.



Slave function

If the slave units receive a command message from the master unit, it responds accordingly. Do not execute the F145 (SEND) or F146 (RECV) instructions if the unit is used as a slave unit.



MODBUS RTU command message frame

START	ADDRESS	FUNCTION	DATA	CRC CHECK	END
3.5-character time	8 bits	8 bits	n*8 bits	16 bits	3.5-character time

ADDRESS (Unit no.)	8 bits, 0 to 99 (decimal) • 0 = Broadcast address • Slave unit no. is 1 to 99 (decimal) • For Modbus, 0 to 247 (decimal)
FUNCTION	8 bits
DATA	Varies depending on the commands.
CRC	16 bits
END	3.5-character time (differs depending on baud rate. Refer to "Reception done judgment time".)

Response in normal status

The same message as a command is returned for a single write command.

A part of a command message (6 bytes from the beginning) is returned for a multiple write command.

Response in abnormal status

If a parameter which is to be processed but is disabled is found in a command (except for a transmission error):

Slave address (unit number) Function code + 80H Error code CRC	1, 2 or 3

Error code contents

1: Function code error
2: Device number error (out of range)
3: Device quantity error (out of range)

Reception done judgment time

The process for receiving a message is complete after all data has been received and the time given in this table has been reached.

Baud rate	Reception done judgment time
2400	Approx. 13.3 ms
4800	Approx. 6.7 ms
9600	Approx. 3.3 ms
19200	Approx. 1.7 ms
38400	Approx. 0.8 ms
57600	Approx. 0.6 ms
115200	Approx. 0.3 ms

Supported commands

Executable instructions for master	Code (decimal)	Name (MODBUS original)	Name for FP-X	Remarks (Reference No.)
F146 (RECV)	01	Read Coil Status	Read Y and R Coils	0X
F146 (RECV)	02	Read Input Status	Read X Input	1X
F146 (RECV)	03	Read Holding Registers	Read DT	4X
F146 (RECV)	04	Read Input Registers	Read WL and LD	3X
F145 (SEND)	05	Force Single Coil	Write Single Y and R	0X
F145 (SEND)	06	Preset Single Register	Write DT 1 Word	4X
Cannot be issued	08	Diagnostics	Loopback Test	
F145 (SEND)	15	Force Multiple Coils	Write Multiple Ys and Rs	0X
F145 (SEND)	16	Preset Multiple Registers	Write DT Multiple Words	4X
Not supported	20	Read General Reference	Read FL	6X
Not supported	20	Write General Reference	Write FL	6X
Cannot be issued	22	Mask Write 4X Register	Write DT Mask	4X
Cannot be issued	23	Read/Write 4X Registers	Read/Write DT	4X

◆ NOTE

The items in the shaded area of the table body are not supported by the FP-X.

Modbus reference no. and the FP-X device no.

Device name		Reference No.		
Modbus	**FP-X**	**Modbus**	**FP-X (decimal)**	**FP-X (hexadecimal)**
Coil	Y	000001 to 002048	0 to 2047	0 to 7FF
Coil	R	002049 to 009999	2048 to 9998	800 to 270E
Input	X	100001 to 109999	0 to 9998	0 to 270E
Holding register	DT	400001 to 432765	0 to 32764	0 to 27FFC
Input register	WL	300001 to 300128	0 to 127	0 to 7F
Input register	LD	302001 to 302256	2000 to 2255	7D0 to 8CF

◆ REFERENCE

For details on Modbus settings and communication using the F145 and F146 commands, please refer to your programming tool's online help.

Chapter 8

High-Speed Counter and Pulse Output

8.1 Overview

The **main unit** can count pulses using inputs X0 to X7 (single-phase 8 channels, 2-phase 4 channels).

The **pulse I/O cassette** (AFPX-PLS) can:

- count pulses (high-speed counter)
- execute the pulse and PWM output.

One pulse I/O cassette (AFPX-PLS) can count single-phase 2-channel or 2-phase 1-channel. 1-channel pulse output is also available.

The pulse I/O cassette can count faster pulses than the main unit's input.

Number of Channels

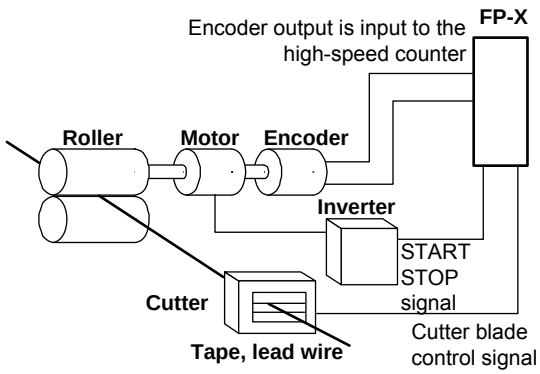
		High-speed counter	Pulse output
Built into control unit		Single-phase 8 channels or 2-phase 4 channels	None
Pulse I/O cassette (AFPX-PLS)	**When using C30/C60 (see note)**	Max. single-phase 4 channels and 2-phase 2 channels	Max. 2 channels
	When using C14 (see note)	Single-phase 2 channels or 2-phase 1 channel	1 channel

◆ NOTE

When one cassette is added to C14 or 2 units are added to C30 and C60.

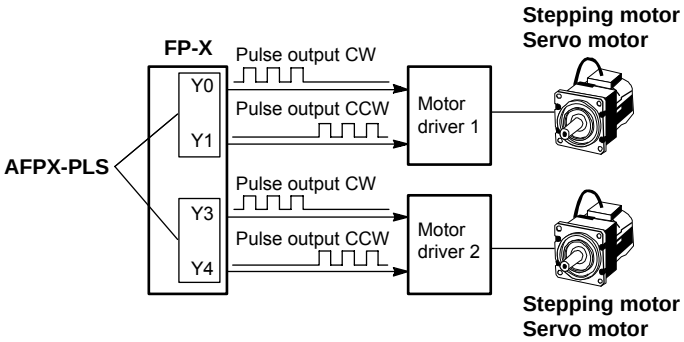
High-speed counter function

The high-speed counter function counts external inputs such as those from sensors or encoders. When the count reaches the target value, this function turns the desired output on or off.



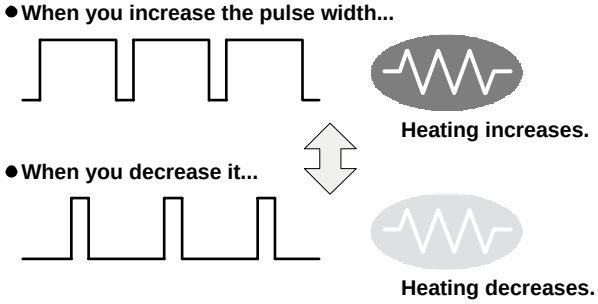
Pulse output function

By connecting a commercially available motor driver to the PLC, positioning control can be performed with the pulse output function. Using special instructions, trapezoidal control, home return, or JOG operation is possible.



PWM output function

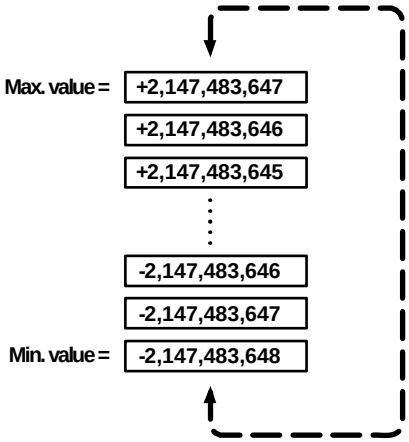
A special instruction makes it possible to output pulses with a specified duty ratio.



Counting range

The counting range of the built-in high-speed counter is from -2,147,483,648 to 2,147,483,647 (coded 32-bit binary).

The high-speed counter is a ring counter. Consequently, if the counted value exceeds the maximum value, the counter returns to the minimum value. Similarly, if the counted value drops below the minimum value, the counter goes back to the maximum value and continues counting from there.



◆ NOTE

When the linear interpolation instruction F175_SPSH is used, the value for the target value or the amount of travel should be set so that it is within the range of -8,388,608 to +8,388,607 (coded 24-bit binary).

Allocation of I/O numbers for the pulse I/O cassette

Use the programming tool to make allocation settings, as indicated in this table.

Notation in the tool	Cassette mounting part 1	Cassette mounting part 2
X0 to X5	X100 to X105	X200 to X205
Y0 to Y5	Y100 to Y105	Y200 to Y205

8.2 Function Specifications and Restrictions

This section contains the specifications and restrictions of the functions using the high-speed counter.

8.2.1 High-Speed Counter Specifications

High-speed counter via the input of the main unit

Channel no.		Input contact	Memory area being used			Performance specifications	
			Control flag	Elapsed value area	Target value area	Min. input pulse width (see page 166)	Max. counting speed
[1-phase] Incremental, decremental	CH0	X0	R9110	DT90300 DT90301	DT90302 DT90303	50µs	10kHz
	CH1	X1	R9111	DT90304 DT90305	DT90306 DT90307		
	CH2	X2	R9112	DT90308 DT90309	DT90310 DT90311		
	CH3	X3	R9113	DT90312 DT90313	DT90314 DT90315		
	CH4	X4	R9114	DT90316 DT90317	DT90318 DT90319		
	CH5	X5	R9115	DT90320 DT90321	DT90322 DT90323		
	CH6	X6	R9116	DT90324 DT90325	DT90326 DT90327		
	CH7	X7	R9117	DT90328 DT90329	DT90330 DT90331		
[2-phase] 2-phase input One input	CH0	X0 X1	R9110	DT90300 DT90301	DT90302 DT90303	100 µs	5 kHz
	CH2	X2 X3	R9112	DT90308 DT90309	DT90310 DT90311		
	CH4	X4 X5	R9114	DT90316 DT90317	DT90318 DT90319		
	CH6	X6 X7	R9116	DT90324 DT90325	DT90326 DT90327		

Related instructions:

F0 (MV): High-speed counter control

F1 (DMV): Read/write of elapsed value of high-speed counter

F166 (HC1S): Target value match on

F167 (CH1R): Target value match off

High-speed counter when using pulse I/O cassette (AFPX-PLS)

Channel No.		Input contact (see note 1)	Memory area being used			Performance specifications	
			Control flag	Elapsed value area	Target value area	Min. input pulse width (see page 166)	Max. counting speed
[1-phase] Incremental, decremental	CH8	X100 (X102)	R9118	DT90332 DT90333	DT90334 DT90335	6,25µs (100µs)	1-phase 2 channels: 80kHz 1-phase 4 channels: 50kHz
	CH9	X101 (X102)	R9119	DT90336 DT90337	DT90338 DT90339		
	CHA (see note s)	X200 (X202)	R911A	DT90340 DT90341	DT90342 DT90343		
	CHB (see note s)	X201 (X202)	R911B	DT90345 DT90346	DT90347 DT90348		
[2-phase] 2-phase input One input Direction distinction	CH8	X100 X101 (X102)	R9118	DT90332 DT90333	DT90334 DT90335	16,7µs (100µs)	2-phase 1 channel: 30kHz 2-phase 2 channels: 25kHz
	CHA (see note s)	X200 X201 (X202)	R911A	DT90340 DT90341	DT90342 DT90343		

Related instructions:

F0 (MV): High-speed counter control

F1 (DMV): Read/write of elapsed value of high-speed counter

F166 (HC1S): Target value match on

F167 (CH1R): Target value match off

◆ NOTES

1. **The values in parentheses are for the reset input. The reset input X102 can be set to either CH8 or CH9. The reset input X202 can be set to either CHA or CHB.**

2. **CHA/CHB can be used when 2 units of AFPX-PLS are installed.**

8.2.2 Pulse Output Specifications

Pulse output when using the pulse I/O cassette (AFPX-PLS)

High-speed counter channel no.		Input/output contact number used.					Memory area used.		
		CW or pulse output	CCW or direction output	Deviation counter clear output	Home input	Near home input	Control flag	Elapsed value area	Target value area
No interpolation	CH0	Y100	Y101	Y102	Y102	DT90052 <bit4>	R911C	DT90348 DT90349	DT90350 DT90351
	CH1	Y200	Y201	Y202	Y202	DT90052 <bit4>	R911D	DT90352 DT90353	DT90354 DT90355
Interpolation	Linear	Y100 Y200	Y101 Y201	Y102 Y202	Y102 Y202	DT90052 <bit4>	R911C R911D	DT90348 DT90349 DT90352 DT90353	DT90350 DT90351 DT90354 DT90355

Max. output frequency:
- Using one ch: Max. 100 kHz
- Using two chs: Max. 80 kHz

Related instructions:
F0 (MV): high-speed counter control
F1 (DMV): Read/write of elapsed value of high-speed counter
F171 (SPDH): trapezoidal control/home return
F172 (PLSH): JOG operation
F174 (SP0H): Data table control
F175 (SPSH) :Linear interpolation control

◆ NOTES

- **For linear interpolation, the home return operation of the interpolation axes should be performed for every channel.**
- **For information on writing to DT90052 (see "Writing Channel Data and Control Code to DT90052" on page 175).**

8.2.3 Pulse Width Modulation Specifications

PWM output when using pulse I/O cassette (AFPX-PLS)

High-speed counter channel no.	Output contact no. used	Memory area used	Output frequency (duty)	Related instructions
		Control flag		
CH0	Y100	R911C	• When resolution = 1000, 1.5Hz to 12.5kHz (0.0 to 99.9%) • When resolution = 100, 15.6kHz to 41.7kHz (0 to 99%)	• F0 (MV), High-speed counter control • F1 (DMV), Read/write of elapsed value of high-speed counter • F173 (PWMH), PWM output
CH1	Y200	R911D		

8.2.4 Functions Used and Restrictions

High-speed counter built in the control unit

2-phase		Single-phase	
No. of channels	Max. frequency	No. of channels	Max. frequency
0	–	1	10kHz
0	–	2	10kHz
0	–	3	10kHz
0	–	4	10kHz
0	–	5	10kHz
0	–	6	10kHz
0	–	7	10kHz
0	–	8	10kHz
1	5kHz	0	10kHz
1	5kHz	1	10kHz
1	5kHz	2	10kHz
1	5kHz	3	10kHz
1	5kHz	4	10kHz
1	5kHz	5	10kHz
1	5kHz	6	10kHz
2	5kHz	0	10kHz
2	5kHz	1	10kHz
2	5kHz	2	10kHz
2	5kHz	3	10kHz
2	5kHz	4	10kHz
3	5kHz	0	10kHz
3	5kHz	1	10kHz
3	5kHz	2	10kHz
4	5kHz	0	–

Pulse I/O set (AFPX-PLS) high-speed counter

2-phase		Single-phase	
No. of channels	Max. frequency	No. of channels	Max. frequency
0	–	1	80 kHz
0	–	2	80 kHz
0	–	3	50 kHz
0	–	4	50 kHz
1	35 kHz	0	–
1	30 kHz	1	50 kHz
1	30 kHz	2	50 kHz
2	25 kHz	0	–

◆ NOTE

Conditions: when the duty is 50%, and the match on/off instruction is not used.

Restrictions on I/O allocations

- Various functions listed in the table of specifications cannot be allocated to one I/O at the same time.
- Except for the examples noted below, inputs and outputs that have been allocated to the various functions cannot be allocated as normal inputs and outputs.

Excepts (AFPX-PLS)

◆ EXAMPLE

If no reset input is used in the high-speed counter function, X102 and X202 can be used as normal inputs.

◆ EXAMPLE

If no output is used to clear the differential counter in the pulse output function, Y102 and Y202 can be used as normal outputs.

Restrictions on executing related instructions (F166 to F175)

- If an instruction related to the high-speed counter "F166 to F175" is executed, the control flag (special internal relay: R9110 to R911D) corresponding to the channel used turns on.
- Please be aware that the control flag "in progress" may change during a scan. To prevent multiple read access to this special internal relay, you should generate a copy of it at the beginning of the program.
- When the control flag for a channel turns on, no other instruction using that same channel can be executed.

8.2.5 Booting Time

The booting time is the time span from the execution of the instruction to the actual pulse output.

Type of instruction	Booting time	
Pulse output instruction F171_SPDH Trapezoidal control/home return	If CW/CCW is set:	approx.200 μs (with 30 steps) approx.400 μs (with 60 steps)
	If pulse/direction is set: (see note)	approx.500 μs (with 30 steps) approx.700 μs (with 60 steps)
Pulse output instruction F172_PLSH JOG operation	If CW/CCW is set:	approx. 20 μs
	If pulse/direction is set: (see note)	approx. 320 μs
Pulse output instruction F174_SP0H Data table control	If CW/CCW is set:	approx. 30 μs
	If pulse/direction is set: (see note)	approx. 330 μs
PWM output instruction F173_PWMH	Approx. 30 μs	

◆ NOTE

If pulse/direction is set, there is a waiting time (approx. 300 μs) between turning on the direction output and executing the pulse output instruction.

8.3 High-Speed Counter Function

The high-speed counter function counts the input signals and, when the target value is reached, turns on and off the desired output.

To turn on an output when the target value is reached, use the "target value match ON" (set) instruction F166 (HC1S). To turn off an output, use the "target value match OFF" (reset) instruction F167 (HC1R).

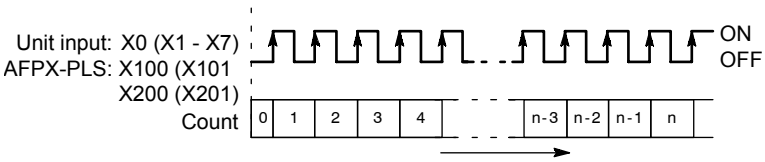
Preset the output to be turned on and off with the SET/RST instruction.

Setting the system registers

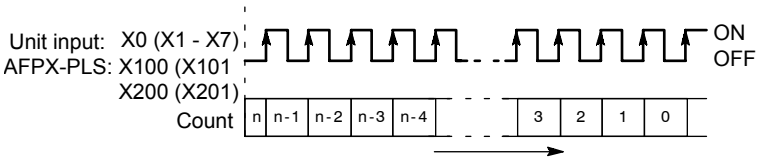
In order to use the high-speed counter function, you must set system register 402 for the input of the main unit and the system registers 400 and 401 for the pulse I/O cassette.

8.3.1 Input and Count Modes

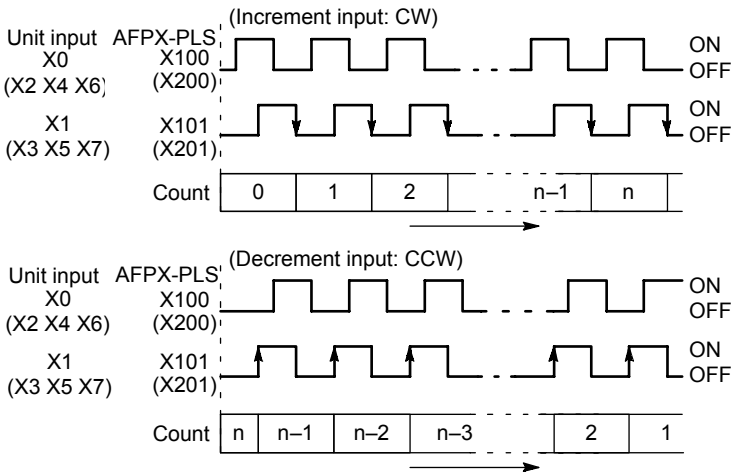
Incremental input mode



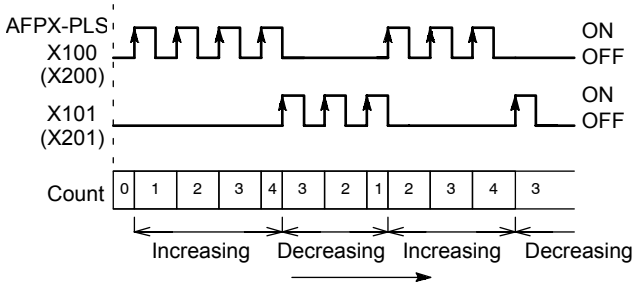
Decremental input mode



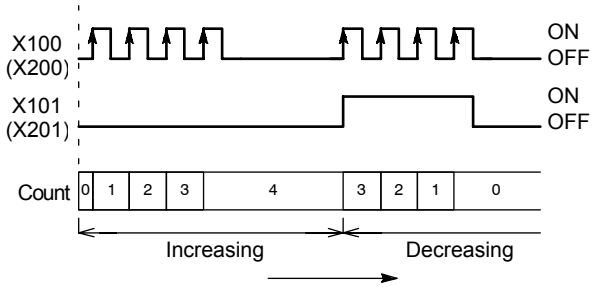
Two-phase input mode



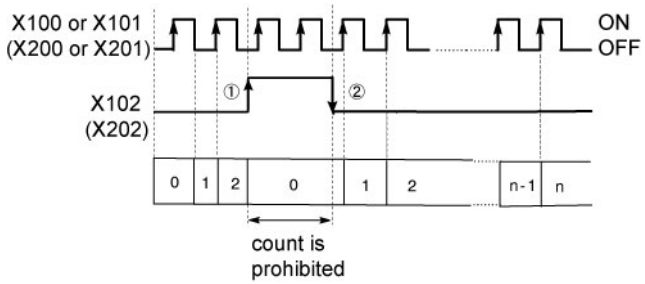
Individual incremental/decremental input mode (pulse I/O cassette only)



Direction discrimination (pulse I/O cassette only)



Count for reset input during incremental input mode (pulse I/O cassette only)



The reset is executed by the interruption at ① (rising edge) and ② (falling edge).

