Panasonic®

PROGRAMMABLE CONTROLLER

FP0R

User's Manual

ARCT1F475E-1

Safety Precautions

Observe the following notices to ensure personal safety or to prevent accidents.
To ensure that you use this product correctly, read this User's Manual thoroughly before use.
Make sure that you fully understand the product and information on safety.
This manual uses two safety flags to indicate different levels of danger.

WARNING

If critical situations that could lead to user's death or serious injury is assumed by mishandling of the product.

-Always take precautions to ensure the overall safety of your system, so that the whole system remains safe in the event of failure of this product or other external factor.
-Do not use this product in areas with inflammable gas. It could lead to an explosion.
-Exposing this product to excessive heat or open flames could cause damage to the lithium battery or other electronic parts.
-Battery may explode if mistreated. Do not recharge, disassemble or dispose of fire.

CAUTION

If critical situations that could lead to user's injury or only property damage is assumed by mishandling of the product.

-To prevent excessive exothermic heat or smoke generation, use this product at the values less than the maximum of the characteristics and performance that are assured in these specifications.
-Do not dismantle or remodel the product. It could cause excessive exothermic heat or smoke generation.
-Do not touch the terminal while turning on electricity. It could lead to an electric shock.
-Use the external devices to function the emergency stop and interlock circuit.
-Connect the wires or connectors securely.
The loose connection could cause excessive exothermic heat or smoke generation.
-Do not allow foreign matters such as liquid, flammable materials, metals to go into the inside of the product. It could cause excessive exothermic heat or smoke generation.
-Do not undertake construction (such as connection and disconnection) while the power supply is on. It could lead to an electric shock.

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Before You Start

Operating environment (Use the unit within the range of the general specifications when installing)
* Ambient temperature: 0 to +55°C
* Ambient humidity: 10 to 95 % RH (at 25 °C, non-condensing)
* For use in pollution Degree 2 environment.
* Do not use the unit in the following environments.
- Direct sunlight
- Sudden temperature changes causing condensation.
- Inflammable or corrosive gas.
- Excessive airborne dust, metal particles or saline matter.
- Benzine, paint thinner, alcohol or other organic solvents or strong alkaline solutions such as ammonia or caustic soda.
- Direct vibration, shock or direct drop of water.
- Influence from power transmission lines, high voltage equipment, power cables, power equipment, radio transmitters, or any other equipment that would generate high switching surges.(100 mm or more)

Static electricity
- Do not touch connector pins directly to prevent static electricity from causing damage.
- Always rid yourself of any static electricity before handling this product.

Power supply
- Use a power supply wire that is twisted.
- The unit has sufficient noise immunity against the noise generated on the power line. However, it is recommended to take measures for reducing noise such as using an isolating transformer before supplying the power.
- Allocate an independent wiring for each power supplying line, input/output device and operating device.
- If using a power supply without a protective circuit, power should be supplied through a protective element such as fuse. If an incorrect voltage is directly applied, the internal circuit may be damaged or destroyed.
- Be sure to supply power to a control and an expansion unit from a single power supply. Turning on/off of the power of all the units must be conducted simultaneously.

Power supply sequence
- Have the power supply sequence such that the power supply of the control unit turns off before the power supply for input and output. If the input/output power supply is turned off before the control unit, or if the control unit is not shut off momentarily, the controller detects change of input level, and might conduct an unexpected operation.

Before turning on the power
When turning on the power for the first time, be sure to take 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 perform a program clear operation before entering a program. Refer to the respective tool software manuals for the details of the operation procedure. (Tool software: FPWIN Pro, FPWIN GR)

Request concerninng program storage
To prevent the accidental loss of programs, the user should consider the following measures.

- Drafting of documents
To avoid accidentally losing programs, destroying files, or overwriting the contents of files, 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 focibly bypassed, the program is deleted. When specifying the password, note it in the specifications manual or in another safe location in case it is forgotten at some point.

Programming Tool Restrictions

Restrictions on usable programming tools depending on the units (as of April, 2009)

Type of programming tool		Type of unit
Windows software	FPWIN GR Ver.2	Used (Ver.2.80 or later)
	FPWIN GR Ver.1	Not used
Windows software Conforms to IEC61131-3	FPWIN Pro Ver.6	Used (Ver.6.10 or later)
MS-DOS software (EOL product)	NPST-GR Ver.4	Not used
	NPST-GR Ver.3	Not used
Handy programming unit (EOL product)	AFP1113V2 AFP1114V2	Not used
	AFP1113 AFP1114	Not used
	AFP1111A AFP1112A AFP1111 AFP1112	Not used
FP memory loader	AFP8670 AFP8671	Used (Ver.2.0 or later)

Note:

- In case of using FPWIN GR Ver.1, please purchase upgrade model FPWIN GR Ver.2.
- FPWIN GR Ver.2 can be upgraded free of charge at our web site.
- FPWIN Pro Ver.6 can be upgraded free of charge at our web site.
- The handy programming unit cannot be used.
  Do not download any programs for other units such as FP1 to the FP0R using the handy programming unit.

Panasonic Electric Works website address: http://panasonic-denko.co.jp/ac/

When Using FP0 Programs

The programs used on the existing FP0 can be used on the FP0R in the following 2 cases.

1. Using the programs in the FP0R specifications.
It enables to make maximum use of the performance and functions of the FP0R.

2. Using the programs in the same specifications as the FP0.
It enables to execute the programs in the same specifications as the FP0 (FP0 compatibility mode).

The points to take care when using the FP0 programs on the FP0R are described below in the above 2 cases.
- When using the programs in the FP0R specifications
- When using the programs in the same specifications as the FP0

When using the programs in the FP0R specifications.
As the FP0 programs cannot be used as they are, it is required to change the following 3 items for the FP0 programs before downloading the programs into the FP0R.

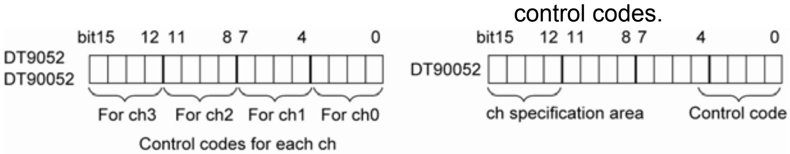
1. Change in the model setting
Change the model for the FP0 programs to the one for the FP0R with a tool software.

2. Resetting of system registers
As the system registers will be initialized once the model setting is changed, reset the system registers if necessary.

3. Modification of the programs
Depending on programs, they should be changed according to the specifications of FP0R.

Reference: Next page
<Differences Between Specifications of FP0 and FP0R Effecting Program Change>

Differences between specifications of FP0 and FP0R effecting program change

Change in data areas	As the size of the data area and the settings of hold and non-hold areas changes, check if the address of the used data memory is correct. The area that has been used as a hold area might be a non-hold area.
Change in supported instructions	The following instructions that are supported on the FP0 cannot be used. Replace them with the instructions for the FP0R based on the following description. [FP0] → [FP0R] F144(TRNS) instruction → F159(MTRN) instruction F168(SPD1) instruction → F171(SPDH), F177(HOME) instructions F169(PLS) instruction → F172 (PLSH) instruction F170(PWM) instruction → F173(PWMH) instruction As for the following instructions, the specifications change. Modify the programs in accordance with the specifications after the change. [FP0] → [FP0R] F12(ICRD) instruction Unit of read: 64 words → Unit of read: 2048 words P13(PICWT) instruction Unit of write: 64 words → Unit of write: 2048 words
Change in special internal relays	The addresses of the following special internal relays are changed. High-speed counter control flag [FP0] → [FP0R] R903A: For CH0 → R9110 : For CH0 R903B: For CH1 → R9111 : For CH1 R903C: For CH2 → R9112 : For CH2 R903D: For CH3 → R9113 : For CH3
Change in special data registers	The contents of the following special data registers are changed. [FP0] DT9052(DT90052) :High-speed counter control flag As each 4 bits of the control code for all 4 channels are allocated, write the control code in the area of the corresponding channel. [FP0R] DT90052 :High-speed counter control flag As the areas to write the channel numbers to be changed and the control codes are separated, write the corresponding channel numbers and control codes.  The addresses of the following special data registers are changed. Elapsed value of high-speed counter CH0 to CH3 [FP0] → [FP0R] DT9044(DT90044)-DT9045(DT90045) → DT90300-DT90301 DT9048(DT90048)-DT9049(DT90049) → DT90304-DT90305 DT9104(DT90104)-DT9105(DT90105) → DT90308-DT90309 DT9108(DT90108)-DT9109(DT90109) → DT90312-DT90313 Target value of high-speed counter CH0 to CH3 [FP0] → [FP0R] DT9046(DT90046)-DT9047(DT90047) → DT90302-DT90303 DT9050(DT90050)-DT9051(DT90051) → DT90306-DT90307 DT9106(DT90106)-DT9107(DT90107) → DT90310-DT90311 DT9110(DT90110)-DT9111(DT90111) → DT90314-DT90315 Note) The numbers in parenthese are for FP0-T32.

When using the FP0R in the same specifications as FP0

The FP0R supports an operation mode "FP0 compatibility mode". Using this mode enables to use the programs of the FP0 as they are.

In the FP0 compatibility mode, the programs except some programs can operate with the same specifications as the FP0.

Note:

The FP0 compatibility mode is not available for the F32 type.

The speed of arithmetic processing in the FP0 compatibility mode is the same as the FP0R, so the timing for processing the program may differ from the original timing for the FP0 program.

If you want to execute the program in the condition close to the original timing, set a constant scan or insert a program that does not affect the external operation to adjust the timing.

How to use FP0 compatibility mode

Download the programs uploaded from the FP0 or the programs that the model code is created as the FP0, using an applicable programming tool for the FP0R A confirmation message will be shown on the tool, and the mode will be automatically changed to the FP0 compatibility mode.

Tools supporting FP0 compatibility mode

FPWIN GR Ver. 2.80 or later/FPWIN Pro Ver.6.10 or later

Restrictions on switching to FP0 compatibility mode

For downloading the FP0 programs to the FP0R in the FP0 compatibility mode, the model setting for the FP0 programs should match the model type of the FP0R as the table below.

Model setting for FP0 program	Applicable FP0R model
C10	C10RM, C10RS, C10CRM, C10CRS
C14	C14RM, C14RS, C14CRM, C14CRS
C16	C16T, C16P, C16CT, C16CP
C32	C32T, C32P, C32CT, C32CP
T32	T32T, T32P, T32CT, T32CP

Differences between the specifications of FP0 compatibility mode and FP0
Basically, the FP0 programs do not need to be modified to activate the FP0 programs in the FP0 compatibility mode, however, as for the following items, the specifications are different. Check the contents, and change the programs if necessary.

1. P13(PICWT) instruction specifications - EEPROM(FROM) write instruction
The execution time of this instruction differs. Depending on the number of write blocks, the execution time may be longer or shorter.

No. of write blocks (No. of words)	FP0	FP0 compatibility mode
1 block (64 words)	Approx. 5ms	Approx. 100ms
2 blocks (128 words)	Approx. 10ms	Approx. 100ms
4 blocks (256 words)	Approx. 20ms	Approx. 100ms
8 blocks (512 words)	Approx. 40ms	Approx. 100ms
16 blocks (1024 words)	Approx. 80ms	Approx. 100ms
32 blocks (2048 words)	Approx. 160ms	Approx. 100ms
33 blocks (2112 words)	Approx. 165ms	Approx. 200ms
41 blocks (2624 words)	Approx. 205ms	Approx. 200ms
64 blocks (4096 words)	Approx. 320ms	Approx. 200ms
96 blocks (6144 words)	Approx. 480ms	Approx. 300ms
256 blocks (16320 words)	Approx. 800ms	Approx. 800ms

②F170(PWM) instruction specifications - PWM output instruction
The settable frequencies differ. Especially, the setting for the low frequency band cannot be specified.

Setting	FP0		FP0 compatibility mode	
	Frequency (Hz)	Cycle (ms)	Frequency (Hz)	Cycle (ms)
H11	1000	1.0	1000	1
H12	714	1.4	750	1.3
H13	500	2.0	500	2
H14	400	2.5	400	2.5
H15	200	5.0	200	5
H16	100	10.0	100	10
H0	38	26.3	40	25
H1	19	52.6	20	50
H2	9.5	105.3	10	100
H3	4.8	208.3	6	166.7
H4	2.4	416.7	Cannot specify (Error occurs)	
H5	1.2	833.3		
H6	0.6	1666.7		
H7	0.3	3333.3		
H8	0.15	6666.7		

3. Data size of elapsed value and target value of pulse output and high-speed counter
The data size is changed.
FP0: 24 bits
FP0 compatibility mode: 32 bits

4. F144(TRNS) instruction specifications - Serial data communication
The following 2 items in the specifications for sending data are changed.
1)Processing of starting data of send buffer
FP0: Stores the number of unsent bytes every one-byte transmission.
FP0 compatibility mode: Stores 0 after the completion of all data transmission.

2)Restriction on the number of sent bytes
FP0: No restriction
FP0 compatibility mode: 2048 bytes

5. F169(PLS) instruction specifications - Pulse output (JOG operation)
The following 2 items in the specifications are changed.
1)"Operation mode and direction output" setting process
FP0: "00: No counting mode" is selectable.
FP0 compatibility mode: "00: No counting mode" is not selectable.
Performs the same operation as the one when specifying "10: Incremental counting mode with not direction output".

2)Pulse width specification
FP0: It is possible to set the fixed pulse width (80μs) or duty ratio.
FP0 compatibility mode: The settings are invalid and the duty ratio of pulse width is fixed at 25%.

6. F168(SPD1) instruction specifications - Positioning control
The specifications during pulse output are changed.
FP0: Not count
FP0 compatibility mode: Count

7. Real number calculation process
As the accuracy of real number calculation has been improved, the calculation result in the FP0 compatibility mode may differ from the result in the existing FP0 program.

8. Process when a secondary battery is out of charge (T32 type only)
If the secondary battery installed in the T32 type is out of charge, the next power-on process will be different.
FP0: The value in the hold area of data memory will be unstable.
FP0 compatibility mode: The value in the hold area of data memory will be cleared to 0.

Chapter 1

Functions and Restrictions of the Unit

1.1 Features and Functions of the Unit

Microcompact PLC which realizes high-speed processing with large-capacity memory.
Further high-speed processing and large capacity has been realized with the same body size as the FP0.
Basic capability is as below, and high-speed processing is possible.
0.08 μ s/Basic instruction: Up to 3000 steps of program
0.58μs/Basic instruction: From 3001 steps of program

Also, large-capacity memory is provided for the program and data register capacities, so that complex arithmetic processing can be executed.
Program memory
16k steps: C10, C14, C16
32k steps' C32, T32, F32
Data register
12k words: C10, C14, C16
32k words: C32, T32, F32

Equipped with a USB 2.0 tool port.
The tool port supports USB2.0FullSpeed, and it enables a super high-speed communication with programming tools. As a very large program of 32k steps can be downloaded in approx. 5 seconds, it enables more efficient program development.

Large-capacity separate comment memory
A separate comment memory area is equipped aside from the program area. I/O comments of 100,000 points can be stored. Program management and maintenance is easy. Also as the area is separated from the program area, program development can be proceeded without concern for the capacity of comment memory.

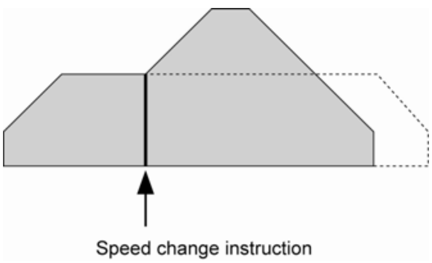
Enhancement of high-pseed counter and pulse output functions
- High-speed counter function
1 phase: Max. 50 kHz x 6 channels　　2 phase: Max. 15 kHz x 3 channels

- Pulse output function
Max. 50 kHz x 4 channels　　Max. 50 kHz linear interpolation x 2 systems

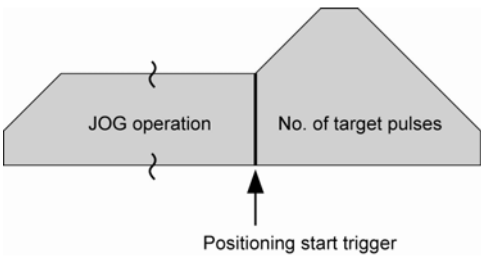
・All the channels for the high-speed counter and pulse output can be controlled simultaneously.

・Supports various positioning functions.

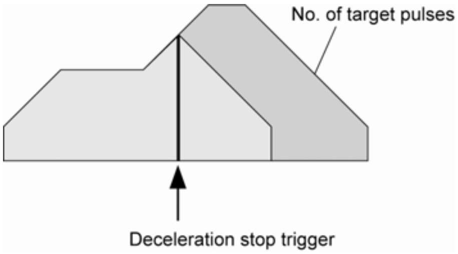
Target speed change function



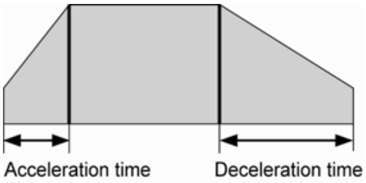
2. JOG positioning function



3. Deceleration stop function



4. Acceleration/deceleration time individual setting function



An additional unit in the lineup, which enables the backup of all data without battery. (F32 type)
On the F32 type, all the data memories (internal relays, data registers, timer/counter) can be automatically held without battery. Maintainability has been dramatically improved as there is no need to change a battery.

Enriching of various communication functions
- Supports PC(PLC) link (supports MEWNET-W0).
- MEWTOCOL master function
- Supports MODBUS RTU (master/slave).
- General-purpose serial communication is available via the tool port/COM port (RS232C) both.

Enriching of editing functions during RUN
More useful functions are provided so that programs can be corrected without stopping the system. It also supports ″Downloading during RUN function" which enables to rewrite all comments and programs as well as "Rewriting during RUN function" which enables to change programs of a maximum of 512 steps.

Enhanced security
It supports the 8-digit password (alphameric) and upload protection function, and the security has been tightened more.

Facilitates program development and management
The FP0R fully supports our Programming tool software FPWIN Pro. Using FPWIN Pro enables partializing/structuring programs or multiplingual programming, and it enables to achieve more efficient program development and program management.

FP0 compatibility
The FP0 compatibility mode enables the programs that have been used on the existing model (FP0) to be activated on the FP0R as they are. Also, the shape and terminal layout is the same as the FP0, therefore, there is no need to review the installation place or to change the wiring.

1.2 Unit Types

1.2.1 FP0R Control Units

Type	Program capacity	Specifications					COM (RS232 C port)	Product No.
		No. of I/O points	Power supply voltage	Input	Output	Connection type		
C10	16k steps	10 points (Input: 6 points/ Output: 4 points)	24V DC	24V DC ±common	Relay output: 2A	Terminal block	—	AFP0RC10RS
						Molex connector	—	AFP0RC10RM
	16k steps	10 points (Input: 6 points/ Output: 4 points)	24V DC	24V DC ±common	Relay output: 2A	Terminal block	Available	AFP0RC10CRS
						Molex connector	Available	AFP0RC10CRM
C14	16k steps	14 points (Input: 8 points/ Output: 6 points)	24V DC	24V DC ±common	Relay output: 2A	Terminal block	—	AFP0RC14RS
						Molex connector	—	AFP0RC14RM
	16k steps	14 points (Input: 8 points/ Output: 6 points)	24V DC	24V DC ±common	Relay output: 2A	Terminal block	Available	AFP0RC14CRS
						Molex connector	Available	AFP0RC14CRM
C16	16k steps	16 points ((Input: 8 points/ Output: 8 points)	24V DC	24V DC ±common	Transistor output: (NPN) 0.2A	MIL connector	—	AFP0RC16T
					Transistor output: (PNP) 0.2A		—	AFP0RC16P
	16k steps	16 points (Input: 8 points/ Output: 8 points)	24V DC	24V DC ±common	Transistor output: (NPN) 0.2A	MIL connector	Available	AFP0RC16CT
					Transistor output: (PNP) 0.2A		Available	AFP0RC16CP
C32	32k steps	32 points (Input: 16 points/ Output: 16 points)	24V DC	24V DC ±common	Transistor output: (NPN) 0.2A	MIL connector	—	AFP0RC32T
					Transistor output: (PNP) 0.2A		—	AFP0RC32P
	32k steps	32 points (Input: 16 points/ Output: 16 point)	24V DC	24V DC ±common	Transistor output: (NPN) 0.2A	MIL connector	Available	AFP0RC32CT
					Transistor output: (PNP) 0.2A		Available	AFP0RC32CP
T32	32k steps	32 points (Input: 16 points/ Output: 16 points)	24V DC	24V DC ±common	Transistor output: (NPN) 0.2A	MIL connector	Available	AFP0RT32CT
					Transistor output: (PNP) 0.2A		Available	AFP0RT32CP
F32	32k steps	32 points (Input: 16 points/ Output: 16 points)	24V DC	24V DC ±common	Transistor output: (NPN) 0.2A	MIL connector	Available	AFP0RF32CT
					Transistor output: (PNP) 0.2A		Available	AFP0RF32CP

1.2.2 FP0 Expansion Units

Product name	Specifications					Part No.	Product No.
	No. of I/O points	Power supply voltage	Input	Output	Connection type		
FP0-E8 Expansion unit	8 points (Input: 8 points)	-	24V DC ±common	-	MIL connector	FP0-E8X	AFP03003
	8 points (Input: 4 points, Output: 4 points)	24V DC	24V DC ±common	Relay output: 2A	Terminal block	FP0-E8RS	AFP03023
					Molex connector	FP0-E8RM	AFP03013
	8 points (Output: 8 points)	24V DC	-	Relay output: 2A	Terminal block	FP0-E8YRS	AFP03020
	8 points (Output: 8 points)	-	-	Transistor output: (NPN) 0.1A	MIL connector	FP0-E8YT	AFP03040
	8 points (Output: 8 points)	-	-	Transistor output: (PNP) 0.1A	MIL connector	FP0-E8YP	AFP03050
FP0-E16 Expansion unit	16 points (Input: 16 points)	-	24V DC ±common	-	MIL connector	FP0-E16X	AFP03303
	16 points (Input: 8 points, Output: 8 points)	24V DC	24V DC ±common	Relay output: 2A	Terminal block	FP0-E16RS	AFP03323
					Molex connector	FP0-E16RM	AFP03313
	16 points (Input: 8 points, Output: 8 points)	-	24V DC ±common	Transistor output: (NPN) 0.1A	MIL connector	FP0-E16T	AFP03343
	16 points (Input: 8 points, Output: 8 points)	-	24V DC ±common	Transistor output: (PNP) 0.1A	MIL connector	FP0-E16P	AFP03353
	16 points (Output: 16 points)	-	-	Transistor output: (NPN) 0.1A	MIL connector	FP0-E16YT	AFP03340
	16 points (Output: 16 points)	-	-	Transistor output: (PNP) 0.1A	MIL connector	FP0-E16YP	AFP03350
FP0-E32 Expansion unit	32 points (Input: 16 points, Output: 16 points)	-	24V DC ±common	Transistor output: (NPN) 0.1A	MIL connector	FP0-E32T	AFP03543
	32 points (Input: 16 points, Output: 16 points)	-	24V DC ±common	Transistor output: (PNP) 0.1A	MIL connector	FP0-E32P	AFP03553

1.2.3 Intelligent Units

Product name	Specifications	Part No.	Product No.	Exclusive manual
FP0 Thermocouple unit	K, J, T, R thermocouples, resolution: 0.1°C	FP0-TC4	AFP0420	ARCT1F366
	K, J, T, R thermocouples, resolution: 0.1°C	FP0-TC8	AFP0421	
FP0 Analog I/O unit	<Input specifications> No. of channels: 2 channels Input range: Voltage: 0 to 5 V, -10~+10V (Resolution: 1/4000) Current: 0 to 20 mA (Resolution: 1/4000)	FP0-A21	AFP0480	ARCT1F390
	<Output specifications> No. of channels: 1 channel Output range: Voltage: -10 to +10 V (Resolution: 1/4000) Current: 0 to 20 mA (Resolution: 1/4000)			
FP0 A/D Converter unit	<Input specifications> No. of channels: 8 channels Input range: Voltage: 0 to 5 V, -10to+10V, -100 to 100 mV (Resolution: 1/4000) Current: 0 to 20 mA (Resolution: 1/4000)	FP0-A80	AFP0401	ARCT1F321
FP0 D/A Converter unit	<Output specifications> No. of channels: 4 channels Output range: (Voltage output type): -10 to +10 V (Resolution: 1/4000) (Current output type): 4 to 20 mA (Resolution: 1/4000)	FP0-A04V	AFP04121	ARCT1F382
		FP0-A04I	AFP04123	
FP0 RTD (Resistance-temperature detector) unit	Pt100、Pt1000、Ni1000 Resolution: 0.1°C/0.01°C (Switch type)	FP0-RTD6	AFP0430	ARCT1F445

1.2.4 Link Units

Product name	Specifications	Power supply voltage	Part No.	Product No.	Exclusive manual
FP0 CC-Link Slave unit	This unit is for making the FP0 function as a slave unit of the CC-Link. Only one unit can be connected to the furthest right edge of the FP0 expansion bus. Note) Accuracy will change if an FP0 thermocouple unit is used at the same time.	24V DC	FP0-CCLS	AFP07943	ARCT1F380
FP0 I/O Link Unit	This is a link unit designed to make the FP0 function as a slave unit to MEWNET-F (remote I/O system).	24V DC	FP0-IOL	AFP0732	This manual
C-NET Adapter S2 type (for FP0 side)	This is an RS485 adapter designed to allow use of the computer link function for connecting to a host cmputer via C-NET. It comes with a 30 cm FP0 tool port cable. A power supply is not required.	-	-	AFP15402	ARCT1F96
C-NET Adapter (for computer side)	This is an RS485 adapter designed to allow use of the computer link function for connecting to a network-connected PLC via C-NET from a host computer.	100 to 240V AC	-	AFP8536	
		24V DC	-	AFP8532	
FP Web-Server2 unit	Connected with FP series PLCs, it conducts Ethernet communication, sends e-mail, and displays the PLC data on HTML pages.		FP-WEB2	AFP0611	ARCT1F446

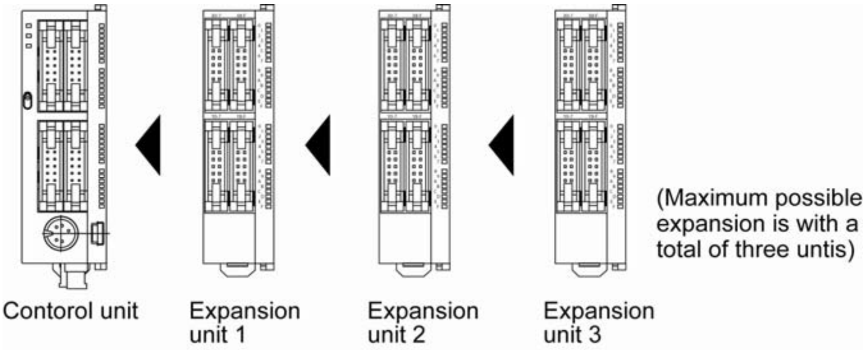
1.2.5 Power Supply Unit

Product name	Specifications	Part No.	Product No.
FP0 Power supply unit	Input voltage: 100 to 240 V AC Free input Output capacity: 0.7A, 24 V DC	FP0-PSA4	AFP0634

1.2.6 Options and Repair Parts

Product name	Specifications		Product No.
FP Memory loader	Data clear type		AFP8670
	Data hold type		AFP8671
Terminal screwdriver	Relay output type. Necessary when wiring terminal blocks (Phoenix).		AFP0806
Molex connector pressure contact tool	Necessary when wiring relay output type and Molex connectors. (MOLEX: 57189-5000)		AFP0805
Multi-wire connector pressure contact tool	Necessary when wiring transistor output type connectors.		AXY52000
FP0 Slim type mounting plate	Mounting plate for mounting FP0 expansion unit on a panel vertically.		AFP0803(10-pack)
FP0 Flat type mounting plate	Mounting plate for mounting Control unit on a panel horizontally.		AFP0804 (10-pack)
Relay output Molex type I/O cable	Loose-wiring cable (9 leads) AWG20, with Molex socket attached at one end, 0.5mm^2, 1 set: 2 cables (blue white)	Length: 1 m	AFP0551(2 cable set)
		Length: 3 m	AFP0553(2 cable set)
Transistor output type I/O cable	Loose-wiring cable (10 leads) AWG22, with connector attached at one end,0.3mm^2 1 set: 2 cables (blue white)	Length: 1 m	AFP0521 (2 cable set)
		Length: 3 m	AFP0523(2 cable set)
Terminal socket	Attaches to relay outputand terminal block type. Maintenance parts		AFP0802(2 cable set)
Molex socket	Attaches to relay output and Molex connector type. Maintenance parts		AFP0801(2 cable set)
Wire-press socket	Attaches to transistor output type. Maintenance parts		AFP0807(2 cable set)
FP0 Power supply cable	Attaches to FP0 various units. Maintenance parts Length: 1m		AFP0581(1-pack)
FP0R/FPΣ Power supply cable	Attaches to FP0R control unit. Maintenance parts. Length: 1m		AFPG805 (1-pack)

1.3 Restrictions on Unit Combination



Up to three expansion units can be added on the right of the FP0R, these expansion units being either expansion units or intelligent units.
A combination of relay output and transistor output types is also possible.

Controllable I/O points

Type of control unit	No. of I/O points when using control unit	When the expansion unit is the same output type	When the expansion unit is a transistor output type
C10	10 points	Max. 58 points	Max. 106 points
C14	14 points	Max. 62 points	Max. 110 points
C16	16 points	Max. 112 points	Max. 112 points
C32 T32 F32	32 points	Max. 128 points	Max. 128 points

Note:
- Install the FP0 thermocouple unit on the right side of all other expansion units.
- If it is installed on the left side, the total precision will deteriorate.
- Install the FP0 CC-Link slave unit on the right side of all other expansion units. There is no expansion connector on the right side.
- Install the FP0 RTD unit on the right side of all other expansion units.

1.4 Programming Tools

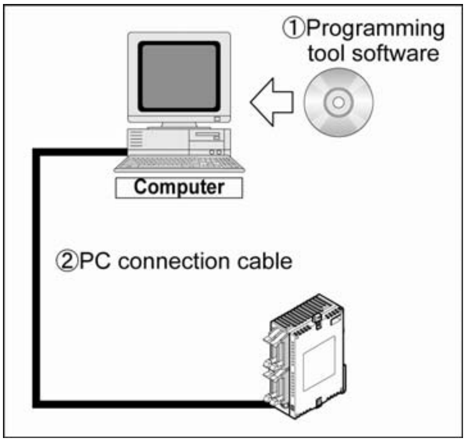
1.4.1 Required Tools for Programming

1.Programming tool software

- The tool software can also be used with the FP series.
- "FPWIN GR Ver.2" or "FPWIN Pro Ver.6" Windows software is used with FP0R.
  FPWIN GR Ver.1x, MS-DOS NPST-GR and FP Programmer cannot be used.

2.PC connection cable

- The connection cable for DOS/V machine is available.
- A commercial miniUSB cable can be used for the connection.



1.4.2 Software Environment and Suitable Cable

Standard ladder diagram tool software FPWIN GR Ver.2

Type of software		OS (Operating system)	Hard disk capacity	Product No.
FPWIN GR Ver.2 English-language menu	Full type	Windows®98 Windows®ME Windows®2000 Windows®XP Windows Vista®	40MB or more	AFPS10520
	Small type			AFPS11520
	Upgrade version			AFPS10520R

Note1) Ver.1.1 must be installed to install the upgrade version.
Note2) Ver.2.0 can be upgraded to Ver.2.1 or later free of charge at our web site (http://panasonic-denko.co.jp/ac).
Use the latest version.
Note3) The small type can be used only for each series of FP-e, FPΣ, FP0 and FP-X.
Note4) If Windows 95 is being used, a USB cable cannot be used for the connection.

Conforms to IEC61131-3 programming tool software FPWIN Pro Ver.6

Type of software	OS (Operating system)	Hard disk capacity	Product No.
FPWIN Pro Ver.6 English-language menu	Windows®2000 Windows®XP Windows Vista®	100MB or more	AFPS50560

Note1) The small type and upgrade version is not available for Ver.6.
Note2) Ver.6.0 can be upgraded to Ver.6.1 or later free of charge at our web site (http://panasonic-denko.co.jp/ac).
Use the latest version.

Type of computer and suitable cable

For the connection between a personal computer (RS232C) and the control unit (RS232C)

D-sub connector cable

Type of PC	PLC side connector	PLC side connector	Specifications	Product No.
DOS/V machine	D-sub 9-pin	Female-Mini DIN round 5-pin	L type (3 m)	AFC8503
		Female-Mini DIN round 5-pin	Straight type (3 m)	AFC8503S

Note) A USB/RS232C onversion cable is necessary to connect with a personal computer without a serial port using a PC connection cable.

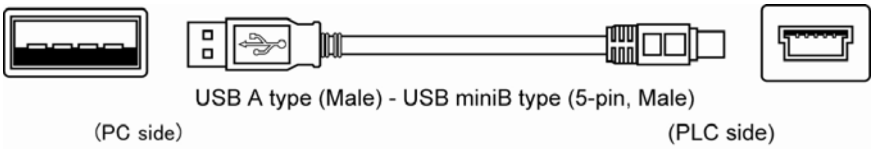
For the connection between a personal computer (USB) and the control unit (USB)

USB cable

Use a commercial cable.

Cable type	Length
USB 2.0 cable (A: miniB)	Max. 5 m

Note) Windows®2000 or later OS is required for the communication with a USB.



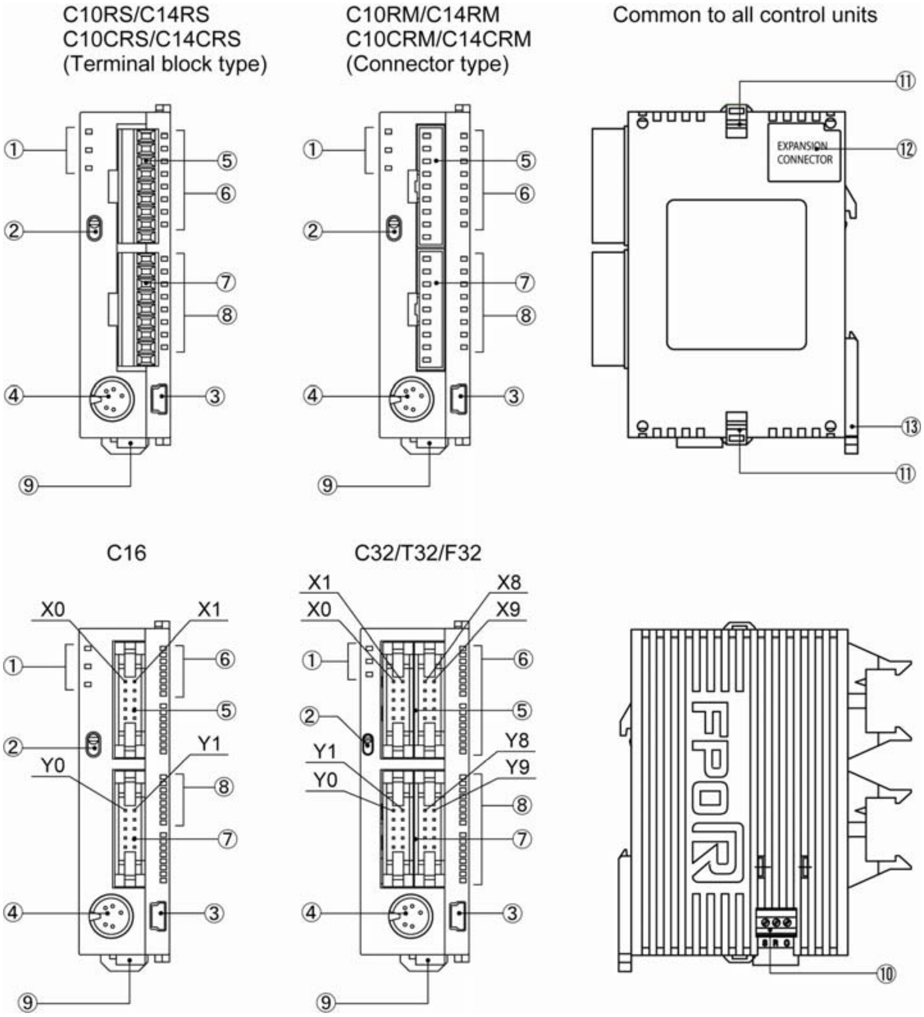
Reference: <Chapter 6 Preparation of USB Port>

Chapter 2

Specifications and Functions of Control Unit

2.1 Part Names and Functions

2.1.1 Part Names and Functions



① **Operation monitor LEDs**

These LEDs display the current operation status of PLC such as RUN/STOP and ERROR/ALARM.

LED	LED and operation status	
RUN (Green)	Lights:	In the RUN mode - The program is being executed.
	Flashes:	The forced input/output is being executed in the RUN mode. (The RUN and PROG. LEDs flash alternately.)
PROG. (Green)	Lights:	In the PROG. mode - The operation has stopped. The forced input/output is being executed in the PROG. mode.
	Flashes:	The forced input/output is being executed in the RUN mode. (The RUN and PROG. LEDs flash alternately.)
ERROR/ALARM (Red)	Flashes	An error is detected during the self-diagnostic function. (ERROR)
	Lights	A hardware error occurs, or operation slows because of the program, and the watchdog timer is activated. (ALARM)

② RUN/PROG. mode switch

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

Switch	Operation mode	
RUN (Position: Up)	RUN mode	:The program is executed and the operation begins.
PROG. (Position: Down)	PROG. mode	:The operation stops. In this mode, programming can be done using a tool software.

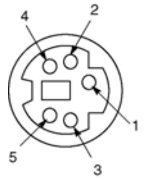
- Switching between RUN and STOP can be also performed by the remote operation from a programming tool.
- When performing remote switching from the programming tool, the setting of the mode switch and the actual mode of operation may differ. Verify the mode with the status indicator LED.
- Restart the power supply to operate in the mode set with the RUN/PROG. mode switch.

③ USB connector (Mini-USB B type (5-pin))

This connector is used to connect a programming tool.
A commercial USB cable (USB2.0 cable (A: miniB)) can be used.

④ Tool port (RS232C)

This connector 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	+5 V	+5 V	Unit → External device

- The followings are the default settings when the unit is shipped from the factory. The system register should be used to change these.

Baud rate	9600bps
Char. Bit	8 bits
Parity check	Odd parity
Stop bit	1 bit

Note) The unit number of the tool port should be set by the system register.

⑤ Input connector

⑥ Input status LEDs

⑦ Output connector

⑧ Output indicator LEDs

⑨ Power supply connector (24 V DC)

Supply 24 V DC. It is connected using the power supply cable (AFPG805) supplied with the unit.

⑩ COM port (RS232C port) (C10CR、C14CR、C16C、C32C、T32C、F32C)

This port is used to connect equipment with RS232C to enable data input/output.

⑪ expansion hook

This hook is used to secure expansion units. The hook on the right side is also used for installation on the flat-type mounting plate (AFP0804).

⑫ Right-side connector for FP0 expansion

This is used to connect the FP0−cum-FPΣexpnasion unit installed on the right side of control unit to the internal circuit. (The connector is located under the seal.)

⑬ DIN hook

This hook enables the unit to attach to a rail at a touch. It is also used to install the unit on the slim type mounting plate (AFP0803).

2.2 Input and Output Specifications

2.2.1 Input Specifications

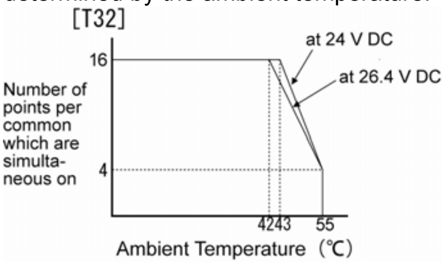
Input specifications (for all types)

Item		Description
Insulation method		Optical coupler
Rated input voltage		24 V DC
operating voltage range		21.6 V DC to 26.4 V DC
Rated input current		Approx. 2.6 mA
Output points per common		For C10: 6 points/common For C14, C16: 8 points/common For C32, T32, F32: 16 points/common (Either the positive or negative of the input power supply can be connected to common terminal.)
Min. on voltage/Min. on current		19.2 V DC/2 mA
Max. off voltage/Max. off current		2.4 V DC/1.2 mA
Input impedance		9.1 kΩ
Response time	OFF→ON	20 μs or less Note) The input time constant can be set using system registers. (0.1 ms to 64 ms)
	ON→OFF	Same as above
Operating mode indicator		LED display

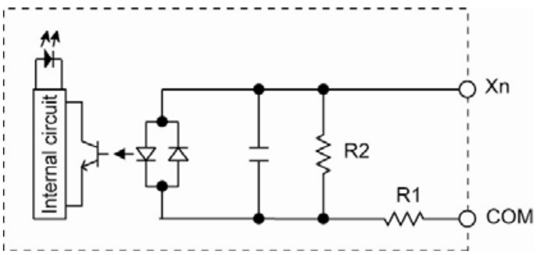
Note) This specification is applied when the rated input a voltage is 24 V DC and the temperature is 25℃.

Limiations on number of simultaneous input on points

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



Circuit diagram



R1=9.1 kΩ R2=1 kΩ

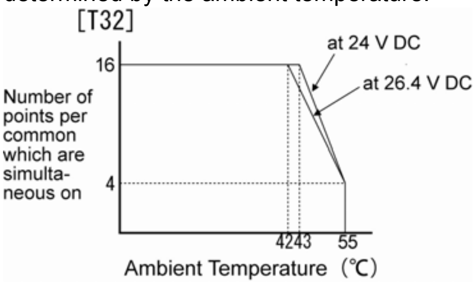
2.2.2 Output Specifications

Transistor output specifications

Item		Description	
		NPN	PNP
Insulation method		Optical coupler	
Output type		Open collector	
Rated load voltage		5 V DC to 24 V DC	24 V DC
Operating load voltage range		4.75 V DC to 26.4 V DC	21.6 V DC to 26.4 V DC
Max. load current		0.2A	
Output points per common		For C16: 8 points/common For C32, T32, F32: 16 points/common	
Off state leakage current		1 μA or less	
On state voltage drop		0.2 V DC or less	
Response time	OFF→ON	20 μs or less (Load current: 5 mA or more) 0.1 ms or less (Load current: 0.5 mA or more)	
	ON→OFF	40 μs or less (Load current: 5 mA or more) 0.2 ms or less (Load current: 0.5 mA or more)	
External power supply (+ and - terminals)	Voltage	21.6V DC to 26.4V DC	
	Current	C16: 30 mA or less C32、T32、F32: 60 mA or less	C16:35 mA or less C32、T32、F32: 70 mA or less
Surge absorber		Zener diode	
Operating mode indicator		LED display	

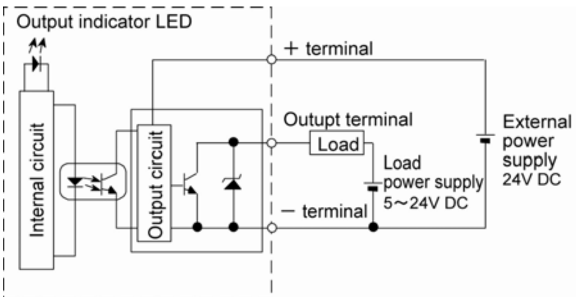
Limiations on number of simultaneous output on points

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

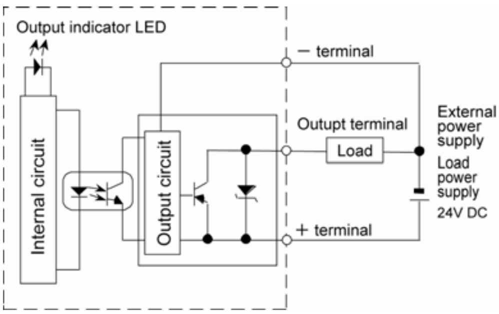


Circuit diagram

[NPN]



[PNP]

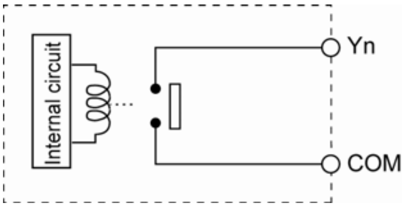


Relay output specifications (C10/C14)

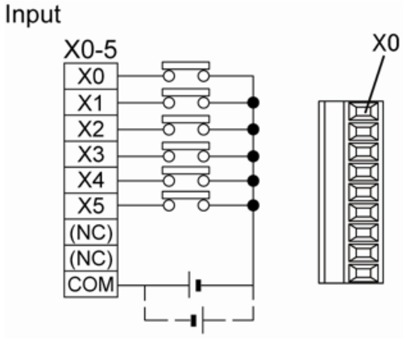
Item		Description
Output type		1a output
Rated control capacity		2 A 250 V AC、2 A 30 V DC (4.5 A or less/common) Note)
Output points per common		C10:2 points/common+1 point/common+1 point/common C14:4 points/common+1 point/common+1 point/common
Response time	OFF → ON	Approx. 10 ms
	ON → OFF	Approx. 8 ms
Lifetime	Mechanical	Min. 20,000,000 operations (Switching rate: 180 times/min.)
	Elecstrical	Min. 100,000 operations (Switching rate: 20 times/min. at rated control capacity)
Surge absorber		None
Operating mode indicator		LED display

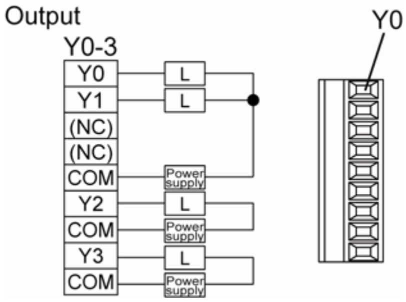
Note) Resistance load

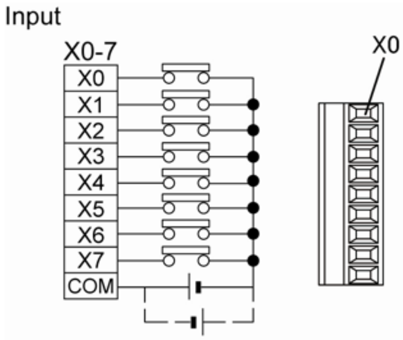
Circuit diagram

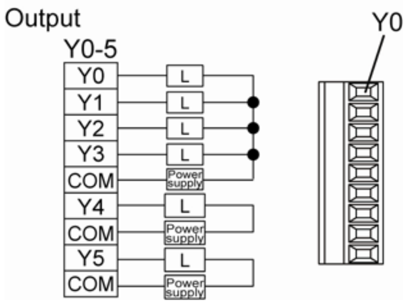


2.3 Terminal layout diagrams

<table>
<tr><th>Model No.</th><th>Terminal layout diagrams</th></tr>
<tr><td>C10RS
C10CRS
C10RM
C10CRM</td><td>

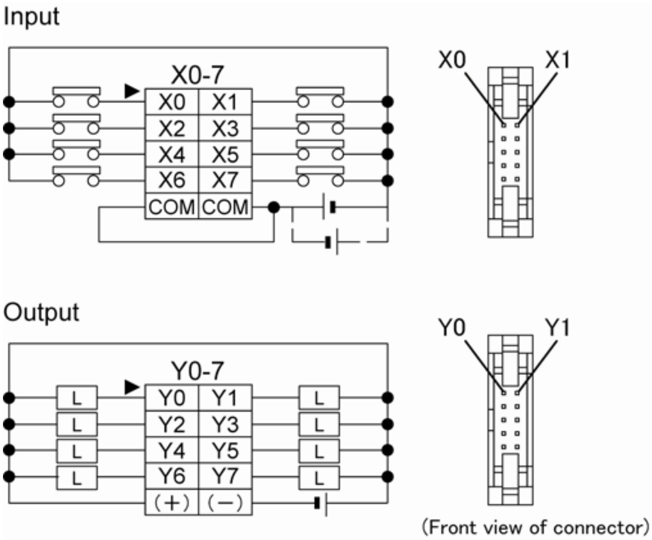


(The above illustration is the terminal block type.)</td></tr>
<tr><td>C14RS
C14CRS
C14RM
C14CRM</td><td>

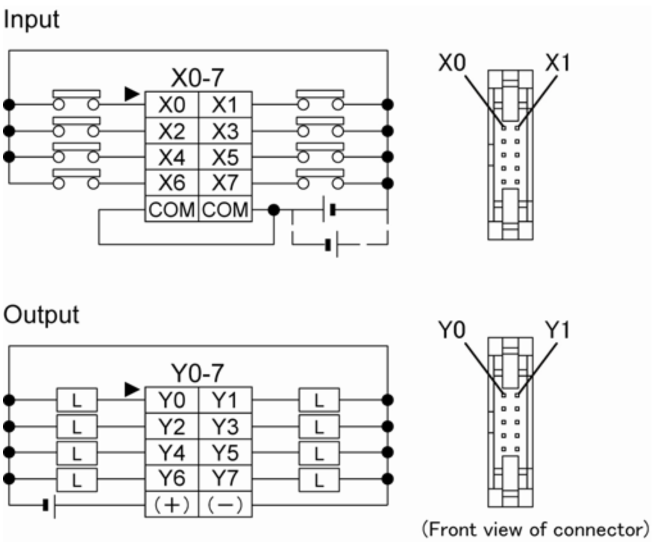


(The above illustration is the terminal block type.)</td></tr>
</table>

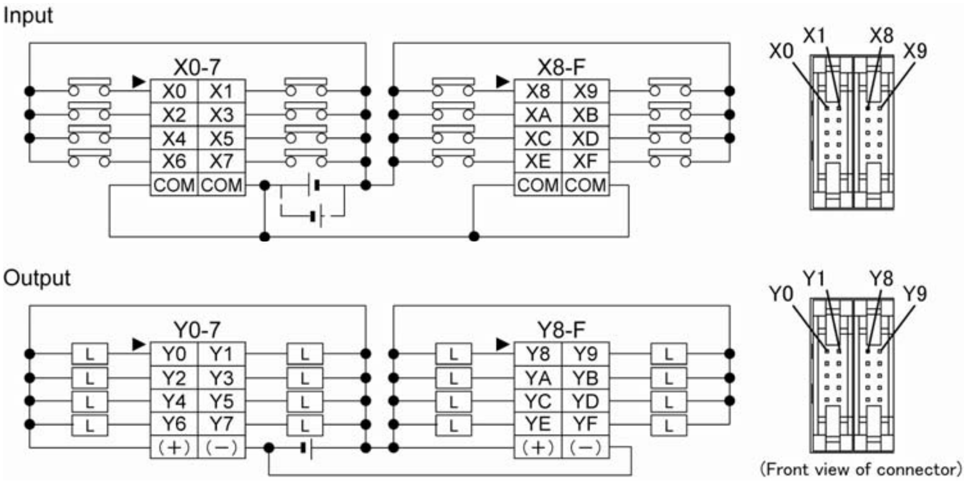
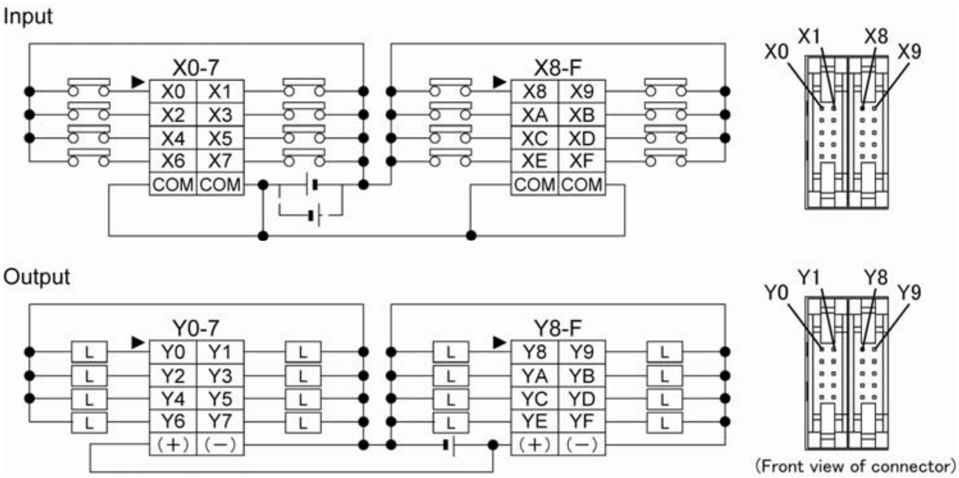
<table>
<tr><th>Model No.</th><th>Terminal layout diagrams</th></tr>
<tr><td>C16T
C16CT</td><td>



Note: Two COM terminals of the input circuit are connected internally.
</td></tr>
<tr><td>C16P
C16CP</td><td>



Note: Two COM terminals of the input circuit are connected internally.
</td></tr>
</table>

Model No.	Terminal layout diagrams
C32T C32CT T32CT F32CT	 **Note:** Four COM terminals of the input circuit are connected internally. Two (+) terminals of the output circuit are connected internally. Two (-) terminals of the output circuit are connected internally.
C32P C32CP T32CP F32CP	 **Note:** Four COM terminals of the input circuit are connected internally. Two (+) terminals of the output circuit are connected internally. Two (-) terminals of the output circuit are connected internally.

2.4 Backup Function and Clock/Calender Function of FP0R-T32

The FP0R-T32 control unit has a secondary battery (Charging type).
The backup function for the operation memory and clock/calender function can be used.

2.4.1 Backup Function

Backup of operation memory
(1) Timer/Counter (T/C)
(2) Internal relays (R)
(3) Data Registers (DT)
(4) Step ladders

The range specified with a programming tool is the hold area to be backed up.
If the range is not specified, it will be the area of the default.
Note) If the battery is out of charge and the hold area becomes indefinite, the value in the hod area will be cleared to 0 when the power supply is turned on again.

Key Point:
Programs and system registers will be held in the internal ROM regardless of the built-in back up battery.

2.4.2 Clock/Calender

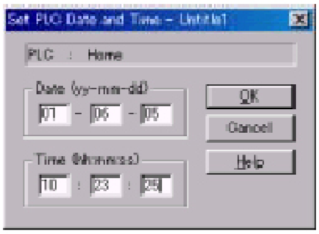
The clock/calender function is available for the FP0R-T32.
Note) As the value is unstable in the initial state, write the value using a programming tool.

Area of clock/calender
With the clock/calender function, data indicating the hour, minute, second, day, year and other information stored in the special data registers DT90053 to DT90057 can be read using the transmission instruction and used in sequence programs.

Special data register No.	Higher bytes	Lower bytes	Reading	Writing
DT90053	Hour data H00 to H23	Minute data H00 to H59	Available	Not available
DT90054	Minute data H00 to H59	Second data H00 to H59	Available	Available
DT90055	Day data H01 to H31	Hour data H00 to H23	Available	Available
DT90056	Year data H00 to H99	Month data H01 to H12	Available	Available
DT90057	-	Day-of-the-week data H00 to H06	Available	Available

Setting of Clock/Calender Function
Setting using a programming tool
Using FPWIN GR
1.Select [Online Edit Mode] under the [Online] on the menu bar, or press the [CTRL] and [F2] keys at the samte time, to switch to the [Online] screen.
2.Select "Set PLC Data and Time" under "Tool" on the menu bar.

Set PLC Date and Time dialog box



The above steps display the "Set PLC Date and Time dialog box" shown at the left. Input the date and time, and click on the "OK" button.

Using FPWIN Pro
1. Select [Online Mode] under the [Online] on the menu bar, or press the [Shift] and [Esc] keys at the samte time, to switch to the [Online Mode] screen.
2. Select "Special Relay/Special Data Register" under "Monitor" on the menu bar.
3. The screen will appear to set various parameters.

Setting and changing using program

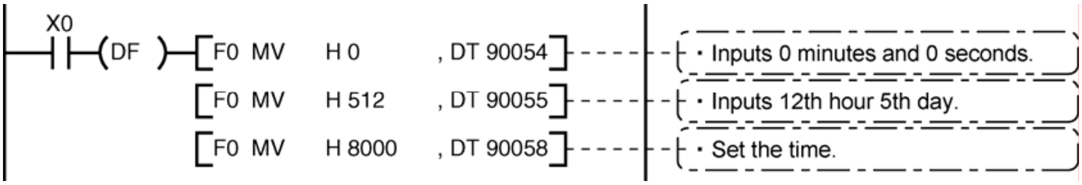
(1) The values written to the special data registers DT90054 to DT90057, which are allocated as the clock/calender setting area, are sent.

(2) A value of H8000 is written to DT90058.

Note) The value can be sent using the differential instruction "DF", or by changing H8000 to H0000.

Example showing the date and time bing written

Set the time to 12:00:00 on the 5th day when the X0 turns on.



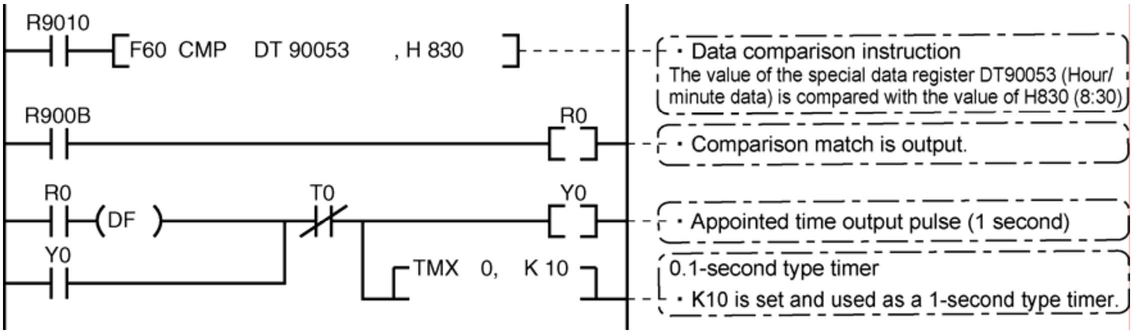
Note: As the value is unstable in the initial state, write the value using a programming tool. As a day of the week is not automatically set on programming tools, fix what day is set to 00, and set the value for 00.

Example showing the clock/calender being used

Sample program for fixed schedule and automatic start

In the example shown here, the clock/calender function is used to output (Y0) signal for one second, at 8:30 a.m. every day.

Here, the "Hour/minute" data stored in the special data register DT90053 is used to output the signal at the appointed time.



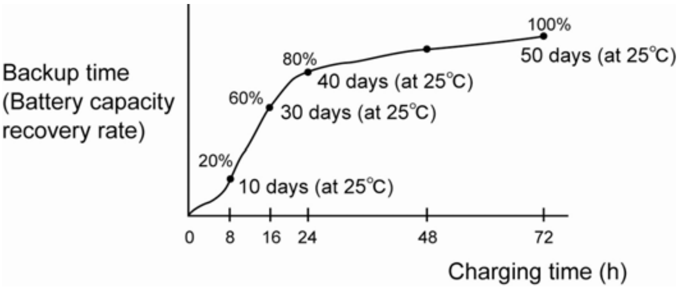
- The hour data is stored in the upper 8 bits of DT90053 and the minute data in the lower 8 bits, in the BCD format.
- This hour and minute data is compared with the appointed time (BCD), and the R900B (=flag) special internal relay is used to detect whether or not it matches the appointed time.

2.4.3 Built-in Backup Battery

Time the built-in backup battery can be used (Backup time)
The built-in backup battery is not charged when the unit is shipped.
Charge the battery surfficiently before use. (Full charge (Ambient temperature: 25℃): 72 hours)
It will be charged automatically if the DC power is supplied to the control unit.

Relation between charging time and backup time
The number of days in the backup time varies according to the rate of charging time.

If it is charged on a full charge (72 hours) at the ambient temperature of 25℃, the bakup time will be approx. 50 days.



The backup time will vary according to the ambient temperature when the battery is charged.

Ambient temperature when charged	Number of days in backup time
70 °C	Approx. 14 days
-20 °C	Approx. 25 days

Predicted life of built-in backup battery
The life of the built-in backup battery varies according to the ambient temperature while the control unit is on (energized).
Note) The temperature when the control unit is off (not powered) has little influence on the battery life.

Ambient temperature	Lifetime of built-in backup battery
55 °C	Approx. 430 days <Approx. 1 year>
45 °C	Approx. 1200 days <Approx. 3 years>
40 °C	Approx. 2100 days <Approx. 6 years>
35 °C	Approx. 3300 days <Approx. 9 years>
34 °C or lower	Approx. 10 years

Note: The built-in backup battery cannot be replaced.

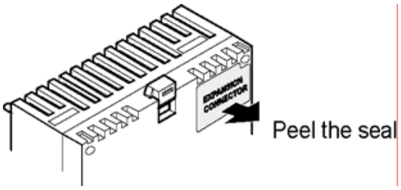
Chapter 3

Expansion

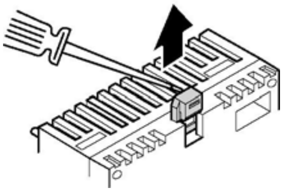
3.1 Expansion Method

The FP0 expansion units (expansion I/O unit, high-performance unit) are connected to the right side of the contorl Unit.
Unit expansion is done using the right-side connector for FP0 expansion and the expansion hooks on the side of the unit.

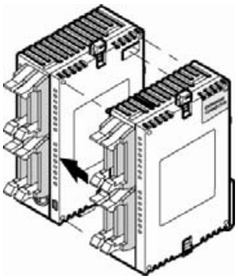
(1) Peel the seal on the right side of the unit to expose the internal right-side connector for the FP0 expansion.



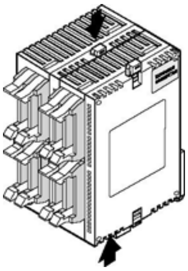
(2) Using a screwdriver or similar tool, pull out the top and bottom expansion hooks.



(3) Align the pins and holes in teh 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.

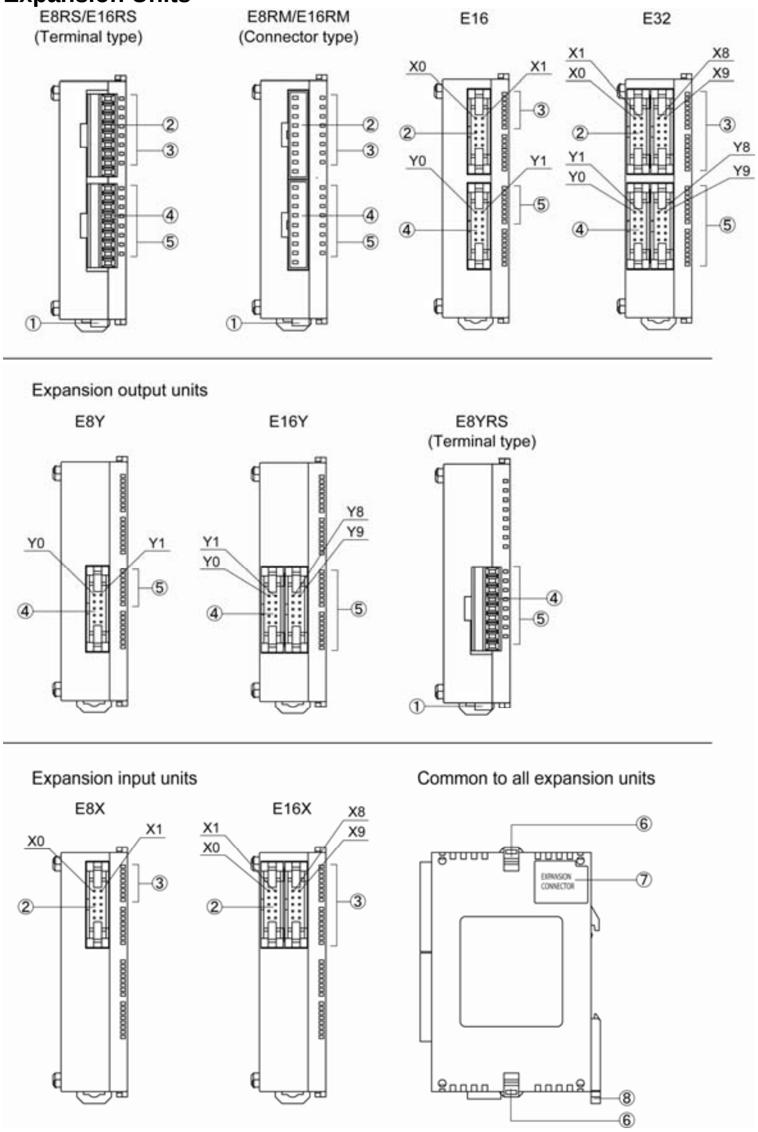


(4) Press down the expansion hooks raised in Step (2) to secure the unit.



3.2 Part Names and Functions

Expansion Units



Part Names and Functions

① **Power supply connector**

Supply 24 V DC. It is connected using the cable (AFP0581) supplied with the unit.

② **Input connector**

③ **Input indicator LED**

④ **Output connector**

⑤ **Output indicator LEDs**

⑥ **Expansion hook**

This hook is used to secure expansion units.

⑦ **Expansion connector**

This connector is used to connect an expansion unit and internal circuit.

⑧ **DIN hook**

This hook enables the unit to attach to a rail at a touch. It is also used to install the unit on the slim type mounting plate (AFP0803).

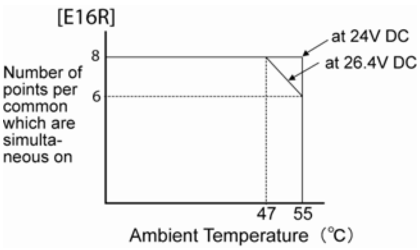
3.3 Input and Output Specifications

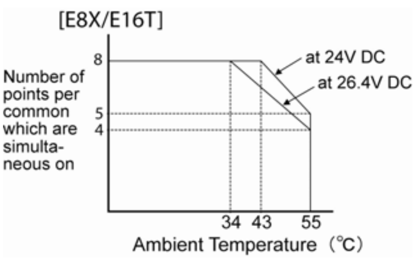
(1)Input specifications

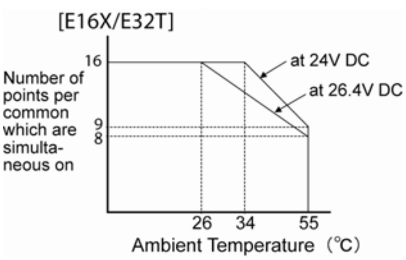
Item		Specifications
Insulation method		Optical coupler
Rated input voltage		24 V DC
Rated input current		Approx. 4.3 mA (at 24 V DC)
Input impedance		Approx. 5.6 kΩ
Operating voltage range		21.6 V DC to 26.4 V DC
Input point per common (Either the positive or negative of the inptu power supply can be connected to common terminal.)	E8X/E16P/E16T	8 points/common
	E32T/E16X	16 points/common
	E8R	4 points/common
Min. on voltage/Min. on current		19.2 V DC/3 mA
Max. off voltage/Max. off current		2.4 V DC/1 mA
Response time	OFF → ON	2 ms or less
	ON → OFF	2 ms or less
Operating mode indicator		LED display

Limiations on number of simultaneous input on points

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







(2) Output specifications
Relay type output specifications
E8RS/E8RM/E8YRS/E16RS/E16RM

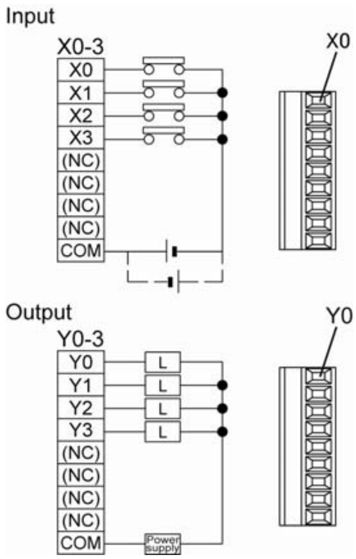
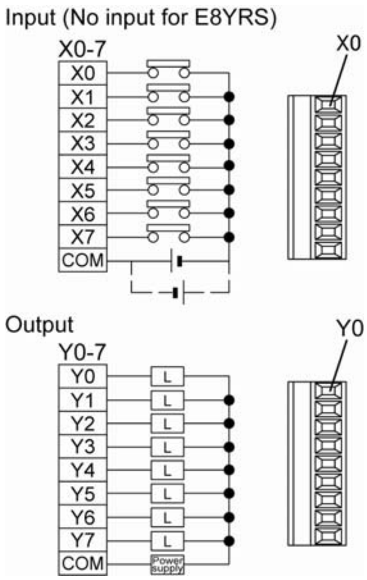
Item		Description
Output type		1a relay output
Rated control capacity:		2 A 250 V AC、2 A 30 V DC (Max. 4.5 A or less/common) Note)
Output points per common	E8R	4 points/common
	E16R, E8YR	8 points/common
Response time	OFF → ON	Approx. 10 ms
	ON → OFF	Approx. 8 ms
Lifetime	Mechanical	Min. 20,000,000 operations
	Electrical	Min. 100,000 operations
Surge absorber		None
Operating mode indicator		LED display

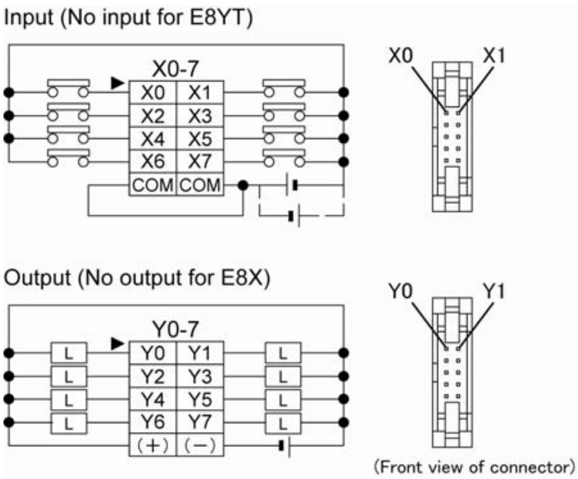
Note) Resistance load

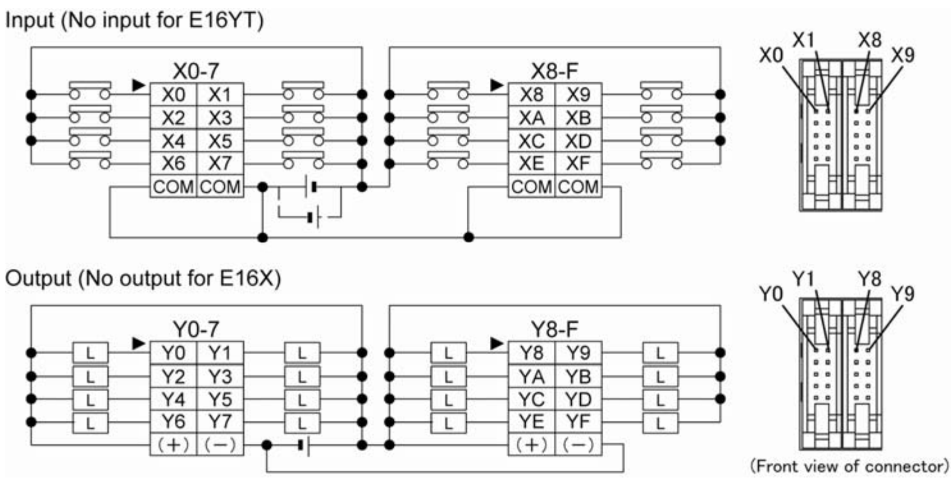
Transistor type output specifications
(NPN output type: E8YT/E16YT/E16T/E32T)
(PNP output type: E8YP/E16YP/E16P/E32P)

Item		Description	
		NPN	PNP
Insulation method		Optical coupler	
Output type		Open collector	
Rated load voltage		5 V DC to 24 V DC	24 V DC
Operating load voltage range		4.75 V DC to 26.4 V DC	21.6 V DC to 26.4 V DC
Max. load current		0.1 A/point (Max. 1 A per common)	
Max. surge current		0.3 A	
Output points per common	E16T, E8Y	8 points/common	
	E32, E16Y	16 points/common	
Off state leakage current		100 µA or less	
On state voltage drop		1.5V or less	
External power supply (for driving internal circuit)	Voltage	21.6 V DC to 26.4 V DC	
	Current	3 mA/1 point	
Response time	OFF→ON	1 ms or less	
	ON→OFF	1 ms or less	
Surge absorber		Zener diode	
Operating mode indicator		LED display	

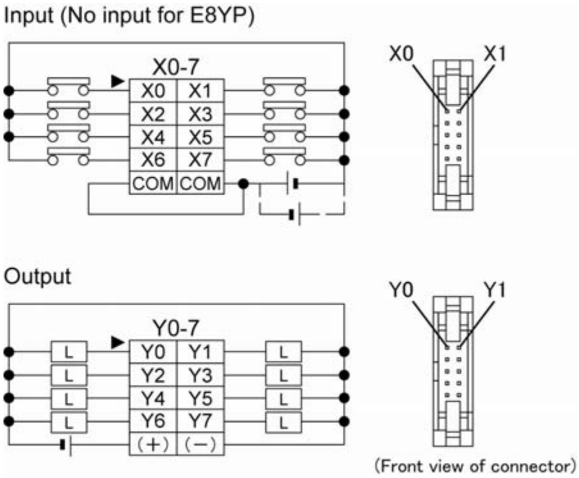
3.4 Terminal layout diagram

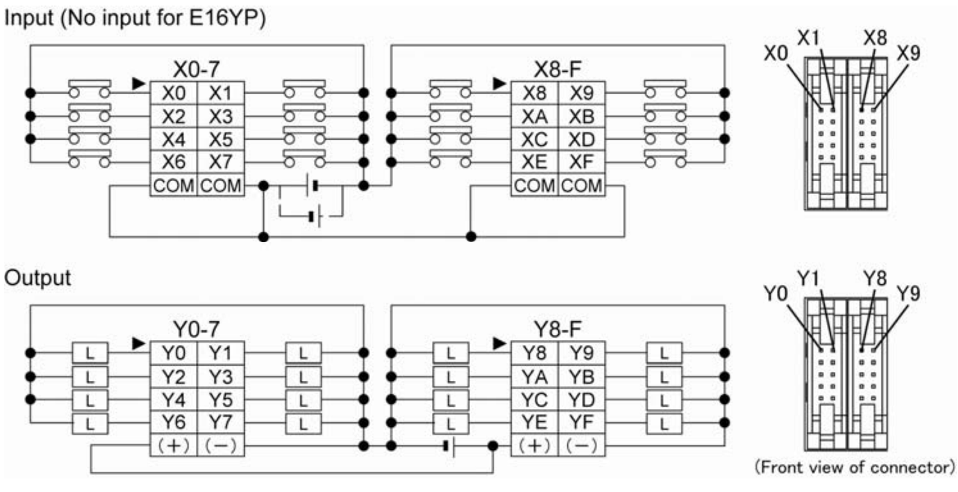
<table>
<tr><th>Model No.</th><th>Terminal layout diagrams</th></tr>
<tr><td>E8RS
E8RM</td><td>
</td></tr>
<tr><td>E16RS
E16RM
E8YRS</td><td>
</td></tr>
</table>

<table>
<tr><th>Model No.</th><th>Terminal layout diagrams</th></tr>
<tr><td>E8X
E16T
E8YT</td><td>


Note: Two COM terminals of the input circuit are connected internally.
</td></tr>
<tr><td>E16X
E32T
E16YT</td><td>


Note: Two COM terminals of the input circuit are connected internally.
Two (+) terminals of the output circuit are connected internally.
Two (-) terminals of the output circuit are connected internally.
</td></tr>
</table>

<table>
<tr><th>Model No.</th><th>Terminal layout diagrams</th></tr>
<tr><td>E16P
E8YP</td><td>


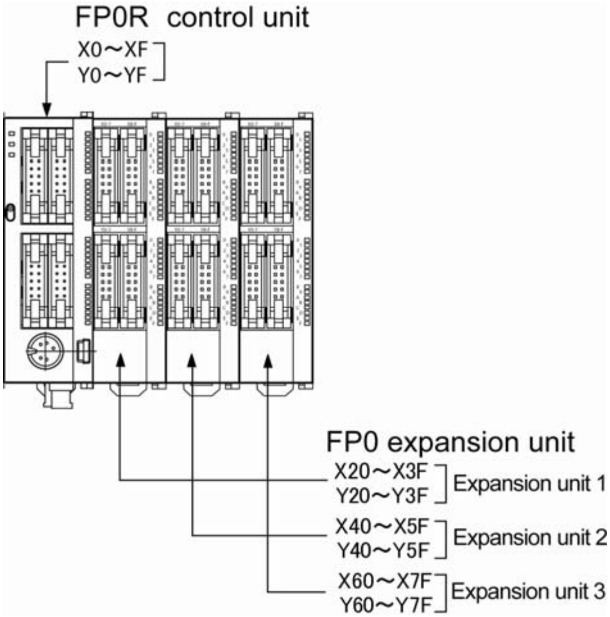
Note: Two COM terminals of the input circuit are connected internally.
</td></tr>
<tr><td>E32P
E16YP</td><td>


Note: Two COM terminals of the input circuit are connected internally.
Two (+) terminals of the output circuit are connected internally.
Two (-) terminals of the output circuit are connected internally.
</td></tr>
</table>

Chapter 4

I/O Allocation

4.1 I/O Allocation



Note) The usable I/O numbers are different depending on the units.

Regarding I/O number

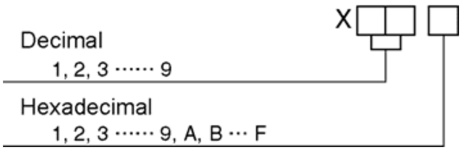
Specifying X and Y numbers

On the FP0R, the same numbers are used for input and output.

Example: X20
Y20 } The same numbers are used for input and output

Expression of numbers for input/output relays

Since input relay "X" and output relay "Y" are handled in units of 16 points, they are expressed as a combination of decimal and hexadecimal numbers as shown below.



4.2 I/O Allocation for FP0R Control Unit

4.2.1 I/O Numbers of FP0R Control Unit

The I/O allocation of FP0R control unit is fixed.

Type of control unit	Number of allocation	I/O number
C10	Input (6 point)	X0 to X5
	Output (4 points)	Y0 to Y3
C14	Input (8 points)	X0 to X7
	Output (6 points)	Y0 to Y5
C16	Input (8 points)	X0 to X7
	Output (8 points)	Y0 to Y7
C32/T32/F32	Input (16 points)	X0 to XF
	Output (16 points)	Y0 to YF

4.3 I/O Numbers of FP0 Expansion Unit

・I/O numbers do not need to be set as I/O allocation is automatically performed when an expansion unit is added.
・The I/O allocation of expansion unit is determined by the installation location.