① Rising edge: Count disabled, elapsed value cleared

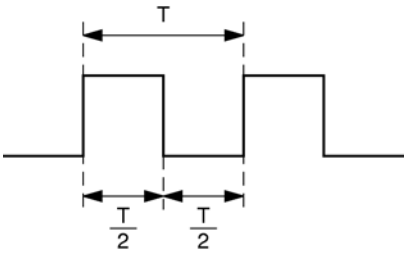
② Falling edge: Count enabled

With bit 2 of DT90052, the reset input can be enabled/disabled (see page 168).

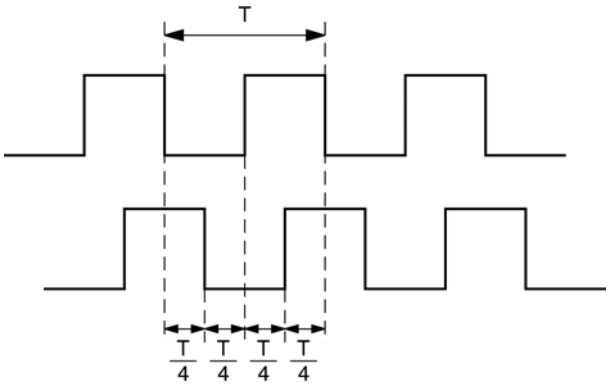
8.3.2 Minimum Input Pulse Width

For the period T (1/frequency), a minimum input pulse width of T/2 (single-phase input) or T/4 (two-phase input) is required.

Single-phase



Two-phase

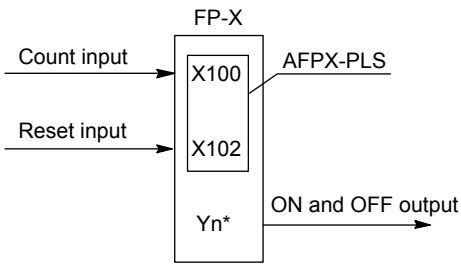


8.3.3 I/O Allocation

As shown in the table of specifications (see page 159), the inputs and outputs used will differ depending on the channel number being used.

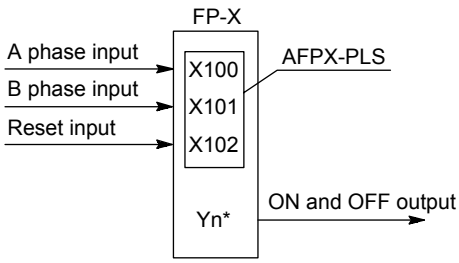
The output turned on and off can be specified with instructions F166 (HC1S) and F167 (HC1R) for the desired output relays and internal relays. However, when output Y of the expansion unit is specified, only Y will be set in the memory and output when the I/O is refreshed. Also, if an internal relay is specified, no signal will be output.

When using CH8 of the pulse I/O cassette with incremental input and reset input



* The output turned on and off when the target value is reached can be specified as desired from the outputs of the main unit or add-on cassette.

When using CH8 of the pulse I/O cassette with two-phase input and reset input



* The output turned on and off when the target value is reached can be specified as desired from the outputs of the main unit or add-on cassette.

8.3.4 Writing Channel Data and Control Code to DT90052

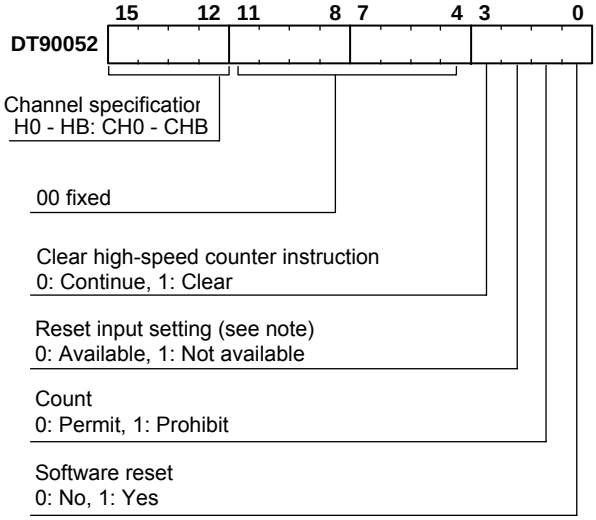
Special data register DT90052 is the high-speed counter and pulse output control flag area of the FP-X. It is used for counter operations such as software reset and count disable. The settings of this register remain until another setting operation is executed.

Operations performed by DT90052

- Resetting the counter (bit 0)
- Enabling/disabling counting operations (bit 1)
- Enabling/disabling a hardware reset (bit 2)
- Clearing high-speed counter instructions **F166_HC1S** to **F176_SPCH**
- Clearing the target value match interrupt

The area DT90052 for writing channels and control codes is allocated as shown below. The control code information is stored by channel in special data registers DT90360 to DT90373.

High-speed counter/pulse output control flag area of FP-X



◆ NOTE

With the reset input setting, the reset input (X102 or X202) allocated in the system registers is enabled or disabled.

Commands to access DT90052

In FPWIN GR, use the **F0_MV** instruction to write to DT90052.

There are two possibilities to access a special data register in FPWIN Pro:

1. Use one of the data transfer functions, e.g. **WORD_TO_SDT**
   Data transfer functions can be used to program hardware-independent libraries. For more information, see the online help.

2. Use the instruction **MOVE** (IEC Standard Library) or **F0_MV/F1_DMV** (FP Library) together with an explicit Matsushita address in the body or in the global variable list.

◆ REFERENCE

You can find a programming example in the the FPWIN Pro online help or the FPΣ User's Manual. You can download the PDF file for this and other manuals from our website free of charge.

8.3.5 Writing and Reading the Elapsed Value

The elapsed value is stored as 32-bit data in the combined area of special data registers DT90300 and DT90301.

Commands to access special data registers

In FPWIN GR, use the **F1_DMV** instruction to read the elapsed value.

There are two possibilities to access a special data register in FPWIN Pro:

1. Use one of the data transfer functions, e.g. **WORD_TO_SDT**
   Data transfer functions can be used to program hardware-independent libraries. For more information, see the online help.
2. Use the instruction **MOVE** (IEC Standard Library) or **F0_MV/F1_DMV** (FP Library) together with an explicit Matsushita address in the body or in the global variable list.

◆ REFERENCE

You can find a programming example in the the FPWIN Pro online help or the FPΣ User's Manual. You can download the PDF file for this and other manuals from our website free of charge.

8.4 Pulse Output Function (Pulse I/O Cassette)

◆ NOTE

You need the pulse I/O cassette (AFPX-PLS) to use the pulse I/O function.

Instructions used and controls

Together with a commercially available pulse-string input type motor driver, the pulse output function can be used for positioning control.

Type of control	Instruction	Description	Cassette needed
Trapezoidal control	F171 (SPDH)	Provides trapezoidal (table-shaped) control for automatically obtaining pulse outputs. You must specify the initial speed, maximum speed, acceleration/deceleration time and target value.	AFPX-PLS
Home return		Permits automatic home return operation.	
JOG operation	F172 (PLSH)	Causes pulses to be output as long as the execution condition is on. A target value can also be set, so that pulse output stops at the point when the target value is matched.	
Data table control	F174 (SP0H)	Permits positioning control in accordance with the specified parameters.	
Linear interpolation	F175 (SPSH)	Causes pulses to be output using linear interpolation control. You must specify the composite speed, the acceleration/deceleration time, and the target value.	2 AFPX-PLS units

Setting the system registers

When using the pulse output function, set the system registers 400 (channel 0) and 401 (channel 1) for pulse output to:

- Pulse output (Y100-Y102/Y200-Y202) or to
- PWM output (Y100/Y200)

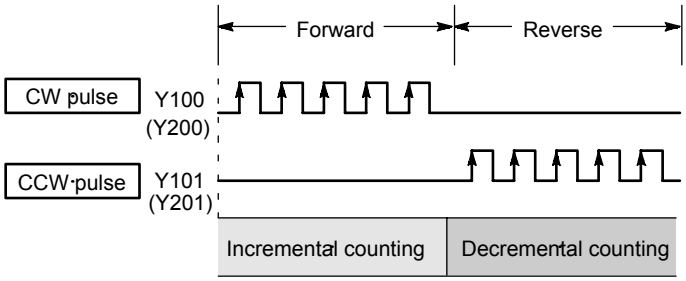
8.4.1 Pulse Output Methods

The pulse output method and position control mode is set using the control code.

◆ REFERENCE

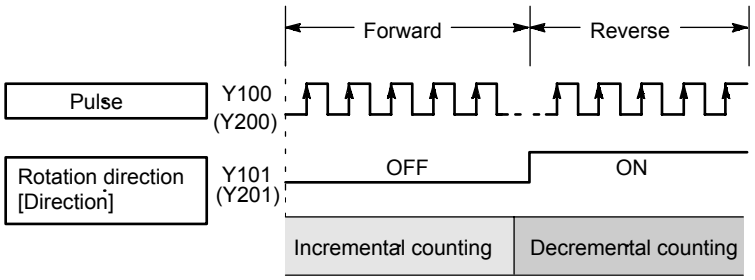
You can find a programming example in the the FPWIN Pro online help or the FPΣ User's Manual. You can download the PDF file for this and other manuals from our website free of charge.

Clockwise/counter-clockwise output method



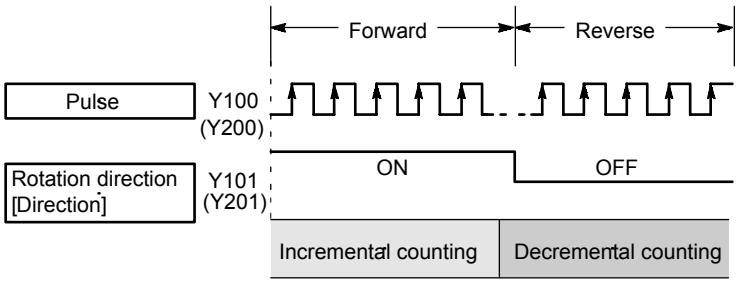
Control is carried out using two pulses: a forward rotation pulse and a reverse rotation pulse.

Pulse/direction output method (forward: OFF/reverse: ON)



Control is carried out using one pulse output to specify the speed and another to specify the direction of rotation with on/off signals. In this mode, forward rotation is carried out when the rotation direction signal is OFF.

Pulse/direction output method (forward: ON/reverse: OFF)



Control is carried out using one pulse output to specify the speed and another to specify the direction of rotation with on/off signals. In this mode, forward rotation is carried out when the rotation direction signal is ON.

◆ **NOTE**

The output signals are the numbers on the pulse I/O cassette. When the pulse output is specified, only the pulse is output. The output memories Y100,Y101,Y200 and Y201 are not output.

8.4.2 Operation Modes

Incremental position control

The pulses set with the target value are output.

Mode / Target value	CW/CCW	Pulse and direction forward OFF/reverse ON	Pulse and direction forward ON/reverse OFF	Counting method
Positive	Pulse output from CW	Pulse output when direction output is OFF	Pulse output when direction output is ON	Incremental
Negative	Pulse output from CCW	Pulse output when direction output is ON	Pulse output when direction output is OFF	Decremental

◆ EXAMPLE

With a current position of 5000 and a target value of +1000, 1000 pulses are output from CW to reach the new position at 6000.

Absolute position control

A number of pulses equal to the difference between the set target value and the current value are output.

Mode / Target value	CW/CCW	Pulse and direction forward OFF/reverse ON	Pulse and direction forward ON/reverse OFF	Counting method
Target value greater than current value	Pulse output from CW	Pulse output when direction output is OFF	Pulse output when direction output is ON	Incremental
Target value less than current value	Pulse output from CCW	Pulse output when direction output is ON	Pulse output when direction output is OFF	Decremental

◆ EXAMPLE

With a current position of 5000 and a target value of +1000, 4000 pulses are output from CCW to reach the new position at 1000.

Home return

After switching on a drive system, there is a difference between the internal position value (elapsed value) and the mechanical position of the axis, which cannot be pre-determined. The internal value must be synchronized with the actual position value of the axis. This is done by means of a home return, during which a position value is registered at a known reference point (home).

When executing the **F171_SPDH** instruction, pulses are continuously output until the home input (X102 or X202) is enabled. To decelerate the movement when near the home position, designate a near home input and set bit 4 of special data register DT90052 to off → on → off. The deviation counter clear output can be set when home return has been completed.

JOG operation

Pulses are output from the specified channel while the trigger for the **F172_PLSH** instruction is on. The pulse output can be stopped when the specified target value is reached.

Direction output and output frequency are specified with this instruction.

8.4.3 Precautions on Programming

◆ NOTE

The state of the control flags may vary during scanning, e.g. if the input condition changes during the scan. To avoid programming conflicts, replace control flags with internal relays at the beginning of your program.

Address	Flag conditions	Use of the flag in the program
R911C Control flag (CH0)	Turns on during execution of pulse output instructions and then maintains that state during pulse output from CH0. This flag is the same for instructions F166 to F175.	Use this flag to prohibit the simultaneous execution of other high-speed counter instructions and pulse output instructions, and to verify completion of an action.
R911D Control flag (CH1)	Turns on during execution of pulse output instructions and then maintains that state during pulse output from CH1. This flag is the same for instructions F166 to F175.	Use this flag to prohibit the simultaneous execution of other high-speed counter instructions and pulse output instructions, and to verify completion of an action.

8.4.4 I/O Allocation

The I/O allocation of pulse output terminals, direction output terminal, and home input is determined by the channel used (see page 161).

The near home input is substituted by allocating the desired contact and turning on and off bit 4 of special data register DT90052.

◆ REFERENCE

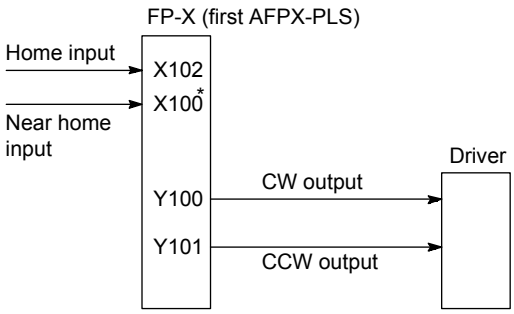
You can find a programming example in the the FPWIN Pro online help or the FPΣ User's Manual. You can download the PDF file for this and other manuals from our website free of charge.

Double pulse input driver (CW/CCW pulse output method)

Two output contacts are used as a pulse output for CW/CCW.

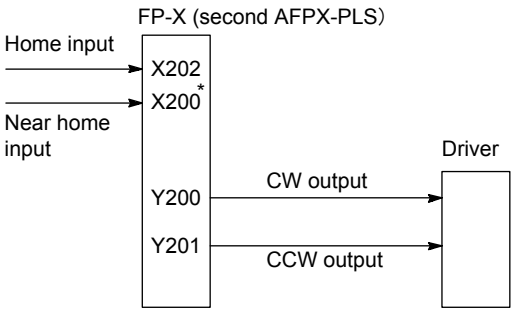
Set the control code for **F171_SPDH** to CW/CCW.

Using CH0



* For example, X100 or X101 on the pulse I/O cassette can be specified for the near home input.

Using CH1



* For example, X200 or X201 on the pulse I/O cassette can be specified for the near home input.

◆ NOTE

If no input is available on the pulse I/O cassette, the input of the main unit can be used.

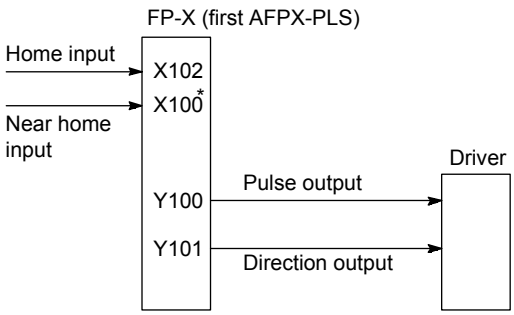
Single pulse input driver (pulse and direction output method)

One output point is used as the pulse output and the other output is used as the direction output.

Set the control code for **F171_SPDH** to pulse and direction.

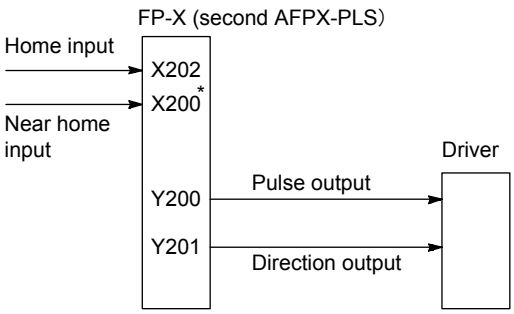
Up to two driver systems can be connected.

Using CH0



* For example, X100 or X101 on the pulse I/O cassette can be specified for the near home input.

Using CH1



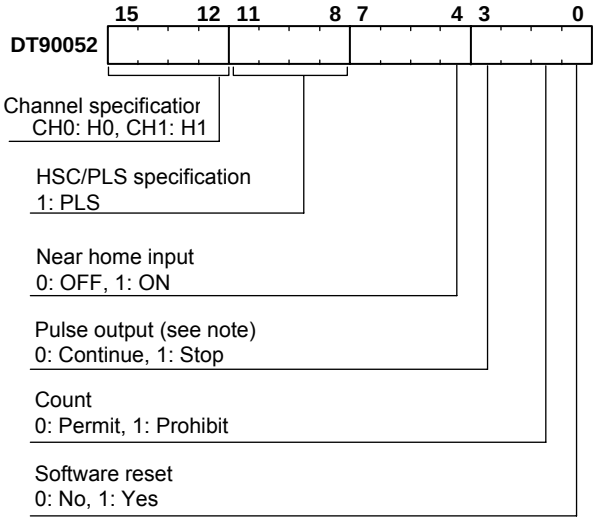
* For example, X200 or X201 on the pulse I/O cassette can be specified for the near home input.

8.4.5 Writing Channel Data and Control Code to DT90052

Special data register DT90052 is the high-speed counter and pulse output control flag area of the FP-X. It is used for resetting the built-in high-speed counter, stopping the pulse output, and setting and resetting the near home input. The settings of this register remain until another setting operation is executed.

The area DT90052 for writing channels and control codes is allocated as shown below. The control code information is stored by channel in special data registers DT90372 to DT90373.

High-speed counter/pulse output control flag area of FP-X



◆ NOTE

The output counting value of the elapsed value area may be different from the input counting value of the motor side if the pulse output is stopped by the "Continue/stop of pulse output". After the pulse output stops, execute the home return.

Commands to access DT90052

In FPWIN GR, use the **F0_MV** instruction to write to DT90052.

There are two possibilities to access a special data register in FPWIN Pro:

1. Use one of the data transfer functions, e.g. **WORD_TO_SDT**
   Data transfer functions can be used to program hardware-independent libraries. For more information, see the online help.

2. Use the instruction **MOVE** (IEC Standard Library) or **F0_MV/F1_DMV** (FP Library) together with an explicit Matsushita address in the body or in the global variable list.

◆ REFERENCE

You can find a programming example in the the FPWIN Pro online help or the FPΣ User's Manual. You can download the PDF file for this and other manuals from our website free of charge.

8.4.6 Writing and Reading the Elapsed Value

The elapsed value is stored as 32-bit data in the combined area of special data registers DT90348 and DT90349.

Commands to access special data registers

In FPWIN GR, use the **F1_DMV** instruction to read the elapsed value.

There are two possibilities to access a special data register in FPWIN Pro:

1. Use one of the data transfer functions, e.g. **WORD_TO_SDT**
   Data transfer functions can be used to program hardware-independent libraries. For more information, see the online help.
2. Use the instruction **MOVE** (IEC Standard Library) or **F0_MV/F1_DMV** (FP Library) together with an explicit Matsushita address in the body or in the global variable list.

◆ REFERENCE

You can find a programming example in the the FPWIN Pro online help or the FPΣ User's Manual. You can download the PDF file for this and other manuals from our website free of charge.

8.5 PWM Output Function

◆ NOTE

The pulse I/O cassette (AFPX-PLS) is necessary to use the PWM output function.

PWM output function

With the F173 (PWMH) instruction, the pulse width modulation output of the specified duty ratio is obtained.

System register setting

When using the PWM output function, set the channel CH0 and CH1 with system register 400 (401) to specify output Y0 (Y1) as a PWM output.

In FPWIN Pro, you can either define a DUT or an array to specify the frequency and the duty. In FPWIN GR, this is done with a data table.

The DUT, array or data table must contain the following elements:

- Control code
- Duty

Control code

Specify the control code by setting the constant K:

Resolution of 1000

K	Frequency (Hz)	Period (ms)
0	1.5	666.7
1	2.0	502.5
2	4.1	245.7
3	6.1	163.9
4	8.1	122.9
5	9.8	102.4
6	19.5	51.2
7	48.8	20.5
8	97.7	10.2
9	201.6	5.0
10	403.2	2.5
11	500.0	2.0
12	694.4	1.4
13	1.0 k	1.0
14	1.3 k	0.8
15	1.6 k	0.6
16	2.1 k	0.5
17	3.1 k	0.3
18	6.3 k	0.2
19	12.5 k	0.1

Resolution of 100

K	Frequency (Hz)	Period (ms)
20	15.6 k	0.06
21	20.8 k	0.05
22	25.0 k	0.04
23	31.3 k	0.03
24	41.7 k	0.02

Duty

Specify the duty using a constant.
If the control code is 0 to 19, the duty is 0 to 999 (0.0% to 99.9%).
If the control code is 20 to 24, the duty is 0 to 990 (0% to 99%).
Values are specified in units of 1% (x+10). Digits behind the decimal point are rounded off.

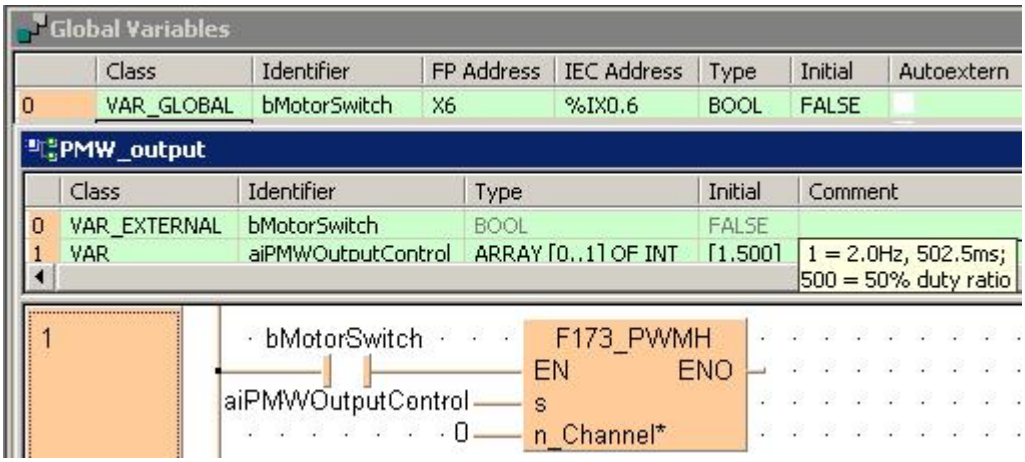
NOTE

If a value outside the specified range is written to the duty area while the instruction is being executed, a frequency with the maximum duty is output. When the execution of the instruction begins, an operation error is displayed.

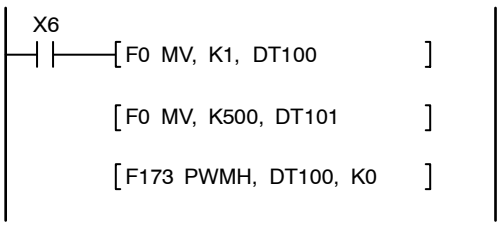
EXAMPLE

While X6 (bMotorSwitch) is in the ON state, a pulse with a period of 502.5ms and a duty ratio of 50% is output from Y100 of the specified channel CH0.

FPWIN Pro in Ladder Diagram



FPWIN GR



Chapter 9

Security Functions

9.1 Password Protect Function

◆ NOTE

Do not forget your password. If you forget your password, you cannot read programs. Even if you ask us for your password, we cannot crack it.

This password protect function is used to prohibit reading and writing programs and system registers by setting a password on the FP-X.

There are two ways to set a password:

- By using the programming tool.
- By using the SYS1 instruction.

◆ REFERENCE

Please refer to your programming tool's online help for detailed information on setting the password.

◆ NOTE

If you are accessing the PLC and a password is set, the PLC will be protected if the power is turned off/on.

How to cancel the password setting

There are two ways to cancel the password setting.

- Unprotect. The password is cancelled and all programs are retained.
- Force cancel. All programs and security information are deleted.

Password data and the master memory cassette (see page 190)

The data on the password setting can be transferred to the master memory cassette together with the programs from the FP-X.
The password information stored in the master memory cassette will be automatically transferred to another control unit when it is installed, and the control unit will be protected.

◆ PROCEDURE

1. **Turn off the power supply of the PLC**
2. **Set the RUN/PROG mode switch to the PROG mode**
3. **Install the master memory cassette to transfer the program on the control unit**

4. **Turn on the power supply of the PLC and transfer the program to the master memory cassette**

   FPWIN Pro: Online → Memory Transfer Services → Memory Transfer Function → Internal (RAM) memory => External (MRTC) memory

   FPWIN GR: Tool → Internal memory → Master memory

9.2 Upload Protection

Data can be lost forever!

When using this function, make backup files of your programs! Keeping your programs is your responsibility. We cannot restore deleted programs even if you ask us. We cannot read data on the control units that are set to prohibit uploading.

Use this function to prohibit programs and system registers on the FP-X from being read or uploaded. When this function is enabled, you cannot:

- upload programs or system registers to a PC
- transfer programs to the master memory cassette.

The setting for this function can be cancelled forcibly using the programming tool. However, all programs, system registers and password information will be deleted!

You can edit files that are controlled with a PC while online using the programming tool. However, programs will be broken if the program on the PLC and the program on the PC do not match absolutely.

Interaction with the password protect function

The upload protection and password protect settings can be used at the same time.

Setting upload protection

You can set the upload protection in one of two ways:

- Using the programming tool.
- By specifying the upload protection information in the master memory cassette, and then transfering it to the control unit.

◆REFERENCE

Please refer to your programming tool's online help for detailed information on setting upload protection.

9.3 FP-X, Master Memory Cassette and Security Settings

Obviously, programs cannot be transferred from an FP-X for which upload protection has been set to the master memory cassette (see page 190).

Upload protection settings can be transferred to the master memory cassette from an FP-X that is not upload protected:

- **FPWIN Pro**: Online → Memory Transfer Services → Memory Transfer Function → Internal (RAM) memory => External (MRTC) memory
- **FPWIN GR**: Tool → Internal memory → Master memory

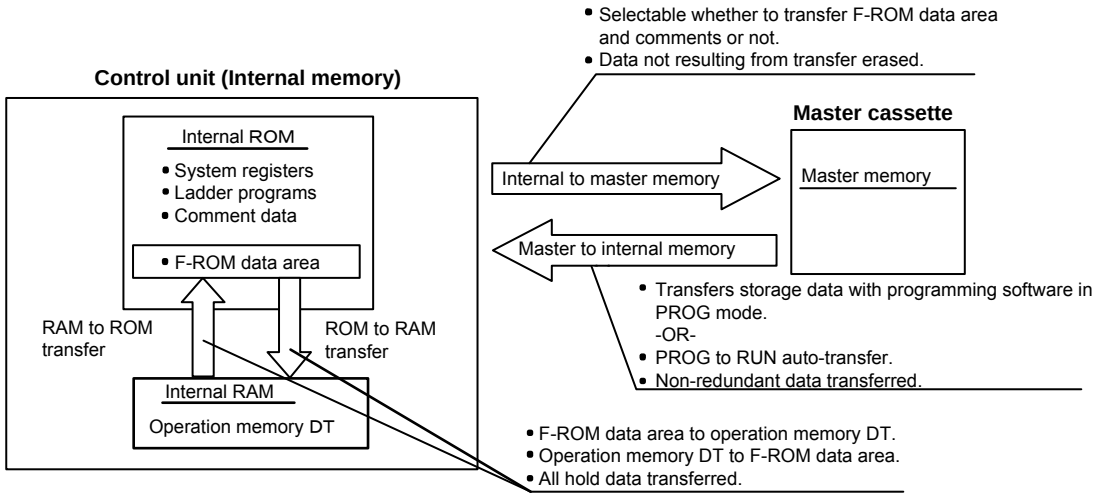
At that time password protection will be transferred simultaneously if defined. If the master memory cassette specified to prohibit uploading is installed on another FP-X, the settings will automatically be transferred to the FP-X, i.e. it will be upload protected as well.

When the master memory cassette is installed on the FP-X and the master memory function is activated, you can neither set a password nor define upload protection for the FP-X. To define security settings for the FP-X, remove the master memory cassette.

Chapter 10

Other Functions

10.1 Transfer Function Between Memories



Flow of program information between memory areas

RAM to ROM transfer function

The entire contents of the DT operation memory in the internal RAM are transferred to the internal F-ROM data area. This function is used to transfer large volumes of the default data to be used in the DT area. The necessary data is read from the internal F-ROM area to be used for programs. Use your programming tool while the FP-X is in PROG mode to make use of this function. Data can be transferred whether the master memory cassette is installed or not.

ROM to RAM transfer function

The entire contents of the F-ROM data area stored in the internal ROM are transferred to the operation memory DT. Use your programming tool while the FP-X is in PROG mode to make use of this function. Data can be transferred whether the master memory cassette is installed or not.

Internal memory to master memory transfer function

The program information (e.g. the programs per se, system registers, F-ROM data, comments and passwords) stored in the internal ROM is transferred to the master memory. The upload disabled information is specified using the programming tool software.

Using the programming software, you can select whether to transfer the F-ROM data area and comments or not. When transferring the F-ROM data area, specify the block number from which to start the transfer and the number of blocks. Use your programming tool while the FP-X is in PROG mode to make use of this function.

When data is transferred to the master memory, all data in the master memory cassette not resulting from the transfer is erased.

Master memory to internal memory transfer function

The information stored in the master memory is transferred to the internal ROM when:

- switching from PROG to RUN mode

- the power supply is turned on in RUN mode
- the transfer instruction is executed by then programming tool software while in the PROG. mode.

Once the data transfer is initiated, the information in the internal memory and the master memory are compared; only non-redundant information is transferred.

◆ REFERENCE

Refer to the online help of your programming tool for detailed information on the transfer function.

10.2 Master Memory Cassette Functions

The master memory cassette is equipped with a:

- realtime clock (calendar timer function) to set year, month, day, day of week and time
- master memory

Using the switch on the back of the cassette, select 1 of the following:

- Realtime clock only (default setting)
- Realtime clock & master memory

◆ NOTES

- **The cassette cannot be used as a master memory when it has been specified to be used as a realtime clock only.**
- **Install the optional backup battery in the control unit to use the realtime clock. The realtime clock does not work without the battery.**

10.2.1 Realtime Clock Function

The realtime clock function can be used if the backup battery (see page 83) is installed in the FP-X and the FP-X master memory cassette (see page 47) is installed.

Area of the realtime clock

With the realtime clock function, data indicating the hour, minute, second, day, year and other information stored in the special data registers DT90053 to DT90057 (see page 238) can be read using the transmission instruction and used in sequence programs.

◆ REFERENCE

For detailed information on setting or reading the realtime clock, please refer to your programming tool's online help.

10.2.2 Master Memory Transfer Function

This function allows you to transfer data in the control unit's internal memory to the master memory cassette. When you install this master memory cassette on another FP-X, you can copy the data from it to the FP-X's internal memory.

To activate the master memory function, you need to turn on the switch on the back of the cassette (see page 47).

Transferring data

The master memory cassette automatically transfers its data when you switch the PLC from PROG to RUN mode.

Using the programming tool while the PLC is in PROG mode, you can transfer data between the master memory cassette and the PLC in either direction. Moreover, you can select what you wish to transfer:

- upload protection
- comments
- F-ROM data area
- programs, systems registers and password if you are using FPWIN Pro.

◆ NOTE

Be careful to remember your password upon transfer!

	FP-X → cassette	Cassette → FP-X
Upload protection	Sets upload protection in master memory cassette. Control units to which data is transferred from this master memory cassette will be upload protected.	If upload protection has been uploaded to the master memory cassette, it will be downloaded to any PLC on which it is installed.
Comments	Transfers comments to the master memory cassette.	Transfers comments to the control unit.
F-ROM data area (see note)	Transfers specified blocks in the F-ROM data area of the control unit (internal ROM) to the master memory cassette.	Transfers specified data blocks to the F-ROM data area in the control unit (internal ROM).
Precautions	All data in the master memory is deleted. So the devices not to be transferred will be deleted.	Non-redundant data transferred.

◆ NOTE

You can read data from the F-ROM data area using the F12 instruction or write data to it using the P13 instruction. It is possible to transfer data to the F-ROM data area using the RAM => ROM transfer function. The storage area is composed of 16 blocks (1 block = 2048 words), from block 0 to 15.

10.3 P13 Instruction

Data registers of 32,765 words can be written to in the built-in ROM (F-ROM data area) of the FP-X control unit using the P13 instruction.

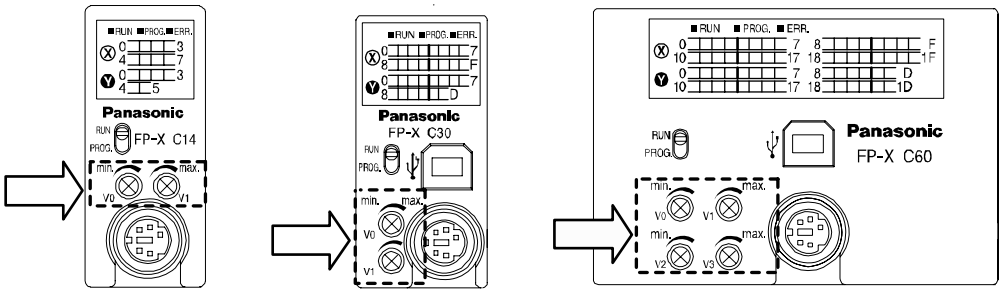
◆ NOTES

- **Writing can be performed up to 10,000 times. After that, correct operation cannot be guaranteed.**
- **If the power supply turns off while the P13 instruction is being executed, data in the hold area may be lost. Also, when the power is shut off during rewriting in the RUN mode, the same thing may happen.**

10.4 Analog Potentiometer

The FP-X is equipped with two (C60R four) analog potentiometers as a standard feature. Turning the potentiometers changes the values of the special data registers DT90040 to DT90044 within a range of K0 to K1000.

You can use the potentiometers to change the internal set values in the PLC without using the programming tool, e.g. to change analog clocks.



Applicable special data register

Control unit	Symbol	Potentiometer no.	Special data register	Range
C14R/C30R C60R	V0	Volume 0	DT90040	K0 to K1000
	V1	Volume 1	DT90041	
C60R	V2	Volume 2	DT90042	
	V3	Volume 3	DT90043	

◆ EXAMPLE

The data register values set with the potentiometers are used as set values for a timer. By this a clock is created that allows you to set the time via a potentiometer.

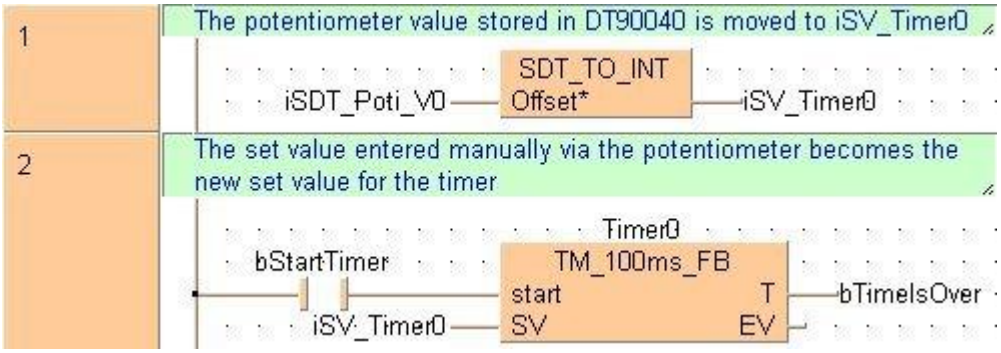
The value of special data register DT90040 is set using V0. This value is written into the set value area (SV) of Timer0 to set the clock.

FPWIN Pro

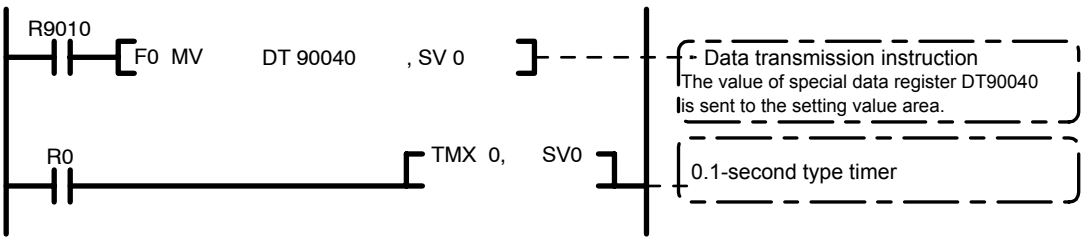
POU Header

	Class	Identifier	Type	Initial	Comment
0	VAR	iSV_Timer0	INT	0	
1	VAR	Timer0	TM_100ms_FB		
2	VAR	bTimeIsOver	BOOL	FALSE	
3	VAR_CONSTANT	iSDT_Poti_V0	INT	40	Offset to DT90040
4	VAR	bStartTimer	BOOL	FALSE	

LD Body



FPWIN GR



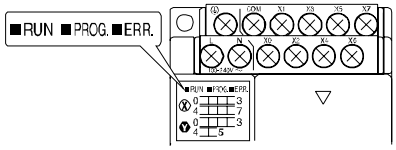
Chapter 11

Self-Diagnostic and Troubleshooting

11.1 Self-Diagnostic Function

The control unit has a self-diagnostic function to identify errors and stop operation if necessary.

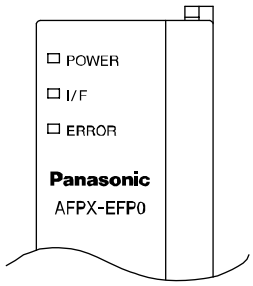
When an error occurs, the status indicator LEDs on the control unit light accordingly.



Status indicator LEDs on the control unit

Status indicator LEDs on the control unit

	LED status			Description	Operation status
	RUN	PROG	ERROR/ ALARM		
Normal condition	On	Off	Off	Normal operation	Operation
	Off	On	Off	PROG. mode LED does not flash even if the output is forced in PROG mode.	Stop
	Flashing	Flashing	Off	Forcing input/output in RUN mode RUN and PROG. LED flash alternately.	Operation
Abnormal condition	On	Off	Flashing	Self-diagnostic error	Operation
	Off	On	Flashing	Self-diagnostic error	Stop
	On or off	On or off	On	System watchdog timer has been activated	Stop



Status indicator LEDs on the expansion FP0 adapter

Status indicator LEDs on the expansion FP0 adapter

	LED status			Description
	POWER	I/F	ERROR	
Normal condition	On	On	Off	Normal operation
Abnormal condition	On	Flashing	Off	FP0 expansion unit is not connected.
	On	On	Flashing	The FP0 expansion unit, that had been connected when the powr supply for the FP-X control unit turned on, became disconnected. There is a data communication error between the expansion FP0 adapter and the FP0 expansion unit, e.g. due to noise, etc.
	On	Off	Off	The expansion FP0 adapter turned on after the FP-X control unit.

Operation when an error occurs

Normally when an error occurs, operation stops. For some errors, the user may select whether operation is to be continued or stopped by setting the system registers with the programming tool.

11.2 Troubleshooting

In the event of an error, follow the steps in the procedures below.

11.2.1 ERROR LED is Flashing

Condition: A self-diagnostic error has occurred.
Check the error code using the programming tool.

◆PROCEDURE

FPWIN Pro: in online mode, Monitor → PLC status

FPWIN GR: Online → Status display

Error code 1 to 9

Condition: syntax error in the program.

◆NOTE

In FPWIN Pro, these errors are detected by the compiler.

Step 1
Change to PROG. mode and clear the error.

Step 2
Execute a total-check function using the programming tool to locate the syntax error.

Error code is 20 or higher

Condition: A self-diagnostic error other than a syntax error has occurred.
Use the programming tool in PROG. mode to clear the error.

◆PROCEDURE

FPWIN Pro: in online mode, Monitor → PLC status, select [Clear]

FPWIN GR: Online → Status display, click [Clear Error]

In PROG mode, the power supply can be turned off and then on again to clear the error, but all of the contents of the operation memory except hold type data are cleared.

An error can also be cleared by executing the self-diagnostic error set instruction F148_ERR.

NOTES

- **If the mode selector switch has been set to "RUN", the error is cleared and at the same time operation is enabled. However, if the problem that caused the error has not been eliminated, it may look as though the error has not been cleared.**
- **When an operation error (error code 45) occurs, the address at which the error occurred is stored in special data registers DT90017 and DT90018. If this happens, monitor the address at which the error occurred before cancelling the error.**

11.2.2 ERROR LED is ON

Condition: The system watchdog timer has been activated and the operation of the PLC has been stopped.

Step 1

Set the mode selector of the PLC from RUN to PROG mode and turn the power off and then on.

- If the ERROR LED is turned on again, there is probably an abnormality in the FP-X control unit. Please contact your dealer.
- If the ERROR LED is flashing (see page 198).

Step 2

Set the mode selector from PROG to RUN mode.

If the ERROR LED is turned on, the program execution time is too long. Check:

- if instructions such as **JUMP** or **LOOP** are programmed in such a way that a scan can never finish.
- that interrupt instructions are executed in succession.

11.2.3 All LEDs are OFF

Step 1

Check the power supply wiring.