Type of unit		Number of allocation	Expansion unit 1	Expansion unit 2	Expansion unit 3
FP0 Expansion unit	FP0-E8X	Input (8 points)	X20 to X27	X40 to X47	X60 to X67
	FP0-E8R	Input (4 points)	X20 to X23	X40 to X43	X60 to X63
		Output (4 points)	Y20 to Y23	Y40 to Y43	Y60 to Y63
	FP0-E8YT/P FP0-E8YR	Ouput (8 points)	Y20 to Y27	Y40 to Y47	Y60 to Y67
	FP0-E16X	Input (16 points)	X20 to X2F	X40 to X4F	X60 to X6F
	FP0-E16R FP0-E16T/P	Input (8 points)	X20 to X27	X40 to X47	X60 to X67
		Output (8 points)	Y20 to Y27	Y40 to Y47	Y60 to Y67
	FP0-E16YT/P	Output (16 points)	Y20 to Y2F	Y40 to Y4F	Y60 to Y6F
	FP0-E32T/P	Input (16 points)	X20 to X2F	X40 to X4F	X60 to X6F
		Output (16 points)	Y20 to Y2F	Y40 to Y4F	Y60 to Y6F
FP0 Analog I/O unit	FP0-A21	Input (16 points) CH0	WX2 (X20 to X2F)	WX4 (X40 to X4F)	WX6 (X60 to X6F)
		Input (16 points) CH1	WX3 (X30 to X3F)	WX5 (X50 to X5F)	WX7 (X70 to X7F)
		Output (16 points)	WY2 (Y20 to Y2F)	WY4 (Y40 to Y4F)	WY6 (Y60 to Y6F)
FP0 A/D conversion unit FP0 Thermocouple unit	FP0-A80 FP0-TC4 FP0-TC8	Input (16 points) CH0, 2, 4, 6	WX2 (X20 to X2F)	WX4 (X40 to X4F)	WX6 (X60 to X6F)
		Input (16 points) CH1, 3, 5, 7	WX3 (X30 to X3F)	WX5 (X50 to X5F)	WX7 (X70 to X7F)
FP0 D/A conversion unit	FP0-A04V FP0-A04I	Input (16 points)	WX2 (X20 to X2F)	WX4 (X40 to X4F)	WX6 (X60 to X6F)
		Output (16 points) CH0, 2	WY2 (Y20 to Y2F)	WY4 (Y40 to Y4F)	WY6 (Y60 to Y6F)
		Output (16 points) CH1, 3	WY3 (Y30 to Y3F)	WY5 (Y50 to Y5F)	WY7 (Y70 to Y7F)
FP0 I/O link unit	FP0-IOL	Input (32 points)	X20 to X3F	X40 to X5F	X60 to X7F
		Output (32 points)	Y20 to Y3F	Y40 to Y5F	Y60 to Y7F
FP0 RTD unit	FP0-RTD	Input (16 points) CH0, 2, 4	WX2 (X20 to X2F)	WX4 (X40 to X4F)	WX6 (X60 to X6F)
		Input (16 points) CH1, 3, 5	WX3 (X30 to X3F)	WX5 (X50 to X5F)	WX7 (X70 to X7F)
		Output (16 points)	WY2 (Y20 to Y2F)	WY4 (Y40 to Y4F)	WY6 (Y60 to Y6F)

- The data for the each channels of 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 convert the data.
- Regarding FP0 CC-Link slave unit, please refer to the exclusive manual.

Chapter 5

Installation and Wiring

5.1 Installation

5.1.1 Installation Environment and Space

Operating environment

(Use the unit within the range of the general specifications when installing)

- Ambient temperature: 0 to +55 ℃
- Ambient humidity: 10 to 95 % RH (at 25 ℃, non-condensing)
- For use in pollution Degree 2 environment.

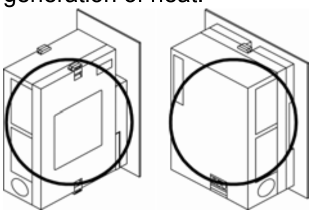
- Do not use the unit in the following environments.
  - Direct sunlight
  - Sudden temperature changes causing condensation.
  - Inflammable or corrosive gas.
  - Excessive airborne dust, metal particles or saline matter.
  - Benzine, paint thinner, alcohol or other organic solvents or strong alkaline solutions such as ammonia or caustic soda.
  - Direct vibration, shock or direct drop of water.
  - Influence from power transmission ilnes, high voltage equipment, power cables, power equipment, radio transmitters, or any other equipment that would generate high switching surges.(100 mm or more)

Static electricity

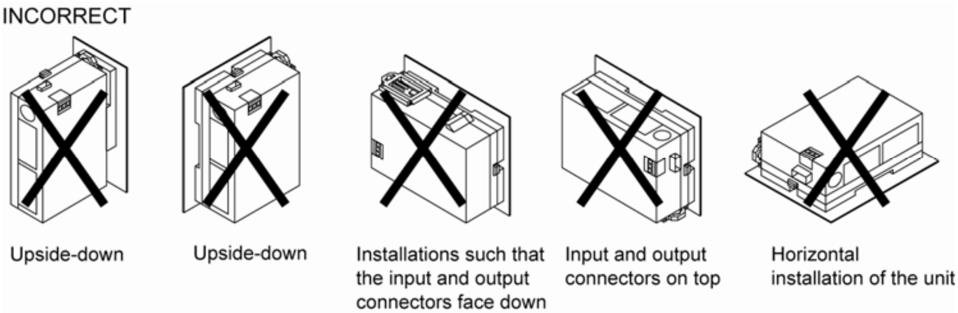
- Do not touch connector pins directly to prevent static electricity from causing damage.
- Always rid yourself of any static electricity before handling this product.

Measures regarding heat discharge

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



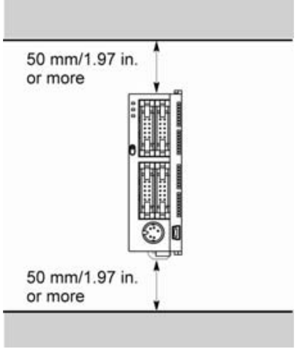
- Do not install the unit as shown below.



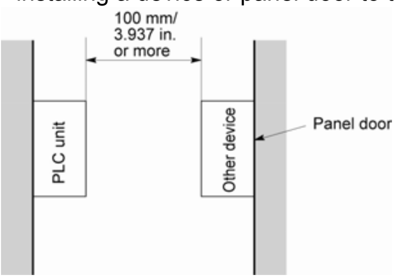
- Do not install the unit above devices which generate heat such heaters, transformers or large scale resistors.

Installation space

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



- Maintain at least 100 mm of space between devices to avoid adverse affects from noise and heat when installing a device or panel door to the front of the PLC unit.



- Leave at least 100 mm of space from the front surface of the control unit in order to allow room for programming tool connections and wiring.

5.1.2 Installation and Removal

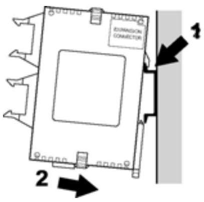
Attachment to DIN rail and removal from DIN rail

The unit can be simply attached to DIN rail.

Procedure of installation

(1) Fit the upper hook of the unit onto the DIN rail.

(2) Without moving the upper hook, press on the lower hook to fit the unit into position.

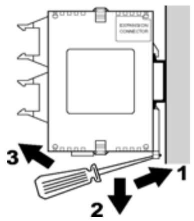


Procedure of removal

(1) Insert a slotted screwdriver into the DIN rail attachment lever.

(2) Pull the attachment lever downwards.

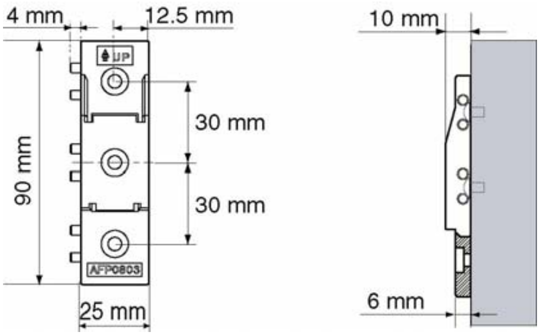
(3) Lift up the unit and remove it from the rail.



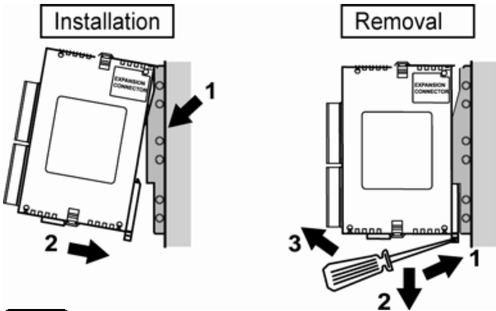
5.1.3 Installation Using the Optional Mounting Plate

When using the slim type FP0 mounting plate (AFP0803)

Use M4 size pan-head screws for attachment of the mounting plate and install according to the dimensions shown below.



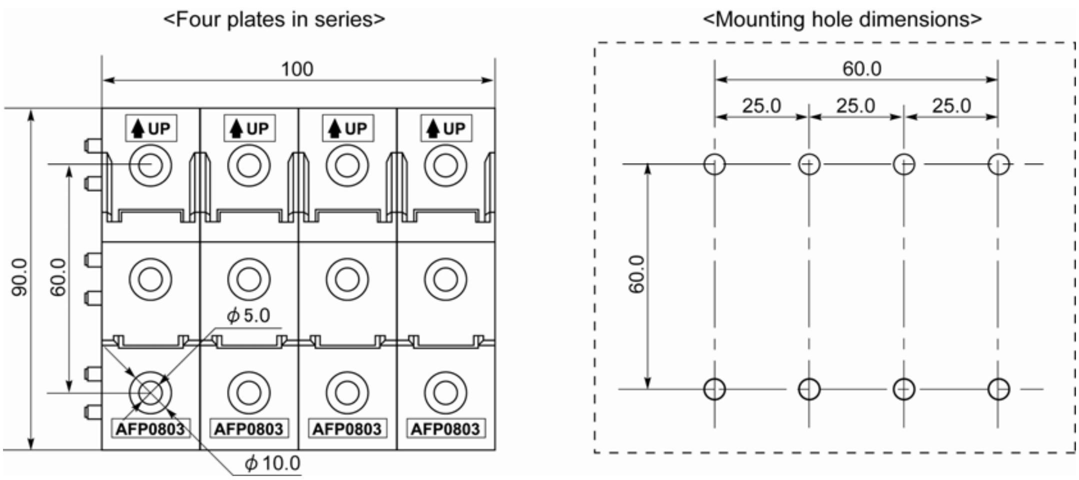
The rest of the procedure is the same as that for attaching the unit to the DIN rails.



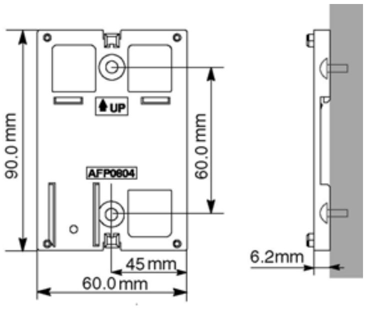
Note:

When using an expansion unit, tighten the screws after joining all of the mounting plate to be connected. Tighten the screws at each of the four corners.

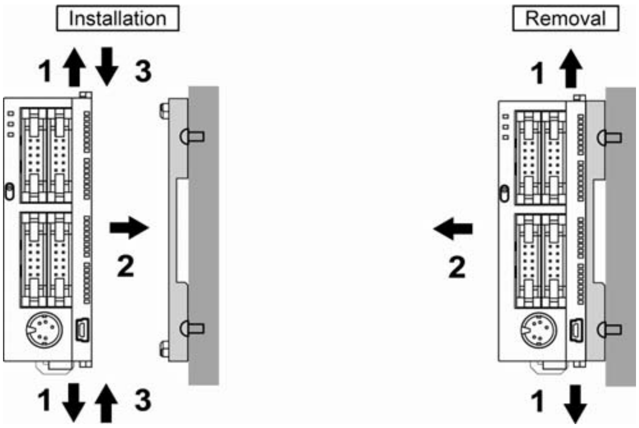
[Example] When using the maximum numbers of the expansion units (with AFP0803)



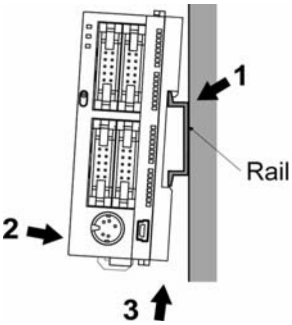
When using the flat type mounting plate (AFP0804)
Use M4 size pan-head screws for attachment of the mounting plate and install according to the dimensions shown below.



Raise the expansion hooks of the unit. Align the expnasion hooks with the mounting plate and press the hooks.



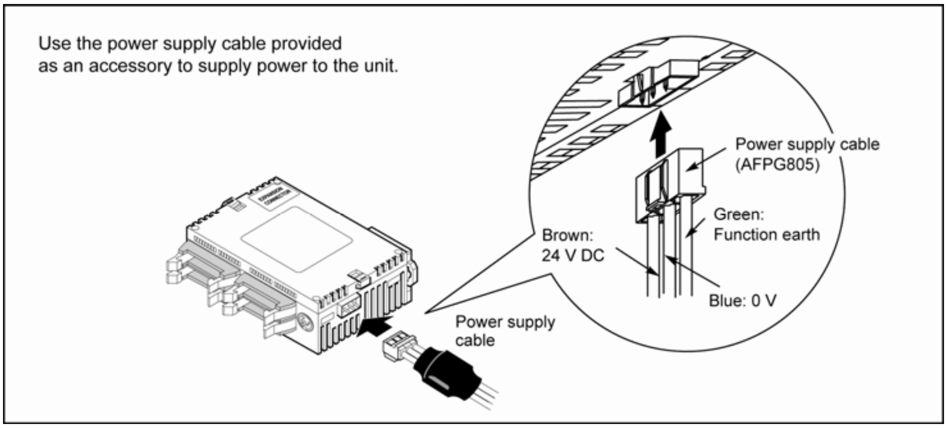
An unit with an attached mounting plate can also be installed sideways on a DIN rail.



Note:
The flat type mounting plate (AFP0804) should be used only with the control unit as a stand-alone unit. It should not be used when the unit is being used in combination with an FP0 expansion unit.

5.2 Wiring of Power Supply

5.2.1 Wiring of Power Supply



Power supply wiring for the unit

Use the power supply cable (Part number: AFPG805) that comes with the unit to connect the power supply.

Brown: 24 V DC

Blue: 0 V

Green: Function earth

Power supply wire

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

Power supply type

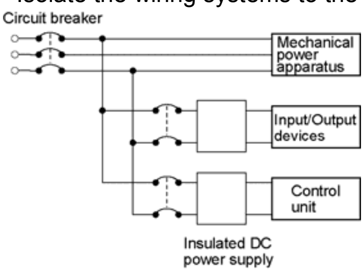
- To protect the system against erroneous voltage from the power supply line, use an insulated power supply with an internal protective circuit.
- The regulator on the unit is a non-insulated type.
- If using a power supply device without an internal protective circuit, always make sure power is supplied to the unit through a protective element such as a fuse.

Power supply voltage

Rated voltage	24V DC
Operating voltage range	21.6V DC to 26.4V DC

Wiring system

- Isolate the wiring systems to the control unit, input/output devices, and mechanical power apparatus.



Measures regarding power supply sequence

- The power supply sequence should be set up so that power to the control unit is turned off before the input/output power supplies.
- If the input/output power supplies are turned off before the power to the control unit, the unit will detect the input fluctuations and may begin an unscheduled operation.
- Be sure to supply power to the control unit and an expansion unit from the same power supply, and turn the power on and off simultaneously for both.

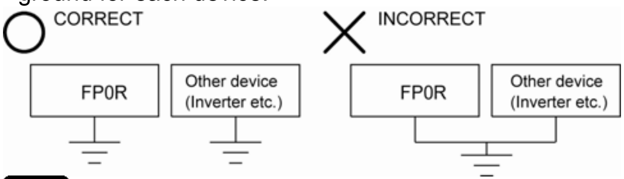
5.2.2 Grounding

In situations of excess noise

Under normal conditions, the inherent noise resistance is sufficient. However, in situations of excess noise, ground the instrument to increase noise suppression.

Exclusive grounding

- The grounding connection should have a resistance of less than 100Ω.
- The point of grounding should be as close to the PLC 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.

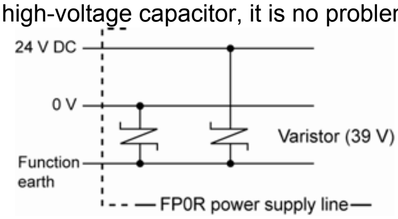


Note:

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

Since the power supply line of the FP0 expansion unit 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.

As for the FP0R control unit, since its power supply line is connected to the function earth through a high-voltage capacitor, it is no problem.



Do not ground the function earth terminal when grounding a plus (+) terminal of the power.

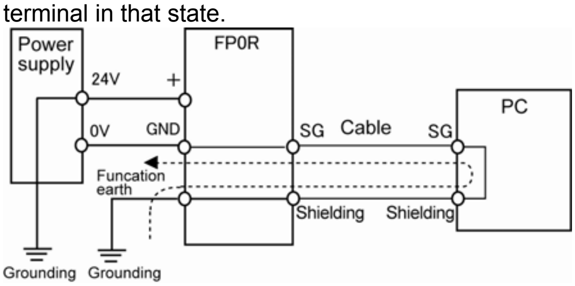
Do not ground the FP0R function earth terminal when grounding a plus (+) terminal of the pwer.

In some computers, the SG terminal of RS232C port and connector shielding are connected.

In addition, an FP0R tool port shielding and function earth terminal are connected.

Therefore, the GND terminal of FP0R and the function earth terminal are connected if the computer is connected.

Especially when the FP0R is connected to a computer with a plus (+) terminal grounded, the GND terminal is in the state that the voltage of -24 V is applied. As a result, short circuit occurs which may lead to the breakage of FP0R and its neighboring parts if the GND terminal is connected to the earth terminal in that state.

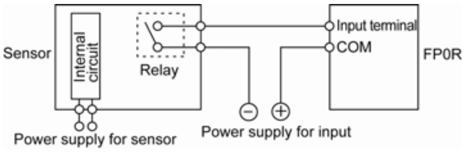


5.3 Wiring of Input and Output

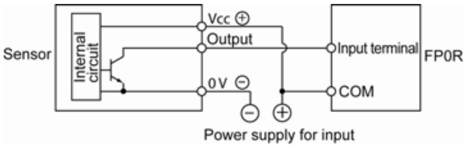
5.3.1 Input Wiring

Connection of photoelectric sensor and proximity sensor

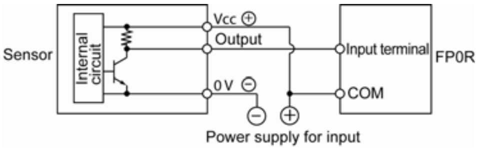
Relay output type



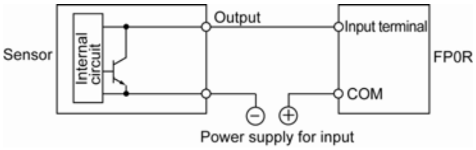
NPN open collector output type



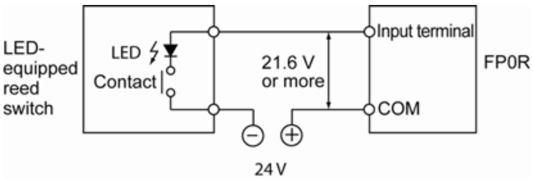
Voltage output type



Two-wire output type

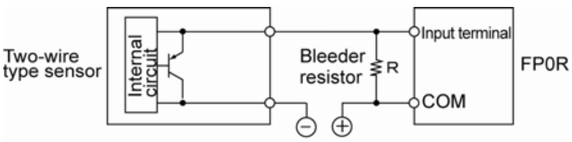


Precaution when using LED-equipped reed switch



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

Precaution when usign two-wire type sensor



I : Sensor's leakage current (mA)
R : Bleeder resistor (kΩ)

The off voltage of the input is 2.4 V, therefore, select the value of bleeder resistor "R" so that the voltage between the COM terminal and the input terminal will be less than 2.4 V.
The input impedance is 9.1 kΩ.

$$I \times \frac{9.1R}{9.1R + R} \leqq 2.4$$ Therefore,

$$R \leqq \frac{21.84}{9.1I - 2.4} \ (k\Omega)$$

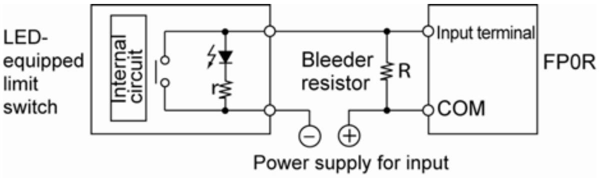
The wattage W of the resistor is:

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

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

If the input of 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 on the left.
The formula is based on an input impedance of 9.1 kΩ. The input impedance varies depending on the input terminal number.

Precaution when using LED-equipped limit switch



r : Internal resistor of limit switch (kΩ)
R : Bleeder resistor (kΩ)

The off voltage of input is 2.4 V, therefore when the power supply voltage is 24 V, select the bleeder resistor "R" so that

The current will be greater than $I = \dfrac{24-2.4}{r}$

The resistance R of the bleeder resistor is:

$$R \leqq \frac{21.84}{9.1I-2.4}\ (k\Omega)$$

The wattage W of the resistor is:

$$W = \frac{(\text{Power supply voltage})^2}{R} \times (3 \text{ to } 5 \text{ times})$$

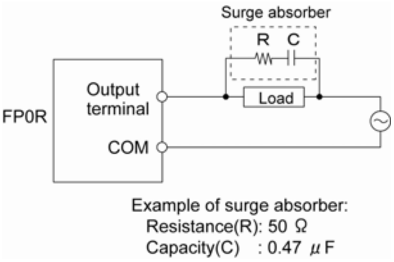
If the input of PLC does not turn off because of leakage current from the LED-equipped limit switch, the use of a bleeder resistor is recommended, as shown on the left.

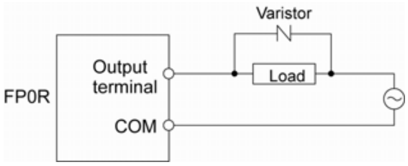
5.3.2 Output Wiring

Protective circuit for inductive loads

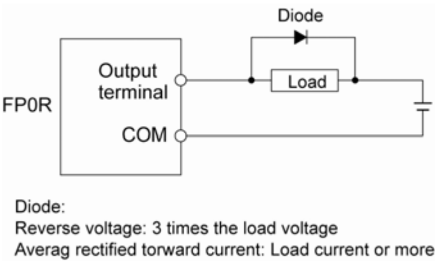
- With an inductive load, a protective circuit should be installed in parallel with the load.
- When switching DC inductive loads with relay output, be sure to connect a diod across the ends of the load.

When using an AC inductive load (Relay output type)



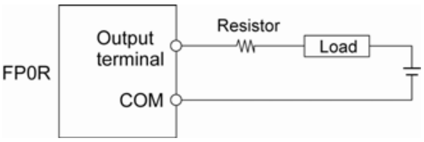


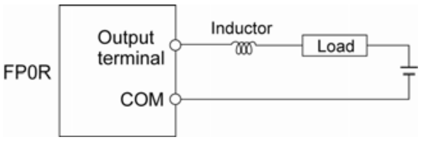
When using an DC nductive load



Precautions when using capacitive loads

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





Use an external fuse as overload protection

A fuse is not built in the output circuit. It is recommended to install external fuses on every circuit, in order to prevend the output ciruict to be burned out when the output is shorted. However, in some cases such as shortcircuit, the element of the unit may not be protected.

5.3.3 Precautions Regarding Input and Output Wirings

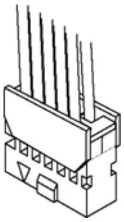
Separate the input, output, and power lines

- 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 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 100 mm.

5.4 Wiring of MIL Connector Type

Supplied connector and suitable wires

The connector listed below is supplied with the unit. Use the suitable wires given below. Also, use the required pressure connection tools for connecting the wires.



Suitable wires (Twisted wire)

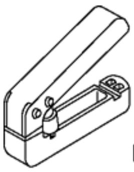
Size	Nominal cross-sectional area	Insulation thickness	Rated current
AWG#22	$0.3mm^2$	Dia. 1.5 to dia. 1.1	3A
AWG#24	$0.2mm^2$		

Supplied connector (AFP0807)

Manufacturer	Type and product No.	
Panasonic Electric Works, Co., Ltd.	Housing	10-pin type only
	Semi-cover	AXW61001A
	Contact	AXW7221(For AWG#22, #24)

Pressure connection tool

Manufacturer	Product No.
Panasonic Electric Works, Co., Ltd	AXY52000



Pressure connection tool

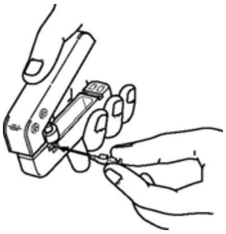
Key Point:

If using a MIL connector for flat cables, specify the product No. AXM110915.
In this case, the suitable wire is AWG#28 and the rated current is 1 A.

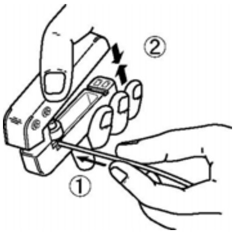
Wiring method

The wire end can be directly crimped without removing the wire's insulation, saving labor.

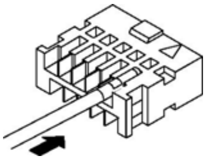
(1) Bend the welder (contact) back from the carrier, and set it in the pressure connection tool.



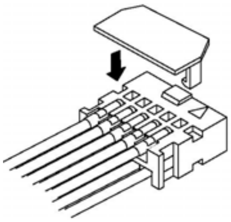
(2) Insert the wire without removing its insulation until it stops, and lightly grip the tool.

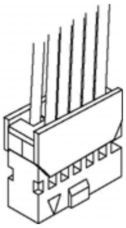


(3) After press-fitting the wire, insert it into the housing.

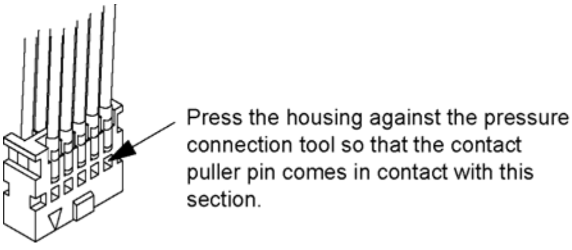


(4) When all wires has been inserted, fit the semi-cover into place.





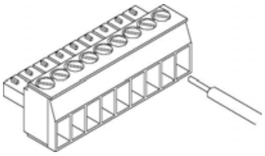
If there is a wiring mistake or the cable is incorrectly pressure-connected, the contact puller pin provided with the fitting can be used to remove the contact.



5.5 Wiring of Terminal Block Type

Attached terminal block/Suitable wires

A screw-down connection type is used for the terminal block. The suitable wires are given below.



Terminal block socket

The terminal sockect manufactured by Phoenix Contact is used.

No. of pins	Model No. of Phoenix Contact	
	Model No.	Product No.
9 pins	MC1,5/9-ST-3,5	1840434

Suitable wires (Twisted wire)

Size	Nominal cross-sectional area
AWG#24 to 16	0.2mm^2 to 1.25mm^2

Pole terminals with compatible insulation sleeve

If a pole terminal is being used, the following models manufactured by Phoenix Contact Co. should be used.

Manufacturer	Cross-sectional area	Size	Phoenix Contact model No.
Phoenix Contact Co.	0.25mm^2	AWG#24	AI 0,25—6 YE
	0.50mm^2	AWG#20	AI 0,5—6 WH
	0.75mm^2	AWG#18	AI 0,75—6 GY
	1.00mm^2	AWG#18	AI 1—6 RD
	0.5mm^2×2	AWG#20 (for 2 pcs)	AI—TWIN 2× 0.5—8 WH

Pressure welding tool for pole terminals

Manufacturer	Model No. of Phoenix Contact	
	Model No.	Product No.
Phoenix Contact Co.	CRIMPFOX UD 6	1204436

For tightening the terminal block

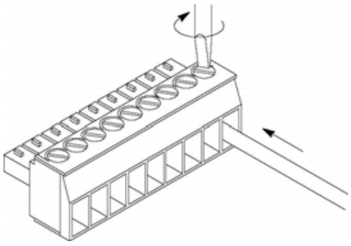
When tightening the terminals of the terminal block, use a screwdriver (Phoenix Contact Co., Product No. 1205037) with a blade size of 0.4 x 2.5 (Part No. SZS 0,4x2,5).

The tightening torque should be 0.22 to 0.25 N m (2.3 to 2.5 kgf-cm) or less.

Wiring method

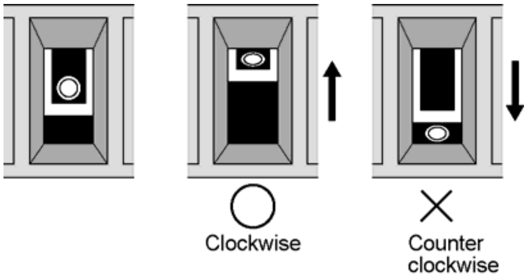
(1) Remove a potion of the wire's insulation.

②Insert the wire into the terminal block until it contacts the back of the block socket, and then tighten the screw clockwise to fix the wire in place. (The tightening torque: 0.22 to 0.25 N m (2.3 to 2.5 kgf-cm))



Notes for wiring

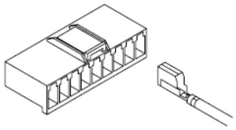
- When removing the wire's insulation, be careful not to scratch the core wire.
- Do not twist the wires to connect them.
- Do not solder the wires to connect them. The solder may break due to vibration.
- After wiring, make sure stress is not applied to the wire.
- In the terminal block socket construciton,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



5.6 Wiring of Molex Connector Type

Supplied connector and suitable wires

The connector listed below is supplied with the unit. Use the suitable wires given below. Also, use the required pressure connection tools for connecting the wires.



Supplied connector

Manufacturer	Molex Japan model No.		
Japan Molex Co., Ltd.	Housing	51067-0900	2 pcs
	Contact	50217-8100	20 pcs

Suitable wires (Twisted wire)

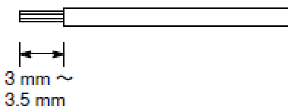
Size	Cross-sectional area	Insulation thickness
AWG#24~18	$0.2mm^2$~$0.75mm^2$	Dia. 1.4 to dia. 3.0

Pressure connection tool

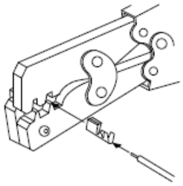
Manufacturer	Molex Japan model No.
Japan Molex Co., Ltd.	57189-5000

Wiring method

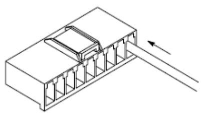
(1) Remove a potion of the wire's insulation.



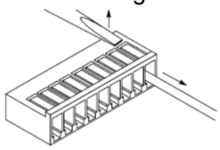
(2) Place the contact in the crimping tool, place the wire in the contact tne lightly squeeze the tool



(3) Insert the crimped wire into the housing until it contacts the back side.



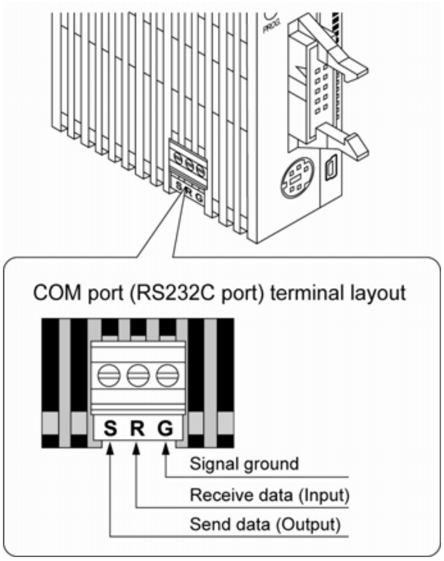
(4) Whe rmoving the wire, use a flat-head screwdriver, or other similar tool, to pull up the hold-down pin of the housing and then pull out the wire.



5.7 Wiring of COM Port (RS232C Port)

Terminal block/Suitable wires

A screw-down connection type is used for the COM port (RS232C port). Use the suitable wires given below.



Terminal block

The communication connector manufactured by Phoenix Contact is used.

No. of pins	Phoenix Contact model No.	
	Model No.	Product No.
3 pins	MKDS1/3-3.5	1751400

Suitable wires (Twisted wire)

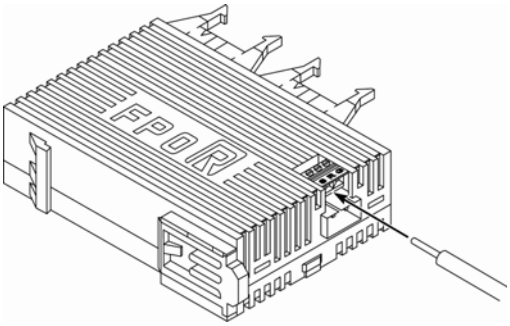
Size	Cross-sectional area
AWG#28 to 16	0.08mm^2 to 1.25mm^2

Use the above wires shielded. it is recommended to ground the shielded part. Also, if usign a pole terminal, refer to "5-5. Wiring of Terminal Block Type".

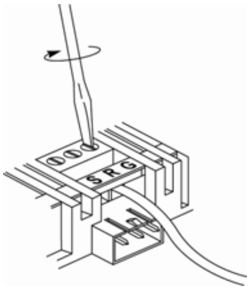
Wiring method

(1) Remove a potion of the wire's insulation.。

(2) Insert the wire into the COM port (RS232C port) until it contacts the back side.



(3) Tighten the screw.

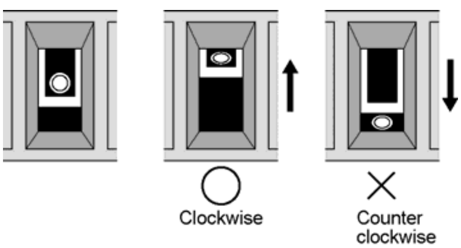


For tightening the terminal block

When tightening the COM port (RS232C port), use a screwdriver (Phoenix Contact Co., Product No. 1205037) with a blade size of 0.4 x 2.5 (Part No. SZS 0,4x2,5). The tightening torque should be 0.22 to 0.25 N•m (2.3 to 2.5 kgf-cm) or less.

Notes for wiring

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



5.8 Safety Measures

5.8.1 Safety Measures

Precautions regarding system design
On the system using PLC, malfunction may occur for the following reasons:。

- Power on timing differences between the PLC and input/output 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 the adequate safety measures listed in the following:

Interlock circuit
When a motor clockwise/counter-clockwise operation is controlled, provide an interlock circuit externally.

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 started after booting the I/O device and mechanical power apparatus. To keep this sequence, the following measures are recommended.
- Turn on the PLC with the mode selector set to the PROG. mode, and then switch to the RUN mode.
- Program the PLC so as to disregard the inputs and outputs until the outside devices are energized.

Note) In case of stopping the operation of the PLC also, have the input/output devices turned off after the PLC has stopped operating.

Grounding
When installing the controller next to devices that generate high voltages from switching, such as inverters, do not ground them together. Use an exclusive ground for each device.

5.8.2 Momentary Power Failures

Operation of momentary power failures
If the duration of the power failure is less than 5 ms, the FP0R continues to operate. If the power is off for 5 ms or longer, operation changes depending on the combination of units, the power supply voltage, and other factors.
(In some cases, operation may be the same as that for a power supply reset.)

5.8.3 Protection of Power Supply and Output Sections

Power supply
An insulated power supply with an internal protective circuit should be used. The power supply for the control unit operation is a non-insulated circuit, so if an incorrect voltage is directly applied, the internal circuit may be damaged or destroyed.
If using a power supply without a protective circuit, power should be supplied through a protective element such as fuse.

Protection of output
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

Preparation of USB Port

6.1 USB Connection

Connectingt the unit with a personal computer using the USB cable enables the communication with our software such a FPWIN GR.

Necessary items for the connection

About PC

The PC with the following OS is necessary to connect the FP0R with the USB.

Windows®2000 **Windows®XP** **Windows Vista®**

Note: The FP0R cannot be connected with the USB cable when using Windows other than the above.

About programming tool

FPWIN GR: Ver. 2.80 or later version

FPWIN Pro: Ver. 6.10 or later version

About USB cable

A commercial cable is necessary.

USB 2.0 cable (A: miniB) Max. 5 m

About USB HUB

A USB HUB cannot be used for the connection.

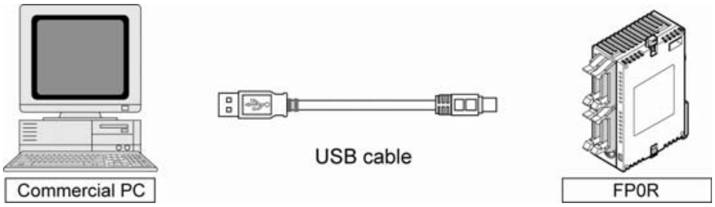
6.1.1 Installation of USB Driver

USB drivers must be installed to connect the unit with the USB.
The installation procedures differ depending on the OS in the PC to be used.

Note:
For the PC with more than one connector, it may be requested to reinstall these two drivers if the positions of the USB connectors are changed. In that case, reinstall the drivers.

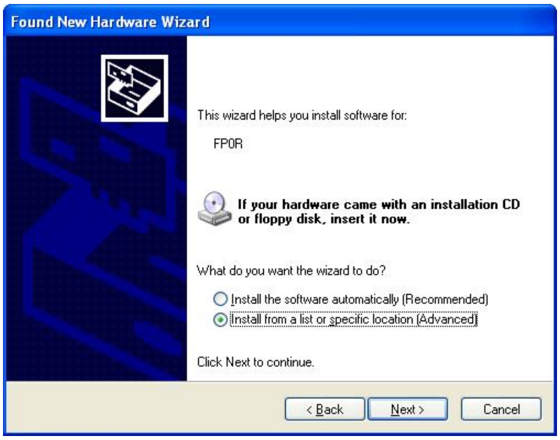
With Windows® XP

1. Turn on the power supply of the FP0R, and connect the FP0R with a PC using the USB cable.



2. After the connection, the PC recognize the USB driver automatically. As the following message is shown, select "No, not this time", and click "Next".

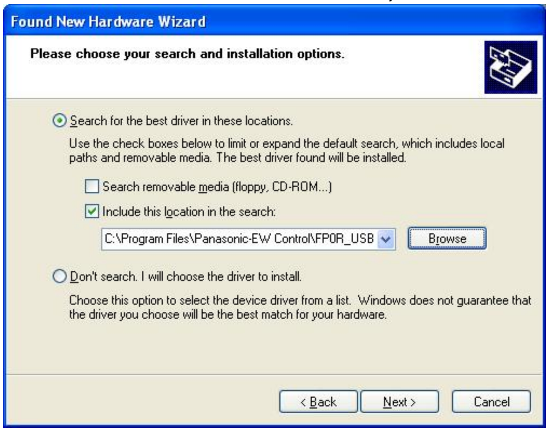
3. As the following message is shown, select "Install from a list of specific location", and click "Next".



4. Select “Search for the best driver in these locations.”, and check “Include this location in the search”. Then, input the folder name below.

「C:\Program Files\Panasonic-EW Control\FP0R USB\2000_XP」

Uncheck the other items. Then, click "Next".



5. The installation of the USB driver starts.

Although an alart for the Windows logo testing is indicated during the installation, click "Continue Anyway" to continue the installation.

6.The next message is shown and the installation of the USB driver completes.

Click "Finish".

The installation of the USB driver has been completed.

6.1.2 Confirming COM Ports

The USB connected to the FP0R 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.

Procedure for displaying Device Manager

Displaying Device Manager

Displays Device Manager when the FP0R is connected to the PC with the USB cable.
The display method varies depending on the OS in the PC to be used.

With Windows® XP

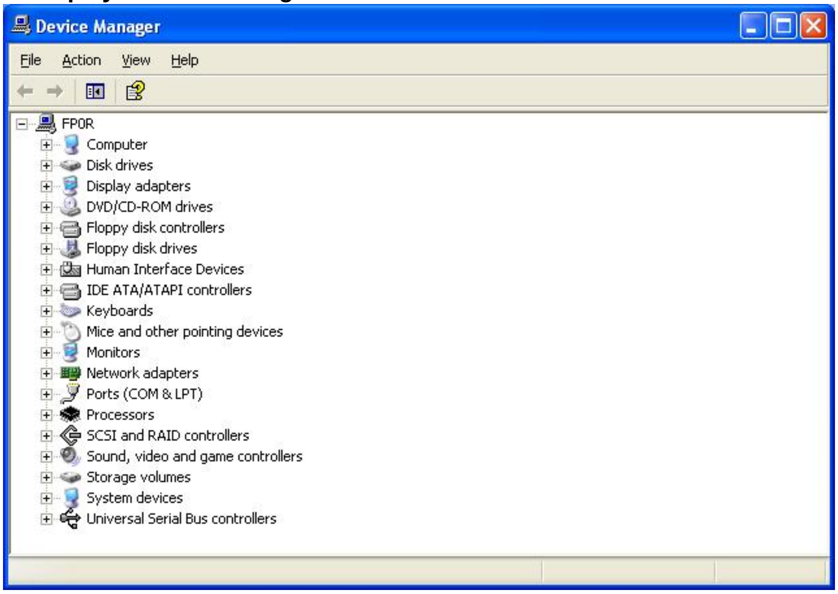
"My computer" → ˝View System information" → Click "Hardware" tab → Click "Device Manager"

With Windows® 2000

"My computer" → ˝Control panel" → ˝System" → Click "Hardware" tab → Click "Device manager" → Click "View" menu → ˝Device by type"

Procedure for confirming COM ports

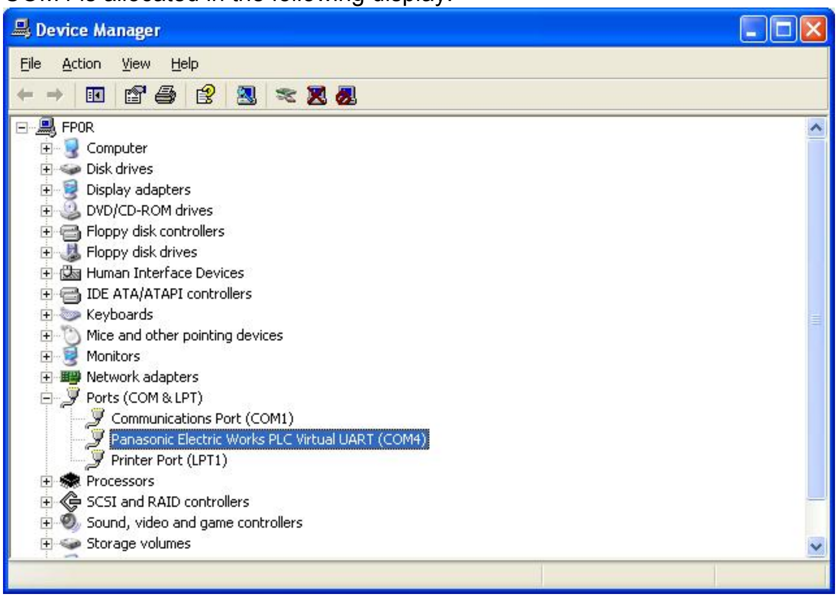
1. Display "Device Manager".