Step 2

Check if the power supplied to the control unit is in the range of the rating. Be sure to check the fluctuation in the power supply.

Step 3

Disconnect the power supply wiring to the other devices if the power supplied to the control unit is shared with them.

- If the LEDs on the control unit turn on at this moment, increase the capacity of the power supply or prepare another power supply for other devices.
- Please contact your dealer for further information.

11.2.4 Diagnosing Output Malfunction

Proceed from the check of the output side to the check of the input side.

Check of output condition 1: Output indicator LEDs are ON

Step 1

Check the wiring of the loads.

Step 2

Check if the power is properly supplied to the loads.

- If the power is properly supplied to the load, there is probably an abnormality in the load. Check the load again.
- If the power is not supplied to the load, there is probably an abnormality in the output section. Please contact your dealer.

Check of output condition 2: Output indicator LEDs are OFF

Step 1

Monitor the output condition using a programming tool.

- If the output monitored is turned on, there is probably a duplicated output error.

Step 2

Forcing ON the output using the programming tool.

- If the output indicator LED is turned ON, go to input condition check.
- If the output indicator LED remains OFF, there is probably an abnormality in the output unit. Please contact your dealer.

Check of input condition 1: Input indicator LEDs are OFF

Step 1

Check the wiring of the input devices.

Step 2

Check that the power is properly supplied to the input terminals.

- If the power is properly supplied to the input terminal, there is probably an abnormality in

the input unit. Please contact your dealer.

- If the power is not supplied to the input terminal, there is probably an abnormality in the input device or input power supply. Check the input device and input power supply.

Check of input condition 2: Input indicator LEDs are ON

PROCEDURE

1. **Monitor the input condition using a programming tool.**

   If the input monitored is OFF, there is probably an abnormality with the input unit. Please contact your dealer.

   If the input monitored is ON, check the leakage current at the input devices (e.g. two-wire type sensor) and check the program again, referring to the following:
   Check for the duplicated use of outputs and for outputs using the high-level instruction.
   Check the program flow when a control instruction such as **MC** or **JP** (FPWIN GR: **MCR** or **JMP**) is used.

11.2.5 A Protect Error Message Appears

Condition:

- The PLC is password protected
- A master memory cassette is attached

The PLC is password protected

Use the programming tool to access the PLC (see online help).

A master memory cassette is attached

You cannot edit program when the master memory cassette is attached. Turn off the power supply and remove the master memory.

11.2.6 PROG Mode Does Not Change to RUN

Condition: A syntax or self-diagnostic error that caused operation to stop has occurred.

Step 1

Check to see if the ERROR LED is flashing (see page 198).

Step 2

Execute a total-check function to determine the location of the syntax error (see online help).

11.2.7 No RS485 Communication

Step 1

Check to make sure the transmission cables have been securely connected between the two (+) terminals and two (-) terminals of the units, and that the final unit has been correctly connected.

Step 2

Check to see if the transmission cables are within the specifications range (see page 82). Make sure all cables in the link are of the same type.

Do not designate any unit other than those at both ends of the network as a terminal station.

Step 3

Check that the link areas do not overlap.

11.2.8 No RS232C Communication

Condition: No communication with:

- 1-channel type RS232C cassette (AFPX-COM1)
- 2-channel type RS232C cassette (AFPX-COM2)
- 1-channel RS485 + 1-channel RS232C cassette (AFPX-COM4)

Step 1

Check whether the receive data terminal of a connected device is connected to the SD, and the send data terminal is connected to the RD. Check whether the SG is connected.

Step 2 (for 1-channel type RS232C cassette only)

Check whether the CS signal is on.

If the CS LED of the communication cassette is off, the CS signal is off.

When using a three-wire port, short-circuit the RS and CS pins of the communication cassette, and turn on the CS signal.

Step 3

Check that link areas do not overlap.

Step 4

When the RS232C is any of the following, make sure the communication cassette is selected for the communication mode.

- When controlling the 1-channel type RS232C with 5 wires (see "Connection Examples" on page 38).
- When using the COM2 port with the 2-channel type RS232C.

- When using the COM2 port with the 1-channel RS485 + 1-channel RS232C.

11.2.9 No RS422 Communication

Condition: No communication with 1-channel type RS485C/RS422 cassette (AFPX-COM3) (see "No RS485 Communication" on page 202).

11.2.10 Expansion Unit Does Not Operate

Step 1

Check whether the terminal setting is specified for the expansion unit.

Check whether the terminal setting is specified for multiple expansion units.

Step 2

Check whether the expansion FP0 adapter is installed in the last position.

If the expansion FP0 adapter is installed in the last position, a terminal setting for other expansion units is not necessary.

Chapter 12

Specifications and Dimensions

12.1 General Specifications

Item	Description	
Ambient temperature	0 to +55°C	
Storage temperature	-40 to +70°C	
Ambient humidity	10 to 95%RH (at 25°C non-condensing)	
Storage humidity	10 to 95%RH (at 25°C non-condensing)	
Breakdown voltage (see note 1)	Between input/output terminals and AC power supply terminal	2300V AC for 1 minute (see note 2)
	Between input terminal and output terminal (see note 3)	
	Between cassette I/O terminals and AC power supply/input/output/protection earth (see note 4)	
	Between AC power supply terminal and protection earth terminal	1500V AC for 1 minute (see note 2)
Insulation resistance (see note 2)	Between input/output terminals and AC power supply terminal/protection earth	100MΩ or more (500V DC measured with a megohmmeter)
	Between input terminal and output terminal	
	Between AC power supply terminal and protection earth terminal (see note 4)	
	Between cassette I/O terminals and AC power supply/input/output/protection earth	
Vibration resistance	5 to 9Hz, single amplitude of 3.5mm, 1 cycle/min 9 to 150Hz, constant acceleration of 9.8m/s^2, 1 cycle/min 10 min on 3 axes	
Shock resistance	Shock of 147m/s^2 or more, 4 times on 3 axes	
Noise immunity	1500 Vp-p with pulse widths 50ns and 1µs (based on in-house measurements) (AC power supply terminal)	
Operation condition	Free from corrosive gases and excessive dust	
Conformed EC directive	EMC: EN61131-2, LVD: EN61131-2	
Overvoltage category	Category II	
Pollution level	Pollution level 2	

◆ NOTES

1. **Not isolated between the tool port, USB port, analog input cassette and communication cassette (RS232C part).**

2. **Cutoff current: 5 mA**

3. **Excluding between the input terminal and the output terminal of the pulse I/O cassette.**

4. **Excluding between the analog I/O cassette, communication cassette (RS232C part) and protection earth terminal.**

Weight

Unit	Part No.	Weight
Control unit	AFPX-C14R	280g
	AFPX-C30R	490g
	AFPX-C60R	780g
Expansion I/O unit	AFPX-E16R	195g
	AFPX-E30R	470g
Expansion FP0 adapter	AFPX-EFP0	65g

Unit		Part No.	Weight
FP-X communication cassette	COM1	AFPX-COM1	20g
	COM2	AFPX-COM2	
	COM3	AFPX-COM3	
	COM4	AFPX-COM4	
Analog input cassette		AFPX-AD2	25g
Input cassette		AFPX-AD2	
Output cassettes		AFPX-TR8 AFPX-TR6P	
Pulse I/O cassette		AFPX-PLS	
Master memory cassette		AFPX-MRTC	20g

Unit's current consumption table

Unit type			Power supply for control unit Current consumption	
			100V AC	200V AC
Control unit		AFPX-C14R	≤ 185mA	≤ 130mA
		AFPX-C30R	≤ 410mA	≤ 260mA
		AFPX-C60R	≤ 540mA	≤ 320mA
Expansion I/O unit (see note)		AFPX-E16R	≤ 65mA	≤ 40mA
		AFPX-E30R	≤ 400mA	≤ 250mA
Communication cassette (see note)		AFPX-COM1 AFPX-COM2	≤ 10mA	≤ 10mA
		AFPX-COM3 AFPX-COM4	≤ 15mA	≤ 10mA
Add-on cassette (see note)	Analog input cassette	AFPX-AD2	≤ 10mA	≤ 10mA
	Input cassette	AFPX-IN8	≤ 10mA	≤ 5mA
	Output cassettes	AFPX-TR8 AFPX-TR6P	≤ 10mA	≤ 5mA
	Pulse I/O cassette	AFPX-PLS	≤ 10mA	≤ 10mA
	Master memory cassette	AFPX-MRTC	≤ 10mA	≤ 10mA
Programmable display GT01 (see note)		AIGT0030B1 AIGT0030H1 (when tool port is directly connected)	≤ 25mA	≤ 15mA

◆ NOTE

These values indicate the increased current consumption of the control unit (refer to the following calculation example).

Unit type		Current consumption
		24V DC
Expansion FP0 adapter	AFPX-EFP0	≤ 10 mA

◆ EXAMPLE

Example calculation of power consumption using a power supply of 100V AC.

C30R + IN8 + TR8 + E16R + EFP0
410mA 10mA 10mA 65mA 10mA + current consumption of FP0 expansion unit (24V DC), e.g. FP0-E32T ≤ 40mA

≤ 495mA (100V AC)

≤ 50mA (24V DC)

12.2 Performance Specifications

Item			Descriptions		
			C14	C30	C60
No. of controllable I/O points		Control unit	14 points (DC input: 8, Relay output: 6)	30 points (DC input: 16, Relay output: 14)	60 points (DC input: 32, Relay output: 28)
		When using E16R expansion I/O units	Max. 30 points	Max. 46 points	Max. 76 points
		When using E30R expansion I/O units	Max. 254 points (up to 8 units)	Max. 270 points (up to 8 units)	Max. 300 points (up to 8 units)
		When using FP0 expansion units	Max. 110 points (up to 3 units)	Max. 126 points (up to 3 units)	Max. 156 points (up to 3 units)
Programming method/Control method			Relay symbol/Cyclic operation		
Program memory			Built-in Flash ROM (without backup battery)		
Program capacity			C14: 16k steps C30/C60: 32k steps		
No. of instructions		Basic	93		
		High-level	216		
Operation speed			From 0.32μs/step (for basic instructions)		
I/O refresh + base time			At 24V DC rated input voltage, 25°C: Base time 0.17 ms (with E16: 0.34 ms x no. of units; with E30: 0.47 ms x no. of units; with expansion FP0 adapter: 1.4 ms + FP0 expansion unit refresh time).		
Operation memory	Relay	External input (X) (see note 1)	1760 points (X0 to X109F)		
		External output (Y) (see note 1)	1760 points (Y0 to Y109F)		
		Internal relay (R)	4096 points (R0 to R255F)		
		Special internal relay (R)	192 points		
		Timer/Counter (T/C)	1024 points (see note 2) (Initial setting, Timer: 1008 points (T0 to T1007), Counter: 16 points (C1008 to C1023)) Timer: can count up to (in units of 1ms, 10ms, 100ms or 1s)x 32767. Counter: Can count up from 1 to 32767.		
		Link relay (L)	2048 points (L0 to L127F)		
	Memory area	Data register (DT)	12285 words (DT0 to DT12284)	32765 words (DT0 to DT32764)	
		Special data register (DT)	374 words		
		Link data register (LD)	256 words (LD0 to LD255)		
		File register	None		
		Index register (I)	14 words (I0 to ID)		
Differential points			Unlimited points		

Item		Descriptions		
		C14	C30	C60
Master control relay points (MCR)		256 points		
No. of labels (JP and LOOP)		256 points		
No. of step ladders		1000 stages		
No. of subroutines		500 subroutines		
No. of interrupt programs		Input 14 programs, periodical interrupt 1 program		
Sampling trace		None		
High-speed counter (see note 6)	Input of main unit	With single-phase 8 chs (10kHz each), with 2-phase 4 chs (5kHz each)		
	Pulse I/O cassette is installed	With single-phase 2 chs (80kHz each), with single-phase 4 chs (50kHz each), 2-phase 1 ch (30kHz), 2-phase 2 chs (25kHz each)		
Pulse output/PWM output (see note7) (Pulse I/O cassette is installed)		Pulse: with 1 ch (100kHz), with 2 chs (80kHz each) PWM: 1.5Hz to 41.7kHz 1000 resolution (≤ 12.5kHz), 100 resolution (> 12.5 kHz)		
Pulse catch input/interrupt input		14 points (Input of main unit: 8 points X0 to X7, Pulse I/O cassette: 3 points x 2)		
Periodical interrupt		0.5ms to 30s		
Potentiometer (Volume) input		C14/C30: 2 points, resolution 10 bits (K0 to K1000) C60: 4 points, resolution 10 bits (K0 to K1000)		
Constant scan		Available		
Realtime clock		Available when AFPX-MRTC is installed (year, month, day, hour, minute, second and day of week). (see note 3)		
Flash ROM backup (see note 4)	Backup by F12, P13 instructions	Data register (32765 words)		
	Automatic backup when power is cut off	Counter 16 points (C1008 to C1023), internal relay 8 points (WR247 to WR255), data register 55 words (C14: DT12230 to DT12284, C30/C60: DT32710 to DT32764)		
Battery backup		Memory that is set as hold area by system register (when an optional battery is installed.) (see note 5)		
Battery life		When AFPX-MRTC is not installed: 3.3 years or more (Actual usage value: 20 years (25°C)) When AFPX-MRTC is installed: 2.1 years or more (Actual usage value: 10 years (25°C))	When AFPX-MRTC is not installed: 2.7 years or more (Actual usage value: 20 years (25°C)) When AFPX-MRTC is installed: 1.8 years or more (Actual usage value: 10 years (25°C)) **Note:** more than 2 batteries can be installed, which increases the battery life correspondingly.	
Password		Available (4 digits, 8 digits)		
Upload protection		Available		
Self-diagnosis function		Such as watchdog timer, program syntax check		
Comment storage		Available (328kbytes) (Backup battery is not necessary)		
PLC link function		Max. 16 units, Link relay: 1024 points, Link register: 128 words (Data transmission and remote programming cannot be performed)		
Rewrite in RUN		Available		

◆ NOTES

1. **The number of points actually available for use is determined by the hardware configuration.**

2. **The number of points can be increased by using an auxiliary timer.**

3. **Precision of realtime clock:**
   - At 0°C: less than 119 seconds per month
   - At 25°C: less than 51 seconds per month
   - At 55°C: less than 148 seconds per month

4. **Writing is available up to 10000 times. When the optional battery is used, all areas can be backed up. Areas to be held and not held can be specified using the system registers.**

5. **If an area is held and the backup battery is not installed, the data may be corrupted as it is not cleared to 0 when the power is turned on. If the battery goes dead, the data in the hold area may likewise be corrupted.**

6. **These are the specifications when the rated input voltage is 24V DC at 25°C. The frequency will decrease depending on voltage, temperature or usage condition.**

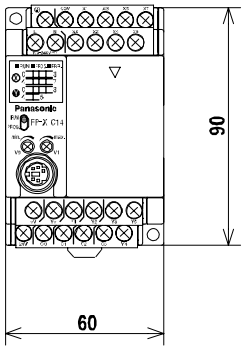
7. **The maximum frequency varies depending on the use.**

8. **The actual lifetime may be shorter than the typical lifetime depending on the usage conditions.**

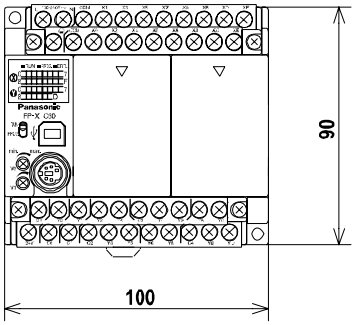
12.3 Dimensions and Installation Diagrams

Control units

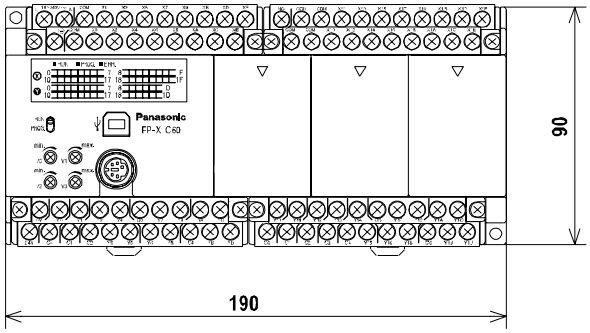
■ AFPX-C14R



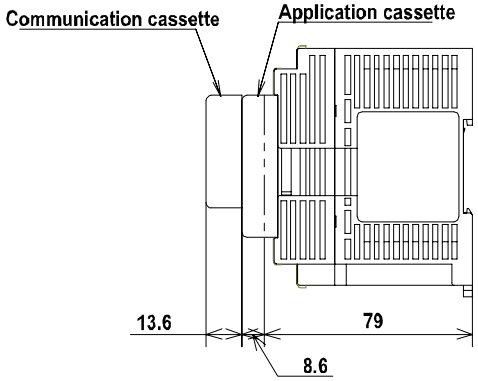
■ AFPX-C30R



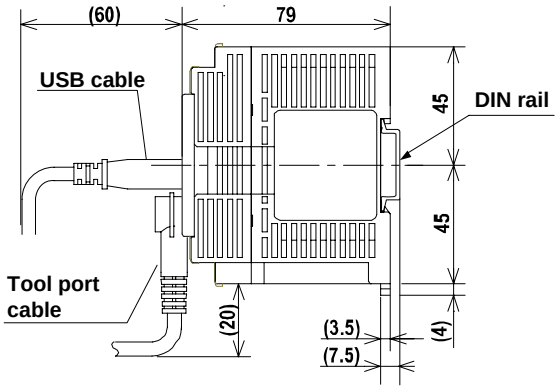
■ AFPX-C60R



■ When installing add-on cassettes

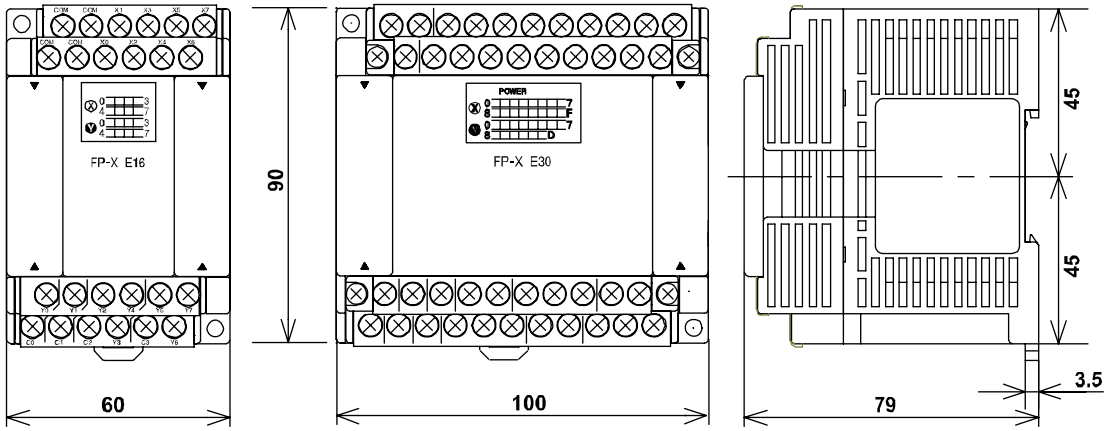


■ When installing cables



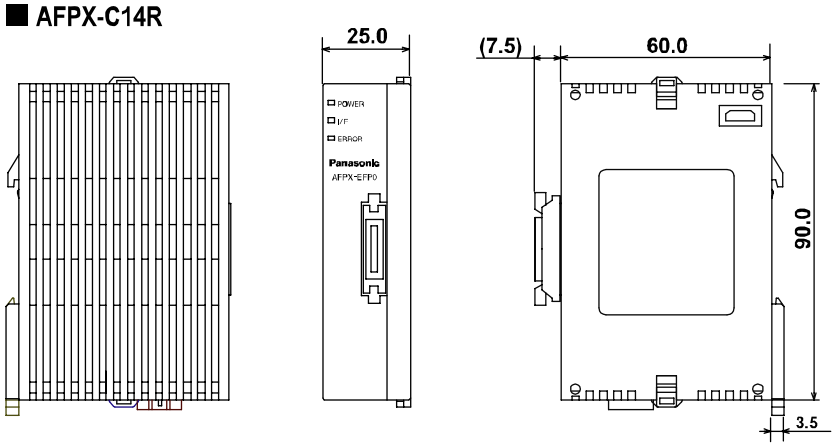
Expansion units

■ **AFPX-E16R** ■ **AFPX-E30R**

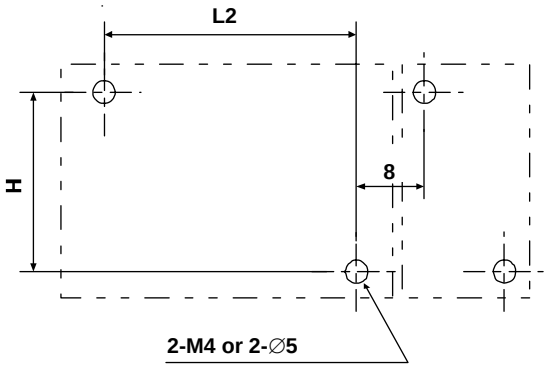


Expansion FP0 adapter

■ **AFPX-C14R**



Dimension diagram for installation



Model	L2	H
C14,E16	52	82
C30	92	
C60	182	

(Tolerance±0.5)

Chapter 13

Programming Information

13.1 Relays, Memory Areas and Constants for FP-X

Relays

Item	Number of points available	Function
External input (X) (see note 1)	1760 points (X0 to X109F)	Turns on or off based on external input.
External output (Y) (see note 1)	1760 points (Y0 to Y109F)	Externally outputs on or off state
Internal relay (R) (see note 2)	4096 points (R0 to R255F)	Relay which turns on or off only within program.
Link relay (L) (see note 2)	2048 points (L0 to L127F)	This relay is a shared relay used for PLC link.
Timer (T) (see note 2)	1024 points (T0 to T1007/C1008 to C1023) (see note 3)	This goes on when the timer reaches the specified time. It corresponds to the timer number.
Counter (C) (see note 2)		This goes on when the timer increments. It corresponds to the timer number.
Special internal relay (R)	192 points (R9000 to R911F)	Relay which turns on or off based on specific conditions and is used as a flag.

Memory areas

Item	Range of memory area available C14, C30/C60		Function
External input (WX) (see note 1)	110 words (WX0 to WX109)		Code for specifying 16 external input points as one word (16 bits) of data.
External output (WY) (see note 1)	110 words (WY0 to WY109)		Code for specifying 16 external output points as one word (16 bits) of data.
Internal relay (WR) (see note 2)	256 words (WR0 to WR255)		Code for specifying 16 internal relay points as one word (16 bits) of data.
Link relay (WL)	128 words (WL0 to WL127)		Code for specifying 16 link relay points as one word (16 bits) of data.
Data register (DT) (see note 2)	12285 words (DT0 to DT12284)	32765 words (DT0 to DT32764)	Data memory used in program. Data is handled in 16-bit units (one word).
Link register (LD) (see note 2)	256 words (LD0 to LD255)		This is a shared data memory which is used within the PLC link. Data is handled in 16-bit units (one word).
Timer/Counter set value area (SV) (see note 2)	1024 words (SV0 to SV1023)		Data memory for storing a target value of a timer and setting value of a counter. Stores by timer/counter number
Timer/Counter elapsed value area (EV) (see note 2)	1024 words (EV0 to EV1023)		Data memory for storing the elapsed value during operation of a timer/counter. Stores by timer/counter number.
Special data register (DT)	374 words (DT90000 to DT90373)		Data memory for storing specific data. Various settings and error codes are stored.
Index register (I)	14 words (I0 to ID)		Register can be used as an address of memory area and constants modifier.

Constants

Item	Range of memory area available
Decimal constants (Integer type) (K)	K-32, 768 to K32, 767 (for 16-bit operation)
	K-2, 147, 483, 648 to K2, 147, 483, 647 (for 32-bit operation)
Hexadecimal constants (H)	H0 to HFFFF (for 16-bit operation)
	H0 to HFFFFFFFF (for 32-bit operation)
Decimal constants (Floating point type) (F)	F-1.175494 x 10^{-38} to F-3.402823 x 10^{38}
	F 1.175494 x 10^{-38} to F 3.402823 x 10^{38}

◆ NOTES

1. **The number of points noted is the number reserved for the calculation memory. The actual number of points available for use depends on the hardware configuration.**

2. **If no batter is used, only the fixed area is backed up (counters 16 points: C1008 to C1023, internal relays 128 points: R2470 to R255F, data registers 55 words, C14: DT12230 to DT12284, C30/C60: DT32710 to DT32764). Writing is available up to 10000 times. When the optional battery is used, all area can be backed up. Areas to be held and not held can be specified using the system registers. If an area is held and the backup battery is not installed, the data may be corrupted as it is not cleared to 0 when the power is turned on. If the battery goes dead, the data in the hold area may likewise be corrupted.**

3. **The points for the timer and counter can be changed via system register 5. The numbers given in the table are the default settings for system register 5.**

13.2 System Registers

System registers are used to set values (parameters) which determine operation ranges and functions used. Set values based on the use and specifications of your program. There is no need to set system registers for functions which will not be used.

13.2.1 Precautions When Setting System Registers

System register settings are effective from the time they are set.

However, MEWNET-W0 PLC link settings, input settings, Tool and COM port communication settings become effective when the mode is changed from PROG to RUN. With regard to the modem connection setting, when the power is turned off and on or when the mode is changed from PROG to RUN, the controller sends a command to the modem which enables it for reception.

When the initialization operation is performed, all system register values (parameters) set will be initialized.

13.2.2 Types of System Registers

Hold/non-hold type settings (system registers 5 to 8, 10, 12 and 14)

The values for the timer and counter can be specified by using system register no. 5 to specify the first number of the counter. System registers nos. 6 to 14 are used to specify the area to be held when a battery is used.

Operation mode settings for error (system registers 4, 20, 23 and 26)

Set the operation mode when errors such as battery error, duplicated use of output, I/O verification error and operation error occur.

Time settings (system registers 31, 32, 34)

Set time-out error detection time and constant scan time.

MEWNET-W0 PLC link settings (system registers 40 to 45, 47, 50 to 55, and 57)

These settings are for using link relays and link registers in MEWNET-W0 PLC link communication. Note that "PLC link" is not the default setting.

Input settings (system registesr 400 to 406)

When using the high-speed counter function, pulse catch function or interrupt function, set the operation mode and the input number to be used for the function.

Tool and COM port communication settings (system registers 410 to 421)

Set these registers when the Tool port, and COM1 and COM2 ports are to be used for computer link, general-purpose serial communication, PLC link, and Modbus communication. Note that the default setting is computer link mode.

13.2.3 Checking and Changing System Registers

PROCEDURE

1. **Set the control unit in the PROG mode**
2. **Check your programming tool's online help for details on how to proceed**

13.2.4 Table of System Registers for FP-X

Hold/Non-hold

Address	Name	Default value	Description	
5	Starting number setting for counter	1008	0 to 1024	• These settings are effective if the optional backup battery is installed. • If no backup battery is used, do not change the default settings. Otherwise proper functioning of hold/non-hold values cannot be guaranteed.
6	Hold type area starting number setting for timer and counter	1008	0 to 1024	
7	Hold type area starting number setting for internal relays	248	0 to 256	
8	Hold type area starting number setting for data registers	C14: 12230 C30, C60: 32710	0 to 32765	
14	Hold or non-hold setting for step ladder process	Non-hold	Hold/ Non-hold	
4	Previous value is held for a leading edge detection instruction (DF instrucion) with MC	Hold	Hold/ Non-hold	
10	Hold type area starting number for PLC W0-0 link relays	64	0 to 64	
11	Hold type area starting number for PLC W0-1 link relays	128	64 to 128	
12	Hold type area starting number for PLC W0-0 link registers	128	0 to 128	
13	Hold type area starting number for PLC W0-1 link registers	256	128 to 256	

Action on error

Address	Name	Default value	Description	
20	Disable or enable setting for duplicated output	Disabled	Disabled/Enabled	
23	Operation setting when an I/O verification error occurs	Stop	Stop/Continuation of operation	
26	Operation setting when an operation error occurs	Stop	Stop/Continuation of operation	
4	Alarm battery error (Operating setting when battery error occurs)	Disabled	Disabled:	When a battery error occurs, a self-diagnostic error is not issued and the ERROR/ALARM LED does not flash.

Address	Name	Default value	Description
			Enabled: When a battery error occurs, a self-diagnostic error is issued and the ERROR/ALARM LED flashes.

Time setting

Address	Name	Default value	Description
31	Wait time setting for multi-frame communication	6500.0ms	10 to 81900ms
32	Timeout setting for SEND/RECV, RMRD/RMWT commands	10000.0ms	10 to 81900ms
34	Constant value settings for scan time	Normal scan	0: Normal scan 0 to 350 ms: Scans once each specified time interval

PLC W0-0 setting

Address	Name	Default value	Description
40	Range of link relays used for PLC link	0	0 to 64 words
41	Range of link data registers used for PLC link	0	0 to 128 words
42	Starting number for link relay transmission	0	0 to 63
43	Link relay transmission size	0	0 to 64 words
44	Starting number for link data register transmission	0	0 to 127
45	Link data register transmission size	0	0 to 127 words
46	PLC link switch flag	Normal	Normal/reverse
47	Maximum unit number setting for MEWNET-W0 PLC link	16	1 to 16

PLC W0-1 setting

Address	Name	Default value	Description
50	Range of link relays used for PLC link	0	0 to 64 words
51	Range of link data registers used for PLC link	0	0 to 128 words
52	Starting number for link relay transmission	64	64 to 127
53	Link relay transmission size	0	0 to 64 words
54	Starting number for link data register transmission	128	128 to 255
55	Link data register transmission size	0	0 to 127 words
57	Maximum unit number setting for MEWNET-W0 PC(PLC) link	16	1 to 16

Pulse I/O cassette (AFPX-PLS)

Address	Name	Default value	Description	
400	High-speed counter operation mode settings (X100 to X102)	CH8: Do not set input X100 as high-speed counter	CH8	Do not set input X100 as high-speed counter. Two-phase input (X100, X101) Two-phase input (X100, X101), Reset input (X102) Incremental input (X100) Incremental input (X100), Reset input (X102) Decremental input (X100) Decremental input (X100), Reset input (X102) Incremental/decremental input (X100, X101) Incremental/decremental input (X100, X101), Reset input (X102) Incremental/decremental control input (X100, X101) Incremental/decremental control input (X100, X101), Reset input (X102)
		CH9: Do not set input X101 as high-speed counter	CH9	Do not set input X101 as high-speed counter. Incremental input (X101) Incremental input (X101), Reset input (X102) Decremental input (X101) Decremental input (X101), Reset input (X102)
	Pulse output operation mode	CH0: Use output as normal output.	CH0	Use output as normal output. Use output Y100 to Y102 as pulse output. Use output Y100 as PWM output.
401	High-speed counter operation mode settings (X200 to X202)	CHA: Do not set input X200 as high-speed counter	CHA	Do not set input X200 as high-speed counter. Two-phase input (X200, X201) Two-phase input (X200, X201), Reset input (X202) Incremental input (X200) Incremental input (X200), Reset input (X202) Decremental input (X202) Decremental input (X202), Reset input (X202) Incremental/decremental input (X200, X201) Incremental/decremental input (X200, X201), Reset input (X202) Incremental/decremental control (X200, X201) Incremental/decremental control (X200, X201), Reset input (X202)
		CHB: Do not set input X201 as high-speed counter	CHB	Does not set input X201 as high-speed counter. Incremental input (X201) Incremental input (X201), Reset input (X202) Decremental input (X201) Decremental input (X201), Reset input (X202)
	Pulse output operation mode	CH1: Use output as normal output.	CH1	Use output as normal output. Use output Y200 to Y202 as pulse output. Use output Y200 as PWM output.

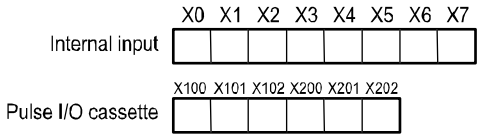
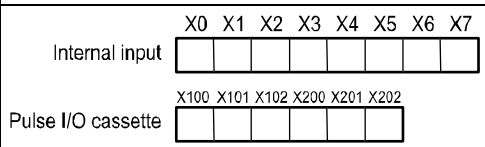
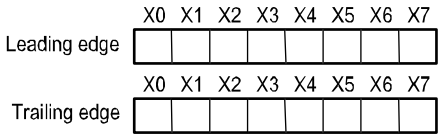
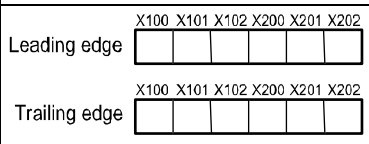
◆ NOTES

- **If the operation mode is set to two-phase, incremental/decremental, or incremental/decremental control, the setting for CH9 is invalid in system register 400 and the setting for CHB is invalid in system register 401.**
- **If reset input settings overlap, the CH9 setting takes precedence in system register 400 and the CHB setting takes precedence in system register 401.**

- **CHA, CHB and CH1 input signals in system register 401 are the signals when the pulse I/O cassette (AFPX-PLS) is installed in the cassette mounting part 2.**
- **If the operation mode setting for the pulse output CH0 and CH1 is carried out, it cannot be used as normal output.**
  When the operation mode for the pulse output CH0 is set to 1, the reset input setting for the high-speed counter CH8 and CH9 is invalid.
  When the operation mode for the pulse output CH1 is set to 1, the reset input setting for the high-speed counter CHA and CHB is invalid.

High-speed counter, interrupt inputs

Address	Name	Default value	Description	
402	High-speed counter operation mode settings	CH0: Do not set input X0 as high-speed counter	CH0	Do not set input X0 as high-speed counter. Incremental input (X0) Decremental input (X0) Two-phase input (X0, X1)
		CH1: Do not set input X1 as high-speed counter	CH1	Do not set input X1 as high-speed counter. Incremental input (X1) Decremental input (X1) Two-phase input (X0, X1)
		CH2: Do not set input X2 as high-speed counter	CH2	Do not set input X2 as high-speed counter. Incremental input (X2) Decremental input (X2) Two-phase input (X2, X3)
		CH3: Do not set input X3 as high-speed counter	CH3	Do not set input X3 as high-speed counter. Incremental input (X3) Decremental input (X3) Two-phase input (X2, X3)
		CH4: Do not set input X4 as high-speed counter	CH4	Do not set input X4 as high-speed counter. Incremental input (X4) Decremental input (X4) Two-phase input (X3 X4)
		CH5: Do not set input X5 as high-speed counter	CH5	Do not set input X5 as high-speed counter. Incremental input (X5) Decremental input (X5) Two-phase input (X4, X5)
		CH6: Do not set input X6 as high-speed counter	CH6	Do not set input X6 as high-speed counter. Incremental input (X6) Decremental input (X6) Two-phase input (X5, X6)
		CH7: Do not set input X7 as high-speed counter	CH7	Do not set input X7 as high-speed counter. Incremental input (X7) Decremental input (X7) Two-phase input (X6, X7)

Address	Name	Default value	Description
403	Pulse catch input settings	Not set	 Select whether to enable the contact for pulse catch input.
404	Interrupt input settings	Not set	 Select whether to enable the contact for interrupt input.
405	Effective interrupt edge setting for internal input	Leading edge	 Select whether the input should be activated at a leading edge, trailing edge or both.
406	Effective interrupt edge setting for pulse I/O cassette input	Leading edge	 Select whether the input should be activated at a leading edge, trailing edge or both.

NOTES

- **For counting two-phase input, only CH0, CH2, CH4 and CH6 can be used. When two-phase input is specified for CH0, CH2, CH4 and CH6, the settings for CH1, CH3, CH5 and CH7 corresponding to each CH no. are ignored. However, specify the same setting for those channels.**
- **The settings for pulse catch and interrupt input can only be specified in system registers 403 and 404.**
- **If system register 400 to 404 have been set simultaneously for the same input relay, the following precedence order is effective:**
  1. High-speed counter
  2. Pulse catch
  3. Interrupt input
  <Example>
  When the high-speed counter is being used in the addition input mode, even if input X0 is specified as an interrupt input or as pulse catch input, those settings are invalid, and X0 functions as counter input for the high-speed counter.

Tool port settings

Address	Name	Default value	Description
410	Unit no. setting	1	1 to 99
412	Communication mode setting	Computer link	Computer link General-purpose communications Modbus RTU
	Selection of modem connection	Disabled	Enabled/Disabled
413	Communication format setting	Data length bit: 8 bits Parity check: “with odd” Stop bit: 1 bit	Enter the settings for the various items. Data length bit: 7 bits/8 bits Parity check: none/with odd/with even Stop bit: 1 bit/2 bits The following setting is valid only when the communication mode specified by system register 412 has been set to “General-purpose serial communication”. • Terminator: CR/CR+LF/None • Header: No STX/STX
415	Communication speed (baud rate) setting	9600 bps	2400 bps 4800 bps 9600 bps 19200 bps 38400 bps 57600 bps 115200 bps
420	Starting address for received buffer of general (serial data) communication mode	0	0 to 32764
421	Buffer capacity setting for data received of general (serial data) communication mode	2048	0 to 2048

COM 1 port settings

Address	Name	Default value	Description
410	Unit no. setting	1	1 to 99
412	Communication mode setting	Computer link	Computer link General-purpose serial communication PC(PLC) link Modbus RTU
	Selection of modem connection	Disabled	Enabled/Disabled

Address	Name	Default value	Description
413	Communication format setting	Data length bit: 8 bits Parity check: Odd Stop bit: 1 bit	Enter the settings for the various items. Data length bit: 7 bits/8 bits Parity check: none/with odd/with even Stop bit: 1 bit/2 bits The following setting is valid only when the communication mode specified by system register 412 has been set to “General-purpose serial communication”. • Terminator: CR/CR+LF/None • Header: No STX/STX
415	Communication speed (Baud rate) setting	9600 bps	2400 bps 4800 bps 9600 bps 19200 bps 38400 bps 57600 bps 115200 bps
416	Starting address for received buffer of general (serial data) communication mode	0	0 to 32764
417	Buffer capacity setting for data received of general (serial data) communication mode	2048	0 to 2048

◆ NOTE

The communication format for PLC link is fixed at: data length 8 bits, odd parity, stop bit 1, communication speed (baud rate) 15200 bps.

COM 2 port settings

Address	Name	Default value	Description
411	Unit no. setting	1	1 to 99
412	Communication mode setting	Computer link	Computer link General-purpose serial communication PLC link Modbus RTU
	Selection of modem connection	Disabled	Enabled/Disabled
	Selection of port	Built-in USB	Built-in USB Communication cassette

Address	Name	Default value	Description
414	Communication format setting	Data length bit: 8 bits Parity check: "with odd" Stop bit: 1 bit	Enter the settings for the various items. Data length bit: 7 bits/8 bits Parity check: none/odd/even Stop bit: 1 bit/2 bits The following setting is valid only when the communication mode specified by system register 412 has been set to "General-purpose serial communication". • Terminator: CR/CR+LF/None • Header: No STX/STX
415	Communication speed (baud rate) setting	9600 bps	2400 bps 4800 bps 9600 bps 19200 bps 38400 bps 57600 bps 115200 bps
416	Starting address for received buffer of general (serial data) communication mode	2048	0 to 32764
417	Buffer capacity setting for data received of general (serial data) communication mode	2048	0 to 2048

◆ NOTES

- **The communication format for PLC link is fixed at: data length 8 bits, odd parity, stop bit 1, communication speed (baud rate) 15200 bps.**
- **Use the system registers to select the USB port for C30 and C60. The USB port is the default setting for the COM2 port of C30 and C60. The communication speed for the USB port is 115.2 kbps no matter what the baud rate setting in system register 415 is.**
  The setting for no. 412 must be changed to communication cassette to use the COM2 port of the communication cassette. The COM2 port of the USB port and the communication cassette cannot be used at the same time.

13.3 Special Internal Relays for FP-X

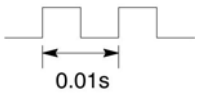
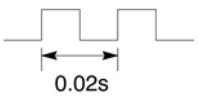
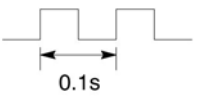
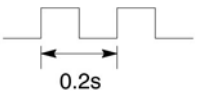
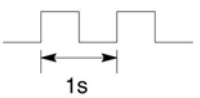
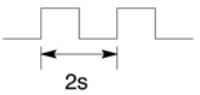
The special internal relays turn on and off under special conditions. The ON and OFF states are not output externally. Writing is not possible with a programming tool or an instruction.

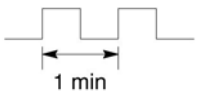
WR900

Relay no. FP address IEC	Name	Description
R9000 **%MX0.900.0**	Self-diagnostic error flag	Turns on when a self-diagnostic error occurs. The content of self-diagnostic error is stored in DT90000.
R9001 **%MX0.900.1**	Not used	—
R9002 **%MX0.900.2**	Application cassette I/O error flag	Turns on when an error is detected in the I/O type application cassette.
R9003 **%MX0.900.3**	Application cassette abnormal error flag	Turns on when an error is detected in the application cassette.
R9004 **%MX0.900.4**	I/O verification error flag	Turns on when an I/O verification error occurs.
R9005 **%MX0.900.5**	Backup battery error flag (non-hold)	Turns on for an instant when a backup battery error occurs.
R9006 **%MX0.900.6**	Backup battery error flag (hold)	Turns on when a backup battery error occurs. Once a battery error has been detected, this is held even after recovery has been made. It goes off if the power supply is turned off, or if the system is initialized.
R9007 **%MX0.900.7**	Operation error flag (hold)	Turns on and keeps the on state when an operation error occurs. The address where the error occurred is stored in DT90017. (indicates the first operation error which occurred).
R9008 **%MX0.900.8**	Operation error flag (non-hold)	Turns on for an instant when an operation error occurs. The address where the operation error occurred is stored in DT90018. The contents change each time a new error occurs.
R9009 **%MX0.900.9**	Carry flag	This is set if an overflow or underflow occurs in the calculation results, and as a result of a shift system instruction being executed.
R900A **%MX0.900.10**	> Flag	Turns on for an instant when the compared results become larger in the comparison instructions.
R900B **%MX0.900.11**	= Flag	Turns on for an instant • when the compared results are equal in the comparison instructions. • when the calculated results become 0 in the arithmetic instructions.
R900C **%MX0.900.12**	< Flag	Turns on for an instant when the compared results become smaller in the comparison instructions.
R900D **%MX0.900.13**	Auxiliary timer instruction flag	Turns on when the set time elapses (set value reaches 0) in the timing operation of the F137_STMR/F183_DSTM auxiliary timer instruction. The flag turns off when the trigger for auxiliary timer instruction turns off.
R900E **%MX0.900.14**	Tool port communication error	Turns on when a communication error at Tool port has occurred.