2. Double-click "Ports (COM & LPT)". As the table of allocation of COM ports is shown, confirm the COM port number.

"Panasonic Electric Works PLC Virtual UART(COMn)" is the allocated COM port.

COM4 is allocated in the following display.



Key Point: The COM port number is necessary for the connection with the FPWIN GR, etc.

6.1.3 Communication with Programming Tool

The following communication setting should be specified to perform the communication with a programming tool (FPWIN GR/FPWIN Pro) using the USB.

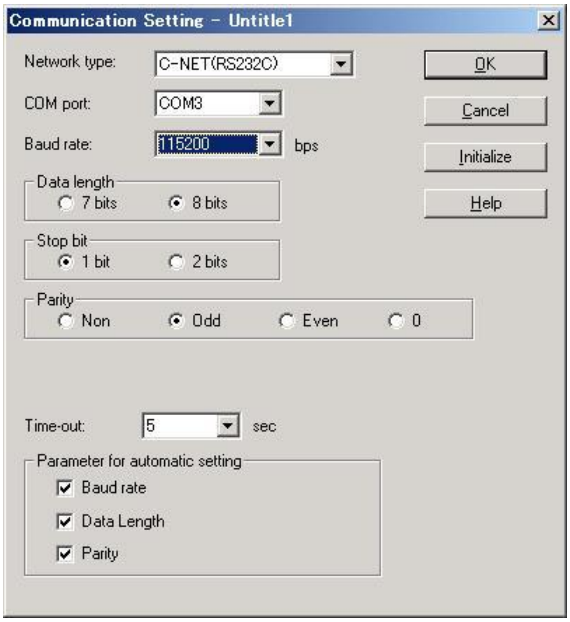
1. Display the "Communication Setting" window from the programming tool.

<Using FPWIN GR>

Select "Communication Setting" under "Option" from the menu bar.

<Using FPWIN Pro>

Select "Communication Setting" under "Online" from the menu bar.



2. Specify the communication setting as the table below. Once the setting has been completed, the communication with the USB becomes available.

Network type	C-NET(RS232C)
Port No.	COM port number allocated for the USB
Baud rate	The baud rate cannot be specified. Even if any rate is selected, the setting will be invalid. (USB2.0 FullSpeed)
Data length	8 bits
Stop bit	1 bit
Parity	Odd

6.1.4 Restrictions on USB Communication

There are restrictions on the USB Communication.

- **For connection the FP0R with the USB, a personal computer which supports USB with the OS supporting the USB (Windows2000/XP/Vista) is required.**

- **The FP0R connected to the USB is recognized by the PC as that is connected through the COM port.**

- **The COM port number of the COM port allocated for the USB is fixed unless you change the number.**

- **When multiple FP0R units are connected to one PC with the USB, they cannot communicate with the PC simultaneously.**
  The PC can communicate with the FP0R that was connected first only, and it cannot communicate with the other FP0R.

Chapter 7

Communication

7.1 Functions and Types

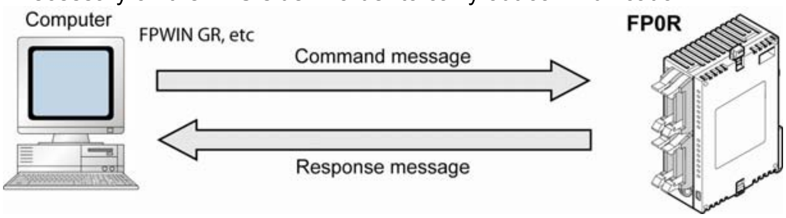
7.1.1 Communication Modes and Communication Ports

On the FP0R, four different communication modes are available.
According to the communication mode to be used, the usable communication ports vary.

Communication mode	Usable communication port
Computer link	Tool port
	USB port
	COM port (RS232C port)
General-purpose serial communication	Tool port
	COM port (RS232C port)
PC(PLC) link	COM port (RS232C port)
MODBUS RTU	COM port (RS232C port)

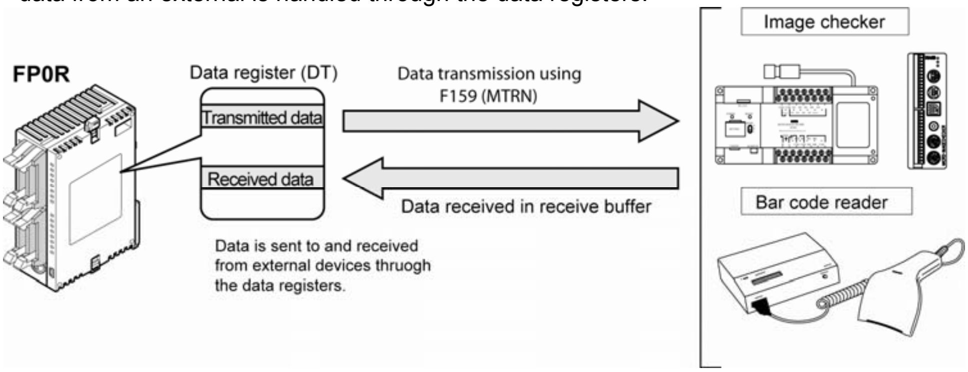
7.1.2 Computer Link

- Computer link is used for communication with a computer connected to the PLC. Instructions (command messages) are transmitted to the PLC, and the PLC responds (sends response messages) based on the instructions received.
- A proprietary MEWNET protocol called MEWTOCOL-COM is used to exchange data between the computer and the PLC.
- The PLC answers automatically to the commands received from the computer, so no program is necessary on the PLC side in order to carry out communication.



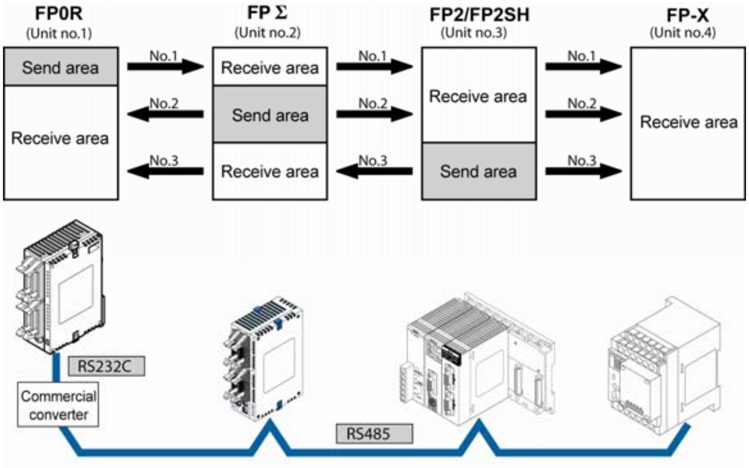
7.1.3 General-purpose Serial Communication

- With general-purpose serial communication, data can be sent back and forth between an external device connected such as an image processing devcie and a bar code reader.
- Reading and writing of data is done using a ladder program in the FP0R, while reading and writing of data from an external is handled through the data registers.



7.1.4 PC(PLC) Link

Using a commercial R232C/RS485 converter enables to configure a PC(PLC) link (MEWNET-W0) with the FP0R.
- Exclusive internal relays "link relays (L)" and data registers "link registers (LD)" are shared between the connected PLCs.

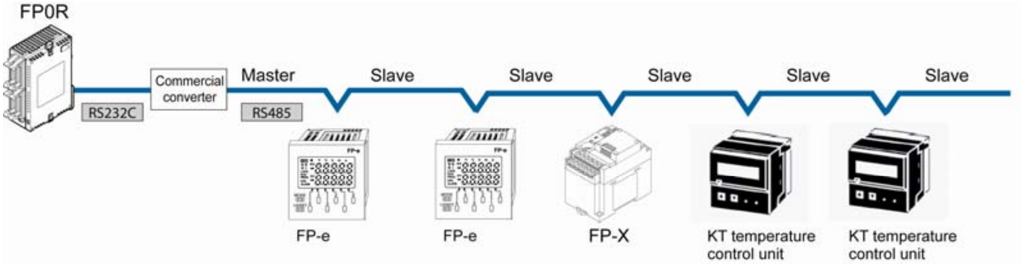


The link relays and link registers of the PLCs contain areas for sending and areas for receiving data. These areas are used to share data among the PLCs.

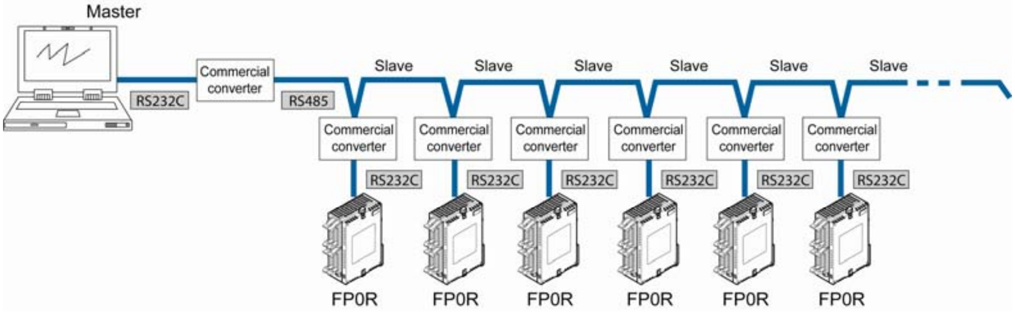
7.1.5 MODBUS RTU

Function overview
- The MODBUS RTU protocol enables the communication between the FP0R and other devices (including our FP-e, Programmable display GT series and KT temperature control unit).
- Communication is performed when the master unit sends instructions (command messages) to slave units and the slave unit returns responses (response messages) according to the instructions.
- Enables the communication between the devices of max. 255 units as the master function and slave function is equipped.

Master function



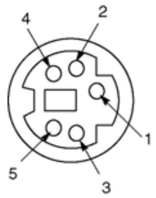
Slave function



7.2 Communicaton Port Type

7.2.1 Tool Port

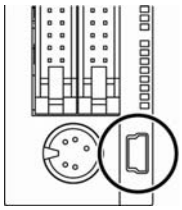
This connector is used to connect a programming tool.
A commercial mini-DIN 5-pin connector is used for the tool port on the control unit.



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

7.2.2 USB Port

This connector is used to connect a programming tool.



A commercial USB2.0 calbe (A: miniB)) can be used.

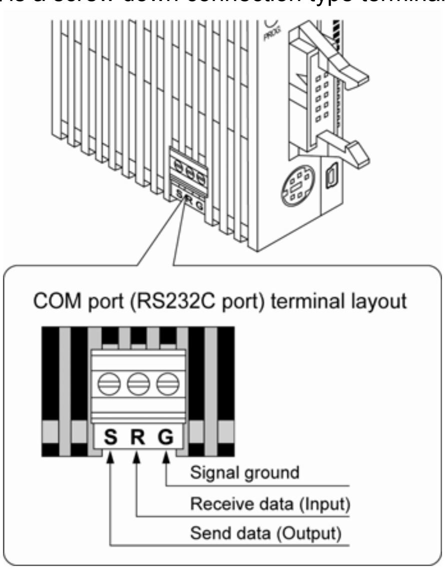
Standard	USB2.0
connector shape	USB miniB type

Note) The USB driver should be installed.

Note: <Chapter 6 Preparation for USB Port>

7.2.3 COM Port (RS232C Port)

It is a screw down connection type terminal block (3-pin). Wire for use it.



Pin No.	Signal name	Name
S	SD	Send Data (Output)
R	RD	Receive Data (Input)
G	SG	Signal Ground

Note: For information on the wiring, refer to <5.7 Wiring of COM Port (RS232C Port)>

7.3 Communication Specifications

Tool Port

	Description
Interface	RS232C
Transmission distance	15 m
Baud rate	2400,4800,9600,19200,38400,57600,115200 bit/s
Communication method	Half-duplex communication
Synchronous method	Start stop synchronous system
Communication format	Data length: 7 bits/8bits Parity: None/Even/Odd Start code: STX/No STX End code: CR/CR+LF/None/ETX Stop bit: 1 bit/2 bits
Data transmission order	Transmits from bit 0 character by character.
Communication mode	Computer link (slave) Modem initialization General-purpose communication (only in RUN mode)

USB port

	Description
Standard (Baud rate)	USB2.0 Fullspeed
Communication mode	Computer link (slave)

COM port (RS232C port)

	Description
Interface	RS232C
Transmission distance	15 m
Baud rate	2400,4800,9600,19200,38400,57600,115200 bit/s
Communication method	Half-duplex communication
Synchronous method	Start stop synchronous system
Communication format	Data length: 7 bits/8bits Parity: None/Even/Odd Start code: STX/No STX End code: CR/CR+LF/None/ETX Stop bit: 1 bit/2 bits
Data transmission order	Transmits from bit 0 character by character.
Communication mode	Computer link (master/slave) Modem initialization General-purpose communication MODBUS RTU (master/slave) PC(PLC) link

Factory default settings

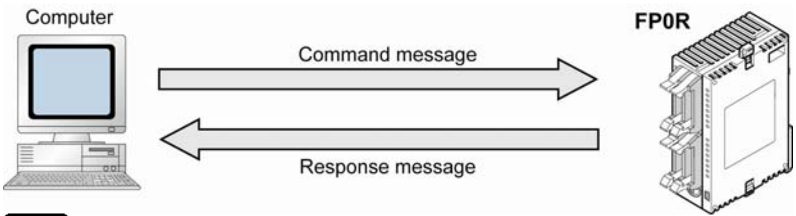
	Baud rate	Data length	Parity	Stop bit
Tool port	9600 bit/s	8 bits	Odd	1 bit
COM port (RS232C port)	9600 bit/s	8 bits	Odd	1 bit

7.4 Communication Function 1: Computer Link

7.4.1 Overview

- Computer link is used for communication with a computer connected to the PLC. Instructions (command messages) are transmitted to the PLC, and the PLC responds (sends response messages) based on the instructions received.
- A proprietary MEWNET protocol called MEWTOCOL-COM is used to exchange data between the computer and the PLC.
- The PLC answers automatically to the commands received from the computer, so no program is necessary on the PLC side in order to carry out communication.

- There are a MEWTOCOL master function and a MEWTOCOL slave function for the computer link. The side that issues commands is called master, and the side that receives the commands, executes the process and sends back responses is called slave.



Note:
It is necessary to set the system register of the communicatio nport to the computer link for using this function. Both the master and slave functions are available for the FP0R, however, only the slave function is available for the tool and USB ports.

MEWTOCOL master function
- This function is to carry out the communication on the master side (side that issues commands) of the computer link. It is executed with the PLC's instruction F145(SEND) or F146(RECV). It is not necessary to write the response process as a ladder, so the program is easier than the general-purpose communication function.

The 1:1 or 1:N communication is available between our devices equipped with the computer link function and the MEWTOCOL-COM. **[Our devices (e.g.)]**: PLC, IPD, temperature control unit, message runner, eco-power meter

MEWTOCOL slave function
- This function is to receive commands from the computer link, execute the process and send back the results. Any special ladder program is not necessary to use this function. (Set the communication conditions in the system registers.) It enables the 1:1 or 1:N communication with a master computer or PLC.
- The program for the computer side must be written in BASIC or C language according to the MEWTOCOL-COM. MEWTOCOL-COM contains the commands used to monitor and control PLC operation.

Communication port
Tool port
USB port
COM port (RS232C port)

7.4.2 MEWTOCOL Slave Function

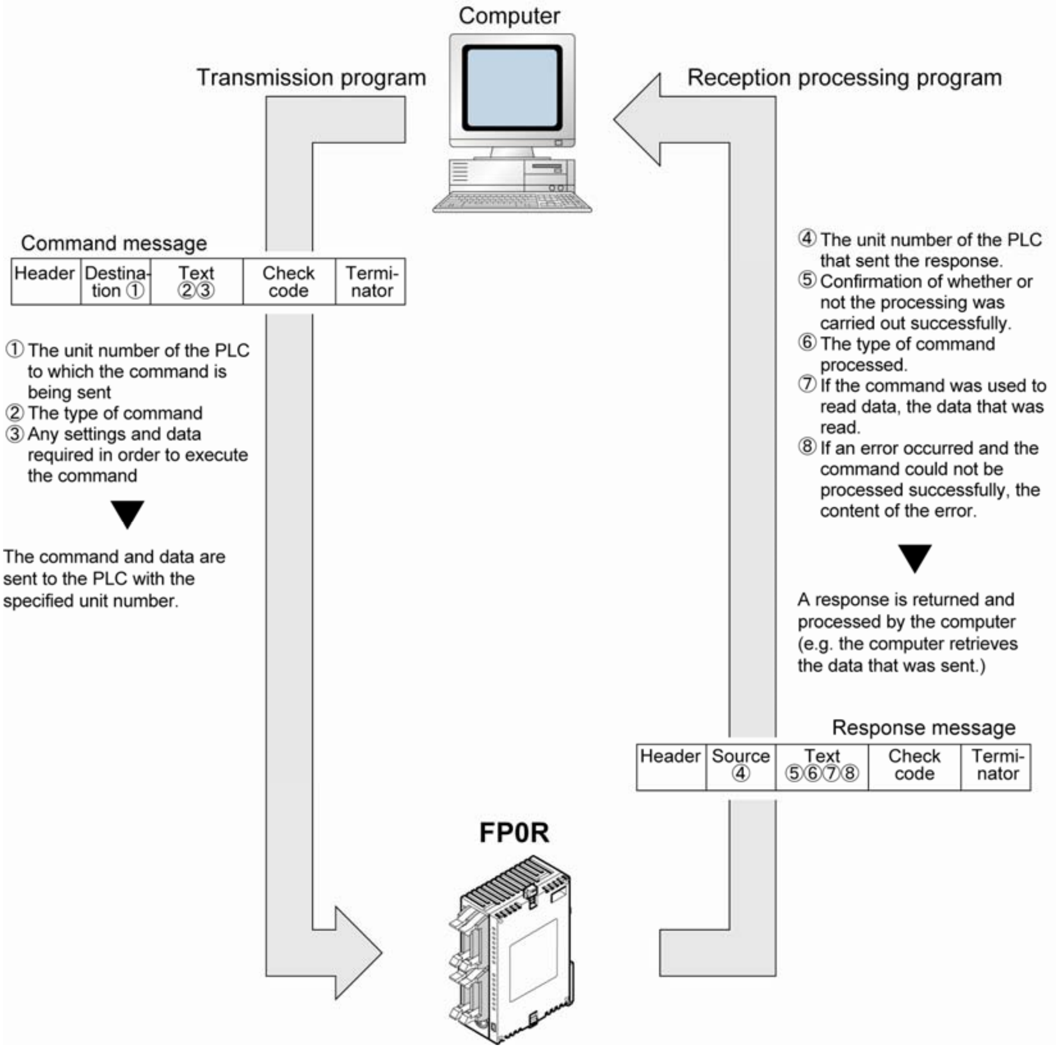
Outline of operation

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 reponse back to the computer. On the computer side, the execution result of the command can be confirmed by the transmitted response.

MEWTOCOL-COM sketch

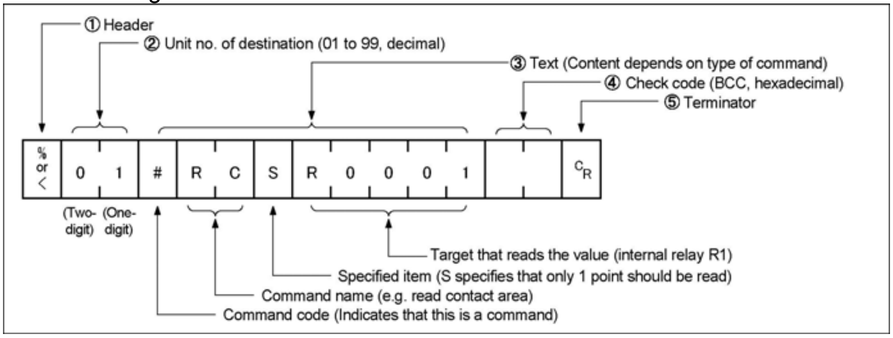
- Communication is carried out in a conversational format, based on the MEWTOCOL-COM communication procedures.
- Data is sent in ASCII format.
- The computer has the first right of transmission.
- The right of transmission shifts back and forth between the computer and the PLC each time a message is sent.



Format of command and response

Command message

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)

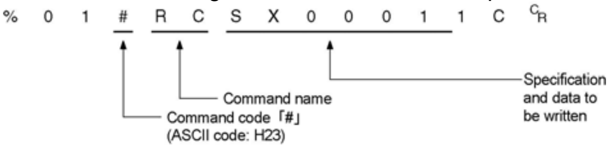
Commands must always have a "%" (ASCII code: H25) or a "<" (ASCII code: H3C) at the beginning of a message.

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 number 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).

Note: When writing

- 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.

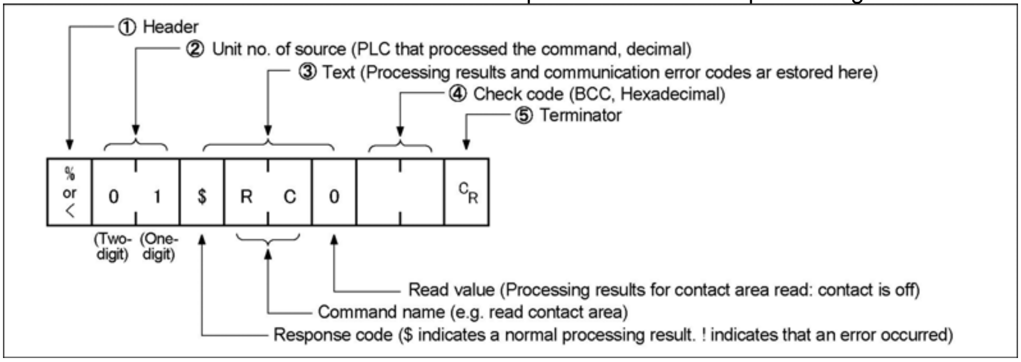
Key Point:

- With the FP0R, an expansion header "<" is supported to send single frame of up to 2048 characters as well as general "%".

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

Response message

The PLC that received the command in the example above sends the processing results to the computer.



1. Header (Start code)

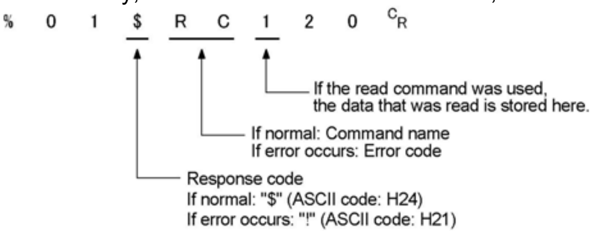
A "%" (ASCII code: H25) or a "<" (ASCII code: H3C) must be at the beginning of a message.
The response must start with the same header that was at the beginning of the command.

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. 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

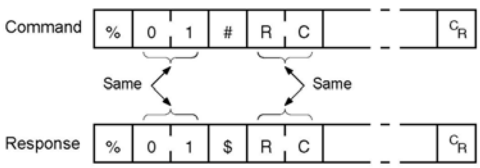
BCC (block check code) for error detection using horizontal parity. The BCC starts from the header and checks each character in sequence, using the exclusive OR operation, and replaces the final result with character text.

5. Terminator (End code)

There is always a "$^{C}{}_{R}$" (ASCII code: H0D) at the end of the message.

Note: When reading

- 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 sucessfully. 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.



Commands to be used

Command name	Code	Description
Read contact area	RC (RCS) (RCP) (RCC)	Reads the on and off status of contancts. ・Specifies only one point. ・Specifies multiple contacts. ・Specifies a range in word units.
Write contact area	WC (WCS) (WCP) (WCC)	Turns contacts on or 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 timer/counter setting value.
Write timer/counter set value area	WS	Writes the 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 using MD and MC.
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. (RUN mode <=> PROG. mode)
Abort	AB	Aborts communication.

7.4.3 Setting Communication Parameters

Tool port/COM port (RS232C port)

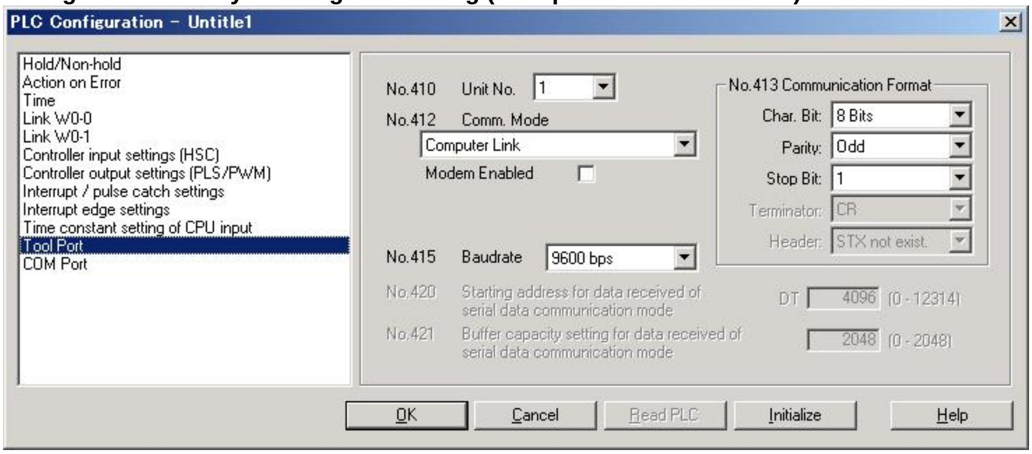
The settings for baud rate and communication format are entered using a programming tool.

Note: When the MEWTOCOL master is used, also select "Computer Link". (COM port only)

Setting with FPWIN GR

Select "Options" in the menu bar, and then select "PLC Configuration". Click **"Tool Port"** or **"COM Port"** from the left list.

Dialog box of PLC system register setting (Tool port selection screen)



No. 410 Unit number

The unit number can be set within a range of 1 to 99.

No. 412 Communication mode

Select the operation mode of communication port operation mode. Click "Computer Link".

No. 413 Communication Format setting

The default setting of communication format is as below.
Set the communication format to match the external device connected to the communication port.
(The terminator and header cannot be changed.)
Char. Bit: 8 bits
Parity: Odd
Stop Bit: 1 bit
Terminator: Setting disable
Header: Setting disable

No. 415 Baud rate setting

The default setting for the baud rate is "9600 bps". Set the value to match the external device connected to the communication port. Select one of the values from "2400, 4800, 9600, 19200, 38400, 57600 and 115200 bps".

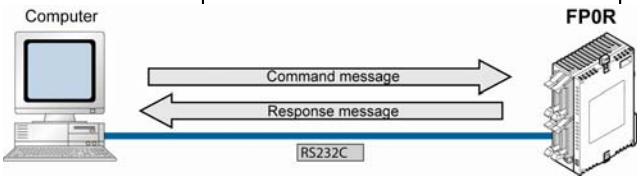
USB port

The setting for the USB port is fixed. The setting for the communication parameter is not available.

7.4.4 1:1 Communication (MEWTOCOL Slave Function)

Overview

For a 1:1 computer link between the FP0R and a computer, and RS232C cable is needed.
Communication is performed via commands from the computer and responses from the PLC.



System register settings

No.	Name	Set value
No.410	Unit No.	1
No.412	Communication mode	Computer link
No.413	Communication format	Char. bit: …… 7 bits/8 bits Parity: ….. None/Odd/Even Stop bit: ………… 1 bit/2 bit Terminator: …….. CR Header: ………… No STX
No.415	Baud rate	2400 to 115200 bps

Note) The communication format and baud rate should be set to match the connected computer.

Programming of computer link

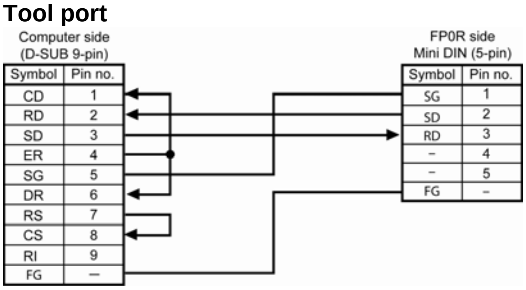
- For a computer link, a program should be created that allows command messages to be sent and response messages to be received on the computer side. No communication program is required on the PLC side.
  (Specify the communication format only by the system register.)
- The program for the computer side must be written in BASIC or C language according to the MEWTOCOL-COM. MEWTOCOL-COM contains the commands used to monitor and control PLC operation.

Key Point:

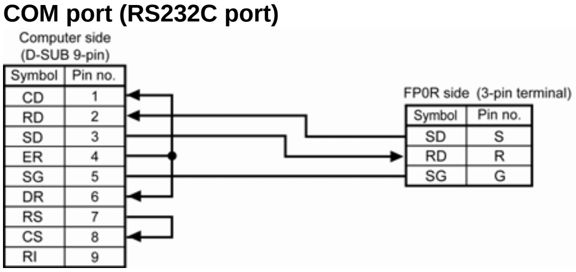
- Using our software Control CommX enables the communication on Visual Basic.
- An add-in software "PCWAY" to be used with a spreadsheet software "Excel" is available to collect data.

Example of connection to the computer <1:1 communication>

Tool port



COM port (RS232C port)

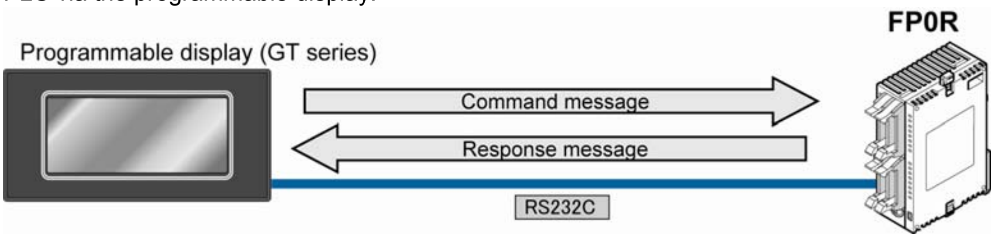


Example of connection with an external device <Programmable display (1:1 communication with GT-series RS232C type)>

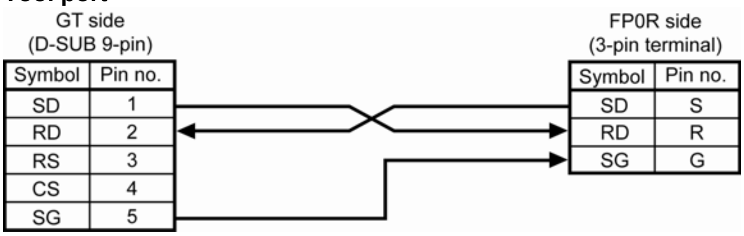
Overview

For a 1:1 computer link between the FP0R and a programmable display, and RS232C cable is needed. Communication is performed via commands from the programmable display and responses from the PLC.

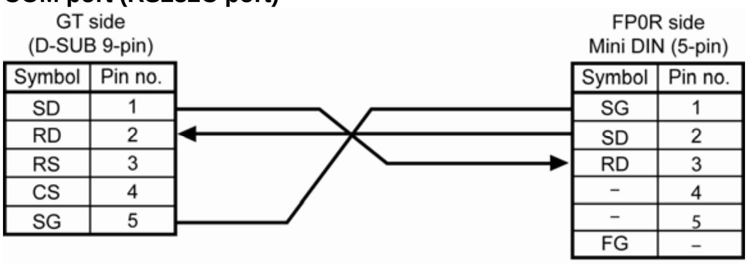
No program is required for communication. Simply set the mutual communication settings to operate the PLC via the programmable display.



Tool port



COM port (RS232C port)



Note:

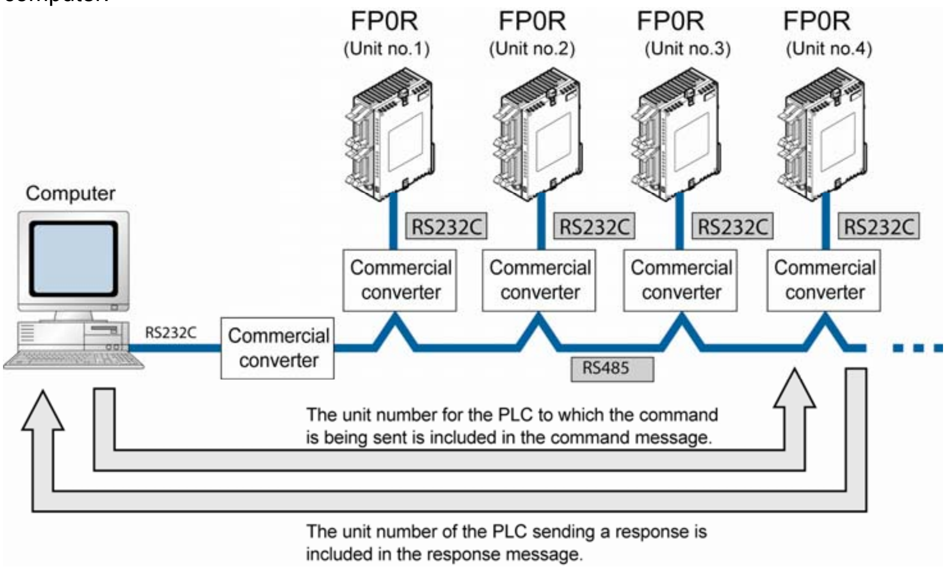
A USB cable cannot be used. Make the connection with the tool port or RS232C port.

Use a recommended cable for the tool port connection.

Reference: <GT series Technical Manual ARCT1F398E>

7.4.5 1:N Communication (MEWTOCOL Slave Function)

A computer and PLCs are connected through a commercially available RS232C-RS485 converter, and the respective computer and PLCs are wired using an RS485 cable with crossover wiring.
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.



Note) Lineeye SI-35 is recommended to be used as a converter.

Setting of unit numbers
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 so that the destination of the command can be identified.
The unit number is specified by using the system register.

Setting system registers

No.	Name	Set Value
No. 410	Unit number	1 to 99 (Set the desired unit number) (With a C-NET adapter, a maximum of 32 units (stations) can be specified.)
No. 412	Communication mode	Computer link
No. 413	Communication format	Char. bit: …… 7 bits/8 bits Parity: ….. None/Odd/Even Stop bit: ……….. 1 bit/2 bit Terminator: …….. CR Header: ……….. STX not exist
No. 415	Baud rate Note2)	2400 to 115200 bps

Note1) The communication format and baud rate should be set to match the connected computer.
Note2) The baud rates of 300, 600 and 1200 bps can be specified by the SYS1 instruction.
However, the setting value of the system register cannot be changed.

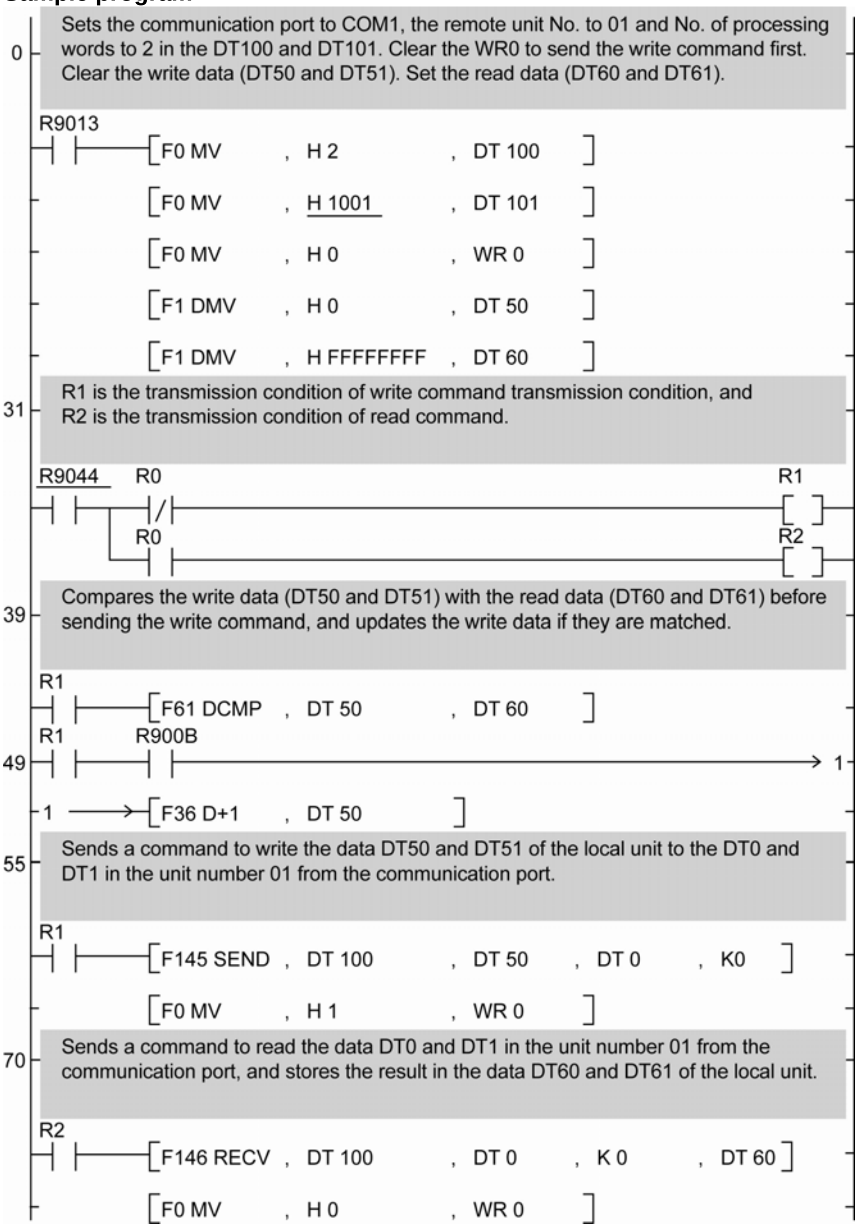
7.4.6 MEWTOCOL Master

Use the F145 (SEND) "Data send" or F146 (RECV) "Data receive" instruction to use the MEWTOCOL master function.