Relay no. FP address IEC	Name	Description
R900F **%MX0.900.15**	Constant scan error flag	Turns on when scan time exceeds the time specified in system register 34 during constant scan execution. This goes on if 0 has been set using system register 34.

WR901

Relay no. FP address IEC	Name	Description	
R9010 **%MX0.901.0**	Always on relay	Always on.	
R9011 **%MX0.901.1**	Always off relay	Always off.	
R9012 **%MX0.901.2**	Scan pulse relay	Turns on and off alternately at each scan.	
R9013 **%MX0.901.3**	Initial (on type) pulse relay	Goes on for only the first scan after operation (RUN) has been started, and goes off for the second and subsequent scans.	
R9014 **%MX0.901.4**	Initial (off type) pulse relay	Goes off for only the first scan after operation (RUN) has been started, and goes on for the second and subsequent scans.	
R9015 **%MX0.901.5**	Step ladder initial pulse relay (on type)	Turns on for only the first scan of a process after the boot at the step ladder control.	
R9016 **%MX0.901.6**	Not used	—	
R9017 **%MX0.901.7**	Not used	—	
R9018 **%MX0.901.8**	0.01 s clock pulse relay	Repeats on/off operations in 0.01 sec. cycles. (ON : OFF = 0.005s : =.005s)	
R9019 **%MX0.901.9**	0.02 s clock pulse relay	Repeats on/off operations in 0.02 s. cycles. (ON : OFF = 0.01s : 0.01s)	
R901A **%MX0.901.10**	0.1 s clock pulse relay	Repeats on/off operations in 0.1 s. cycles. (ON : OFF = 0.05s : 0.05s)	
R901B **%MX0.901.11**	0.2 s clock pulse relay	Repeats on/off operations in 0.2 s. cycles. (ON : OFF = 0.1s : 0.1s)	
R901C **%MX0.901.12**	1 s clock pulse relay	Repeats on/off operations in 1 s. cycles. (ON : OFF = 0.5s : 0.5s)	
R901D **%MX0.901.13**	2 s clock pulse relay	Repeats on/off operations in 2 s. cycles. (ON : OFF = 1s : 1s)	

Relay no. FP address IEC	Name	Description	
R901E **%MX0.901.14**	1 min clock pulse relay	Repeats on/off operations in 1 min. cycles. (ON : OFF = 30s : 30s)	
R901F **%MX0.901.15**	Not used	—	

WR902

Relay no. FP address IEC	Name	Description
R9020 **%MX0.902.0**	RUN mode flag	Turns off while the mode selector is set to PROG. Turns on while the mode selector is set to RUN.
R9021 **%MX0.902.1**	Not used	—
R9022 **%MX0.902.2**	Not used	—
R9023 **%MX0.902.3**	Not used	—
R9024 **%MX0.902.4**	Not used	—
R9025 **%MX0.902.5**	Not used	—
R9026 **%MX0.902.6**	Message flag	Turns on while the F149_MSG instruction is executed.
R9027 **%MX0.902.7**	Not used	—
R9028 **%MX0.902.8**	Not used	—
R9029 **%MX0.902.9**	Forcing flag	Turns on during forced on/off operation for input/output relay timer/counter contacts.
R902A **%MX0.902.10**	Interrupt enable flag	Turns on while the external interrupt trigger is enabled by the ICTL instruction.
R902B **%MX0.902.11**	Interrupt error flag	Turns on when an interrupt error occurs.
R902C **%MX0.902.12**	Not used	—
R902E **%MX0.902.14**	Not used	—
R902F **%MX0.902.15**	Not used	—

WR903

Relay no. FP address IEC	Name	Description
R9030 **%MX0.903.0**	Not used	—
R9031 **%MX0.903.1**	Not used	—
R9032 **%MX0.903.2**	COM1 port mode flag	Turns on when the general purpose communication function is being used Goes off when any function other than the general purpose communication function is being used.
R9033 **%MX0.903.3**	PR instruction flag	Off: Printing is not executed. On: Execution is in progress.
R9034 **%MX0.903.4**	Editing in RUN mode flag	Goes on for only the first scan following completion of a rewrite during the RUN operation.
R9035 **%MX0.903.5**	Not used	—
R9036 **%MX0.903.6**	Not used	—
R9037 **%MX0.903.7**	COM1 port communication error flag	Goes on if a transmission error occurs during data communication. Goes off when a request is made to send data, using the F159_MTRN instruction.
R9038 **%MX0.903.8**	COM1 port reception done flag during general- purpose serial communication	Turns on when the terminator is received during general -purpose serial communication.
R9039 **%MX0.903.9**	COM1 port transmission done flag during general purpose serial communication	Goes on when transmission has been completed in general purpose serial communication. Goes off when transmission is requested in general purpose serial communication.
R903A **%MX0.903.10**	Not used	—
R903B **%MX0.903.11**	Not used	—
R903C **%MX0.903.12**	Not used	—
R903D **%MX0.903.13**	Not used	—
R903E **%MX0.903.14**	TOOL port reception done flag during general purpose communication	Turns on when the terminator is received during general purpose serial communication.
R903F **%MX0.903.15**	TOOL port transmission done flag during general purpose serial communication	Goes on when transmission has been completed in general purpose serial communication. Goes off when transmission is requested in general purpose serial communication.

◆ NOTE

R9030 to R903F can change during 1 scan.

WR904

Relay no. FP address IEC	Name	Description
R9040 **%MX0.904.0**	TOOL port mode flag	Goes on when the general purpose serial communication is used. Goes off when the MEWTOCOL is used.
R9041 **%MX0.904.1**	COM1 port PLC link flag	Turns on while the PLC link function is used.
R9042 **%MX0.904.2**	COM2 port communication mode flag	Goes on when the general purpose serial communication is used. Goes off when the MEWTOCOL is used.
R9043 **%MX0.904.3**	Not used	—
R9044 **%MX0.904.4**	COM1 port SEND/RECV instruction execution flag	Monitors whether the F145_SEND or F146_RECV instructions can be executed or not for the COM1 port. • **Off:** Neither of the instructions can be executed, i.e. one is already being executed. • **On:** One of the above mentioned instructions can be executed.
R9045 **%MX0.904.5**	COM1 port SEND/RECV instruction execution end flag	Monitors if an abnormality has been detected during the execution of the F145_SEND or F146_RECV instructions for the COM1 port: • **Off:** No abnormality detected. • **On:** An abnormality detected. (communication error). The error code is stored in DT90124.
R9046 **%MX0.904.6**	Not used	—
R9047 **%MX0.904.7**	COM2 port communication error flag	Goes on if a transmission error occurs during data communication. Goes off when a request is made to send data, using the F159_MTRN instruction.
R9048 **%MX0.904.8**	COM2 port reception done flag during general purpose communication	Turns on when the terminator is received during general purpose serial communication.
R9049 **%MX0.904.9**	COM2 port transmission done flag during general purpose communication	Goes on when transmission has been completed in general purpose serial communication. Goes off when transmission is requested in general purpose communication.
R904A **%MX0.904.10**	COM2 port SEND/RECV instruction execution flag	Monitors whether the F145_SEND or F146_RECV instructions can be executed or not for the COM2 port. • **Off:** Neither of the instructions can be executed, i.e. one is already being executed. • **On:** One of the above mentioned instructions can be executed.
R904B **%MX0.904.11**	COM2 port SEND/RECV instruction execution end flag	Monitors if an abnormality has been detected during the execution of the F145_SEND or F146_RECV instructions for the COM2 port: • **Off:** No abnormality detected. • **On:** An abnormality detected. (communication error). The error code is stored in DT90125.

Relay no. FP address IEC	Name	Description
R904C to R904F %MX0.904.12 to %MX0.904.15	Not used	—

◆ NOTE

R9040 to R904F can change during 1 scan.

WR905

Relay no. FP address IEC	Name	Description
R9050 %MX0.905.0	MEWNET-W0 PLC link transmission error flag	When using MEWNET-W0 • Turns on when a transmission error occurs at PLC link. • Turns on when there is an error in the PLC link area settings.
R9051 to R905F %MX0.905.1 to %MX0.905.15	Not used	—

WR906: MEWNET-W0 PLC link 0 transmission assurance relays

Relay no. FP address IEC	Unit no.	Description
R9060 **%MX0.906.0**	Unit no. 1	Turns on when the unit no. is communicating properly in PLC link mode. Turns off when operation is stopped, when an error occurs, or when not in the PLC link mode.
R9061 **%MX0.906.1**	Unit no. 2	
R9062 **%MX0.906.2**	Unit no. 3	
R9063 **%MX0.906.3**	Unit no. 4	
R9064 **%MX0.906.4**	Unit no. 5	
R9065 **%MX0.906.5**	Unit no. 6	
R9066 **%MX0.906.6**	Unit no. 7	
R9067 **%MX0.906.7**	Unit no. 8	
R9068 **%MX0.906.8**	Unit no. 9	
R9069 **%MX0.906.9**	Unit no. 10	
R906A **%MX0.906.10**	Unit no. 11	
R906B **%MX0.906.11**	Unit no. 12	
R906C **%MX0.906.12**	Unit no. 13	
R906D **%MX0.906.13**	Unit no. 14	
R906E **%MX0.906.14**	Unit no. 15	
R906F **%MX0.906.15**	Unit no. 16	

WR907: MEWNET-W0 PLC link 0 operation mode relays

Relay no. FP address IEC	Unit no.	Description
R9070 **%MX0.907.0**	Unit no. 1	Turns on when the unit no. is in RUN mode. Turns off when the unit no. is in PROG. mode.
R9071 **%MX0.907.1**	Unit no. 2	
R9072 **%MX0.907.2**	Unit no. 3	
R9073 **%MX0.907.3**	Unit no. 4	
R9074 **%MX0.907.4**	Unit no. 5	
R9075 **%MX0.907.5**	Unit no. 6	
R9076 **%MX0.907.6**	Unit no. 7	
R9077 **%MX0.907.7**	Unit no. 8	
R9078 **%MX0.907.8**	Unit no. 9	
R9079 **%MX0.907.9**	Unit no. 10	
R907A **%MX0.907.10**	Unit no. 11	
R907B **%MX0.907.11**	Unit no. 12	
R907C **%MX0.907.12**	Unit no. 13	
R907D **%MX0.907.13**	Unit no. 14	
R907E **%MX0.907.14**	Unit no. 15	
R907F **%MX0.907.15**	Unit no. 16	

WR908: MEWNET-W0 PLC link 1 transmission assurance relays

Relay no. FP address IEC	Unit no.	Description
R9080 **%MX0.908.0**	Unit no. 1	Turns on when the unit no. is communicating properly in PLC link mode. Turns off when operation is stopped, when an error occurs, or when not in the PLC link mode.
R9081 **%MX0.908.1**	Unit no. 2	
R9082 **%MX0.908.2**	Unit no. 3	
R9083 **%MX0.908.3**	Unit no. 4	
R9084 **%MX0.908.4**	Unit no. 5	
R9085 **%MX0.908.5**	Unit no. 6	
R9086 **%MX0.908.6**	Unit no. 7	
R9087 **%MX0.908.7**	Unit no. 8	
R9088 **%MX0.908.8**	Unit no. 9	
R9089 **%MX0.908.9**	Unit no. 10	
R908A **%MX0.908.10**	Unit no. 11	
R908B **%MX0.908.11**	Unit no. 12	
R908C **%MX0.908.12**	Unit no. 13	
R908D **%MX0.908.13**	Unit no. 14	
R908E **%MX0.908.14**	Unit no. 15	
R908F **%MX0.908.15**	Unit no. 16	

WR909: MEWNET-W0 PLC link 1 operation mode relays

Relay no. FP address IEC	Unit no.	Description
R9090 **%MX0.909.0**	Unit no. 1	Turns on when the unit no. is in RUN mode. Turns off when the unit no. is in PROG. mode.
R9091 **%MX0.909.1**	Unit no. 2	
R9092 **%MX0.909.2**	Unit no. 3	
R9093 **%MX0.909.3**	Unit no. 4	
R9094 **%MX0.909.4**	Unit no. 5	
R9095 **%MX0.909.5**	Unit no. 6	
R9096 **%MX0.909.6**	Unit no. 7	
R9097 **%MX0.909.7**	Unit no. 8	
R9098 **%MX0.909.8**	Unit no. 9	
R9099 **%MX0.909.9**	Unit no. 10	
R909A **%MX0.909.10**	Unit no. 11	
R909B **%MX0.909.11**	Unit no. 12	
R909C **%MX0.909.12**	Unit no. 13	
R909D **%MX0.909.13**	Unit no. 14	
R909E **%MX0.909.14**	Unit no. 15	
R909F **%MX0.909.15**	Unit no. 16	

WR910

Relay no. FP address IEC	Name	Description
R9100 to R910F **%MX0.910.0 to %MX0.910.15**	Not used	—

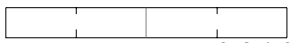
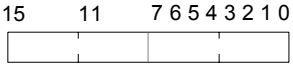
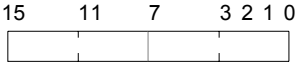
WR911

Relay no. FP address IEC	Control flag name	Description
R9110 **%MX0.911.0**	HSC-CH0	Turns on while the F166_HC1S and F167_HC1R instructions are executed. Turns off when the F166_HC1S and F167_HC1R instructions are completed.
R9111 **%MX0.911.1**	HSC-CH1	
R9112 **%MX0.911.2**	HSC-CH2	
R9113 **%MX0.911.3**	HSC-CH3	
R9114 **%MX0.911.4**	HSC-CH4	
R9115 **%MX0.911.5**	HSC-CH5	
R9116 **%MX0.911.6**	HSC-CH6	
R9117 **%MX0.911.7**	HSC-CH7	
R9118 **%MX0.911.8**	HSC-CH8	
R9119 **%MX0.911.9**	HSC-CH9	
R911A **%MX0.911.10**	HSC-CHA	
R911B **%MX0.911.11**	HSC-CHB	
R911C **%MX0.911.12**	PLS-CH0	Turns on while pulses are being output by the F171_SPDH, F172_PLSH, F173_PWMH and F174_SP0H instructions.
R911D **%MX0.911.13**	PLS-CH1	
R911E **%MX0.911.14**	Not used	—
R911F **%MX0.911.15**	Not used	—

13.4 Special Data Registers for FP-X

Special data registers are one word (16-bit) memory areas which store specific information.

(A: Available, N/A: Not available)

FP Address IEC Address	Name	Description	Read	Write
DT90000 **%MW5.90000**	Self-diagnostic error code	The self-diagnostic error code is stored here when a self-diagnostic error occurs.	A	N/A
DT90001 **%MW5.90001**	Not used	—	N/A	N/A
DT90002 **%MW5.90002**	Position of abnormal I/O board for application cassette	When an error occurs at the I/O board for the application cassette, the bit corresponding to the board will turn on. 15 11 7 3 2 1 0 (bit no.)  3 2 1 0 (expansion no.) on: error, off: normal	A	N/A
DT90003 **%MW5.90003**	Not used	—	N/A	N/A
DT90004 **%MW5.90004**	Not used	—	N/A	N/A
DT90005 **%MW5.90005**	Not used	—	N/A	N/A
DT90006 **%MW5.90006**	Position of abnormal application cassette	When an error occurs at the intelligent board for the application cassette, the bit corresponding to the board will turn on. 15 11 7 3 2 1 0 (bit no.)  3 2 1 0 (expansion no.) on: error, off: normal	A	N/A
DT90007 **%MW5.90007**	Not used	—	N/A	N/A
DT90008 **%MW5.90008**	Not used	—	N/A	N/A
DT90009 **%MW5.90009**	Communication error flag for COM 2	Stores the error contents when using COM 2 port.	A	N/A
DT90010 **%MW5.90010**	Extension I/O verify error unit	When the state of installation of FP-X expansion I/O unit has changed since the power was turned on, the bit corresponding to the unit no. will turn on. Monitor using binary display. 15 11 7 6 5 4 3 2 1 0 (bit no.)  7 6 5 4 3 2 1 0 (unit no.) on: error, off: normal	A	N/A
DT90011 **%MW5.90011**	Add-on cassette verify error unit	When the state of installation of an FP-X add-on cassette has changed since the power was turned on, the bit corresponding to the unit no. will turn on. Monitor using binary display. 15 11 7 3 2 1 0 (bit no.)  3 2 1 0 (expansion no.) on: error, off: normal	A	N/A

FP Address IEC Address	Name	Description	Read	Write
DT90012 **%MW5.90012**	Not used	—	N/A	N/A
DT90013 **%MW5.90013**	Not used	—	N/A	N/A
DT90014 **%MW5.90014**	Operation auxiliary register for data shift instruction	One shift-out hexadecimal digit is stored in bit positions 0 to 3 when the data shift instruction, **F105_BSR** or **F106_BSL** is executed. The value can be read and written by executing **F0_MV** instruction.	A	A
DT90015 **%MW5.90015**	Operation auxiliary register for division instruction	The divided remainder (16-bit) is stored in DT90015 when the division instruction **F32_%** or **F52_B%** instruction is executed. The divided remainder (32-bit) is stored in DT90015 and DT90016 when the division instruction **F33_D%** or **F53_DB%** is executed. The value can be read and written by executing the **F0_MV** instruction.	A	A
DT90016 **%MW5.90016**			A	A
DT90017 **%MW5.90017**	Operation error address (hold type)	After commencing operation, the address where the first operation error occurred is stored. Monitor the address using decimal display.	A	N/A
DT90018 **%MW5.90018**	Operation error address (non-hold type)	The address where an operation error occurred is stored. Each time an error occurs, the new address overwrites the previous address. At the beginning of a scan, the address is 0. Monitor the address using decimal display.	A	N/A
DT90019 **%MW5.90019**	2.5ms ring counter (see note)	The data stored here is increased by one every 2.5ms. (H0 to HFFFF) Difference between the values of the two points (absolute value) x 2.5ms = elapsed time between the two points.	A	N/A
DT90020 **%MW5.90020**	10μs ring counter (see note)	The data stored here is increased by one every 10.24μs. (H0 to HFFFF) Difference between the values of the two points (absolute value) x 10.24μs = elapsed time between the two points. **Note:** The exact value is 10.24μs.	A	N/A
DT90021 **%MW5.90021**	Not used	—	N/A	N/A

◆ NOTE

It is renewed once at the beginning of each one scan.

(A: Available, N/A: Not available)

FP Address IEC Address	Name	Description	Read	Write
DT90022 **%MW5.90022**	Scan time (current value) (see note)	The current scan time is stored here. The scan time is calculated using the formula: Scan time (ms) = stored data (decimal) x 0.1ms Example: 50 indicates 5ms.	A	N/A
DT90023 **%MW5.90023**	Scan time (minimum value) (see note)	The minimum scan time is stored here. Scan time is calculated using the formula: Scan time (ms) = stored data (decimal) x 0.1 ms Example: K50 indicates 5 ms.	A	N/A
DT90024 **%MW5.90024**	Scan time (maximum value) (see note)	The maximum scan time is stored here. The scan time is calculated using the formula: Scan time (ms) = stored data (decimal) x 0.1ms Example: 125 indicates 12.5ms.	A	N/A
DT90025 **%MW5.90025**	Mask condition monitoring register for interrupts (INT 0 to 13)	The mask conditions of interrupts using the **ICTL** instruction is stored here. Monitor using binary display. 15 13 11 7 3 0 (Bit no.) 13 11 7 3 0 (INT no.) 0: interrupt disabled (masked 1: interrupt enabled (unmasked	A	N/A
DT90026 **%MW5.90026**	Not used	—	N/A	N/A
DT90027 **%MW5.90027**	Periodical interrupt interval (INT24)	The value set by the **ICTL** instruction is stored. • 0: periodical interrupt is not used • 1 to 3000: 0.5ms to 1.5s or 10ms to 30s	A	N/A
DT90028 **%MW5.90028**	Not used	—	N/A	N/A
DT90029 **%MW5.90029**	Not used	—	N/A	N/A
DT90030 **%MW5.90030**	Message 0	The contents of the specified message are stored in these special data registers when the **F149_MSG** instruction is executed.	A	N/A
DT90031 **%MW5.90031**	Message 1			
DT90032 **%MW5.90032**	Message 2			
DT90033 **%MW5.90033**	Message 3			
DT90034 **%MW5.90034**	Message 4			
DT90035 **%MW5.90035**	Message 5			
DT90036 **%MW5.90036**	Not used	—	N/A	N/A

◆ NOTE

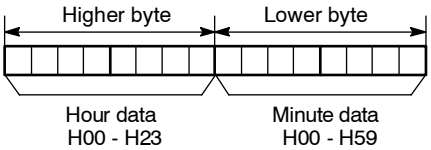
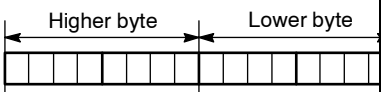
Scan time display is only possible in RUN mode and shows the operation cycle time. (In PROG mode, the scan time for the operation is not displayed.) The

maximum and minimum values are cleared each time the mode is switched from RUN to PROG.

(A: Available, N/A: Not available)

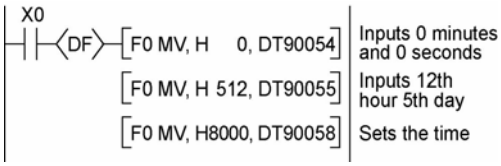
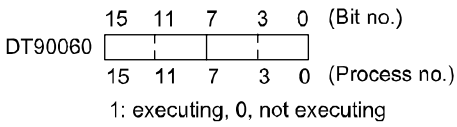
FP Address IEC Address	Name	Description	Read	Write
DT90037 **%MW5.90037**	Operation auxiliary register for search instruction **F96_SRC**	The number of data that match the searched data is stored here when the **F96_SRC** instruction is executed.	A	N/A
DT90038 **%MW5.90038**	Operation auxiliary register for search instruction **F96_SRC**	The position of the first matching data is stored here when the **F96_SRC** instruction is executed.	A	N/A
DT90039 **%MW5.90039**	Not used	—	N/A	N/A
DT90040 **%MW5.90040**	Potentiometer (volume) input V0	The potentiometer value (0 to 1000) is stored here. This value can be used in analog timers and other applications by using the program to read this value to a data register. V0→DT90040 V1→DT90041	A	N/A
DT90041 **%MW5.90041**	Potentiometer (volume) input V1			
DT90042 **%MW5.90042**	Potentiometer (volume) input V2	For C60 only: The potentiometer value (0 to 1000) is stored here. This value can be used in analog timers and other applications by using the program to read this value to a data register. V0→DT90042 V1→DT90043	A	N/A
DT90043 **%MW5.90043**	Potentiometer (volume) input V3			
DT90044 **%MW5.90044**	Used by system	Used by the system.	A	A
DT90045 **%MW5.90045**	Not used	—	N/A	N/A
DT90046 **%MW5.90046**	Not used	—	N/A	N/A
DT90047 **%MW5.90047**	Not used	—	N/A	N/A
DT90048 **%MW5.90048**	Not used	—	N/A	N/A
DT90049 **%MW5.90049**	Not used	—	N/A	N/A
DT90050 **%MW5.90050**	Not used	—	N/A	N/A
DT90051 **%MW5.90051**	Not used	—	N/A	N/A

(A: Available, N/A: Not available)

<table>
<tr><th>FP Address
IEC Address</th><th>Name</th><th>Description</th><th>Read</th><th>Write</th></tr>
<tr><td>DT90052
%MW5.90052</td><td>High-speed counter and pulse output control flag</td><td>Used to reset the high-speed counter, disable counting, continue or clear high-speed counter instruction.
High-speed counter control code setting (see page 168)
Pulse output control code setting (see page 175)</td><td>N/A</td><td>A</td></tr>
<tr><td>DT90053
%MW5.90053</td><td>Clock/calendar monitor (hour/minute)</td><td>Hour and minute data of the clock/calendar are stored here. This data is read-only data. It cannot be overwritten.
 
</td><td>A</td><td>N/A</td></tr>
<tr><td>DT90054
%MW5.90054</td><td>Clock/calendar setting (minute/second)</td><td rowspan="4">The year, month, day, hour, minute, second, and day-of-the-week data for the calendar timer is stored. The built-in calendar timer will operate correctly through the year 2099 and supports leap years. The calendar timer can be set by writing a value using a programming tool software or a programming instruction (see example for DT90058).
 

<table>
<tr><td>DT90054</td><td>Minute
H00 - H59</td><td>Second
H00 - H59</td></tr>
<tr><td>DT90055</td><td>Day
H01 - H31</td><td>Hour
H00 - H23</td></tr>
<tr><td>DT90056</td><td>Year
H00 - H99</td><td>Month
H01 - H12</td></tr>
<tr><td>DT90057</td><td>—</td><td>Day-of-the-week
H00 - H06</td></tr>
</table></td><td rowspan="4">A</td><td rowspan="4">A</td></tr>
<tr><td>DT90055
%MW5.90055</td><td>Clock/calendar setting (day/hour)</td></tr>
<tr><td>DT90056
%MW5.90056</td><td>Clock/calendar setting (year/month)</td></tr>
<tr><td>DT90057
%MW5.90057</td><td>Clock/calendar setting (day-of-the-week)</td></tr>
</table>

(A: Available, N/A: Not available)

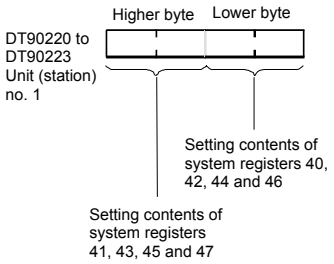
FP Address IEC Address	Name	Description	Read	Write
DT90058 **%MW5.90058**	Clock/calendar time setting and 30 seconds correction register	By setting the highest bit of DT90058 to 1, the time will be set according to the values written to DT90054 to DT90057. After the time is set, DT90058 is cleared to 0. **FPWIN Pro:** You can conveniently set the real-time clock using the **SET_RTC_DTBCD** instruction (see online help). **FPWIN GR:** Use the F0 (MV) instruction to set the corresponding data registers. **Example**: Set the time to 12:00:00 on the 5th day when X0 turns on.  **Note:** If the values of DT90054 to DT90057 are changed with the programming tool software, the time will be set when the new values are written. Therefore, it is unnecessary to write to DT90058. **When correcting times of less than 30 seconds** By setting the lowest bit of DT90058 to 1, the "seconds" value will be rounded off to the nearest minute. 	A	A
DT90059 **%MW5.90059**	Serial communication error code	Error code is stored here when a communication error occurs.	N/A	N/A
DT90060 to DT90122 **%MW5.90060 to %MW5.90122**	Step ladder process (0 to 999)	Indicates the startup condition of the step ladder process. When the process starts, the bit corresponding to the process number turns on. Monitor using binary display. **Example:** 		
DT90123 **%MW5.90123**	Not used	—	N/A	N/A

(A: Available, N/A: Not available)

FP Address IEC Address	Name	Description	Read	Write
DT90124 **%MW5.90124**	SEND/RECV end code for COM1 port	For details, refer to the programming manual or online help for the F145 and F146 instructions.	N/A	N/A
DT90125 **%MW5.90125**	SEND/RECV end code for COM2 port	For details, refer to the programming manual or online help for the F145 and F146 instructions.	N/A	N/A
DT90126 **%MW5.90126**	Forced ON/OFF operating station display	Used by the system	N/A	N/A
DT90127 to DT90139 **%MW5.90127 to %MW5.90139**	Not used	—	N/A	N/A
DT90140 **%MW5.90140**	MEWNET-W0 PLC link 0 status	The number of times the receiving operation is performed.	A	N/A
DT90141 **%MW5.90141**	MEWNET-W0 PLC link 0 status	The current interval between two receiving operations: value in the register × 2.5ms	A	N/A
DT90142 **%MW5.90142**	MEWNET-W0 PLC link 0 status	The minimum interval between two receiving operations: value in the register × 2.5ms	A	N/A
DT90143 **%MW5.90143**	MEWNET-W0 PLC link 0 status	The maximum interval between two receiving operations: value in the register × 2.5ms	A	N/A
DT90144 **%MW5.90144**	MEWNET-W0 PLC link 0 status	The number of times the sending operation is performed.	A	N/A
DT90145 **%MW5.90145**	MEWNET-W0 PLC link 0 status	The current interval between two sending operations: value in the register × 2.5ms	A	N/A
DT90146 **%MW5.90146**	MEWNET-W0 PLC link 0 status	The minimum interval between two sending operations: value in the register × 2.5ms	A	N/A
DT90147 **%MW5.90147**	MEWNET-W0 PLC link 0 status	The maximum interval between two sending operations: value in the register × 2.5ms	A	N/A
DT90148 **%MW5.90148**	MEWNET-W0 PLC link 1 status	The number of times the receiving operation is performed.	A	N/A
DT90149 **%MW5.90149**	MEWNET-W0 PLC link 1 status	The current interval between two receiving operations: value in the register × 2.5ms	A	N/A
DT90150 **%MW5.90150**	MEWNET-W0 PLC link 1 status	The minimum interval between two receiving operations: value in the register × 2.5ms	A	N/A
DT90151 **%MW5.90151**	MEWNET-W0 PLC link 1 status	The maximum interval between two receiving operations: value in the register × 2.5ms	A	N/A
DT90152 **%MW5.90152**	MEWNET-W0 PLC link 1 status	The number of times the sending operation is performed.	A	N/A
DT90153 **%MW5.90153**	MEWNET-W0 PLC link 1 status	The current interval between two sending operations: value in the register × 2.5ms	A	N/A
DT90154 **%MW5.90154**	MEWNET-W0 PLC link 1 status	The minimum interval between two sending operations: value in the register × 2.5ms	A	N/A
DT90155 **%MW5.90155**	MEWNET-W0 PLC link 1 status	The maximum interval between two sending operations: value in the register × 2.5ms	A	N/A
DT90156 **%MW5.90156**	MEWNET-W0 PLC link 0 status	Area used for measurement of receiving interval.	A	N/A
DT90157 **%MW5.90157**	MEWNET-W0 PLC link 0 status	Area used for measurement of sending interval.	A	N/A

FP Address IEC Address	Name	Description	Read	Write
DT90158 **%MW5.90158**	MEWNET-W0 PLC link 1 status	Area used for measurement of receiving interval.	A	N/A
DT90159 **%MW5.90159**	MEWNET-W0 PLC link 1 status	Area used for measurement of sending interval.	A	N/A
DT90160 **%MW5.90160**	MEWNET-W0 PLC link 0 unit no.	Stores the unit no. of a PLC link	A	N/A
DT90161 **%MW5.90161**	MEWNET-W0 PLC link 0 error flag	Stores the error contents of a PLC link	A	N/A
DT90162 to DT90169 **%MW5.90162 to %MW5.90169**	Not used	—	N/A	N/A
DT90170 **%MW5.90170**	MEWNET-W0 PLC link 1 status	Duplicated destination for PLC inter-link address.	A	N/A
DT90171 **%MW5.90171**	MEWNET-W0 PLC link 1 status	Counts how many times a token is lost.	A	N/A
DT90172 **%MW5.90172**	MEWNET-W0 PLC link 1 status	Counts how many times two or more tokens are detected.	A	N/A
DT90173 **%MW5.90173**	MEWNET-W0 PLC link 1 status	Counts how many times a signal is lost.	A	N/A
DT90174 **%MW5.90174**	MEWNET-W0 PLC link 1 status	No. of times undefined commands have been received	A	N/A
DT90175 **%MW5.90175**	MEWNET-W0 PLC link 1 status	No. of times sum check errors have occurred during reception.	A	N/A
DT90176 **%MW5.90176**	MEWNET-W0 PLC link 1 status	No. of times format errors have occurred in received data.	A	N/A
DT90177 **%MW5.90177**	MEWNET-W0 PLC link 1 status	No. of times transmission errors have occurred.	A	N/A
DT90178 **%MW5.90178**	MEWNET-W0 PLC link 1 status	No. of times procedural errors have occurred.	A	N/A
DT90179 **%MW5.90179**	MEWNET-W0 PLC link 1 status	No. of times overlapping master units have occurred.	A	N/A
DT90180 to DT90218 **%MW5.90180 to %MW5.90218**	Not used	—	N/A	N/A

(A: Available, N/A: Not available)

FP Address IEC Address	Name		Description	Read	Write
DT90219 **%MW5.90219**	Unit no. (station no.) selection for DT90220 to DT90251		0: Unit no. (station no.) 1 to 8, 1: Unit no. (station no.) 9 to 16	A	N/A
DT90220 **%MW5.90220**	PLC link unit (station) no. 1 or 9	System registers 40 and 41	The contents of the system register settings pertaining to the PLC inter-link function for the various unit numbers are stored as shown below. **Example:** When DT90219 is 0  System register 46 (see "Table of System Registers for FP-X" on page 219) of each respective station determines which block of data is transferred: • **Normal**: PLC link 0, as defined by system registers 40 - 45 and 47. • **Reverse**: PLC link 1, as defined by system registers 50 - 55 and 57.	A	A
DT90221 **%MW5.90221**		System registers 42 and 43			
DT90222 **%MW5.90222**		System registers 44 and 45			
DT90223 **%MW5.90223**		System registers 46 and 47			
DT90224 **%MW5.90224**	PLC link unit (station) no. 2 or 10	System registers 40 and 41			
DT90225 **%MW5.90225**		System registers 42 and 43			
DT90226 **%MW5.90226**		System registers 44 and 45			
DT90227 **%MW5.90227**		System registers 46 and 47			
DT90228 **%MW5.90228**	PLC link unit (station) no. 3 or 11	System registers 40 and 41			
DT90229 **%MW5.90229**		System registers 42 and 43			
DT90230 **%MW5.90230**		System registers 44 and 45			
DT90231 **%MW5.90231**		System registers 46 and 47			
DT90232 **%MW5.90232**	PLC link unit (station) no. 4 or 12	System registers 40 and 41			
DT90233 **%MW5.90233**		System registers 42 and 43			
DT90234 **%MW5.90234**		System registers 44 and 45			
DT90235 **%MW5.90235**		System registers 46 and 47			
DT90236 **%MW5.90236**	PLC link unit (station) no. 5 or 13	System registers 40 and 41			
DT90237 **%MW5.90237**		System registers 42 and 43			
DT90238 **%MW5.90238**		System registers 44 and 45			
DT90239 **%MW5.90239**		System registers 46 and 47			

(A: Available, N/A: Not available)

FP Address IEC Address	Name		Description	Read	Write
DT90240 **%MW5.90240**	PLC link unit (station) no. 6 or 14	System registers 40 and 41	See previous table.	A	A
DT90241 **%MW5.90241**		System registers 42 and 43			
DT90242 **%MW5.90242**		System registers 44 and 45			
DT90243 **%MW5.90243**		System registers 46 and 47			
DT90244 **%MW5.90244**	PLC link unit (station) no. 5 or 15	System registers 40 and 41			
DT90245 **%MW5.90245**		System registers 42 and 43			
DT90246 **%MW5.90246**		System registers 44 and 45			
DT90247 **%MW5.90247**		System registers 46 and 47			
DT90248 **%MW5.90248**	PLC link unit (station) no. 8 or 16	System registers 40 and 41			
DT90249 **%MW5.90249**		System registers 42 and 43			
DT90250 **%MW5.90250**		System registers 44 and 45			
DT90251 **%MW5.90251**		System registers 46 and 47			
DT90252 to DT90256 **%MW5.90252 to %MW5.90256**	Not used		—	N/A	N/A

Concerning the special data registers for high-speed counting, DT90300 to DT90347 and pulse I/O, DT90348 to DT90355.

- They are all available for reading and writing.
- In FPWIN Pro, you have several convenient programming methods available to access the target or elapsed value areas, including assignment operation with system variables. Please refer to the online help for details.
- For FPWIN GR, use the F1 (DMV) instruction to write to the elapsed value. Use the F166 (HC1S) and F167 (HC1R) instructions to write to the target value area.

FP Address IEC Address	Name			Description
DT90300 **%MW5.90300**	Elapsed value area	Lower words	HSC-CH0	Counting area for input (X0) or (X0, X1) of the main unit.
DT90301 **%MW5.90301**		Higher words		
DT90302 **%MW5.90302**	Target value area	Lower words		The target value is set when instructions F166_HC1S and F167_HC1R are executed.
DT90303 **%MW5.90303**		Higher words		
DT90304 **%MW5.90304**	Elapsed value area	Lower words	HSC-CH1	Counting area for input (X1) of the main unit.
DT90305 **%MW5.90305**		Higher words		
DT90306 **%MW5.90306**	Target value area	Lower words		The target value is set when instructions F166_HC1S and F167_HC1R are executed.
DT90307 **%MW5.90307**		Higher words		
DT90308 **%MW5.90308**	Elapsed value area	Lower words	HSC-CH2	Counting area for input (X2) or (X2, X3) of the main unit.
DT90309 **%MW5.90309**		Higher words		
DT90310 **%MW5.90310**	Target value area	Lower words		The target value is set when instructions F166_HC1S and F167_HC1R are executed.
DT90311 **%MW5.90311**		Higher words		
DT90312 **%MW5.90312**	Elapsed value area	Lower words	HSC-CH3	Counting area for input (X3) of the main unit.
DT90313 **%MW5.90313**		Higher words		
DT90314 **%MW5.90314**	Target value area	Lower words		The target value is set when instructions F166_HC1S and F167_HC1R are executed.
DT90315 **%MW5.90315**		Higher words		
DT90316 **%MW5.90316**	Elapsed value area	Lower words	HSC-CH4	Counting area for input (X4) or (X4, X5) of the main unit.
DT90317 **%MW5.90317**		Higher words		
DT90318 **%MW5.90318**	Target value area	Lower words		The target value is set when instructions F166_HC1S and F167_HC1R are executed.
DT90319 **%MW5.90319**		Higher words		

FP Address IEC Address	Name			Description
DT90320 **%MW5.90320**	Elapsed value area	Lower words	HSC-CH5	Counting area for input (X5) of the main unit.
DT90321 **%MW5.90321**		Higher words		
DT90322 **%MW5.90322**	Target value area	Lower words		The target value is set when instructions F166_HC1S and F167_HC1R are executed.
DT90323 **%MW5.90323**		Higher words		
DT90324 **%MW5.90324**	Elapsed value area	Lower words	HSC-CH6	Counting area for input (X6) or (X6, X7) of the main unit.
DT90325 **%MW5.90325**		Higher words		
DT90326 **%MW5.90326**	Target value area	Lower words		The target value is set when instructions F166_HC1S and F167_HC1R are executed.
DT90327 **%MW5.90327**		Higher words		
DT90328 **%MW5.90328**	Elapsed value area	Lower words	HSC-CH7	Counting area for input (X7) of the main unit.
DT90329 **%MW5.90329**		Higher words		
DT90330 **%MW5.90330**	Target value area	Lower words		The target value is set when instructions F166_HC1S and F167_HC1R are executed.
DT90331 **%MW5.90331**		Higher words		
DT90332 **%MW5.90332**	Elapsed value area	Lower words	HSC-CH8	Counting area for input (X0) or (X0, X1) of the main unit.
DT90333 **%MW5.90333**		Higher words		
DT90334 **%MW5.90334**	Target value area	Lower words		The target value is set when instructions F166_HC1S and F167_HC1R are executed.
DT90335 **%MW5.90335**		Higher words		
DT90336 **%MW5.90336**	Elapsed value area	Lower words	HSC-CH9	Counting area for input (X1 of the pulse I/O cassette.
DT90337 **%MW5.90337**		Higher words		
DT90338 **%MW5.90338**	Target value area	Lower words		The target value is set when instructions F166_HC1S and F167_HC1R are executed.
DT90339 **%MW5.90339**		Higher words		
DT90340 **%MW5.90340**	Elapsed value area	Lower words	HSC-CHA	Counting area for input (X3) or (X3, X4) of the pulse I/O cassette.
DT90341 **%MW5.90341**		Higher words		
DT90342 **%MW5.90342**	Target value area	Lower words		The target value is set when instructions F166_HC1S and F167_HC1R are executed.
DT90343 **%MW5.90343**		Higher words		

FP Address IEC Address	Name			Description
DT90344 **%MW5.90344**	Elapsed value area	Lower words	HSC-CHB	Counting area for input (X4) of the pulse I/O cassette.
DT90345 **%MW5.90345**		Higher words		
DT90346 **%MW5.90346**	Target value area	Lower words		The target value is set when instructions F166_HC1S and F167_HC1R are executed.
DT90347 **%MW5.90347**		Higher words		
DT90348 **%MW5.90348**	Elapsed value area	Lower words	PLS-CH0	Counting area for output (Y0, Y1) of the pulse I/O cassette.
DT90349 **%MW5.90349**		Higher words		
DT90350 **%MW5.90350**	Target value area	Lower words		The target value is set when instructions F171_SPDH, F172_PLSH, F174_SP0H and F175_SPSH are executed.
DT90351 **%MW5.90351**		Higher words		
DT90352 **%MW5.90352**	Elapsed value area	Lower words	PLS-CH1	Counting area for output (Y3, Y4) of the pulse I/O cassette.
DT90353 **%MW5.90353**		Higher words		
DT90354 **%MW5.90354**	Target value area	Lower words		The target value is set when instructions F171_SPDH, F172_PLSH, F174_SP0H and F175_SPSH are executed.
DT90355 **%MW5.90355**		Higher words		

(A: Available, N/A: Not available)

FP Address IEC Address	Name		Description	Read	Write
DT90356 to DT90359 %MW5.90356 to %MW5.90359	Not used.		—	N/A	N/A
DT90360 %MW5.90360	Control flag monitor area	HSC-CH0	When HSC control is executed and data is written to DT90052, the setting value for the target CH is stored in each CH.	A	N/A
DT90361 %MW5.90361		HSC-CH1			
DT90362 %MW5.90362		HSC-CH2			
DT90363 %MW5.90363		HSC-CH3			
DT90364 %MW5.90364		HSC-CH4			
DT90365 %MW5.90365		HSC-CH5			
DT90366 %MW5.90366		HSC-CH6			
DT90367 %MW5.90367		HSC-CH7			
DT90368 %MW5.90368		HSC-CH8			
DT90369 %MW5.90369		HSC-CH9			
DT90370 %MW5.90370		HSC-CHA			
DT90371 %MW5.90371		HSC-CHB			
DT90372 %MW5.90372		PLS-CH0			
DT90373 %MW5.90373		PLS-CH1			

13.5 MEWTOCOL-COM Communication Commands

Command name	Code	Description
Read contact area	RC (RCS) (RCP) (RCC)	Reads the on and off status of contacts. • Specifies only one point. • Specifies multiple contacts. • Specifies a range in word units.
Write contact area	WC (WCS) (WCP) (WCC)	Turns contacts on and off. • Specifies only one point. • Specifies multiple contacts. • Specifies a range in word units.
Read data area	RD	Reads the contents of a data area.
Write data area	WD	Writes data to a data area.
Read timer/counter set value area	RS	Reads the value set for a timer/counter.
Write timer/counter set value area	WS	Writes a timer/counter setting value.
Read timer/counter elapsed value area	RK	Reads the timer/counter elapsed value.
Write timer/counter elapsed value area	WK	Writes the timer/counter elapsed value.
Register or Reset contacts monitored	MC	Registers the contact to be monitored.
Register or Reset data monitored	MD	Registers the data to be monitored.
Monitoring start	MG	Monitors a registered contact or data.
Preset contact area (fill command)	SC	Embeds the area of a specified range in a 16-point on and off pattern.
Preset data area (fill command)	SD	Writes the same contents to the data area of a specified range.
Read system register	RR	Reads the contents of a system register.
Write system register	WR	Specifies the contents of a system register.
Read the status of PLC	RT	Reads the specifications of the programmable controller and error codes if an error occurs.
Remote control	RM	Switches the operation mode of the programmable controller.
Abort	AB	Aborts communication.