Communication port

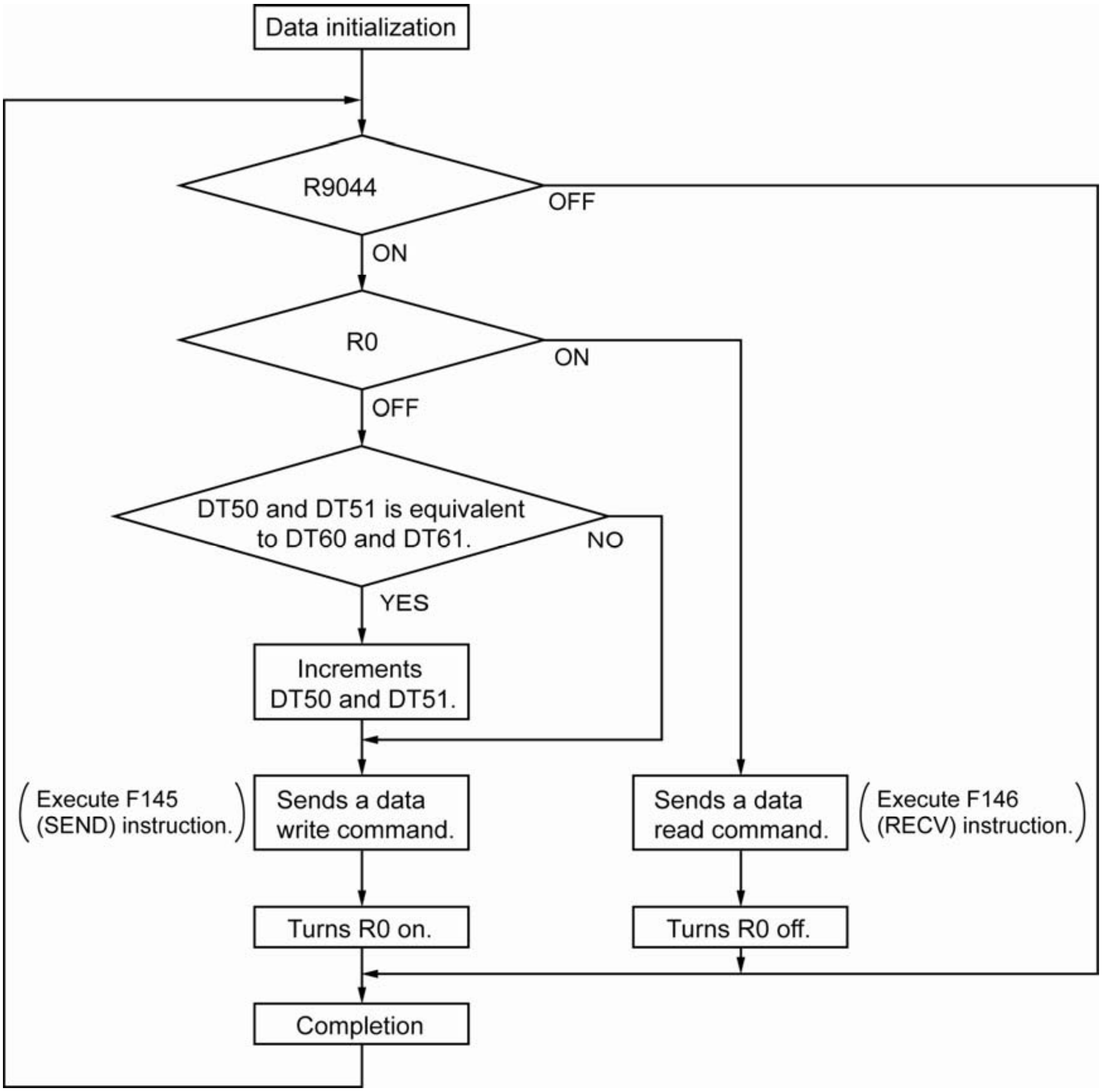
The MEWTOCOL master is not available for the tool port. It is available for the COM port (RS232C port) only.

Sample program



Reference: For information on the F145(SEND) and F146(RECV) instructions,
<Programming Manual ARCT1F353E>

Flowchart



With the above program, the procedures 1 to 3 are executed repeatedly.

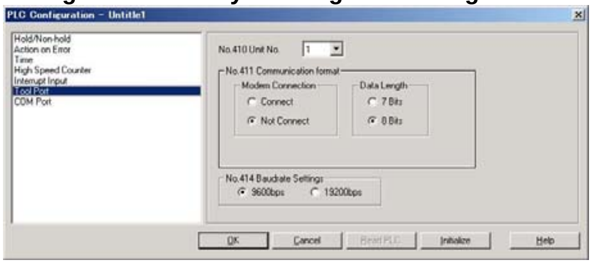
1. Updates the write data if the write data (DT50 and DT51) and the read data (DT60 and DT61) are matched.
2. Writes the DT50 and DT51 of the local unit into the data DT0 and DT1 in the unit number 1 from the COM port (RS232C port).
3. Reads the DT0 and DT1 in the unit number 1 into the data DT60 and DT61 of the local unit from the COM port (RS232C port).

7.4.7 Setting in Compatiblity Mode with FP0 (FP0 Compatibility Mode)

Setting Communication Parameters
Confirm that the model of the programming tool is FP0.
Note) Only the salve function is available in the FP0 compatibility mode.

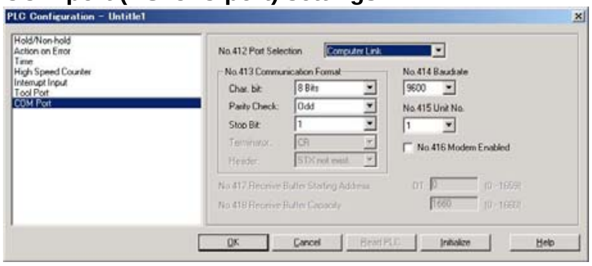
Usable communication ports on FP0R (FP0 compatibility mode)
Tool port
USB port （No communication parameter）
COM port (RS232C port)

Tool port settings
Dialog box of PLC system register setting



No. 410 Unit number
The unit number can be set within a range of 1 to 32.
No. 411 Communication format
Modem connection: Connect/Not Connect
Char. bit: 7 bits/8 bits
- Change the value to match the connected external device.
No. 414 Baud rate setting
The baud rate of 9600 or 19200 bps can be selected. Specify the value to match the connected external device.

COM port (RS232C port) settings

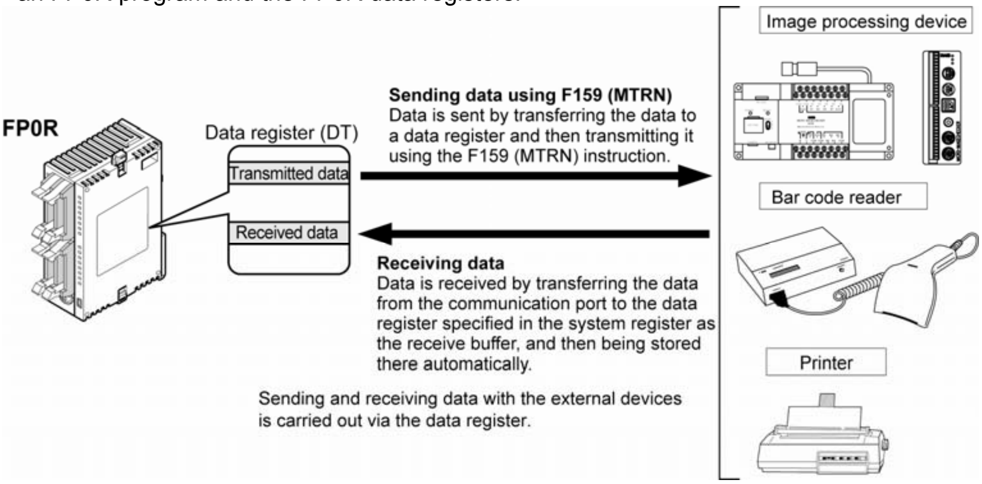


No. 412 Mode selection
Select the computer link.
No. 413 Communication Format
Char. Bit: 7 bits/8 bits
Parity: None/Odd/Even
Stop bit: 1 bit/2 bits
Terminator: CR
Header: STX not exist
- Change the value to match the connected external device.
No. 414 Baud rate
Select one of the values from "300, 600, 1200, 2400, 4800, 9600 and 19200 bps".
No. 415 Unit number
The unit number can be set within a range of 1 to 32.
No. 416 Modem enabled
Check the box to connect a modem.

7.5 Communication Function 2: General-purpose Serial Communication

7.5.1 Overview

- In general-purpose serial communication, data is sent and received over the communication port 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 communication port by means of an FP0R program and the FP0R data registers.

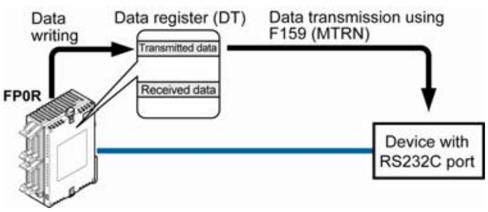


Outline of operation

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 PLC and an external device.

Sending data

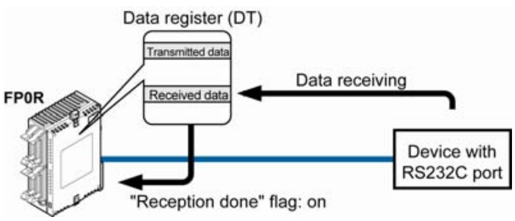
Data to be transmitted from the PLC is stored in the data register used as the send buffer (DT). When F159(MTRN) is executed, the data is output from the communicaton port.



- 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 communication 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 4094 bytes.

Key Point: In the compatibility mode with the FP0 (FP0 compatibility mode), the F159(MTRN) instruction is changed to the F144(TRNS) instruction.

Communication Port

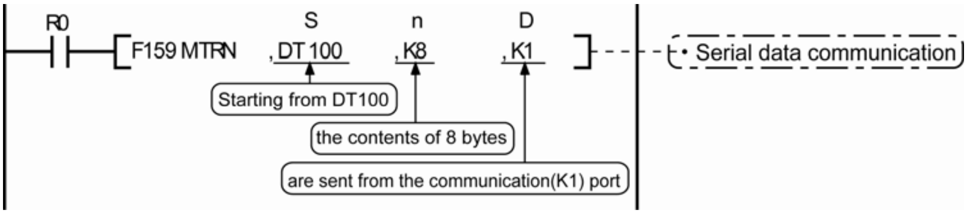
Tool port

COM port (RS232C port)

7.5.2 Programming Example of General-purpose Serial Communication

The F159(MTRN) instruction is used to send and receive data via the specified communication port.

F159 (MTRN) instruction
Data is sent and received via the specified COM port .



Devices that can be specified for S:	Only data registers (DT) can be specified as the send buffer.
Devices that can be specified for n:	WX, WY, WR, WL, SV, EV, DT, LD, I (I0 to ID), K, H
Devices that can be specified for D:	Only the K constants (K0 and K1 only)

Sending data
The amount of data specified by n is sent to the external device from among the data stored in the data table, starting with the area specified by S, through the communication port specified by D. Data can be sent with the header and terminator automatically attached. A maximum of 2048 bytes can be sent. When the above program is run, the eight bytes of data contained in DT101 to DT104 and stored in the send buffer starting from DT100 are sent from the communication port.

Receiving data
Data can be received when the “reception done” flag is off. The received data is stored in the receive buffe specified by the system register. When the reception of the data is completed (the terminator is received), the “reception done” flag turns on, and subsequently, receiving data is prohibited. To receive the next data, execute the F159 (MTRN) instruction and turn the “reception done” flag off to clear the number of received bytes to 0. To receive data continuously without sending data, clear the number of transmitted bytes to 0 (set “n” to “K0”), and then execute the F159 (MTRN) instruction.

Reference: <Programming Manual ARCT1F353E>

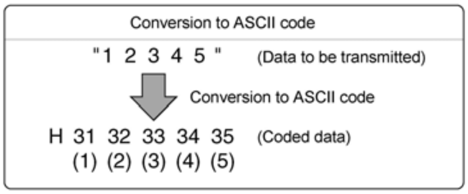
Binary communication
Selecting “STX not exist” for the header and “None” for the terminator in the general-purpose serial communication enables the binary communication.
Sending data: Sends the data of bytes to be specified.
Receiving data: Check the No. of bytes received before the process. At that time, the reception done flag does not work.

Data to be sent/received with FP0R
Remember the following when accessing data in the FP0R send and receive buffers:

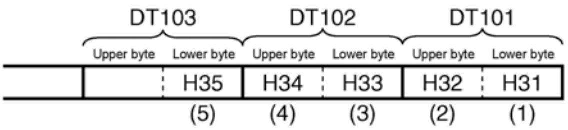
- If a header has been chosen in the communication format settings, the code STX (H02) will automatically be added at the beginning of the data begin sent.
- The data without the code STX at the reception is stored in the receive buffer, and the “reception done” flag turns on when the terminator (end code) is received. When the terminator has been set to “None”, the “reception done” flag does not work.
  However, if the code STX is added in the middle of the data, the number of received byte is cleared to 0, and the data is stored from the beginning of the receive buffer again.
- 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:
The data “12345” is transmitted as an ASCII code to an external device.
1. Data sent using the F95 (ASC) instruction should be converted to ASCII code data.

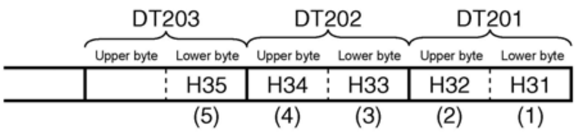


2. If DT100 is being used as the start address of send buffer, data will be stored in sequential order in the data registers starting from the next register (DT101), in two-byte units consisting of the upper and the lower byte.



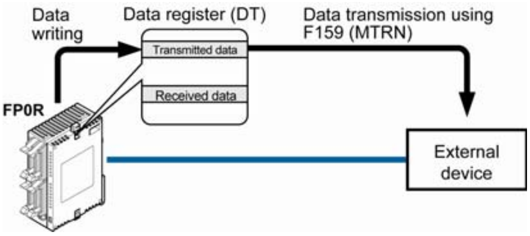
Receiving data:
The data of the receive area being read is ASCII code data.

Example:
The data “12345C_R” is transmitted from a device with RS232C port.
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.

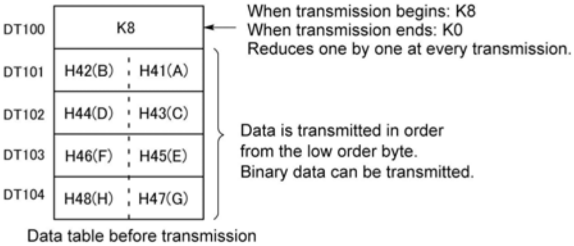


7.5.3 Sending Data

Communication with external devices is handled through the data registers.
Data to be output is stored in the data register used as the send buffer (DT), and when the F159 (MTRN) instruction is executed, the data is output from the communication port.

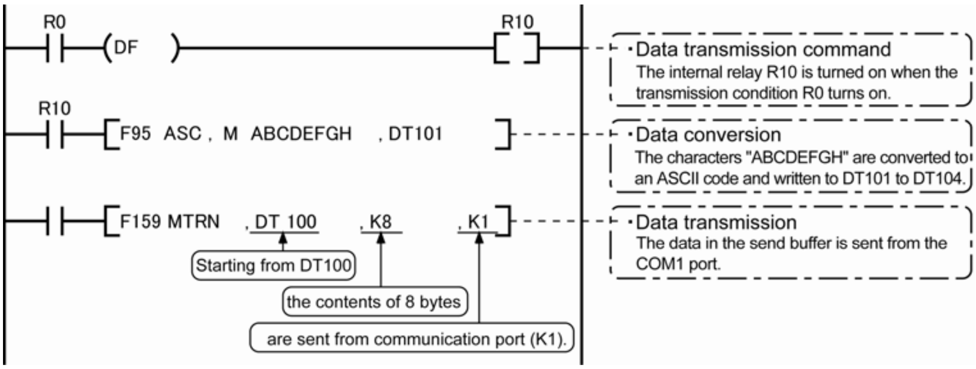


Data table for transmission (send buffer)



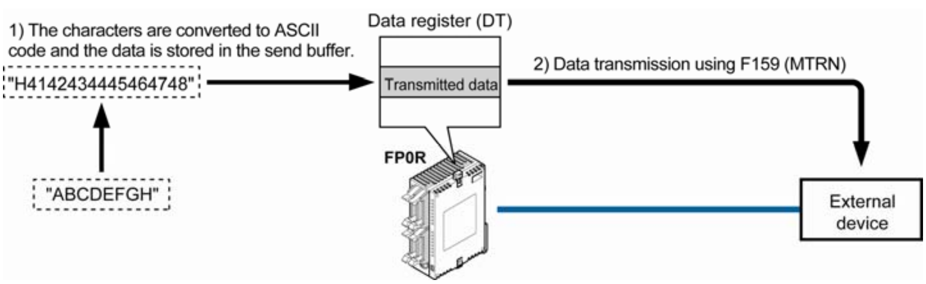
Sample program for sending data

The following program transmits the characters “ABCDEFGH (Hex)” to an external device using the communication port.



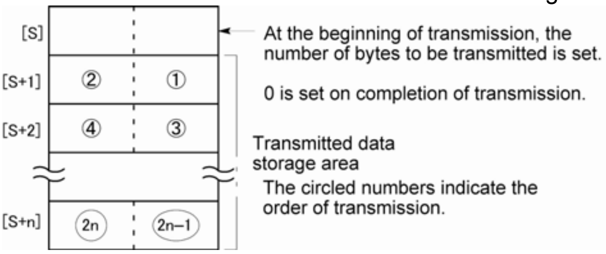
The program described above is executed in the following sequence.
1) “ABCDEFGH” is converted to an ASCII code and stored in a data register.
2) The data is sent from the communication port using the F159 (MTRN) instruction.

Explanatory diagram



Explanation of data table

The data table for transmission starts at the data register specified in S.



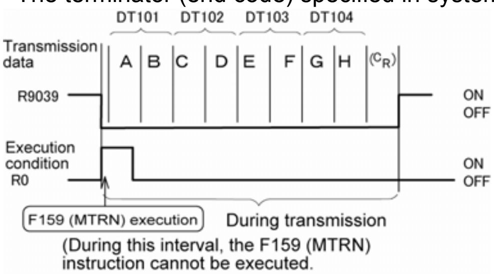
- Use an F0 (MV) or F95 (ASC) instruction to write the data to be transmitted to the transmission data storage area specified in S.

Transmission process

When the execution condition of the F159 (MTRN) instruction turns on and the “transmission done” flag R9039 is on, operation is as follows:

1. The number of transmission data [N] is preset in the start address of send buffer [S]. The “reception done” flag R9038 is turned off, and the reception data number is cleared to 0.
2. The set data is transmitted in order from the lower-order byte in S+1 of the table.

- During transmission, the “transmission done” flag R9039 turns off.
- If system register 413 is set to header (start code) with STX, the header is automatically added to the beginning of the data.
- The terminator (end code) specified in system register 413 is automatically added to the end of the data.



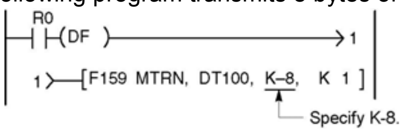
3. When all of the specified quantity of data has been transmitted, the S value is cleared to 0 and the “transmission done” flag R9039 turns on.

When you do not wish to add the terminator (end code) during transmissions:

- Specify the number of bytes to be transmitted using a negative number.
- If you also do not wish to add a terminator to received data, set system register 413 to “Terminator - None”.

Programming example:

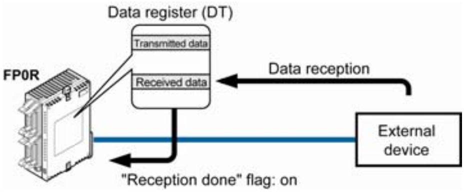
The following program transmits 8 bytes of data without adding the terminator.



Key Point:

- Do not include the terminator (end code) in the transmission data. The terminator is added automatically.
- When “STX exist” is specified for the header (start code) in system register 413, do not add the header to the transmission data. The header is added automatically.

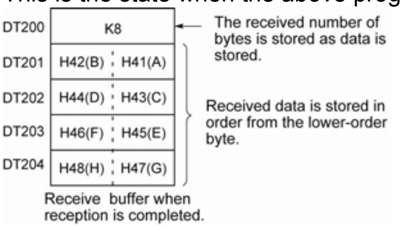
7.5.4 Receiving Data



Data input from the communication port is stored in the receive buffer specified by the system register, and the “reception done” flag goes on. If the “reception done” flag is off, data can be received at any time.

Data table for reception (receive buffer)

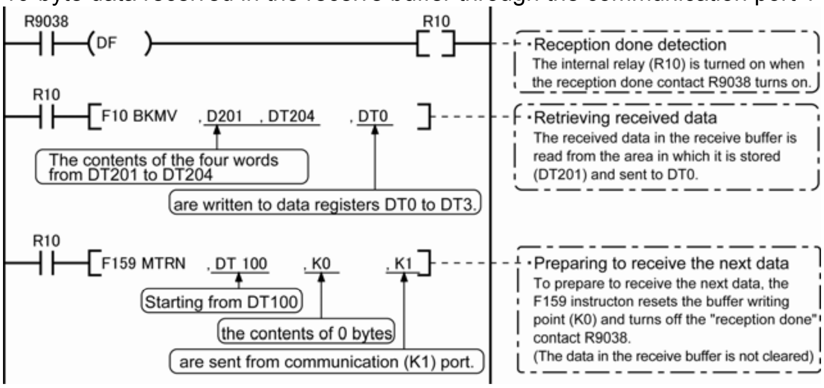
This is the state when the above program is executed.



DT200 to DT204 are used as the receive buffer.
System register settings are as follows:
- System register 416: K200
- System register 417: K5

Sample program for receiving data

10-byte data received in the receive buffer through the communication port 1 are copied to DT0.

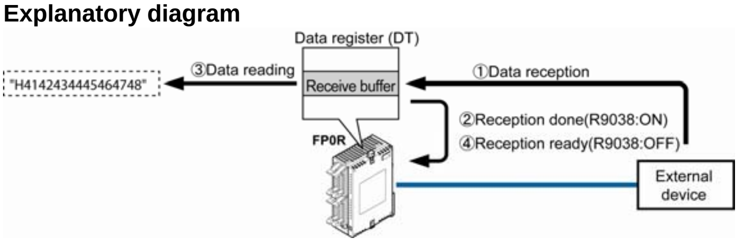


The program described above is executed in the following sequence.
1) The data sent from external devices is stored in the receive buffer.
2) The “reception done” contact R9038 is turned on.
3) The received data is sent from the receive buffer to the area starting with data register DT0.
4) The F159 (MTRN) instruction is executed with no data to clear the number of received bytes and to turn off the reception done” contact R9038. The system is now ready to receive the next data.
(The data in the receive buffer is not cleared.)

Note:

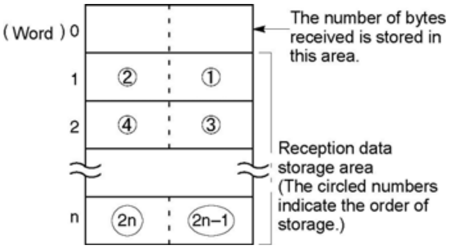
Be aware that the “reception done” flag R9038 changes even while a scan is in progress (e.g., if the “reception done” flag is used multiple times as an input condition, there is a possibility of different statuses existing within the same scan.) To prevent multiple read access to the special internal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

Explanatory diagram



Explanation of data table

Data sent from an external device connected to the communication port is stored in the data registers that have been set as the receive buffer.

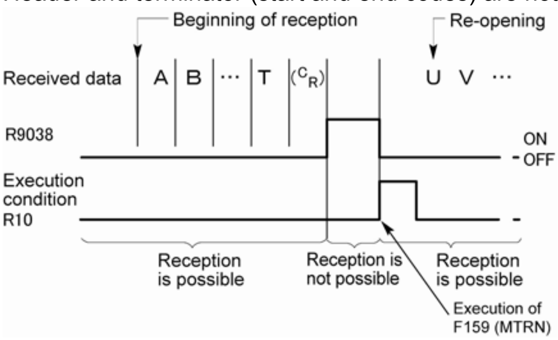


- Specify the data registers in system register 416 to 419.
- The number of bytes of data received is stored in the starting address of the receive buffer. The initial value is 0.
- Received data is stored in the received data storage area in order from the lower -order byte.

Reception process

When the “reception done” flag R9038 is off, operation takes place as follows when data is sent from an external device. (The R9038 flag is off during the first scan after RUN).

1. Incoming data is stored in order from the lower-order byte of the 2nd-word area of the receive buffer. Header and terminator (start and end codes) are not stored.

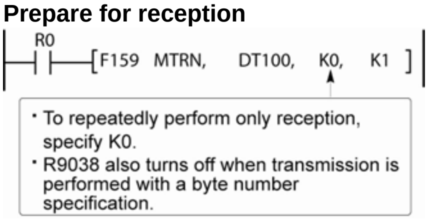


2. When the terminator (end code) is received, the “reception done” flag R9038 turns on. Reception of any further data is prohibited. When the terminator has been set to “None”, the “reception done” flag does not turn on. Check the number of received bytes to judge wehher the reception has completed or not.
3. When an F159 (MTRN) instruction is executed, the “reception done” flag R9038 turns off (except the case when the terminator has been set to “None”), the number of received bytes is cleared, and subsequent data is stored in order from the lower-order byte.

For repeated reception of data, perform the following steps:

1. Receive data
2. Reception done (R9038: on, reception prohibited)
3. Process received data
4. Execute F159 (MTRN) (R9038: off, reception possible)
5. Receive subsequent data

Prepare for reception



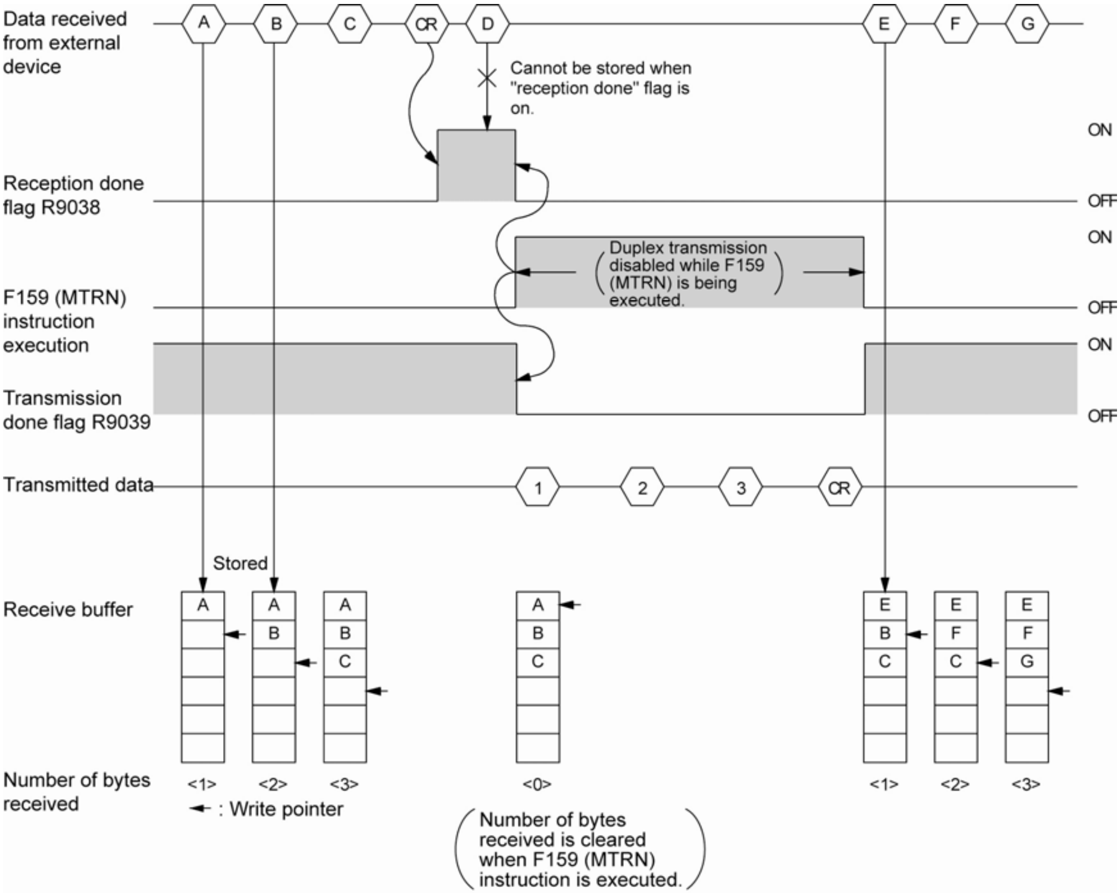
- The “reception done” flag R9038 turns on when data reception from the external device is completed. Reception of any further data is prohibited.
- To receive subsequent data, you must execute the F159 (MTRN) instruction to turn off the “reception done” flag R9038.

7.5.5 Flag Operation in Serial Communication

Header: No-STX, Terminator: CR

Receiving data:

The “reception done” flag, the “transmission done” flag, and the F159 (MTRN) instruction are related as follows:

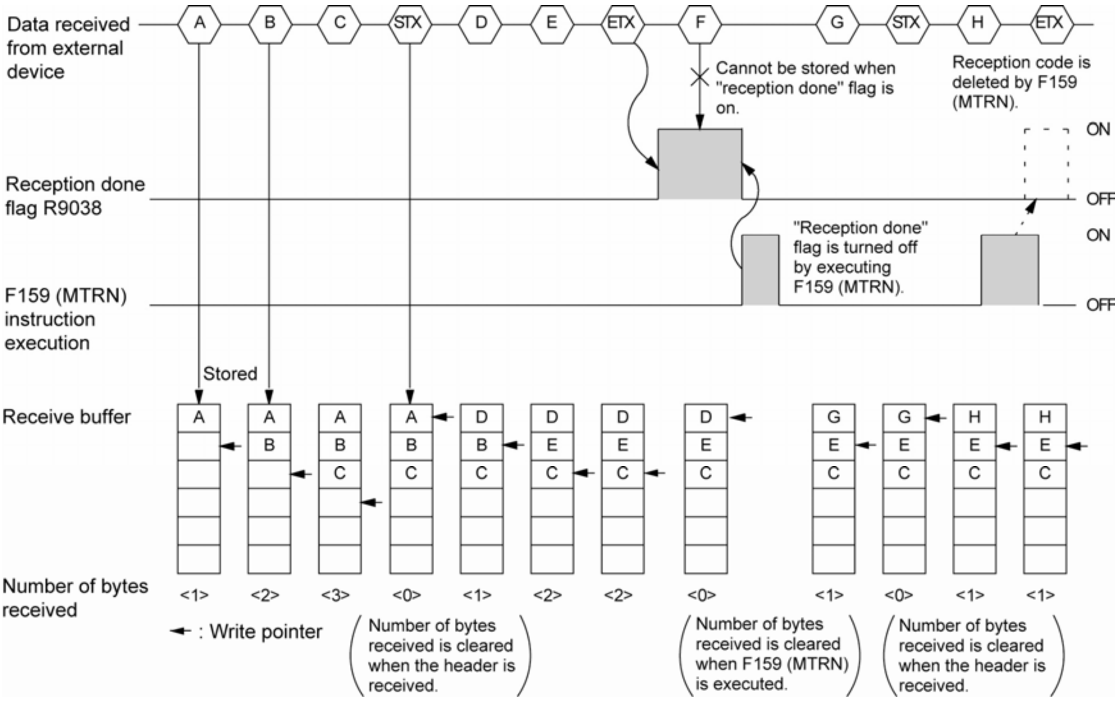


- For general-purpose serial communication, half-duplex transmission must be used.
- Reception is disabled when the “reception done” flag R9038 is on.
- When F159 (MTRN) is executed, the number of bytes received is cleared, and the address (write pointer) in the receive buffer is reset to the initial address.
- Also, when F159 (MTRN) is executed, the error flag R9037, the “reception done” flag R9038 and the “transmission done” flag R9039 goes off.
- Duplex transmission is disabled while F159 (MTRN) is being executed. The “transmission done” flag R9039 must be observed.
- Reception stops if the error flag R9037 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 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.

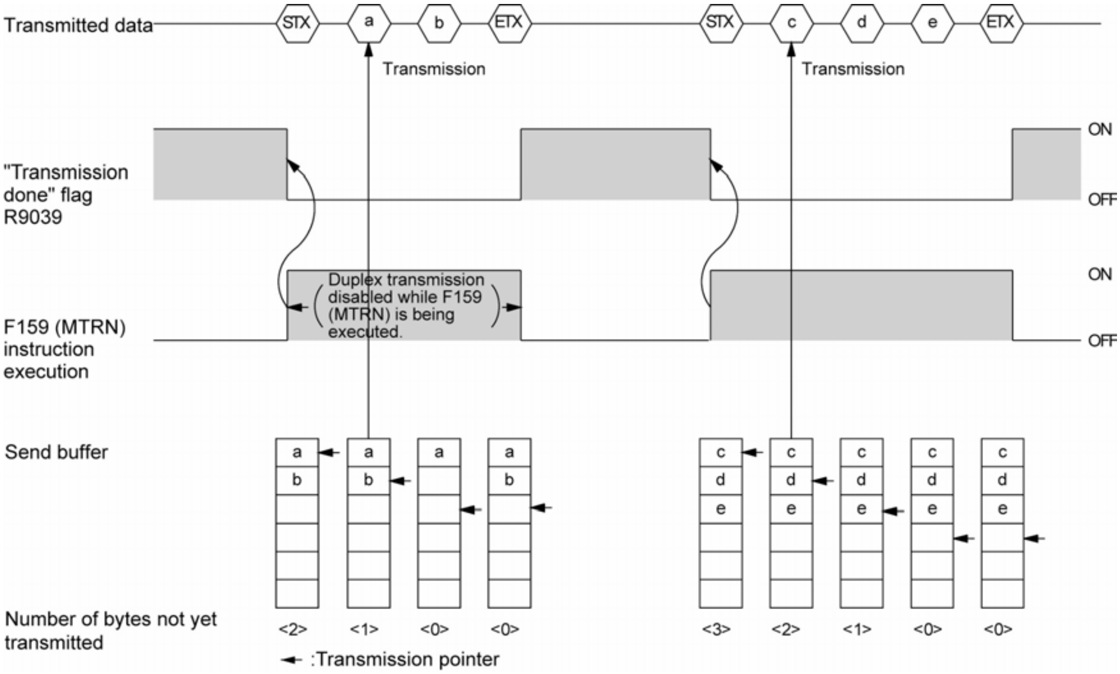
Header: STX, Terminator: ETX
Receiving data:
The “reception done” flag, the “transmission done” flag, and the F159 (MTRN) instruction are related as follows:



- 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 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 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:

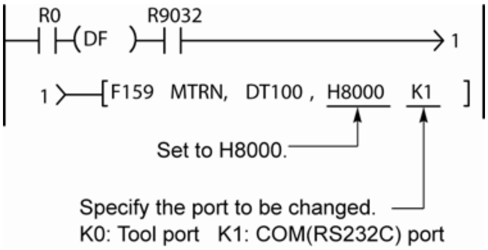


- Header (STX) and terminator (ETX) are automatically added to the data being transmitted. The data is transmitted to an external device.
- When the F159 (MTRN) instruction is executed, the “transmission done” flag R9039 goes off.
- Duplex transmission is disabled while F159 (MTRN) is being executed. The “transmission done” flag R9039 must be observed.

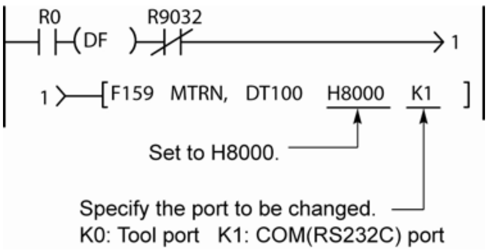
7.5.6 Changing Communication Mode Using F159(MTRN) Instruction

An F159 (MTRN) instruction can be executed to change between general-purpose serial communication mode and computer link mode. To do so, specify H8000 for n (the number of transmission bytes) and execute the instruction.

Changing from "general-purpose" to "computer link"



Changing from "computer link" to "general-purpose"



R9032: The COM port mode flag turns on when general-purpose serial communication mode is selected.

Note:

When the power is turned on, the operating mode selected in system register 412 takes effect.
It is not possible to change to the MODBUS RTU mode.

7.5.7 Setting Communication Parameters

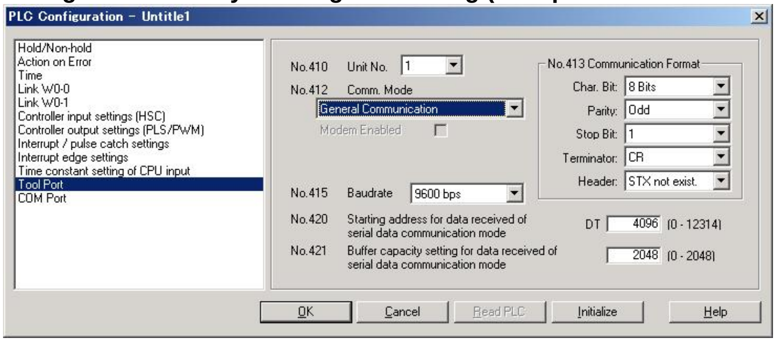
Tool port/COM port (RS232C port)

The settings for baud rate and communication format of the tool port are entered using a programming tool.

Setting with FPWIN GR

Select "Options" in the menu bar, and then select "PLC Configuration". Click **"Tool Port"** or **"COM Port"** from the left list.

Dialog box of PLC system register setting (Tool port selection screen)



No. 410 Unit number

The unit number can be set within a range of 1 to 99.

No. 412 Communication mode

Select the operation mode of communication port operation mode. Click "General communication".

No. 413 Communication Format setting

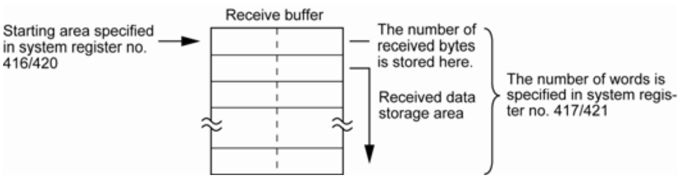
The default setting of communication format is as below.
Set the communication format to match the external device connected to the communication port.
(The terminator and header cannot be changed.)
Char. Bit: 8 bits
Parity: Odd
Stop Bit: 1 bit
Terminator: CR
Header: STX not exist

No. 415 Baud rate setting

The default setting for the baud rate is "9600 bps". Set the value to match the external device connected to the communication port. Select one of the values from "2400, 4800, 9600, 19200, 38400, 57600 and 115200 bps".

No. 416 Starting address for data received (For the tool port: No. 420)
No. 417 Buffer capacity setting for data received (For the tool port: No. 421)

For the general-purpose serial communication, setting "Receive buffer" is required.
To change this area, specify the starting address using system register No. 416 or 420 and the volume (number of words) using No. 417or 421. The receive buffer layout is shown below. When setting for the tool port and the COM port (RS232C port) both, do not specify the same buffer number.



7.5.8 Connection with 1:1 Communication (General-purpose Serial Communication)

System register settings

No.	Name	Set Value	
No. 412	Selection of communication mode	General-purpose serial communication	
No. 413	Communication format	Char. bit: ……	7 bits/8 bits
		Parity: …..	None/Odd/Even
		Stop bit: …………	1 bit/2 bits
		Terminator: ……..	CR/CR+LF/None/ETX
		Header: …………	STX not exist
No. 415	Baud rate Note1)	2400 to 115200 bps	
No. 416 No. 420	Starting address for receive buffer Note2)	C10, 14, 16: DT0 to DT12314 C32, T32, F32: DT0 to DT32764 (Default setting: Tool port: DT4096, COM(RS232C) port: DT0	
No. 417 No. 421	Receive buffer capacity Note1)	0 to 2048 words (Default setting: 2048 words)	

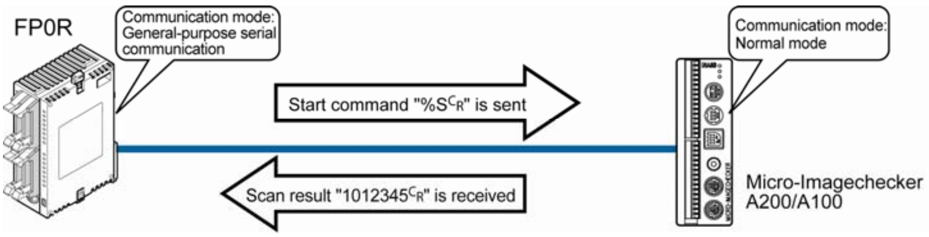
Note1) The baud rates of 300, 600 and 1200 bps can be specified by the SYS1 instruction. However, the setting value of the system register cannot be changed.

Note2) No. 416 and 417 is the COM(RS232C) port. No. 420 and 421 is the tool port.