13.6 Hexadecimal/Binary/BCD

Decimal	Hexadecimal	Binary data	BCD data (Binary Coded Decimal)
0	0000	0000 0000 0000 0000	0000 0000 0000 0000
1	0001	0000 0000 0000 0001	0000 0000 0000 0001
2	0002	0000 0000 0000 0010	0000 0000 0000 0010
3	0003	0000 0000 0000 0011	0000 0000 0000 0011
4	0004	0000 0000 0000 0100	0000 0000 0000 0100
5	0005	0000 0000 0000 0101	0000 0000 0000 0101
6	0006	0000 0000 0000 0110	0000 0000 0000 0110
7	0007	0000 0000 0000 0111	0000 0000 0000 0111
8	0008	0000 0000 0000 1000	0000 0000 0000 1000
9	0009	0000 0000 0000 1001	0000 0000 0000 1001
10	000A	0000 0000 0000 1010	0000 0000 0001 0000
11	000B	0000 0000 0000 1011	0000 0000 0001 0001
12	000C	0000 0000 0000 1100	0000 0000 0001 0010
13	000D	0000 0000 0000 1101	0000 0000 0001 0011
14	000E	0000 0000 0000 1110	0000 0000 0001 0100
15	000F	0000 0000 0000 1111	0000 0000 0001 0101
16	0010	0000 0000 0001 0000	0000 0000 0001 0110
17	0011	0000 0000 0001 0001	0000 0000 0001 0111
18	0012	0000 0000 0001 0010	0000 0000 0001 1000
19	0013	0000 0000 0001 0011	0000 0000 0001 1001
20	0014	0000 0000 0001 0100	0000 0000 0010 0000
21	0015	0000 0000 0001 0101	0000 0000 0010 0001
22	0016	0000 0000 0001 0110	0000 0000 0010 0010
23	0017	0000 0000 0001 0111	0000 0000 0010 0011
24	0018	0000 0000 0001 1000	0000 0000 0010 0100
25	0019	0000 0000 0001 1001	0000 0000 0010 0101
26	001A	0000 0000 0001 1010	0000 0000 0010 0110
27	001B	0000 0000 0001 1011	0000 0000 0010 0111
28	001C	0000 0000 0001 1100	0000 0000 0010 1000
29	001D	0000 0000 0001 1101	0000 0000 0010 1001
30	001E	0000 0000 0001 1110	0000 0000 0011 0000
31	001F	0000 0000 0001 1111	0000 0000 0011 0001
.	.	.	.
.	.	.	.
.	.	.	.
63	**003F**	0000 0000 0011 1111	0000 0000 0110 0011
.	.	.	.
.	.	.	.
.	.	.	.
255	**00FF**	0000 0000 1111 1111	0000 0010 0101 0101
.	.	.	.
.	.	.	.
.	.	.	.
9999	**270F**	0010 0111 0000 1111	1001 1001 1001 1001

13.7 ASCII Codes

b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0	ASCII HEX code	Least significant digit	Most significant digit: 0	1	2	3	4	5	6	7
										b7							
										b6	0	0	0	0	1	1	1	1
										b5	0	0	1	1	0	0	1	1
										b4	0	1	0	1	0	1	0	1
				0	0	0	0		0	NUL	DEL	SPACE	0	@	P		p
				0	0	0	1		1	SOH	DC1	!	1	A	Q	a	q
				0	0	1	0		2	STX	DC2	”	2	B	R	b	r
				0	0	1	1		3	ETX	DC3	#	3	C	S	c	s
				0	1	0	0		4	EOT	DC4	$	4	D	T	d	t
				0	1	0	1		5	ENQ	NAK	%	5	E	U	e	u
				0	1	1	0		6	ACK	SYN	&	6	F	V	f	v
				0	1	1	1		7	BEL	ETB	’	7	G	W	g	w
				1	0	0	0		8	BS	CAN	(	8	H	X	h	x
				1	0	0	1		9	HT	EM	)	9	I	Y	i	y
				1	0	1	0		A	LF	SUB	*	:	J	Z	j	z
				1	0	1	1		B	VT	ESC	+	;	K	[	k	{
				1	1	0	0		C	FF	FS	,	<	L	\	l	「
				1	1	0	1		D	CR	GS	–	=	M	]	m	}
				1	1	1	0		E	SO	RS	.	>	N	^	n	~
				1	1	1	1		F	SI	US	/	?	O	_	o	DEL

Chapter 14

Error Codes

14.1 General Information about Errors

14.1.1 FP-Series PLCs and ERROR Display

FP-Series PLCs' LEDs display errors in different ways.

Model	Display		Behavior
FP1, FP-M, FP2, FP3, FP10SH	LED	ERROR.	Continually lit
FP , FP0, FP-X	LED	ERROR/ALARM	Flashes/continually lit
FP-e	Screen display	ERR.	Continually lit

14.1.2 MEWTOCOL-COM Transmission Errors

These are error codes from a PC or other computer device that occur during an abnormal response when communicating with a PLC using MEWTOCOL-COM.

14.2 Table of Syntax Check Error

In FPWIN Pro, syntax errors are detected by the compiler and are therefore not critical.

Error code	Name	Operation status	Description and steps to take
E1	Syntax error	Stops	A program with a syntax error has been written. Change to PROG. mode and correct the error.
E2 (* Note)	Duplicated output error	Stops	Two or more OT(Out) instructions and KP(Keep) instructions are programmed using the same relay. Change to PROG. mode and correct the program so that one relay is not used for two or more OT instructions and KP instructions. Or, set the duplicated output to “enable (K1)” in system register 20.
E3	Not paired error	Stops	For instructions which must be used in a pair such as jump (JP and LBL), one instruction is either missing or in an incorrect position. Change to PROG. mode and enter the two instructions which must be used in a pair in the correct positions.
E4	Parameter mismatch error	Stops	An instruction has been written which does not agree with system register settings. For example, the number setting in a program does not agree with the timer/counter range setting. Change to PROG. mode, check the system register settings, and change so that the settings and the instruction agree.
E5 (* Note)	Program area error	Stops	An instruction which must be written to a specific area (main program area or subprogram area) has been written to a different area (for example, a subroutine SUB to RET is placed before an ED instruction). Change to PROG. mode and enter the instruction into the correct area.
E6	Compile memory full error (Available PLC: FPΣ/FP-X/ FP2SH/FP10SH)	Stops	The program stored in the FPΣ/FP2SH/FP10SH is too large to compile in the program memory. Change to PROG. mode and reduce the total number of steps for the program.
E7	High-level instruction type error (Available PLC: FPΣ/FP-X/ FP2/FP2SH/FP3/ FP10SH)	Stops	In the program, high-level instructions, which execute in every scan and at the leading edge of the trigger, are programmed to be triggered by one contact [e.g., F0 (MV) and P0 (PMV) are programmed using the same trigger continuously]. Correct the program so that the high-level instructions executed in every scan and only at the leading edge are triggered separately.
E8	High-level instruction operand error	Stops	There is an incorrect operand in an instruction which requires a specific combination operands (for example, the operands must all be of a certain type). Enter the correct combination of operands.
E9	No program error (Available PLC: FP2SH/FP10SH)	Stops	Program may be damaged. Try to send the program again.
E10	Rewrite during RUN syntax error	Continues	When inputting with the programming tool software, a deletion, addition or change of order of an instruction (ED, LBL, SUB, RET, INT, IRET, SSTP, and STPE) that cannot perform a rewrite during RUN is being attempted. Nothing is written to the CPU.

◆ NOTE

This error is also detected if you attempt to execute a rewrite containing a syntax error during RUN. In this case, nothing will be written to the CPU and operation will continue.

14.3 Table of Self-Diagnostic Errors

Not all errors apply to all PLCs.

E20 - E39

Error code	Name	Operation status	Description and steps to take
E20	CPU error	Stops	Probably a hardware abnormality. Please contact your dealer.
E21 E22 E23 E24 E25	RAM error	Stops	Probably an abnormality in the internal RAM. Please contact your dealer.
E26	User's ROM error	Stops	FP2, FP2SH, FP3, FP10SH: ROM is not installed. There may be a problem with the installed ROM. - ROM contents are damaged - Program size stored on the ROM is larger than the capacity of the ROM Check the contents of the ROM
			FP-X: If the master memory cassette is mounted, the master memor cassette may be damaged. Remove the master memory, and check whether the ERROR turns off. If the ERROR turned off, rewrite the master memory as its contents are damaged, and use it again. If the ERROR does not turn off, please contact your dealer.
			FP0, FP-e, FPΣ, FP1 C14, C16: Probably an abnormality in the built-in ROM. Please contact your dealer.
			All FP-Ms and FP1 C24, C40, C56, and C72: Probably an abnormality in the memory unit or master memory unit. Program the memory unit or master memory unit again and try to operate. If the same error is detected, try to operate with another memory unit or master memory unit.
E27	Intelligent unit installation error	Stops	Intelligent units installed exceed the limitations (i.e. 4 or more link units). Turn off the power and re-configure intelligent units referring to the hardware manual.
E28	System register error	Stops	Probably an abnormality in the system register. Check the system register setting or initialize the system registers.
E29	Configuration parameter error	Stops	A parameter error was detected in the MEWNET-W2 configuration area. Set a correct parameter.
E30	Interrupt error 0	Stops	Probably a hardware abnormality. Please contact your dealer.

Error code	Name	Operation status	Description and steps to take
E31	Interrupt error 1	Stops	An interrupt occurred without an interrupt request. A hardware problem or error due to noise is possible. Turn off the power and check the noise conditions.
E32	Interrupt error 2	Stops	An interrupt occurred without an interrupt request. A hardware problem or error due to noise is possible. Turn off the power and check the noise conditions.
			There is no interrupt program for an interrupt which occurred. Check the number of the interrupt program and change it to agree with the interrupt request.
E33	Multi-CPU data unmatch error	CPU2 stops	This error occurs when a FP3/FP10SH is used as CPU2 for a multi-CPU system. Please contact your dealer.
E34	I/O status error	Stops	An abnormal unit is installed. Check the contents of special data register DT9036/DT90036 and locate the abnormal unit. Then turn off the power and replace the unit with a new one.
E35	MEWNET-F (remote I/O) slave illegal unit error	Stops	A unit, which cannot be installed on the slave station of the MEWNET-F link system, is installed on the slave station. Remove the illegal unit from the slave station.
E36	MEWNET-F limitation error	Stops	The number of slots or I/O points used for MEWNET-F exceeds the limitation. Re-configure the system so that the number of slots and I/O points is within the specified range.
E37	MEWNET-F I/O mapping error	Stops	I/O overlap or I/O setting that is over the range is detected in the allocated I/O and MEWNET-F I/O map. Re-configure the I/O map correctly.
E38	MEWNET-F slave I/O mapping error	Stops	I/O mapping for remote I/O terminal boards, remote I/O terminal units and I/O link unit is not correct. Re-configure the I/O map for slave stations according to the I/O points of the slave stations.
E39	IC memory card read error	Stops	When reading in the program from the IC memory card (due to automatic reading because of the dip switch 3 setting or program switching due to F14 (PGRD) instruction): - IC memory card is not installed. - There is no program file or it is damaged. - Writing is disabled. - There is an abnormality in the AUTOEXEC.SPG file. - Program size stored on the card is larger than the capacity of the CPU. Install an IC memory card that has the program properly recorded and execute the read once again.

E40 and above

Error code	Name	Operation status	Description and steps to take
E40	I/O error	Selectable	With FP3/FP10SH, communication error in the MEWNET-TR system has occurred. For all other PLCs an abnormality in an I/O unit has been detected. Check the contents of special data registers DT9002 and DT9003/DT90002 and DT90003 and the erroneous MEWNET-TR master unit or abnormal I/O unit (also expansion unit or application cassette). Then check the unit. Selection of operation status using system register 21: - to continue operation, set K1 (CONT) - to stop operation, set K0 (STOP)
E41	Intelligent unit error	Selectable	An abnormality in an intelligent unit. Check the contents of special data registers DT9006 and DT9007/DT90006 and DT90007 and locate the abnormal intelligent unit. Then check the unit referring to its manual. Selection of operation status using system register 22: - to continue operation, set K1 (CONT) - to stop operation, set K0 (STOP)
E42	I/O unit verify error	Selectable	I/O unit wiring condition has changed compared to that at time of power-up. Check the contents of special data registers DT9010 and DT9011/DT90010 and DT90011 and locate the erroneous unit. Then check the unit and correct the wiring. Selection of operation status using system register 23: - to continue operation, set K1 (CONT) - to stop operation, set K0 (STOP)
E43	System watching dog timer error	Selectable	Scan time required for program execution exceeds the setting of the system watchdog timer. Check the program and modify it so that FP2SH/FP10SH can execute a scan within the specified time. Selection of operation status using system register 24: - to continue operation, set K1 (CONT) - to stop operation, set K0 (STOP)
E44	Slave station connecting time error for MEWNET-F system	Selectable	The time required for slave station connection exceeds the setting of the system register 35. Selection of operation status using system register 25: - to continue operation, set K1 (CONT) - to stop operation, set K0 (STOP)
E45	Operation error	Selectable	Operation became impossible when a high-level instruction was executed. Check the contents of special data registers DT9017 and DT9018/DT90017 and DT90018 to find the program address where the operation error occurred. Then correct the program. Refer to the explanation of operation error and the instruction. Selection of operation status using system register 26: - to continue operation, set K1 (CONT) - to stop operation, set K0 (STOP)

Error code	Name	Operation status	Description and steps to take
E46	Remote I/O communication error	Selectable	**MEWNET-F communication error:** A communication abnormally was caused by a transmission cable or during the power-down of a slave station. Check the contents of special data registers DT9131 to DT9137/DT90131 to DT90137 and locate the abnormal slave station and recover the slave condition. Selection of operation status using system register 27: - to continue operation, set K1 (CONT) - to stop operation, set K0 (STOP) **S-Link communication error (with FP0-SL1 unit only):** When one of the S-LINK errors (ERR1, 3 or 4) has been deteced,error code E46 (remote I/O (S-LINK) communication error) is stored. Selection of operation status using system register 27: - to continue operation, set K1 (CONT) - to stop operation, set K0 (STOP)
E47	MEWNET-F attribute error	Selectable	MEWNET-F communication error A communication abnormally was caused by a transmission cable or during the power-down of a slave station. Check the contents of special data registers DT9131 to DT9137/DT90131 to DT90137 and locate the abnormal slave station and recover the communication condition. Selection of operation status using system register27: - to continue operation,set K1 - to stop operation, set K0
E50	Backup battery error	Continues	The voltage of the backup battery lowered or the backup battery of CPU is not installed. Check the installation of the backup battery and then replace battery if necessary. By setting the system register 4 in K0 (NO), you can disregard this error. However, the BATT. LED turns on.
E51	MEWNET-F terminal station error	Continues	Terminal station settings were not properly performed.Check stations at both ends of the communication path, and set them in the terminal station using the dip switches.
E52	MEWNET-F I/O update synchronous error	Continues	Set the INITIALIZE/TEST selector to the INITIALIZE position while keeping the mode selector in the RUN position. If the same error occurs after this, please contact your dealer.
E53	Multi-CPU registration error	Continues	Abnormality was detected when the multi-CPU system was used. Please contact your dealer.
E54	IC memory card backup battery error	Continues	The voltage of the backup battery for the IC memory card is getting low. The BATT. LED does not turn on. Charge or replace the backup battery of IC memory card. (The contents of the IC memory card cannot be guaranteed.)
E55	IC memory card backup battery error	Continues	The voltage of the backup battery for IC memory card is getting low. The BATT. LED does not turn on. Charge or replace the backup battery of IC memory card. (The contents of the IC memory card cannot be guaranteed.)

Error code	Name	Operation status	Description and steps to take
E56	Incompatible IC memory card error	Continues	The IC memory card installed is not compatible with FP2SH/FP10SH. Replace the IC memory card compatible with FP2SH/FP10SH.
E57	No unit for the configuration	Continues	MEWNET-W2 The MEWNET-W2 link unit is not installed in the slot specified using the configuration data. Either install a unit in the specified slot or change the parameter.
E100 to E199	Self- diagnostic error set by F148 (ERR)/ P148 (PERR) instruction	Stops	The self-diagnostic error specified by the F148 (ERR)/P148 (PERR) instruction is occurred. Take steps to clear the error condition according to the specification you chose.
E200 to E299		Continues	

14.4 MEWTOCOL-COM Error Codes

Error code	Name	Description
!21	NACK error	Link system error
!22	WACK error	Link system error
!23	Unit no. overlap	Link system error
!24	Transmission format error	Link system error
!25	Link unit hardware error	Link system error
!26	Unit no. setting error	Link system error
!27	No support error	Link system error
!28	No response error	Link system error
!29	Buffer closed error	Link system error
!30	Time-out error	Link system error
!32	Transmission impossible error	Link system error
!33	Communication stop	Link system error
!36	No destination error	Link system error
!38	Other communication error	Link system error
!40	BCC error	A transfer error occurred in the data received.
!41	Format error	A formatting error in the command received was detected.
!42	No support error	A non-supported command was received.
!43	Multiple frames procedure error	A different command was received when processing multiple frames.
!50	Link setting error	A non-existing route number was specified. Verify the route number by designating the transmission station.
!51	Transmission time-out error	Transmission to another device is not possible because the transmission buffer is full.
!52	Transmit disable error	Transmission processing to another device is not possible (link unit runaway, etc.).
!53	Busy error	Processing of command received is not possible because of multiple frame processing or because command being processed is congested.
!60	Parameter error	Content of specified parameter does not exist or cannot be used.
!61	Data error	There was a mistake in the contact, data area, data number designation, size designation, range, or format designation.
!62	Registration over error	Operation was done when number of registrations was exceeded or when there was no registration.
!63	PC mode error	PC command that cannot be processed was executed during RUN mode.
!64	External memory error	An abnormality occurred when loading RAM to ROM/IC memory card. There may be a problem with the ROM or IC memory card. When loading, the specified contents exceeded the capacity. Write error occurs. -ROM or IC memory card is not installed. -ROM or IC memory card does not conform to specifications -ROM or IC memory card board is not installed.

Error code	Name	Description
!65	Protect error	A program or system register write operation was executed when the protect mode (password setting or DIP switch, etc.) or ROM operation mode was being used.
!66	Address error	There was an error in the code format of the address data. Also, when exceeded or insufficient address data, there was a mistake in the range designation.
!67	No program error and no data error	Cannot be read because there is no program in the program area or the memory contains an error. Or, reading of non-registered data was attempted.
!68	Rewrite during RUN error	When inputting with programming tool software, editing of an instruction (ED, SUB, RET, INT, IRET, SSTP, and STPE) that cannot perform a rewrite during RUN is being attempted. Nothing is written to the CPU.
!70	SIM over error	Program area was exceeded during a program write process.
!71	Exclusive access control error	A command that cannot be processed was executed at the same time as a command being processed.

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