1:1 communication with Micro-Imagechecker

Overview

The FP0R and Micro-Imagechecker A200/A100 are connected using an RS232C cable. The results of the scan are stored in the data registers of the FP0R.



After the scan start code "%SC_R" has been sent from the FP0R side, the scan result is returned from the Micro-Imagechecker as the response.

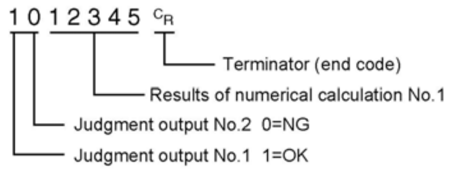
Communication format settings for Micro-Imagechecker

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

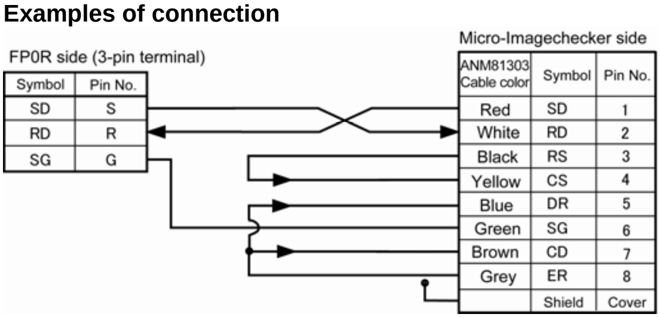
No.	Name	Set Value	
No. 51	Communication mode	Normal mode	
No. 52	Serial settings	Baud rate: …………. Char. bit: ………….. Stop bit: …………….. Parity : ……………….. Flow control: ………..	9600 bps 8 bits 1 bit None/Odd None
No. 53	Serial output settings	Output digit: ……….. Invalid Digit: ………. Read End: …..………. Process End: ………. Numerical calculation: Judgment: ………….	5 column Repl. 0 None None Output Output

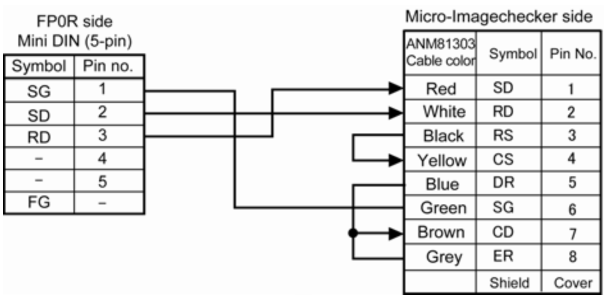
Key Point:

- 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 "Output" should be specified for the "Numerical calculation" parameter.
- With the above settings, the following data will be output from the Micro-Imagechecker.



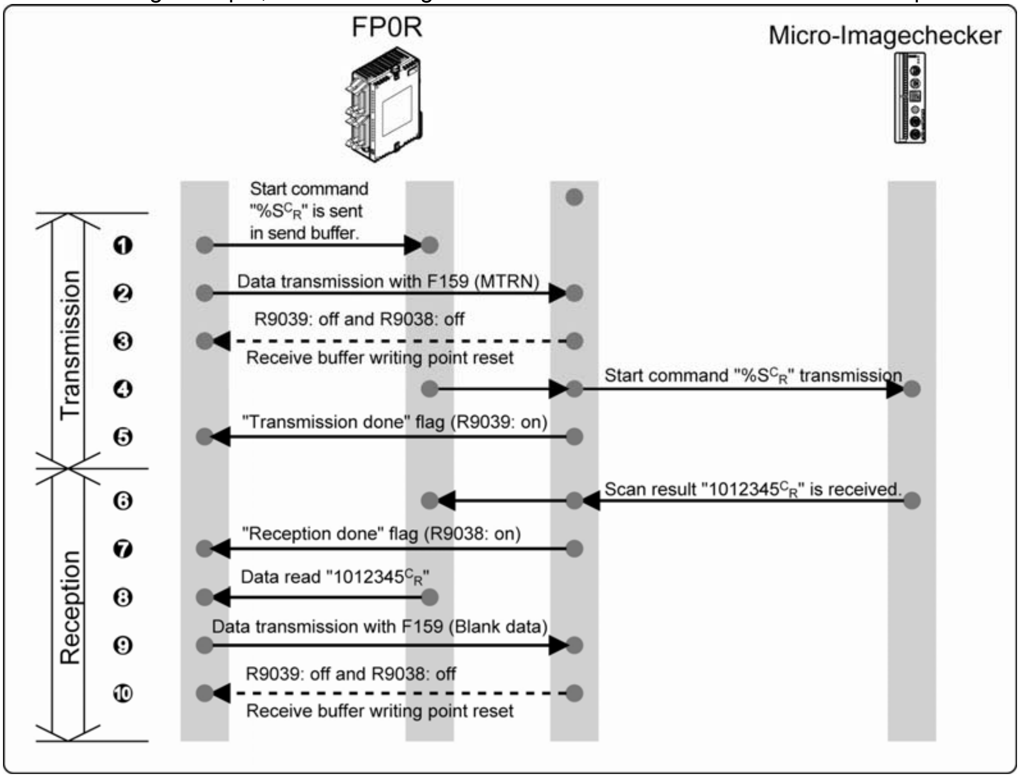
Examples of connection





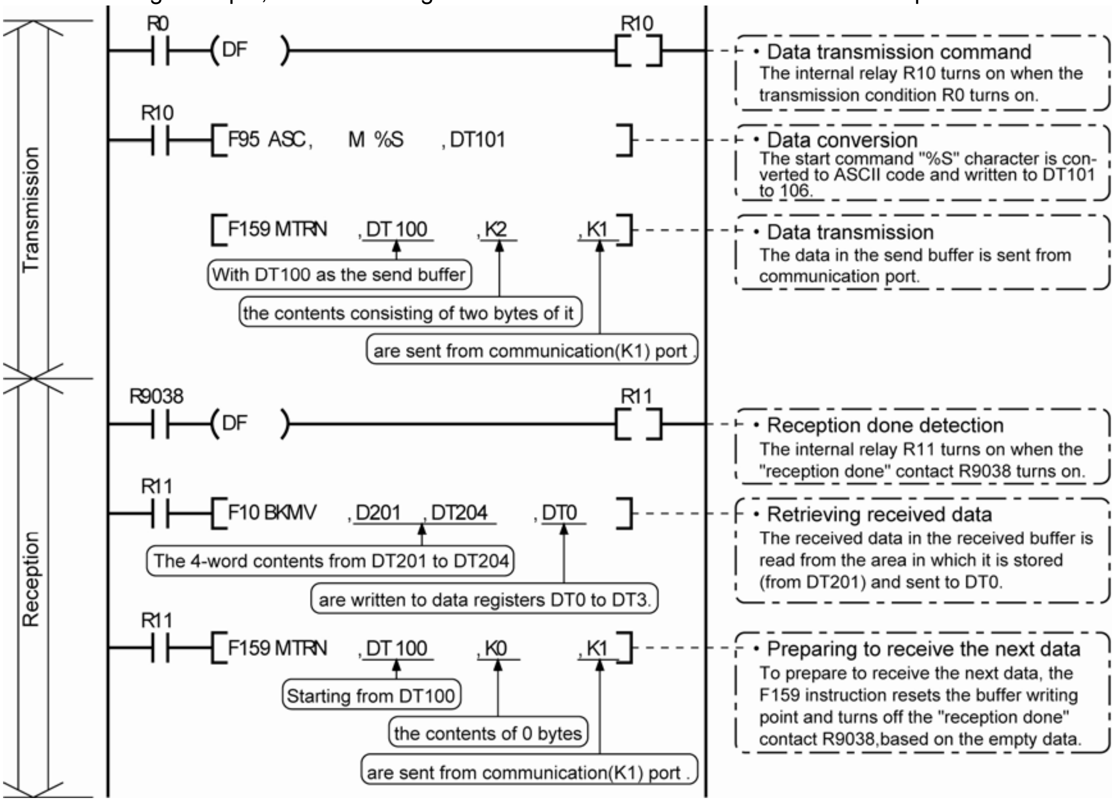
Procedure of communication

In the following example, the Micro-Imagechecker is connected to the communication port.



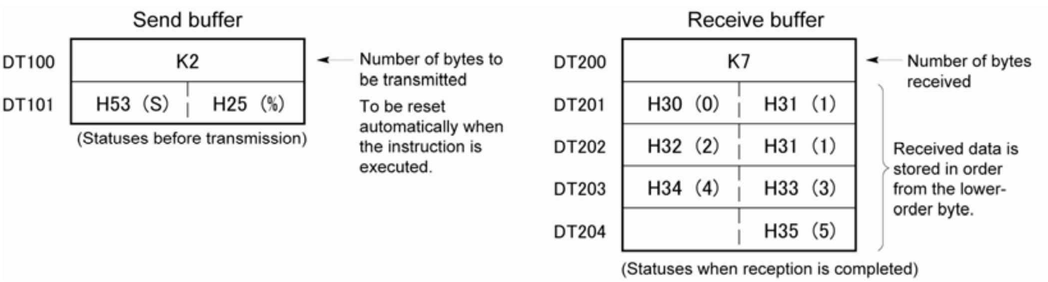
Sample program

In the following example, the Micro-Imagechecker is connected to the communication port.



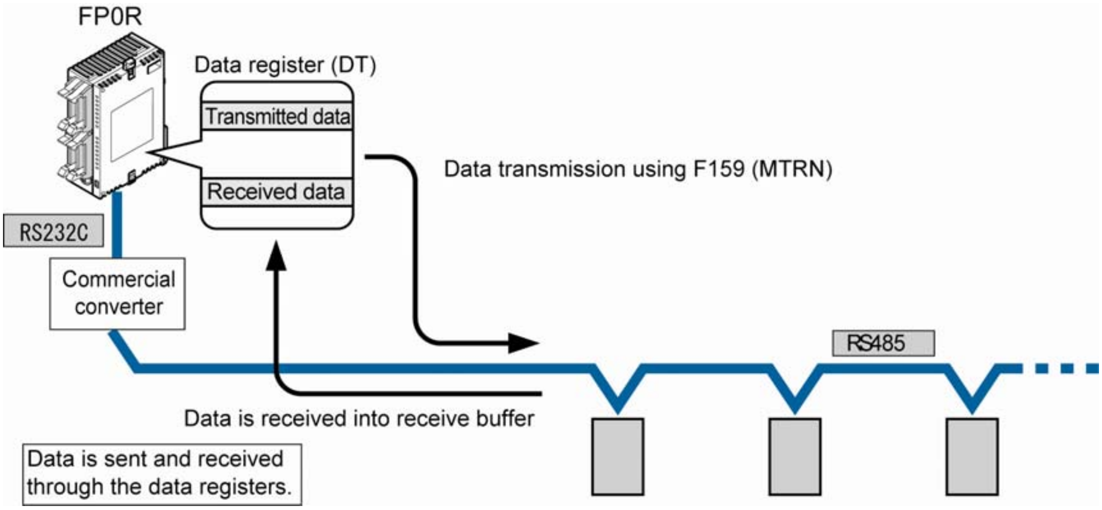
Buffer statuses

The following shows the statuses of the send and receive buffers when the sample program is run.



7.5.9 1:N Communication (General-purpose Serial Communication))

The FP0R and the external units are connected using an RS485 cable. Using the protocol that matches the external units, the F159 (MTRN) instruction is used to send and receive data.



System register settings

No.	Name	Set Value
No. 412	Selection of communication mode	General-purpose serial communication
No. 413	Communication format	Char. bit: …… 7 bits/8 bits Parity: ….. None/Odd/Even Stop bit: ……….. 1 bit/2 bits Terminator: …….. CR/CR+LF/None/ETX Header: ………… STX not exist
No. 415	Baud rate Note2)	2400 to 115200 bps
No. 416 No. 420	Starting address for receive buffer Note3)	C10, 14, 16: DT0 to DT12314 C32, T32, F32: DT0 to DT32764 (Default setting: Tool port: DT4096, COM(RS232C) port: DT0
No. 417 No. 421	Receive buffer capacity Note3)	0 to 2048 words

Note1) The communication format and baud rate should be set to match the connected devices.

Note2) The baud rates of 300, 600 and 1200 bps can be specified by the SYS1 instruction. However, the setting value of the system register cannot be changed.

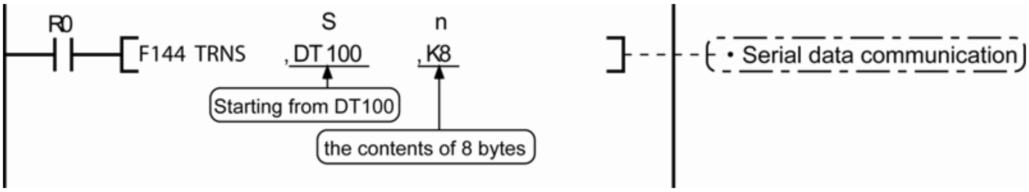
Note3) No. 416 and 417 is the COM(RS232C) port. No. 420 and 421 is the tool port.

7.5.10 Settings in Compatibility Mode with FP0 (FP0 Compatibility Mode)

Programming Example of General-purpose Serial Communicationin FP0 compability mode
The high-level instruction F144(TRNS) is used to send and receive data via the COM port (RS232C port). (The F159(MTRN) instruction is used in the normal FP0R mode.)

Key Point: In the FP0 compatiblity mode, the F144(TRNS) instruction is used instead of F159(MTRN) instruction.

F144(TRNS) instruction
Data is sent and received between the FP0R and an external device via the COM port (RS232C port).



Devices that can be specified for S:	Only data registers (DT) can be specified as the send buffer.
Devices that can be specified for n:	WX, WY, WR, WL, SV, EV, DT, LD, I (I0 to ID), K, H

Sending data
The amount of data specified by n is sent to the external device from among the data stored in the data table, starting with the area specified by S, through the COM port specified by D. Data can be sent with the header and terminator automatically attached. A maximum of 2048 bytes can be sent. When the above program is run, the eight bytes of data contained in DT101 to DT104 and stored in the send buffer starting from DT100 are sent from the COM port.

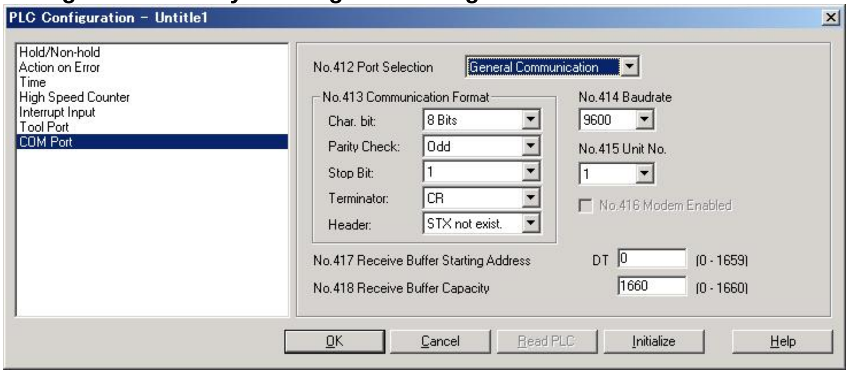
Receiving data
Data can be received when the “reception done” flag is off. The received data is stored in the receive buffe specified by the system register. When the reception of the data is completed (the terminator is received), the “reception done” flag (R9038) turns on, and subsequently, receiving data is prohibited. To receive the next data, execute the F144(TRNS) instruction and turn the “reception done” flag (R9038) off to clear the number of received bytes to 0. To receive data continuously without sending data, clear the number of transmitted bytes to 0 (set “n” to “K0”), and then execute the F144 (TRNS) instruction.

Reference: <Programming Manual ARCT1F353E>

Setting Communication Parameters
Confirm that the model of the programming tool is FP0.

Usable communication port
COM port (RS232C port)

COM port (RS232C port) settings
Dialog box of PLC system register setting



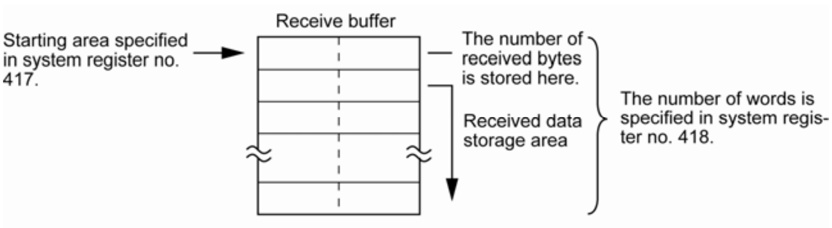
No. 412 Communication mode
Select "General communication".

No. 413 Communication Format setting
Char. Bit: 7 bits/8 bits
Parity: None/Odd/Even
Stop bit: 1 bit/2 bits
Terminator: End code: CR/CR+LF/None/ETX
Header: STX not exist/STX
- Specify the value to match the connected external device.

No. 414 Baud rate setting
Select one of the values from "300, 600, 1200, 2400, 4800, 9600 and 19200 bps".

No. 415 Unit number
The unit number can be set within a range of 1 to 99.

No. 417 Starting address for data received
No. 417 Buffer capacity setting for data received
For the general-purpose serial communication, setting "Receive buffer" is required.
To change this area, specify the starting address using system register No. 417 and the volume (number of words) using No. 418. The receive buffer layout is shown below.



Starting address for data received	C10,C14,C16: DT0 to DT1659
	C32 : DT0 to DT6143
	T32 : DT0 to DT16383
	(Default: Tool port: DT4096 COM(RS232C) port: DT0)
Buffer capacity setting for data received	C10, C14, C16: 0 to 1660 words (Default: 1660 words)
	C32: 0 to 6144 words (Default: 6144 words)

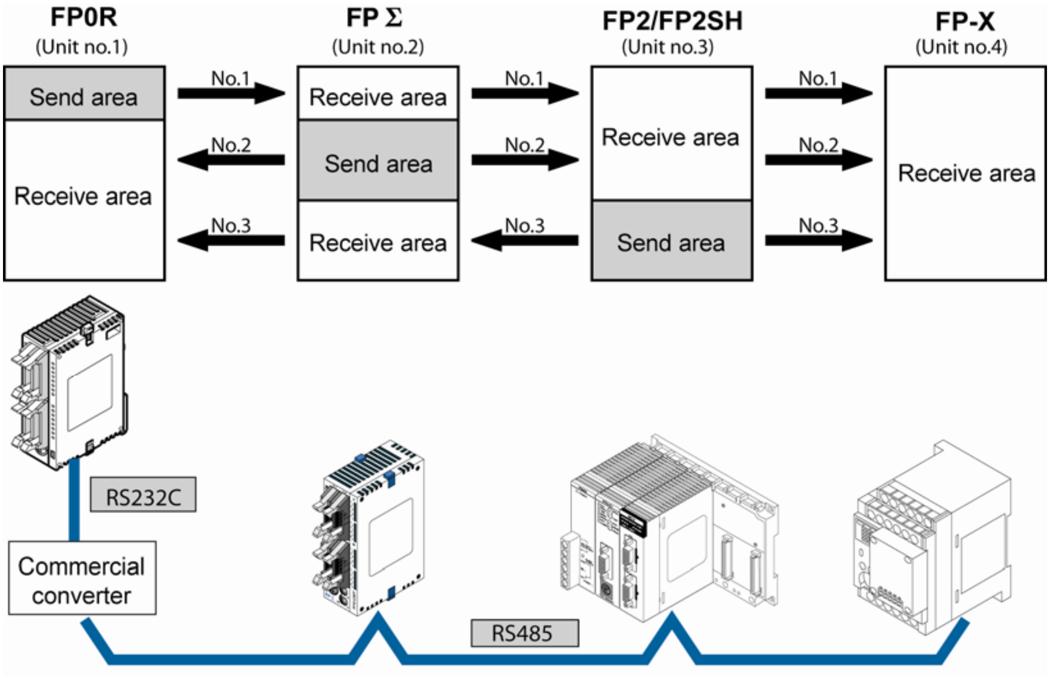
7.6 Communication Function 3: PC(PLC) link Function

7.6.1 Overview

Using a commercial R232C/RS485 converter enables to configure a PC(PLC) link (MEWNET-W0) with the FP0R.

- Exclusive internal relays "link relays (L)" and data registers "link registers (LD)" are shared between the connected PLCs.

- 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.
- The status of the link relays and link registers in any one PLC is fed back to all of the other PLCs connected to the network, so control of data that needs to be consistent throughout the network, such as target production values and type codes, can easily be implemented to coordinate the data, and the data of all units are updated at the same time.

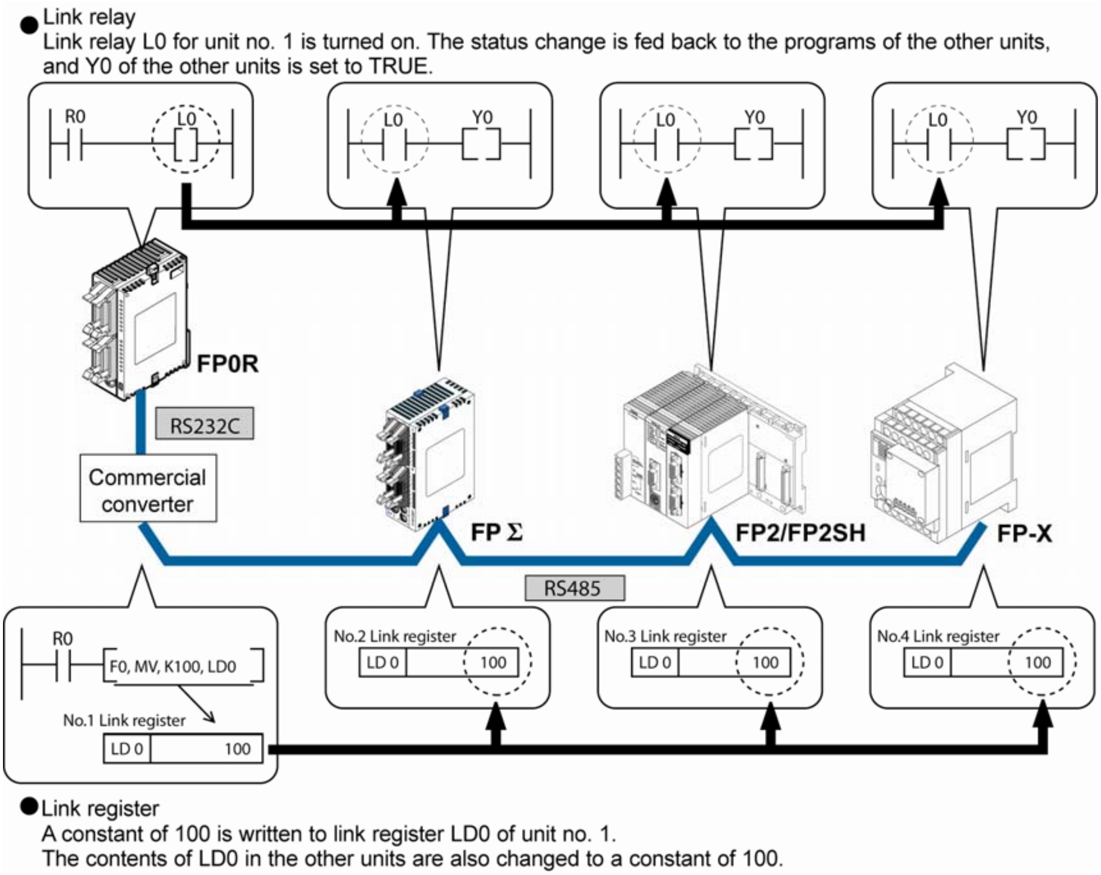


The link relays and link registers of the PLCs contain areas for sending and areas for receiving data. These areas are used to share data among the PLCs.

Operation of PLC link

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.



Communication port

It is available for the COM port (RS232C port) only.

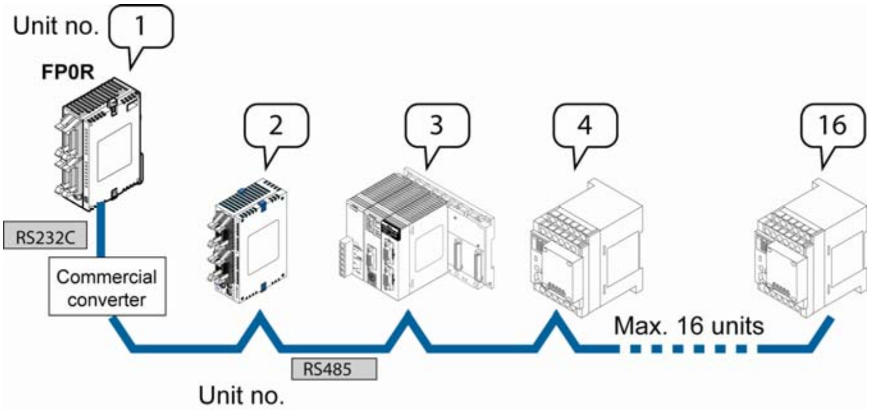
7.6.2 Setting of Unit Numbers

By default, the unit number for the communication port is set to 1 in the system registers.
In a PC(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 unit number is specified either by using **the SYS1 instruction** or **the system register**.

Note1) The priority order for unit number settings is as follows:
1. SYS1 instruction
2. System registers

Note2) 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.
Note3) If fewer than 16 units are linked, the transmission time can be shortened by setting the largest unit number in system register no. 47.



Unit numbers are the numbers to identify the different PLCs on the same network. The same number must not be used for more than one PLC on the same network.

Note:
When using the PC(PLC) link with the RS232C, the number of units is 2.

7.6.3 Setting Communication Parameters: PC(PLC) Link

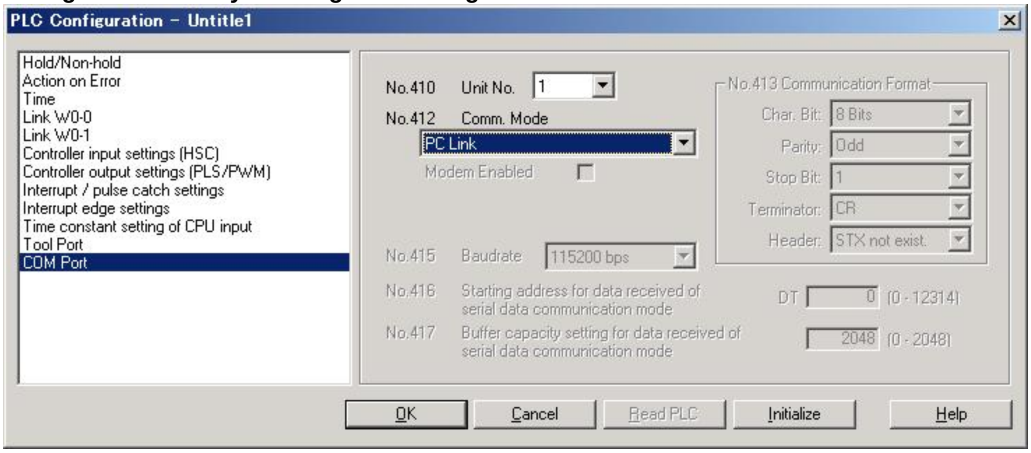
Settings for baud rate and communication format

The settings for baud rate and communication format of the COM(RS232C) port are entered using a programming tool.

Setting with FPWIN GR

Select "Options" in the menu bar, and then select "PLC Configuration". Click the "COM Port" tab.

Dialog box of PLC system register setting



No. 410 Unit number

The unit number can be set within a range of 1 to 16.

No. 412 Communication Mode

Select the communication mode for the RS232C port.

Click on ▼, and select “PC Link”.

Key Point:

When using a PC(PLC) link, the communication format and baud rate are fixed:

No.	Name	Set Value	
No. 413	Communication format	Char. bit: …… Parity: ….. Stop bit: ………… Terminator: …….. Header: …………	8 bits Odd 1 bit CR STX not exist
No. 415	Baud rate setting for COM1 port	115200 bps	

7.6.4 Link Area Allocation

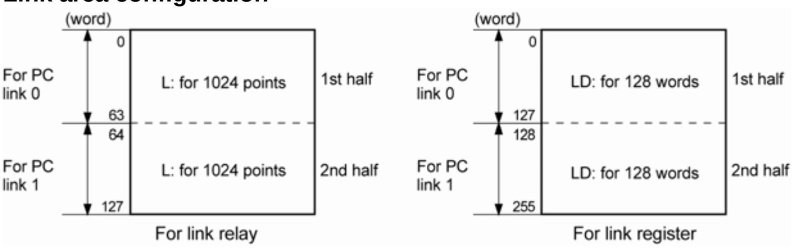
The link relays and link registers to be used in the PC(PLC) link are allocated in the link area of the CPU unit. Link area allocations are specified by setting the system registers of the CPU unit.

System registers

No.		Name	Default value	Set value
For PC (PLC) link 0	40	Range of link relays used for PC(PLC) link	0	0 to 64 words
	41	Range of link data registers used for PC(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 127 words
	46	PC(PLC) link switch flag	Normal	Normal: 1st half Reverse: 2nd half
	47	Maximum unit number setting for MEWNET-W0 PC(PLC) link	16	1 to 16 Note)
For PC (PLC) link 1	46	PC(PLC) link switch flag	Normal	Normal: 1st half Reverse: 2nd half
	50	Range of link relays used for PC(PLC) link	0	0 to 64 words
	51	Range of link data registers used for PC(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 127 words
	57	Maximum unit number setting for MEWNET-W0 PC(PLC) link	16	1 to 16 Note)

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

Link area configuration



- Link areas consist of link relays and link registers, and are divided into areas for PC(PLC) link 0 and PC(PLC) link 1 and used with those units.
- The link relay which can ben used in an area for either PC(PLC) link 0 or PC(PLC) link 1 is maximum 1024 points (64 words), and the link register is maximum 128 words.

Note:

The PC link 1 can be used to connect with the second PC link W0 of the FP2 Multi Communication Unit (MCU). At that time, the link relay number and link register number for the PC link can be the same values as the FP2 (from WL64, from LD128).

Reference:

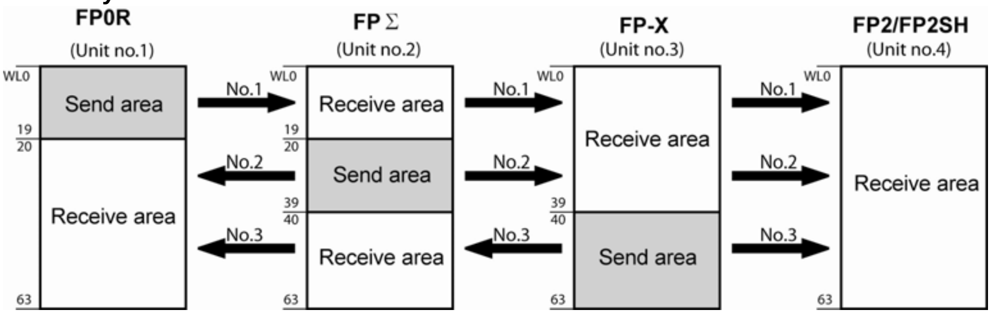
For the information on FP2-MCU, <Chapter 5 Communication Function PC(PLC) Link in FP2 Multi Communication Unit Technical Manual ARCT1F396E>.

Example of allocation

The areas for PC(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 PC(PLC) link 0

Link relay allocation

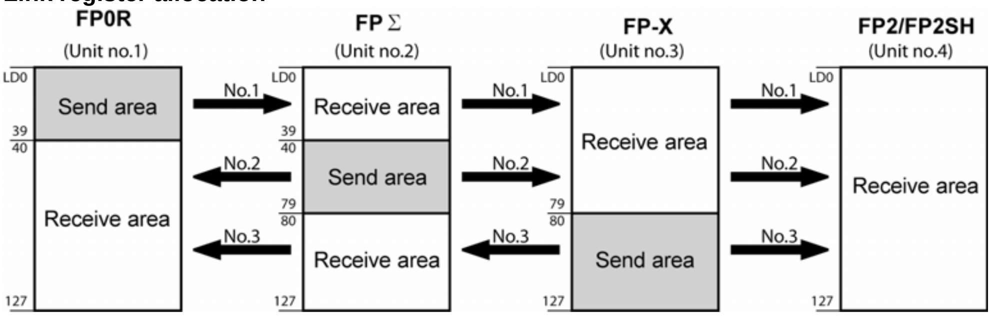


System registers

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

Link register allocation



System registers

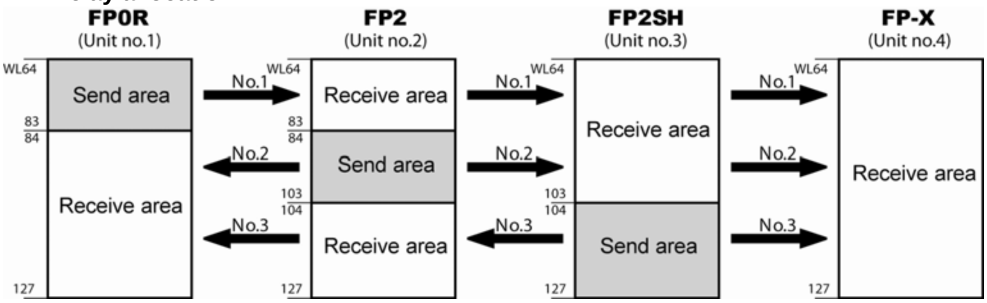
No.	Name	Setting for various units			
		No. 1	No. 2	No. 3	No. 4
41	Range of link registers used	128	128	128	128
44	Starting No. for link register transmission	0	40	80	0
45	Link register transmission size	40	40	48	0

Note) No. 41 (range of link registers used) must be set to the same range for all the 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 PC(PLC) link 1

Link relay allocation

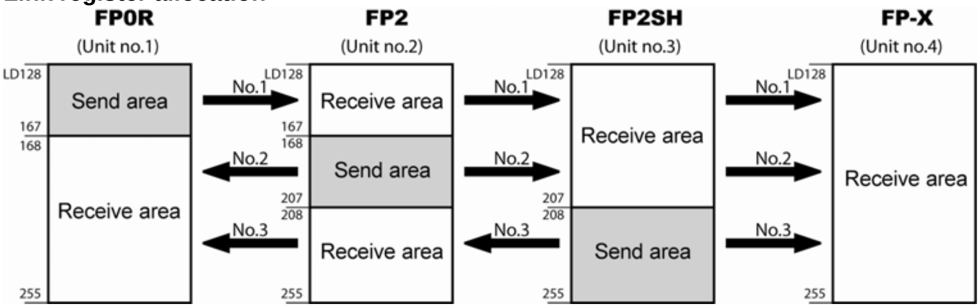


System registers

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) No. 50 (range of link relays used) must be set to the same range for all the 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) No. 51 (range of link registers used) must be set to the same range for all the 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.

Note:

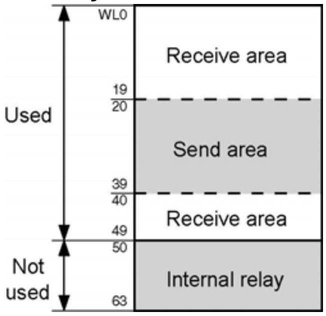
The PC link 1 can be used to connect with the second PC link W0 of the FP2 Multi Communication Unit (MCU). At that time, the link relay number and link register number for the PC link can be the same values as the FP2 (from WL64, from LD128).

Reference:

For the information on FP2-MCU, <Chapter 5 Communication Function PC(PLC) Link in FP2 Multi Communication Unit Technical Manual ARCT1F396E>.

Partial use of link areas
In the link areas available for PC(PLC) link, link relays with a total of 1024 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.

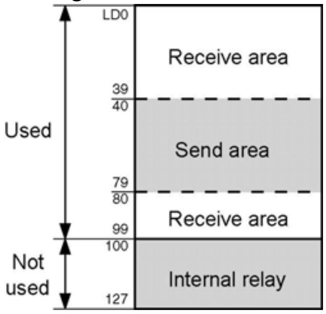
Link relay allocation



No.	Name	No.
No. 40	Range of link relays used	50
No. 42	Starting No. of word for link relay transmission	20
No. 43	Link relay transmission size	20

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

Link register allocation



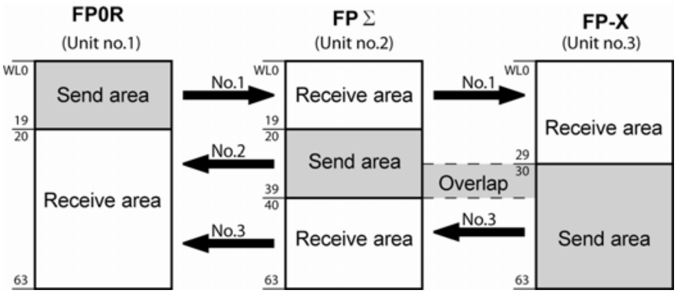
No.	Name	No.
No. 41	Range of link registers used	100
No. 44	Starting No. for link register transmission	40
No. 45	Link register transmission size	40

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

Note: Precautions When Allocating Link Areas
If a mistake is made when allocating a link area, be aware that an error will result, and communication will be disalbed.

Avoid overlapping send areas
When sending data from a send area to the receive area of another PLC, there must be a link relay and link register with the same number in the receive area on the receiving side. In the example shown below, there is an area between No. 2 and No. 3 which is overlapped, and this will cause an error, so that communication cannot be carried out.

Example of link relay allocations

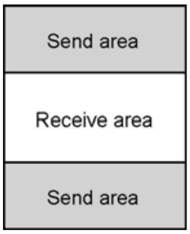


System registers

No.	Name	Set value of various control units		
		No. 1	No. 2	No. 3
No. 40	Range of link relays used	64	64	64
No. 42	Starting No. of word for link relay transmission	0	20	30
No. 43	Link relay transmission size	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

7.6.5 Setting the Largest Unit Number for PC(PLC) Link

The largest unit number can be set using system register no. 47 (using system register no. 57 for PC(PLC) link 1).

[Sample setting]

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

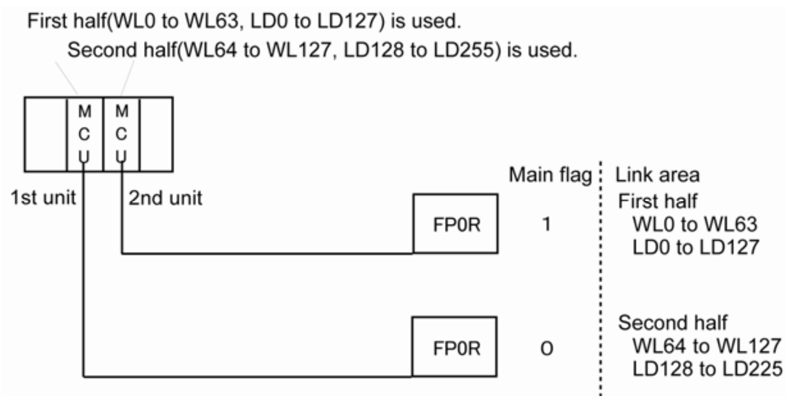
Note:

- 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 (in system register no. 57 for PC(PLC) link 1).
- For all PLCs which are linked, the same value should be set for the largest unit number.
- If there are fewer than 16 units linked and the largest unit number has not been set (default=16), or the largest unit number has been set but the unit number settings are not consecutive, or the unit number settings are consecutive but there is a unit for which the power supply has not been turned on, the response time for the PC(PLC) link (the link transmission cycle) will be longer.

Reference: <7.6.7 PC(PLC) Link Response Time>

Setting PC(PLC) link switching flag

PC(PLC) link switching flag can be set using 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 loink relays and registers are used.



7.6.6 Monitoring

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

Transmission assurance relays
For PC(PLC) link 0: R9060 to R906F (correspond to unit no. 1 to 16)
For PC(PLC) link 1: R9080 to R908F (correspond to unit no. 1 to 16)
If the transmission data from a different unit is being used with the various PLCs, check to make sure the transmission assurance relay for the target unit is on before using the data.
Exclusive internal relays "link relays (L)" and data registers "link registers (LD)" are shared between the connected PLCs.

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

Operation mode relays
For PC(PLC) link 0: R9070 to R907F (correspond to unit no. 1 to 16)
For PC(PLC) link 1: R9090 to R909F (correspond to unit no. 1 to 16)
The operation modes (RUN/PROG.) can be checked for any given PLC.

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

PLC link transmission error relay R9050 (link 1)
This relay goes on if a problem is detected during transmission.

Relay no.	R9050															
Unit no.	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Conditions for on/off	ON: When a transmission error has occurred in the PC(PLC) link, or when there is an error in the setting for the PC(PLC) link area OFF: When there is no transmission error.															

Key Point: Monitoring the PC(PLC) link status
Using a programming tool, the PC(PLC) link status items, such as the transmission cycle time and the number of times that errors have occurred, can be monitored.

Using FPWIN GR: Select [Status Display] under [Online] in the menu. Click the [PC link] button after the [Status Display] screen is shown.

Using FPWIN Pro: Select [PLC Link Status] under [Online] in the menu.

Note: Remote programming of the linked PLCs is not possible from the programming tool.

7.6.7 PC(PLC) Link Response Time

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

$$T\ max. = \underbrace{Ts1 + Ts2 + \cdots + Tsn}_{①\ Ts\ \text{(transmission time per station)}} + \underbrace{Tlt}_{②\ Tlt\ \text{(link table sending time)}} + \underbrace{Tso}_{③\ Tso\ \text{(master station scan time)}} + \underbrace{Tlk}_{④\ Tlk\ \text{(link addition processing time)}}$$

The various items in the formula are calculated as described below.

① Ts (transmission time per station)
Ts = scan time + Tpc (PC(PLC) link sending time)

Tpc = Ttx (sending time per byte) x Pcm (PLC link sending size)
Ttx = 1/(baud rate 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/(baud rate 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/(baud rate 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/(baud rate 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 PLCs is 1 ms.
Ttx = 0.096   Each Pcm = 23 + (4 + 8) x 4 = 71 bytes   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 bytes   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) ≒ 4.13 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 register 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 bytes
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 bytes
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 bytes
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

Note:

- 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 PC(PLC) link response time is longer.
- The SYS1 instruction can be used to minimize thte transmission cycle time even if there are one or more stations that have not been added to the link.

Reducing the transmission cycle time when there are stations that have not been added

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.

$$T\ max. = Ts1 + Ts2 + \cdot\ \cdot\ \cdot\ \cdot\ \cdot\ \cdot + Tsn + Tlt + Tso + \underline{Tlk}$$

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.

<Programming example of SYS1 instruction>

(SYS1, M PCLK1T0, 100)

Function: Setting SYS1 to change the waiting time for a link to be added to the PC(PLC) link from the default value of 400 ms to 100 ms.

Keywords:Setting for key word no. 1: PCLK1T0
Permissible range for key word no. 2: 10 to 400 (10 ms to 400 ms)
Note) Enter one space after M and then enter 12 characters to be aligned to the right.
If the second keyword is 2 digits, put 2 spaces, and if it is 3 digits, put one space.

Note:

If there are any unitss 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 problem.

- 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.)

Error detection time for transmission assurance relays

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 the PLC to be turned off at the other stations. This time period can be shortened using the SYS1 instruction.

<Programming example of SYS1 instruction>

(SYS1, M PCLK1T1, 100)

Function: Setting SYS1 to change the time that the PC(PLC) link transmission assurance is off from the default value of 6400 ms to 100 ms.

Keywords: Setting for key word no. 1: PCLK1T1

Permissible range for key word no. 2: 100 to 6400 (100 ms to 6400 ms)

Note) Enter one space after M and then enter 12 characters to be aligned to the right.

If the second keyword is 3 digits, put 2 spaces, and if it is 4 digits, no space is needed.

Note:

- 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 short time has been set, the transmission assurance relay may not function properly. (The shortest time that can be set is 100 ms.)

7.7 Communication Function 4: MODBUS RTU Communication

7.7.1 Overview of Functions

- The MODBUS RTU protocol enables the communication between the FP0R and other devices (including our FP-X, FP-e, Programmable display GT series, KT temperature control unit and MODBUS device made by other companies).
- Enables to have conversations if the master unit sends instructions (command messages) to slave units and the slave units respond (response messages) according to the instructions.
- Enabels the communication between the devices of max. 99 units as the master function and slave function is equipped.

About MODBUS RTU

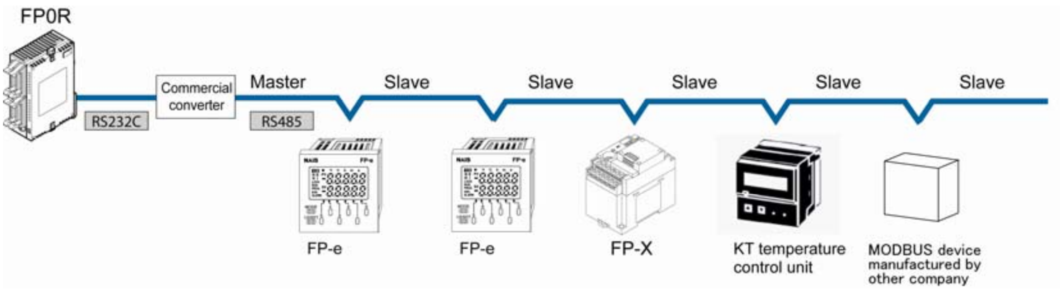
- The MODBUS RTU communication is a function for the master unit to read and write the data in slave units communicating between them.
- There are ASCII mode and RTU (binary) mode in the MODBUS protocol, however, the FP0R is supported with the RTU (binary) mode only.

Master function

Writing and reading data for various slaves is available using the F145 (SEND) and F146 (RECV) instructions.

Individual access to each slave and the global transmission is possible.

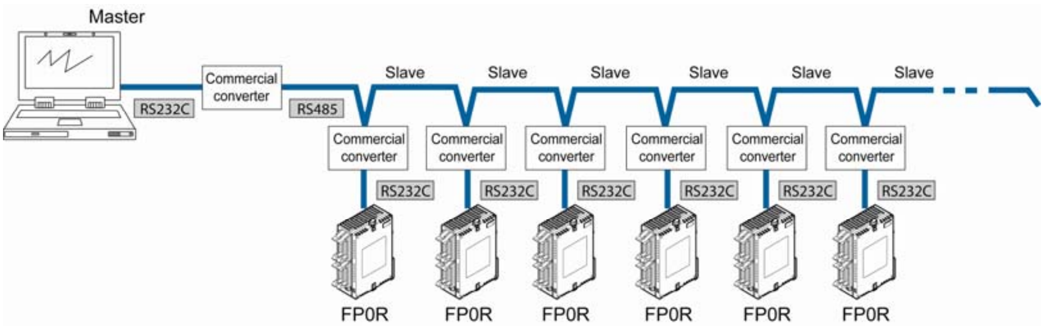
Use Type II instructions of F145 and F146 (Type directly specifing MODBUS address) to communication with MODBUS devices made by other companies.



Slave function

If the slave units receive a command message from the master unit, they send back the response message corresponding to the content.

Do not execute the F145 (SEND) or F146 (RECV) instructions when the unti 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)
Note1) 0= Broadcast address
Note2) Slave unit No. is 1 to 99 (decimal)
Note3) For MODBUS, 0 to 247 (decimal)

FUNCTION 8 bits

DATA Varies depending on commands.

CRC 16 bits

END 3.5-character time (Differs depending on baud rate. Refer to reception judgement time.)

Response in normal status

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

Response in abnormal status

In case a parameter disabled to be processed is found in a command (except transmission error)

Slave address (unit number) Function code + 80H Error code CRC	One of either 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 completes when the time that is exceeding the time mentioned below has passed after the final data was received.

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

Note) The reception done judgment time is an approx. 32-bit time.

Supported commands

Executable instructions for master	Code (decimal)	Name (MODBUS original)	Name for FP0R	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
Cannot be issued	22	Mask Write 4X Register	Write DT Mask	4X
Cannot be issued	23	Read/Write 4X Registers	Read/Write DT	4X

Table for MODBUS reference No. and FP0R device No.

MODBUS reference No.			Data on BUS (hexadecimal)	FP0R device No.
Coil		000001-001760	0000-06DF	Y0-Y109F
		002049-006144	0800-17FF	R0-R255F
Input		100001-101760	0000-06DF	X0-X109F
Holding register	C10, C14, C16	400001-412316	0000-301B	DT0-DT12315
	C32, T32, F32	400001-432765	0000-7FFC	DT0-DT32765
Input register		300001-300128	0000-007F	WL0-WL127
		302001-302256	07D0-08CF	LD0-LD255

7.7.2 Setting Communication Parameters

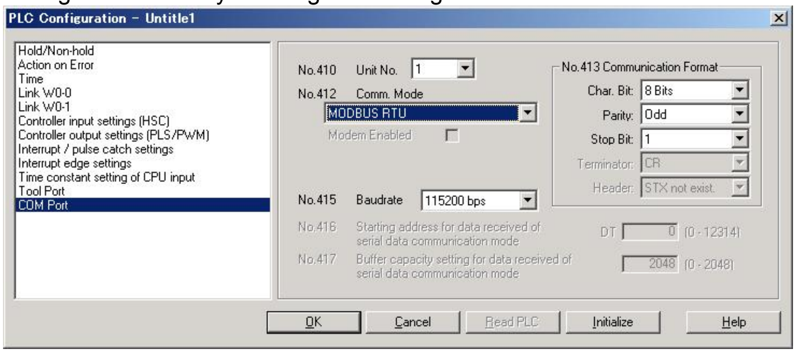
Settings for baud rate and communication format

The settings for baud rate and communication format of the COM(RS232C) port are entered using a programming tool.

Setting with FPWIN GR

Select "Options" in the menu bar, and then select "PLC Configuration". Click the "COM Port" tab.

Dialog box of PLC system register setting



No. 410 Unit number

The unit number can be set within a range of 1 to 99.

No. 412 Communication mode

Select the communication mode for the COM(RS232C) port.

Click on ▼, and select “MODBUS RTU link”.

No. 413 Communication Format setting

The default setting of communication format is as below.

Set the communication format to match the external device connected to the communication port.

(The terminator and header cannot be changed.)

Char. Bit: 8 bits

Parity: Odd

Stop Bit: 1 bit

Terminator: Setting disable

Header: Setting disable

No. 415 Baud rate setting

The default setting for the baud rate is "9600 bps". Set the value to match the external device connected to the communication port. Select one of the values from "2400, 4800, 9600, 19200, 38400, 57600 and 115200 bps".

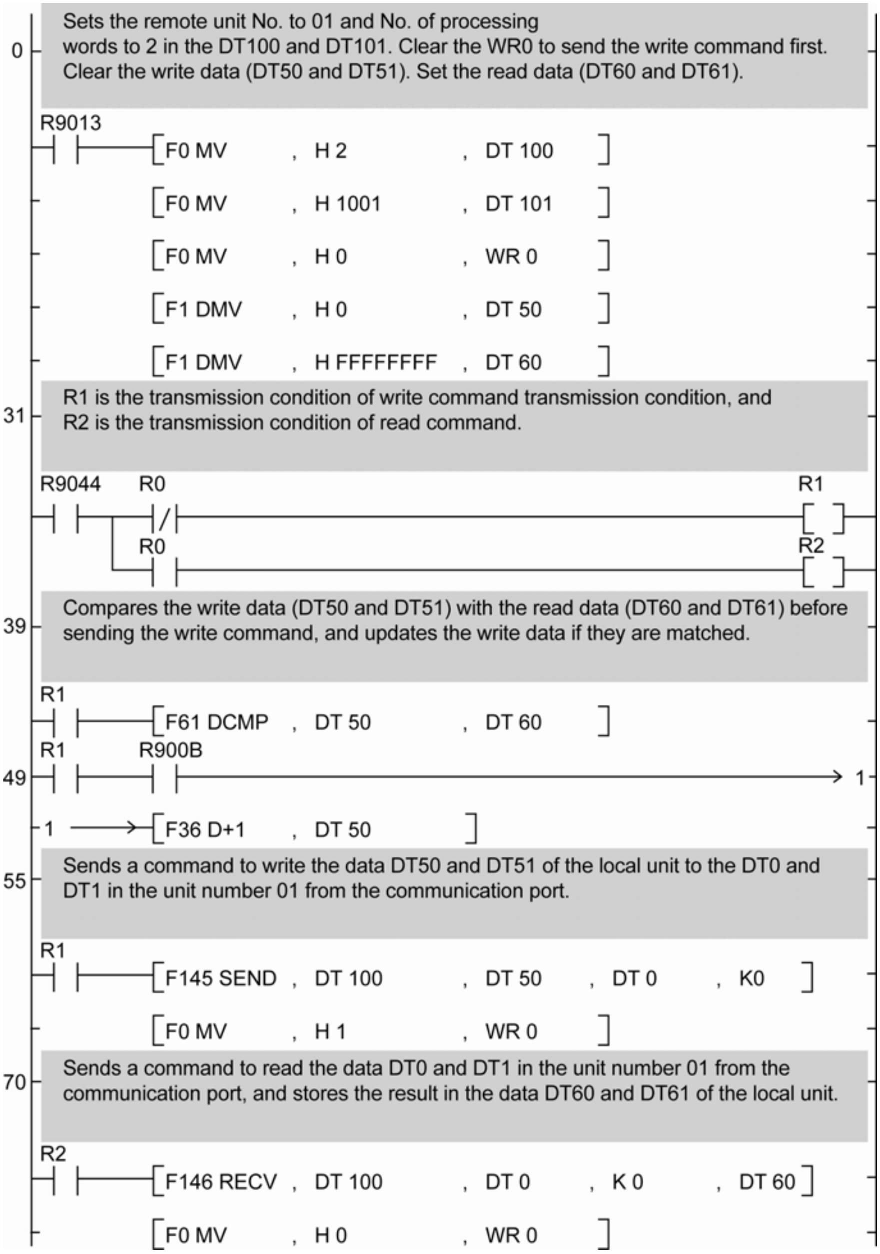
For information on F145 (SEND) and F146 (RECV) instructions

Reference: <Programming Manual ARCT1F353E>

7.7.3 MODBUS Master

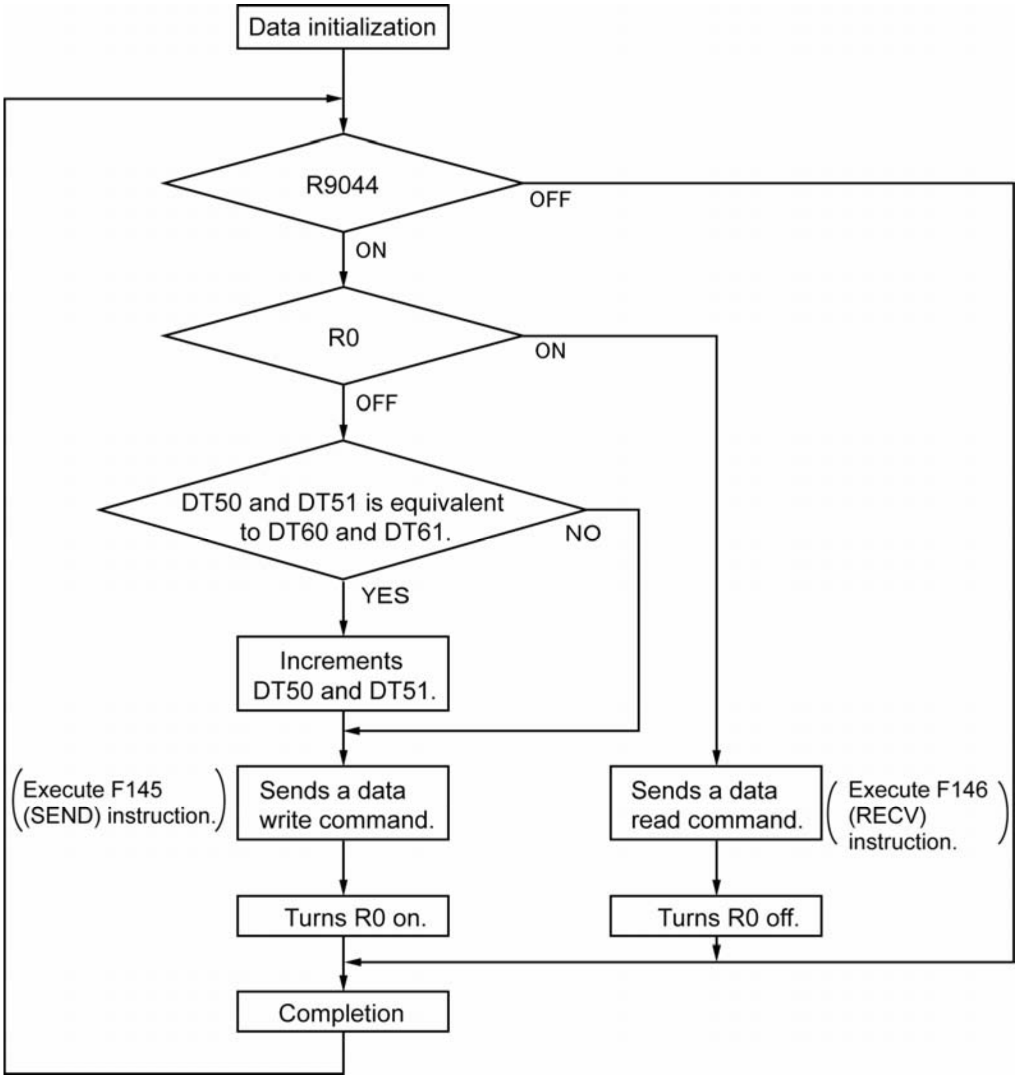
Use the F145 (SEND) “Data send” or F146 (RECV) “Data receive” instruction to use the MODBUS master function.

Sample program



Reference: For the information on the F145(SEND) and F146(RECV) instructions, <Programming Manual ARCT1F313E>

Flow chart

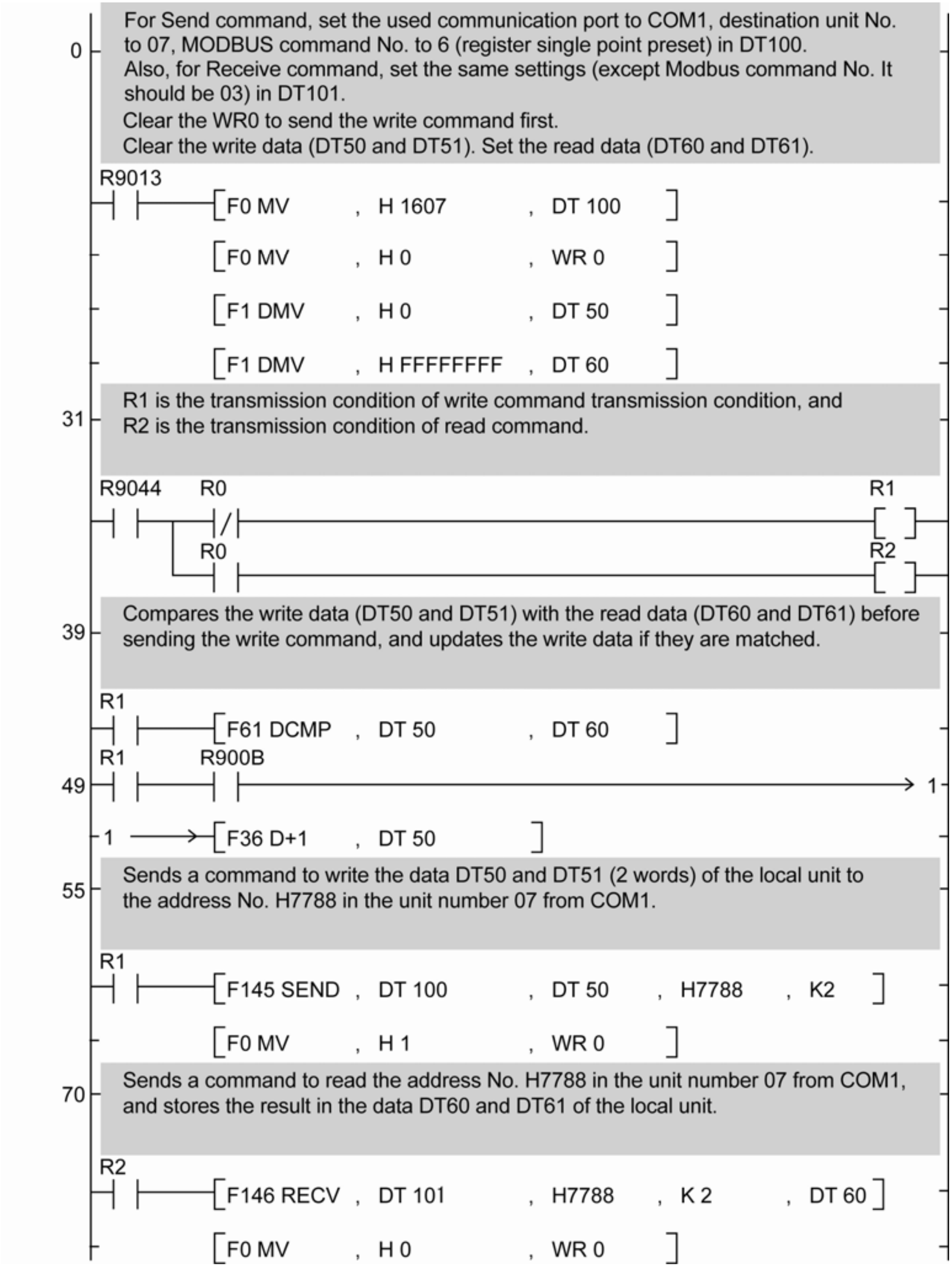


The above program executes the operation 1 to 3 repeatedly.

1. Updates the write data if the write data (DT50 and DT51) and the read data (DT60 and DT61) are matched.
2. Writes the DT50 and DT51 of the local unit into the data DT0 and DT1 in the unit number 1 from the COM (RS232C) port.
3. Reads the data DT0 and dT1 in the unit number 1 into the data DT60 and DT61 of the local unit from the COM (RS232C) port.

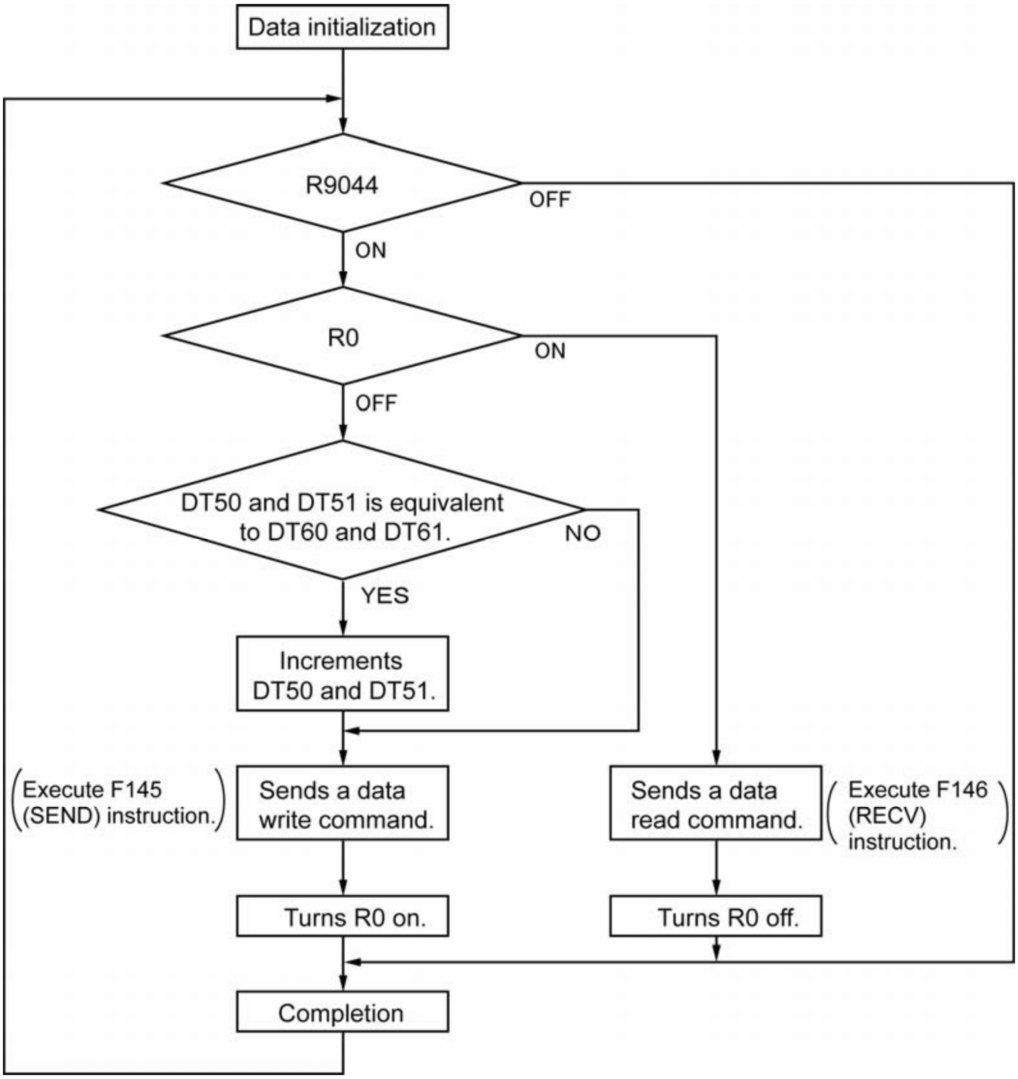
Sample program (For Type II)

Use a program as below to directly specify a MODBUS address.



Reference: For the information on the F145(SEND) and F146(RECV) instructions, <Programming Manual ARCT1F313E>

Flow chart (For Type II)



The above program executes the operation 1 to 3 repeatedly.

1. Updates the write data if the write data (DT50 and DT51) and the read data (DT60 and DT61) are matched.
2. Writes the DT50 and DT51 of the local unit into the data No. H7788 in the unit number 07 from the COM (RS232C) port.
3. Reads the data No. H7788 in the unit number 07 into the data DT60 and DT61 of the local unit from the COM (RS232C) port.

Chapter 8

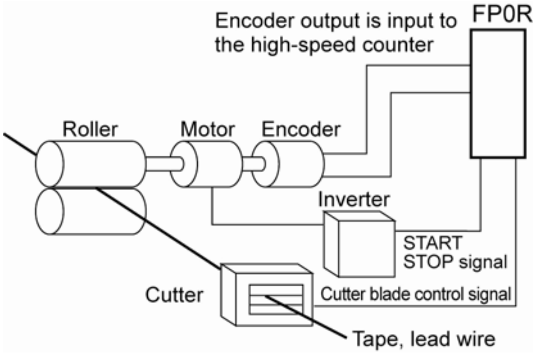
High-speed counter, Pulse Output and PWM Output functions

8.1 Overview of Each Functions

8.1.1 Three Pulse Input/Output Functions

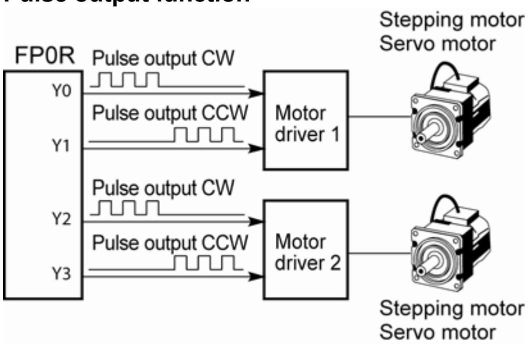
There are three functions available when using the high-speed counter built into the FP0R.

High-speed counter function



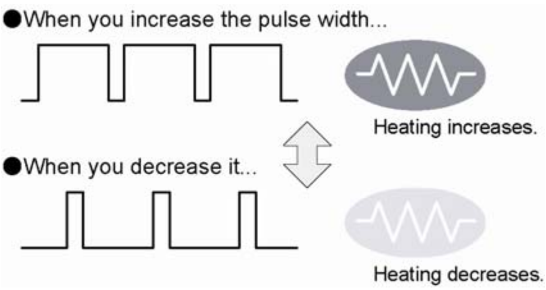
The high-speed counter function counts external inputs such as those from sensors or encoders. When the count reaches the target value, this function turns on/off the desired output.

Pulse output function



Combined with a commercially available motor driver, the function enables positioning control. With the exclusive instruction, you can perform trapezoidal control, home return, and JOG operation.

PWM output function



By using the exclusive instruction, the PWM output function enables a pulse output of the desired duty ratio.

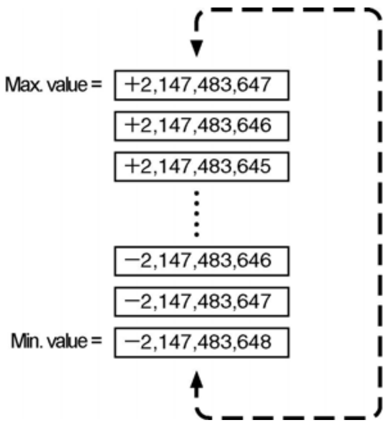
8.1.2 Performance of Built-in High-speed Counter

Number of Channel

- There are six channels for the built-in high-speed counter
- The channel number allocated for the high-speed counter will change depending on the function being used.

Counting range

- K-2, 147, 483, 648 to K+2, 147, 483, 647 (Coded 32-bit binary)
- The built-in high-speed counter is a ring counter. Consequently, if the counted value exceeds the maximum value, it returns to the minimum value. Similarly, if the counted value drops below the minimum value, it goes back to the maximum value and continues counting from there.



Note:

When the linear interpolation instruction F175 is used, the value for the target value or the amount of travel should be set so that it is within the range indicated below.
-8,388,608 to +8,388,607 (Coded 24-bit binary)

8.2 Function Specifications and Restricted Items

8.2.1 Specifications

High-speed counter function

High-speed counter channel No.		Input/output contact No. being used: Input contact number (value in parenthesis is reset input) Note1)	Memory area being used: Control flag	Memory area being used: Elapsed value area	Memory area being used: Target value area	Performance specifications: Mini-mum input pulse width Note2)	Performance specifications: Maximum counting speed
[Single phase] Incremental, Decremental	CH0	X0 (X2)	R9110	DT90300 to DT90301	DT90302 to DT90303	10µs	6CH: 50 kHz
	CH1	X1 (X2)	R9111	DT90304 to DT90305	DT90306 to DT90307		
	CH2	X3 (X5)	R9112	DT90308 to DT90309	DT90310 to DT90311		
	CH3	X4 (X5)	R9113	DT90312 to DT90313	DT90314 to DT90315		
	CH4 Note3)	X6 (None)	R9114	DT90316 to DT90317	DT90318 to DT90319		
	CH5 Note3)	X7 (None)	R9115	DT90320 to DT90321	DT90322 to DT90323		
[2-phase] 2-phase input One input, Direction distinction	CH0	X0 X1 (X2)	R9110	DT90300 to DT90301	DT90302 to DT90303	25µs	1CH: 15kHz 2CH: 15kHz 3CH: 10kHz
	CH2	X3 X4 (X5)	R9112	DT90308 to DT90309	DT90310 to DT90311		
	CH4 Note3)	X6 X7 (None)	R9114	DT90316 to DT90317	DT90318 to DT90319		

Related instructions:

F0(MV) :High-speed counter control
F1(DMV) :Read/write of elapsed value of high-speed counter
F165(CAM0): CAM control
F166(HC1S) :Target value match on
F167(HC1R) :Target value match off
F178(PLSM): Input pulse measurement

Note1) Reset input X2 can be set to either CH0 or CH1. Reset input X5 can be set to either CH2 or CH3.

Note2) **Reference**: For information on minimum input pulse width, see <8.3.3 Minimum Input Pulse Width>.

Note3) It is not available for C10 type.

Note4) The maximum counting speed is the values when execucing the conditions of each item (counting method or number of channels) only.
They are the values when not executing the HSC match on/off instruction and other pulse I/O process simultaneously, or not execuitng an interrupt program.

Pulse output function

High-speed counter channel No.			Input/output contact number used: CW or pulse output	CCW or sign output	Deviation counter clear output	Home input	Near home input Note2)
Independence	CH0		Y0	Y1	Y6 or Y8 Note3)	X4	DT90052 <bit4>
	CH1		Y2	Y3	Y7 or Y9 Note3)	X5	
	CH2		Y4	Y5	None or YA	X6	
	CH3		Y6	Y7	None or YB	X7	
Linear Interpolation	CH0	X axis	Y0	Y1	Y6 or Y8 Note3)	X4	
		Y axis	Y2	Y3	Y7 or Y9 Note3)	X5	
	CH1	X axis	Y4	Y5	None or YA	X6	
		Y axis	Y6	Y7	None or YB	X7	

High-speed counter channel No.			Memory area used: Position control starting input	Pulse output instruction flag	Elapsed value area	Target value area	Target area for match on/off
Independence	CH0		X0	R9120	DT90400 to DT90401	DT90402 to DT90403	DT90404 to DT90405
	CH1		X1	R9121	DT90410 to DT90411	DT90412 to DT90413	DT90414 to DT90415
	CH2		X2	R9122	DT90420 to DT90421	DT90422 to DT90423	DT90424 to DT90425
	CH3		X3	R9123	DT90430 to DT90431	DT90432 to DT90433	DT90434 to DT90435
Linear Interpolation	CH0	X axis	-	R9120	DT90400 to DT90401	DT90402 to DT90403	DT90404 to DT90405
		Y axis		R9121	DT90410 to DT90411	DT90412 to DT90413	DT90414 to DT90415
	CH1	X axis		R9122	DT90420 to DT90421	DT90422 to DT90423	DT90424 to DT90425
		Y axis		R9123	DT90430 to DT90431	DT90432 to DT90433	DT90434 to DT90435

Max. output frequency
-No change of speed, 4CH: 50 kHz
-Using linear interpolation: 2H: 50 kHz

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(HC1R) :Target value match off
F171 (SPDH) :trapezoidal control/JOG positioning
F172 (PLSH) :JOG operation
F174 (SP0H) :Data table control
F175 (SPSH) :Linear interpolation control
F177 (HOME) :Home return

Note1) The pulse output function is only available with the transistor output type.

Note2) **Reference**: For DT90052, see <8.4.4 Pulse Output Control Instruction (F0) (F1)>.
Note3) For C16 type, Y6(CH0) and Y7(CH1). For C32 type, Y8(CH0) and Y9(CH1).
Note4) The maximum frequencies are the values when execuing the conditions of each item (output method or number of channels) only.
They are the values when not executing the change of speed or match on/off instruction and other pulse I/O process simultaneously, or not execuitng an interrupt program.

PWM output function

High-speed counter channel No.	Output contact No. used	Pulse output instruction flag	Output frequency (duty)	Related instructions
CH0	Y0	R9120	Frequency: 6 Hz to 4.8 kHz 0.0% to 99.9% (Resolution: 1000)	F0(MV) (High-speed counter control) F173(PWMH) (PWM output)
CH1	Y2	R9121		
CH2	Y4	R9122		
CH3	Y6	R9123		

Note) The PWM output function is only available with the transistor output type.

Memo

8.2.2 Functions Used and Restrictions

Simplified chart - Maximum counting speed of High-speed counter

The maximum counting speed of the high-speed counter varies according to No. of channels to be used or the simultaneous use of the pulse output function. Use the chart below as a guide.

Combination of high-speed counter									Max. counting speed (Frequency kHz) Combination with pulse output function (Trapezoidal control, No change in speed 50kHz)			
									No pulse output		Pulse output 1 CH	
Single-phase						2-phase			Single-phase	2-phase	Single-phase	2-phase
CH0	CH1	CH2	CH3	CH4	CH5	CH0	CH2	CH4				
A						-			50	-	50	-
A	A								50		50	
A	A	A							50		50	
A	A	A	A						50		50	
A	A	A	A	A					50		40	
A	A	A	A	A	A				50		40	
-						A			-	15	-	14
						A	A			15		10
						A	A	A		10		10
		A				A			50	15	50	14
		A	A			A			50	15	50	14
		A	A	A		A			50	15	50	14
		A	A	A	A	A			50	15	50	14
				A		A	A		50	15	50	10
				A	A	A	A		50	15	50	10
A								A	50	15	50	12
A	A							A	50	13	50	12
A	A	A						A	50	12	50	11
A	A	A	A					A	50	12	50	9
A							A	A	50	13	50	10
A	A						A	A	50	12	50	10

Note) The maximum counting speed may be lower than the above-mentioned values when the change of pulse output speed, CAM control instruction, target value match ON/OFF instruction and other interrupt programs are executed simultaneously.

Max. counting speed (Frequency kHz)					
Combination with pulse output function (Trapezoidal control, No change in speed 50kHz)					
Pulse output 2 CH		Pulse output 3 CH		Pulse output 4 CH	
Single-phase	2-phase	Single-phase	2-phase	Single-phase	2-phase
50	-	50	-	30	-
50		35		25	
50		30		20	
40		30		20	
35		29		20	
30		24		15	
-	10	-	10	-	10
	9		8		8
	9		8		8
50	10	44	10	30	10
50	10	40	10	28	10
44	10	30	10	25	10
35	10	25	10	20	10
50	9	35	8	28	8
40	9	30	8	25	8
50	10	50	10	40	8
50	10	45	8	35	7
50	9	40	8	30	7
50	8	35	8	30	7
50	10	50	8	40	8
50	9	45	8	35	7

Note) The maximum counting speed may be lower than the above-mentioned values when the change of pulse output speed, CAM control instruction, target value match ON/OFF instruction and other interrupt programs are executed simultaneously.

FP0R pulse output performance

Independent control

Single-phase				Maximum output frequency kHz
CH0	CH1	CH2	CH3	
Available				50
Available	Available			50
Available	Available	Available		50
Available	Available	Available	Available	50

Note) Even if all channels are used, they can be used within the ranges above.

Interpolation control

Linear interpolation		Maximum output frequency kHz (Composite speed)
CH0	CH2	
Available		50
Available	Available	50

Note) Even if all channels are used for the interpolation function, they can be used within the ranges above.

Note) The maximum counting speed may be lower than the above-mentioned values when the change of pulse output speed, CAM control instruction, target value match ON/OFF instruction and other interrupt programs are executed simultaneously.

8.3 High-speed Counter Function

8.3.1 Overview of High-speed Counter Function

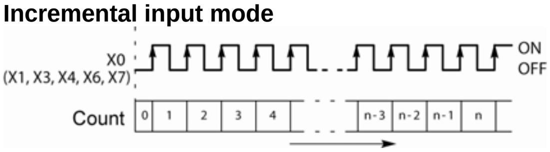
- The high-speed counter function counts the input signals, and when the count reaches the target value, turns on and off the desired output.
- To turn on an output when the target value is matched, use the target value match ON instruction F166 (HC1S). To turn off an output, use the target value match OFF instruction F167 (HC1R).
- Preset the output to be turned on and off with the SET/RET instruction.

Setting the system register

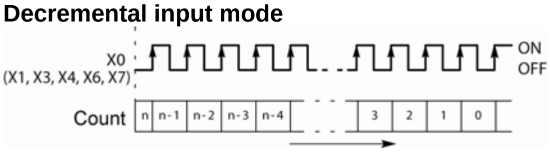
In order to use the high-speed counter function, it is necessary to set system register numbers nos. 400 and 401.

8.3.2 Input Modes and Count

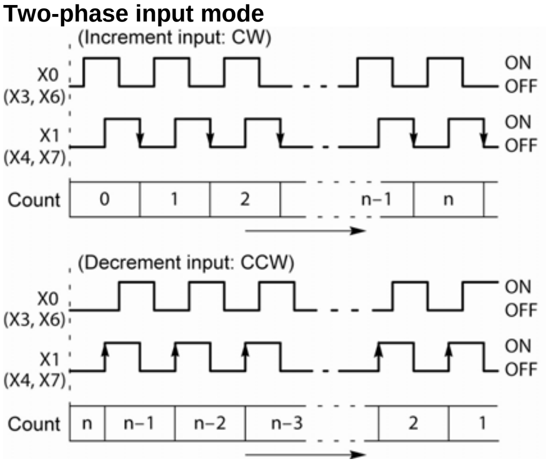
Incremental input mode



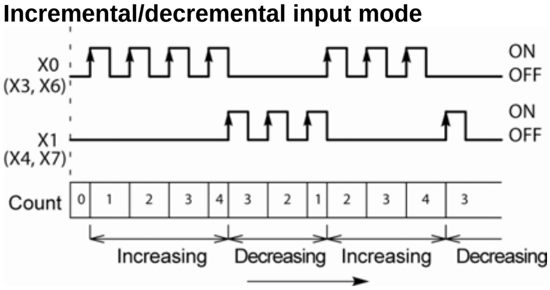
Decremental input mode



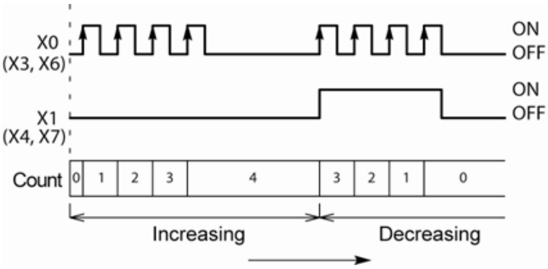
Two-phase input mode



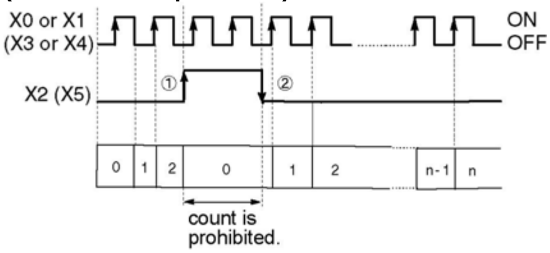
Incremental/decremental input mode



Direction discrimination



Count for reset input
(Incremental input mode)

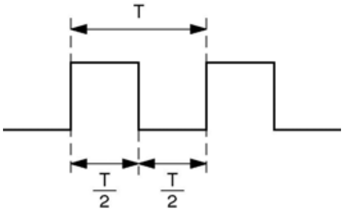


The reset input is executed by the interruption at (1) on (edge) and (2) off (edge).
(1) on (edge) … Count disable, Elapsed value clear
(2) off (edge) … Count enable
DT90052 (bit2): “able/disable” setting of the input can be set by the reset input.

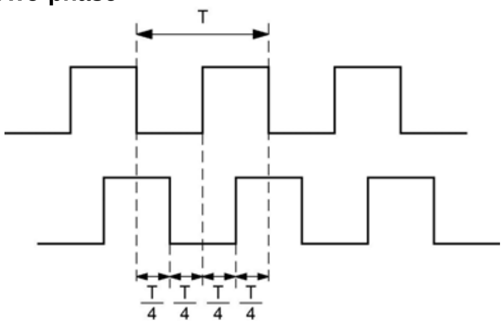
8.3.3 Minimum Input Pulse Width

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>



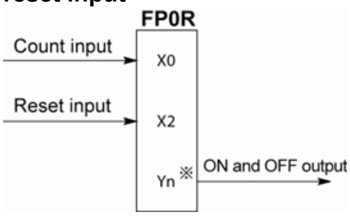
<Two-phase>



8.3.4 I/O Allocation

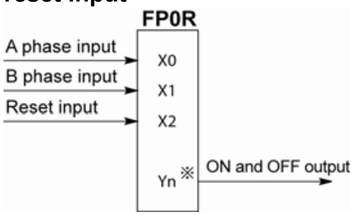
- As shown in the table in the previous section “8.2.1”, the inputs and outputs used will differ depending on the channel number being used.
- The output turned on and off can be specified from Y0 to Y7 as desired with instructions F166 (HC1S) and F167 (HC1R).

When using CH0 with incremental input and reset input



* The output turned on and off when the target value is reached can be specified from Y0 to Y7 as desired.

When using CH0 with two-phase input and reset input



* The output turned on and off when the target value is reached can be specified from Y0 to Y7 as desired.

Reference: <8.2.1 Table of Specifications>

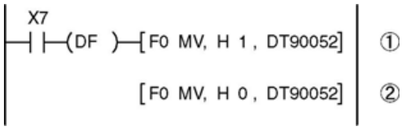
8.3.5 Instructions used with High-speed Counter Function

High-speed counter control instruction (F0)
- This instruction is used for counter operations such as software reset and count disable.
- Specify this instruction together with the special data register DT90052.
- Once this instruction is executed, the settings will remain until this instruction is executed again.

Operations that can be performed with this instruction
- Counter software reset (bit0)
- Counting operation enable/disable (bit1)
- Hardware reset enable/disable (bit2)
- Clear high-speed counter instructions F166 to F167
- Clear target value match interrupt

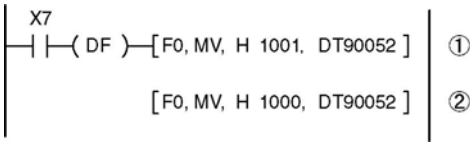
Example: Performing a software reset

In case of CH0

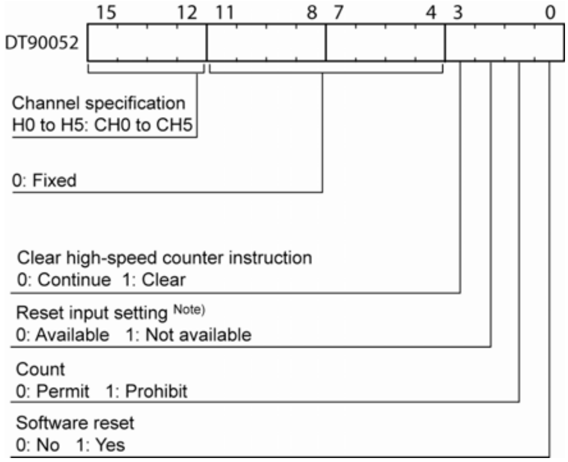


In the above program, the reset is performed in step (1) and 0 is entered just after that in step (2). The count is now ready for operation. If it is only reset, counting will not be performed.

In case of CH1



High-speed counter/pulse output control flag area of FP0R



- The area DT90052 for writing channels and control codes is allocated as shown in the left figure.
- Control codes written with an F0 (MV) instruction are stored by channel in special data registers DT90370 to DT90375.

Note) In the reset input setting, the reset input (X2 or X5) allocated in the high-speed counter setting of the system registers are defined to “enable/disable”.

High-speed counter control flag monitor area

Channel No.	Control code flag monitor area
CH0	DT90370
CH1	DT90371
CH2	DT90372
CH3	DT90373
CH4	DT90374
CH5	DT90375

Elapsed value write and read instruction (F1)

- This instruction writes or reads the elapsed value of the high-speed counter.
- Specify this instruction together with the elapsed value area of high-speed counter after the special data register DT90300.
- If the F1 (DMV) instruction is executed specifying DT90300, the elapsed value will be stored as 32-bit data in the combined area of special data registers DT90300 and DT90301.
- Use this F1 (DMV) instruction to set the elapsed value.

Example 1: Writing the elapsed value

```
 X7
-| |-(DF )-[F1 DMV, K3000, DT90044 ]
```

Set the initial value of K3000 in the high-speed counter.

Example 2: Reading the elapsed value

```
 X7
-| |-(DF )-[F1 DMV, DT90044, DT100 ]
```

Read the elapsed value of the high-speed counter and copies it to DT100 and DT101.

Target value match ON instruction (F166)

Example 1:

```
 XA
-| |-(DF )-[F166 HC1S, K0, K10000, Y7]
```

If the elapsed value (DT90300 and DT90301) for channel 0 matches K10000, output Y7 turns on.

Example 2:

```
 XB
-| |-(DF )-[F166 HC1S, K2, K20000, Y6]
```

If the elapsed value (DT90308 and DT90309) for channel 2 matches K20000, output Y6 turns on.

Target value match OFF instruction (F167)

Example 1:

```
 XC
-| |-(DF )-[F167 HC1R, K1, K30000, Y4]
```

If the elapsed value (DT90304 and DT90305) for channel 1 matches K30000, output Y4 turns off.

Example 2:

```
 XD
-| |-(DF )-[F167 HC1R, K3, K40000, Y5]
```

If the elapsed value (DT90312 and DT90313) for channel 3 matches K40000, output Y5 turns off.

Input pulse measurement instruction (F178)

```
 R9013
-| |----[ F0 MV, H 150, DT100 ]

      [ F0 MV, K 10, DT101 ]
 R3
-| |------[ F178 PLSM, DT100, DT101, DT200 ]
```

High-speed counter channel: 0
No. of moving average: 5
Unit of pulse period measurement: 1us
Period of counting the number of pulses: 10 ms

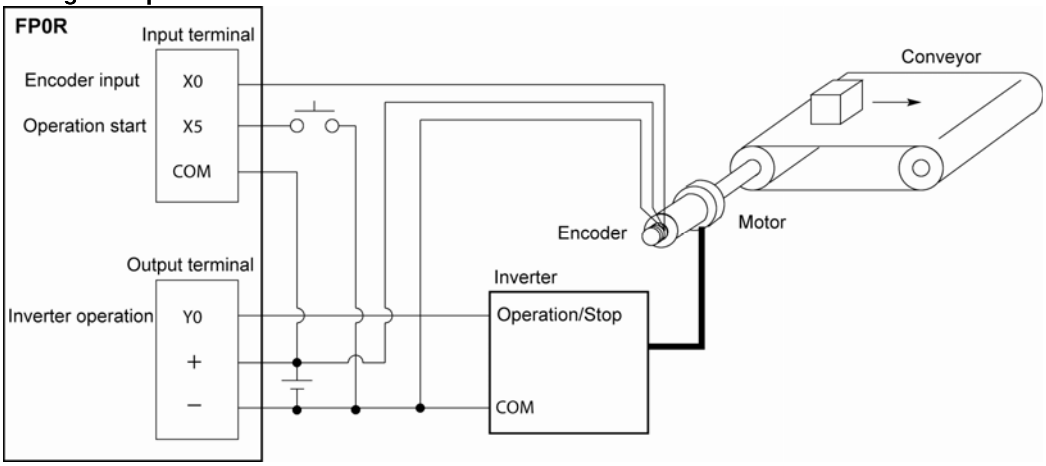
Stores;
No. of pulses (moving average value) in DT200 to DT201
No. of pulses (in 1us unit) in DT202 to DT203
No. of pulses (in 1ms unit) in DT204 to DT205.
* In this example, "No. of pulses in 1ms unit" is 0 ms.

Note) The last numbers of the actual measured values may vary due to the measurement error.

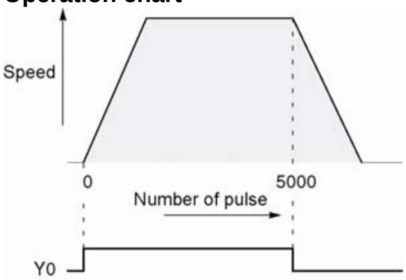
8.3.6 Sample program

Positioning operations with a single speed inverter

Wiring example



Operation chart

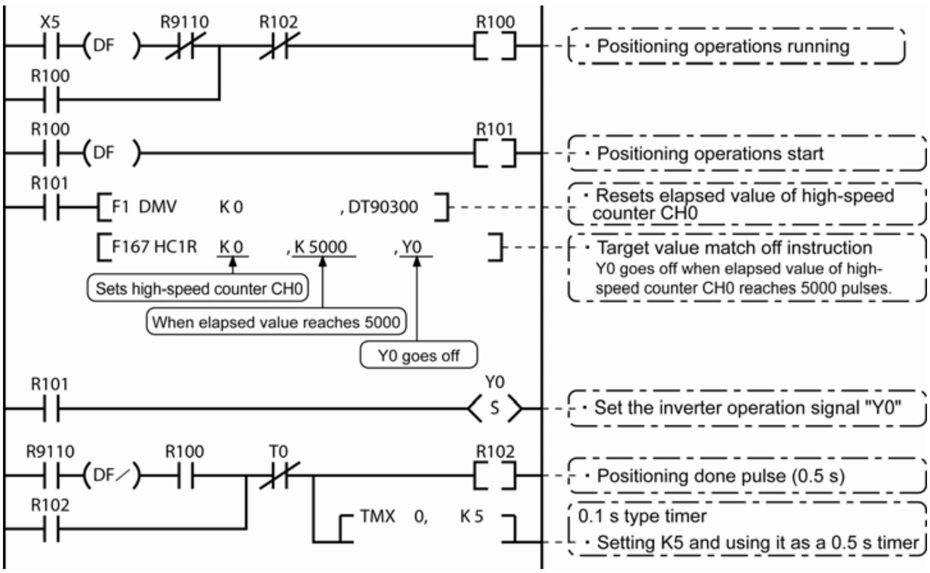


I/O allocation

I/O No.	Description
X0	Encoder input
X5	Operation start signal
Y0	Inverter operation signal
R100	Positioning operation running
R101	Positioning operation start
R102	Positioning done pulse
R9110	High-speed counter CH0 control flag

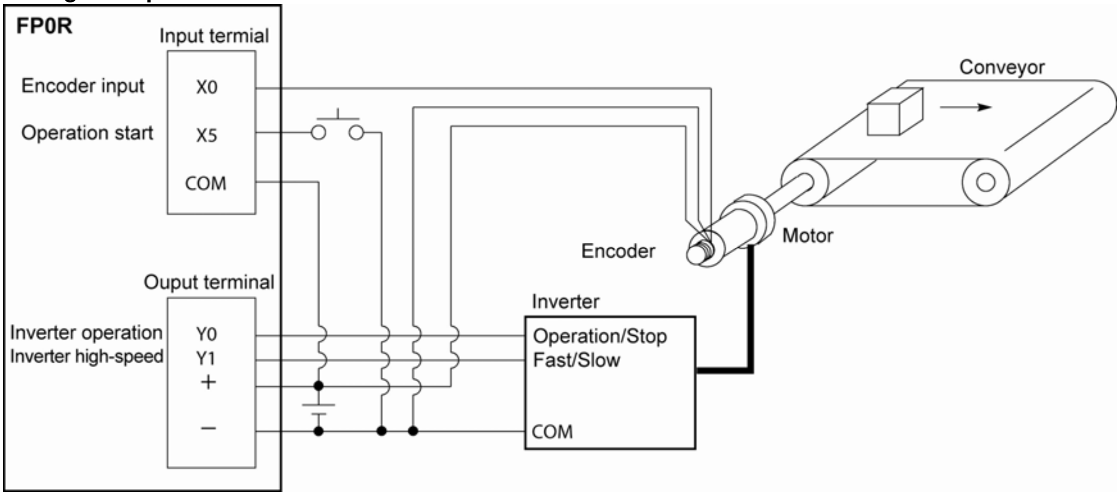
Program

When X5 is turned on, Y0 turns on and the conveyor begins moving. When the elapsed value (DT90300 and DT90301) reaches K5000, Y0 turns off and the conveyor stops.

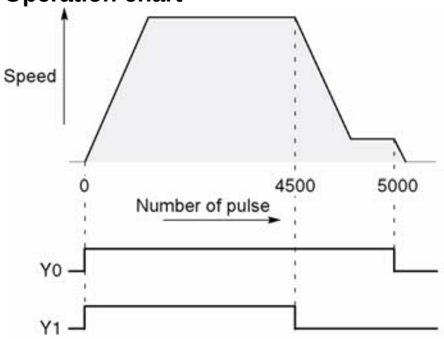


Positioning operations with a double speed inverter

Wiring example



Operation chart

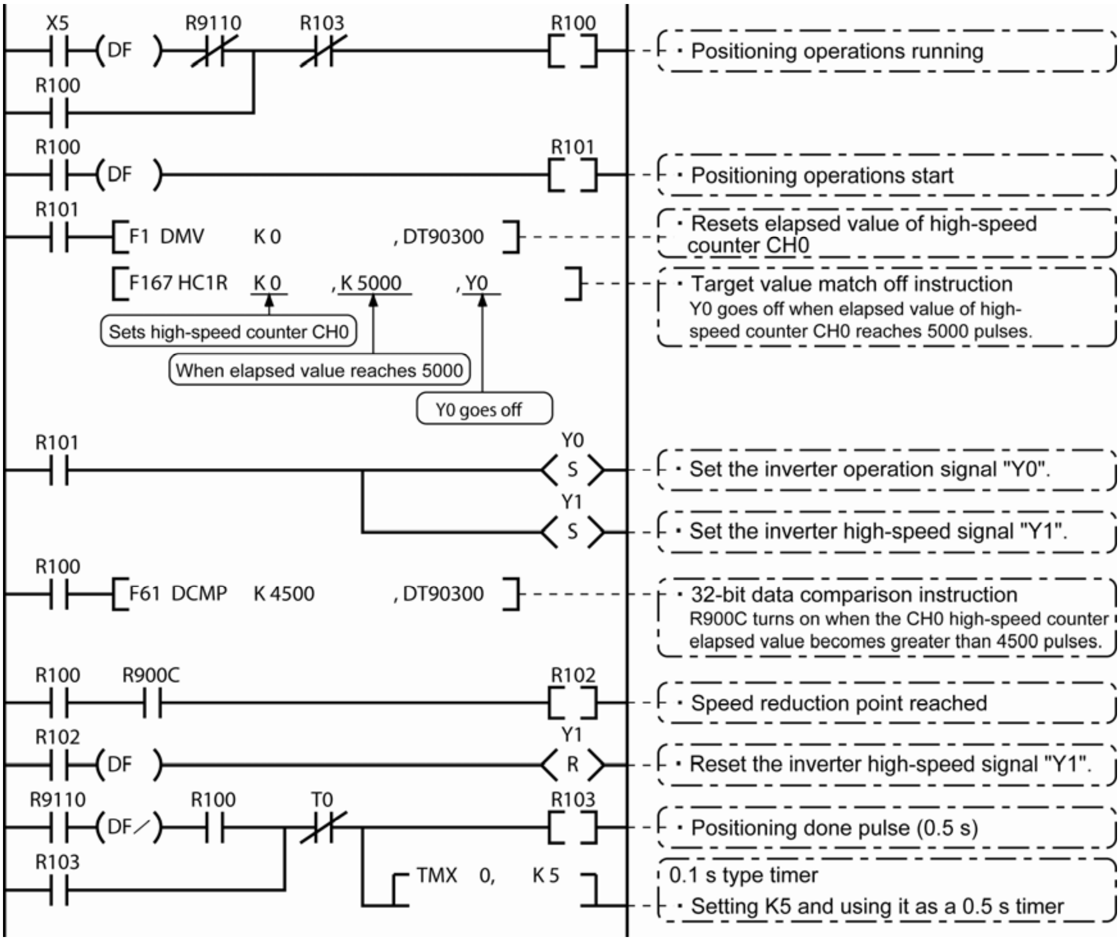


I/O allocation

I/O No.	Description
X0	Encoder input
X5	Operation start signal
Y0	Inverter operation signal
Y1	Inverter high-speed signal
R100	Positioning operation running
R101	Positioning operation start
R102	Arrival at deceleration point
R103	Positioning done pulse
R900C	Comparison instruction <flag>
R9110	High-speed counter CH0 control flag

Program

When X5 is turned on, Y0 and Y1 turn on and the conveyor begins moving. When the elapsed value (DT90300 and DT90301) reaches K4500, Y1 turns off and the conveyor begins decelerating. When the elapsed value reaches K5000, Y0 turns off and the conveyor stops.



8.4 Pulse Output Function

8.4.1 Overview of Pulse Output 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	Exclusive instru- ction	Description
Trapezoidal control	F171	Provides trapezoidal (table-shaped) control for automatically obtaining pulse outputs by specifying the initial speed, target speed, acceleration time, deceleration time and target value.
JOG positioning	F171	Outputs the specified pulses and performs the deceleration stop according to the position control starting input during the pulse output (JOG operation).
JOG operation	F172	Causes pulses to be output as long as the execution condition is on. The change in the target speed while pulses being output or deceleration stop can be performed.
Data table control	F174	Enables positioning control in accordance with the specified data table.
Linear interpolation	F175	Enables the linear interpolation control, by specifying the composite speed, acceleration time, deceleration time, X-axis target value and Y-axis target value.
Home return	F177	Enables automatic home return operation.

Note:

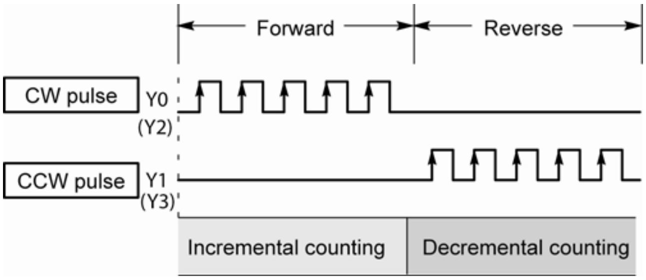
The pulse output function can be used with the transistor output type only.

Setting the system register

When using the pulse output function, set the channels corresponding to system registers 400 and 401 to “Do not use high-speed counter”.

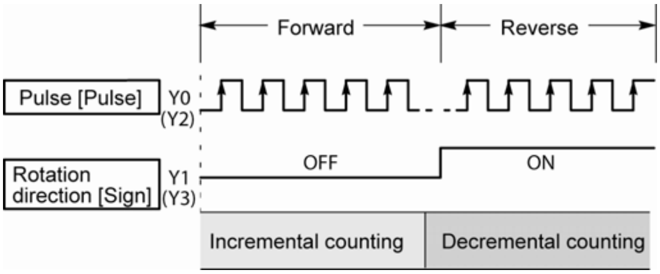
8.4.2 Types of Pulse Output Method and Operation Modes

Clockwise/counter-clockwise output method



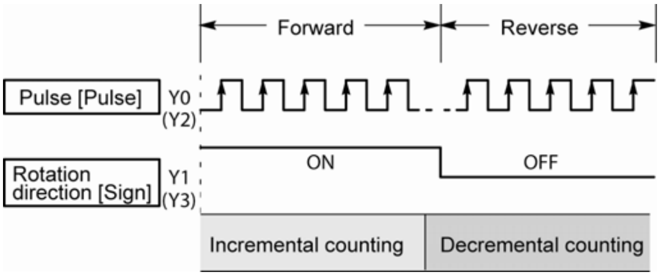
Control is carried out using two pulses: a forward rotation pulse and a reverse rotation pulse.

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 signals is ON.

Operation mode

Incremental <Relative value control>

Outputs the pulses set with the target value.

Selected Mode / Target value	CW/CCW	Pulse and direction forward OFF/ reverse ON	Pulse and direction forward ON/ reverse OFF	HSC 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:

When the current position (value of elapsed value area) is 5000, the pulse of 1000 is output from CW by executing the pulse output instruction with the target value +1000, and the current position will be 6000.

Absolute <Absolute value control>

Outputs a number of pulses equal to the difference between the set target value and the current value.

Selected Mode / Target value	CW/CCW	Pulse and direction forward OFF/ reverse ON	Pulse and direction forward ON/ reverse OFF	HSC 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:

When the current position (value of elapsed value area) is 5000, the pulse of 4000 is output from CCW by executing the pulse output instruction with the target value +1000, and the current position will be 1000.

Home return

- When executing the F177 (HOME) instruction, the pulse is continuously output until the home input (X4, X5, X6 or X7) 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 output when home return has been completed.

JOG operation

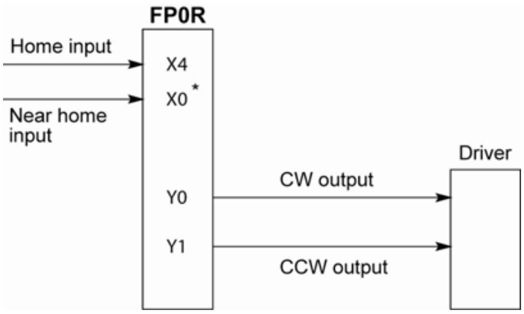
- Pulses are output from the specified channel while the trigger for F172 (PLSH) instruction is in the ON state. The change in the target speed while pulses being output or deceleration stop can be performed.
- The direction output and output frequency are specified by F172 (PLSH) instruction.

8.4.3 I/O Allocation

Double pulse input driver
(CW pulse input and CCW pulse input method)

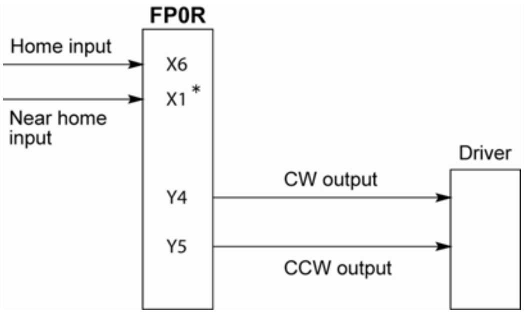
- Two output contacts are used as a pulse output for “CW, CCW”.
- The I/O allocation of pulse output terminal and home input is determined by the channel used.
- Set the control code for F171 (SPDH) instruction to “CW/CCW”.

<When using CH0>



* X0 or any other input can be specified for the near home input.

<When using CH2>

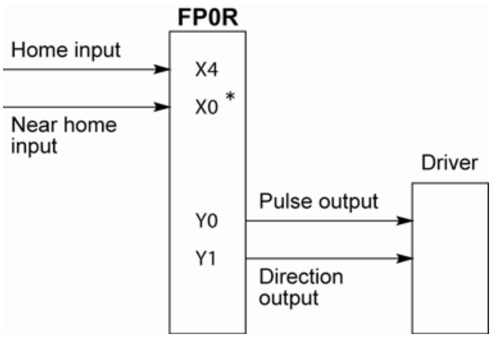


* X1 or any other input can be specified for the near home input.

Single pulse input driver
(pulse input and directional switching input method)

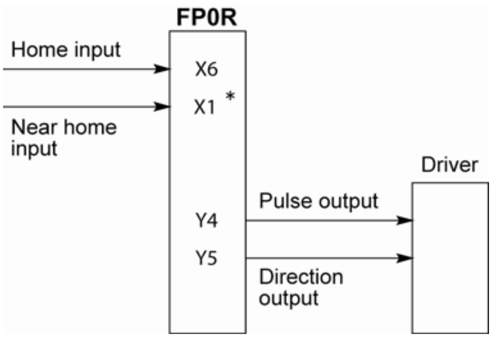
- One output point is used as a pulse output and the other output is used as a direction output.
- The I/O allocation of pulse output terminal, direction output terminal, and home input is determined by the channel used.
- Near home input is substituted by allocating the desired contact and turning on and off the <bit4> of special data register DT90052.
- Up to four driver systems can be connected.

<When using CH0>



* X0 or any other input can be specified for the near home input.

<When using CH2>



* X1 or any other input can be specified for the near home input.

Reference: <8.2.1 Table of Specifications>

8.4.4 Pulse output control instructions (F0) (F1)

Pulse output control instruction (F0)

- This instruction is used for resetting the built-in high-speed counter, stopping the pulse output, and setting and resetting the near home input.
- Specify this F0 (MV) instruction together with special data register DT90052.
- Once this instruction is executed, the settings will remain until this instruction is executed again.

Example 1:
Enable the near home input during home return operations and begin deceleration.
In case of CH0

```
X3
--| |--(DF )--[ F0 MV, H 110, DT90052]   ①

              [ F0 MV, H 100, DT90052]   ②
```

In case of CH2

```
X4
--| |--(DF )--[ F0 MV, H2110, DT90052]   ①

              [ F0 MV, H2100, DT90052]   ②
```

In these programs, the near home input is enabled in step (1) and 0 is entered just after that in step (2) to perform the preset operations.

Example 2:
Performing a forced stop of the pulse output.
In case of CH0

```
X7
--| |--(DF )--[F0 MV, H 108, DT90052]

              [F0 MV, H 100, DT90052]
```

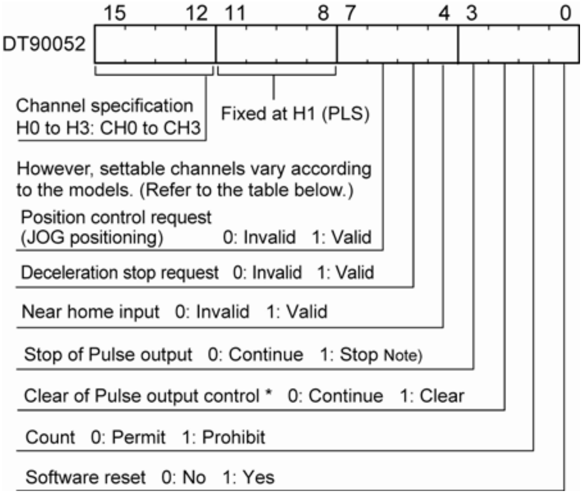
In case of CH2

```
X8
--| |--(DF )--[F0 MV, H2108, DT90052]

              [F0 MV, H2100, DT90052]
```

The output counting value of the elapsed value area may be different from the input counting value of the motor side if the forced stop is executed by these programs.

Key Point: : pulse output control flag area of FP0R



- The area DT90052 for writing channels and control codes is allocated as shown in the left figure.
- Control codes written with an F0 (MV) instruction are stored by channel in special data register DT90380 to DT90383.

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.

* The pulse output control is available when controlling the pulse output ch with F166(HC1S) or F167(HC1R) instruction.

Pulse output control flag monitor area

Channel No.	Control code monitor area
CH0	DT90380
CH1	DT90381
CH2	DT90382
CH3	DT90383

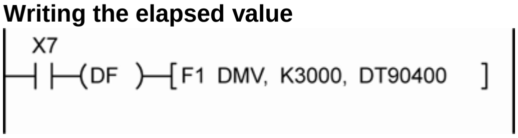
Reference: <8.2.1 Table of specifications> for information on the special data register.

Elapsed value write and read instruction (F1)

- This instruction is used to read the pulse number counted by the pulse output control.
- Specify this F1 (DMV) instruction together with the pulse output elapsed value area after the special data register DT90400.
- If the F1 (DMV) instruction is executed specifying DT90400, the elapsed value will be stored as 32-bit data in the combined area of special data registers DT90400 and DT90401.
- Use only this F1 (DMV) instruction to set the elapsed value.

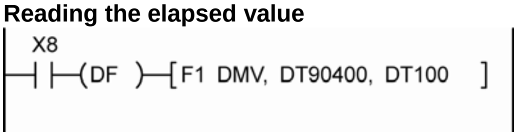
Example 1:

Writing the elapsed value



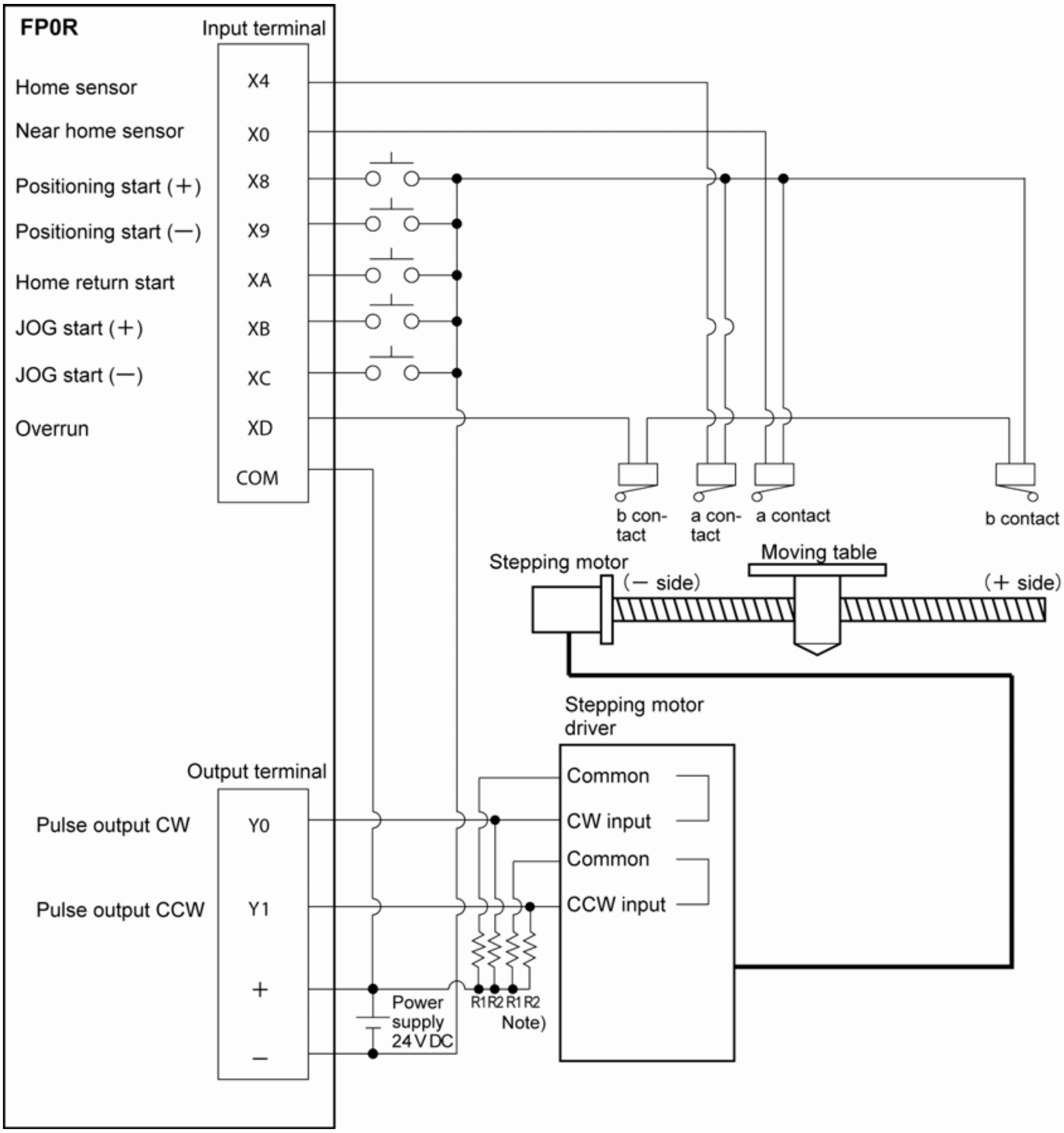
Set the initial value of K3000 for the pulse output CH0.

Reading the elapsed value



Reads the elapsed value of the pulse output CH0 to DT100 and DT101.

Wiring example



Note) When the stepping motor input is a 5 V optical coupler type, connect a resister of 2 kΩ (1/2 W) to R1, and connect a resistor of 2 kΩ (1/2 W) – 470 Ω (2 W) to R2.

Table of I/O allocation

I/O No.	Description	I/O No.	Description
X4	Home sensor input	**XD**	Overrunning signal
X0	Near home sensor input	**Y0**	Pulse output CW
X8	Positioning start signal (+)	**Y1**	Pulse output CCW
X9	Positioning start signal (-)	**R10**	Positioning in progress
XA	Home return start signal	**R11**	Positioning operation start
XB	JOG start signal (+)	**R12**	Positioning done pulse
XC	JOG start signal (-)	**R9110**	Pulse output instruction flag for CH0

8.4.5 Positioning Control Instruction F171 - Trapezoidal Control

This instruction automatically performs trapezoidal control according to the specified data table while the execution condition is on. The target speed can be changed during the trapezoidal control. (The total number of pulses to be output will not change.)
Also, it is possible to perform the deceleration stop duirng the control.
There are two kinds of control methoda, which are type 0 and type 1. When using the type 0, the speed can be changed regarding the initially specified target speed as the maximum value. When using the type 1, the speed can be changed in a range up to the maximum frequency.

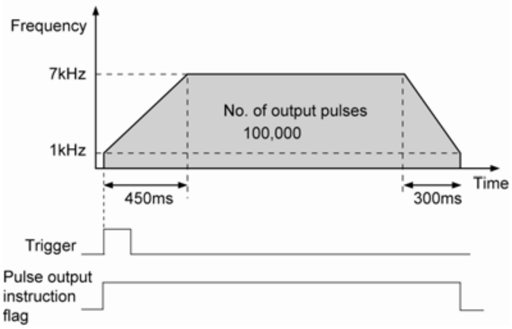
```
 R0
-| |---( DF )---[ F1 DMV, H10000000, DT0 ]
                [ F1 DMV, K1000, DT2     ]
                [ F1 DMV, K7000, DT4     ]
                [ F1 DMV, K450, DT6      ]
                [ F1 DMV, K300, DT8      ]
                [ F1 DMV, K100000, DT10  ]
 R1
-| |---( DF )---[ F171 SPDH, DT0, K0     ]
```

Pulses are output from Y0 at an initial speed of 1000 Hz, a target speed of 7000 Hz, an acceleration time of 450 ms, a deceleration time of 300 ms and a movement amount of 100,000 pulses.

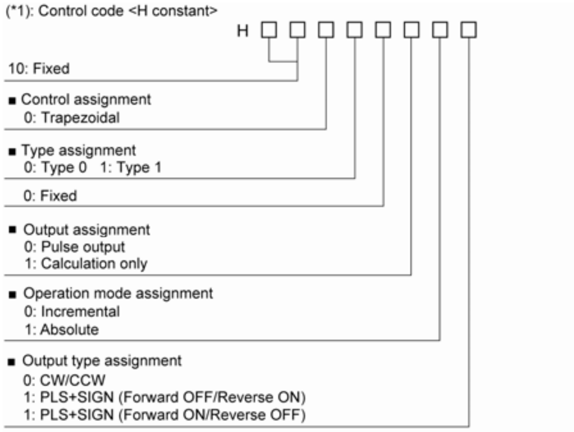
●Positioning data table

DT0	Control code *1	Trapezoidal control Incremental CW/CCW
DT2	Initial speed *2	1000 Hz
DT4	Max. speed *2	7000 Hz
DT6	Acceleration time *3	450 ms
DT8	Deceleration time *3	300 ms
DT10	Target value *4	100,000 pulses

●Pulse output diagram



(*1): Control code <H constant>



(*2) : Frequency (Hz) <K constant>
1 Hz to 50 kHz [K1 to K50000 (Unit: Hz)]

(*3) : Acceleration time and deceleration time <K constant>
K1 to K32760 (Unit: ms)
When using the type 0:
Acceleration time from the initial speed to the target speed, and deceleration time from the target speed to the initial speed
When using the type 1:
Acceleration time from the initial speed to the maximum speed 50 kHz, and deceleration time from the maximum speed 50 kHz to the initial speed

(*4) : Target value <K constant>
K-2147483648 to K2147483647

Note the following characteristics according to the specified initial speed.
1. When the initial speed is 1 or higher, and lower than 46Hz, the control up to the maximum frequency to the degree of 10kHz can be performed. If the frequency is higher than that, the speed error will be larger.
2. When the initial speed is 46 or higher, and lower than 184Hz, the control up to 50kHz can be performed.
3. When the initial speed is 184 or higher, the control up to 50kHz can be performed. The speed error around 50kHz will be smallest.

Change of speed during pulse output
1. With the type 0, if a value larger than the target speed at start-up is specified, it will be corrected to the target speed at start-up.
With the type 1, if the target value is set to a value larger than 50kHz, it will be corrected to 50kHz.
2. If the elapsed value crosses over the acceleration forbidden area starting position during accelerating, acceleration cannot be performed. For information on the acceleration forbidden area starting position, check with the special registers (from DT90400).
3. For deceleration, the speed cannot be lower than the deceleration minimum speed. For information on the deceleration minimum speed, check with the special registers (from DT90400).

Explanation of pulse output operation
Pulses are output using a duty of 25% fixedly.
When outputting with the PULSE+SIGN method, pulses will be output approx. 300μs later after the output of direction signal. (The characteristics of a motor driver is considered.)

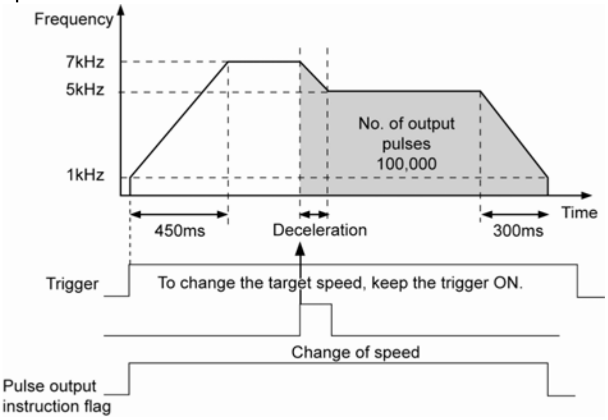
Operaiton mode of trapezoidal control

There are two operation modes for the FP0R trapezoidal control, which are type 0 and type 1. Those operation specifications vary when the target speed is changed during the trapezoidal control. For changing the target speed, the execution condition (trigger) should be on during the trapezoidal control. Also, it is possible for the both types to perform the deceleration stop control.

Type 0

The speed can be changed regarding the initially specified target speed as the maximum value during the trapezoidal control. (In the example below, the maixmum is 7 kHz.)

The acceleration time and deceleration time should be set to a time between the initial speed and target speed.



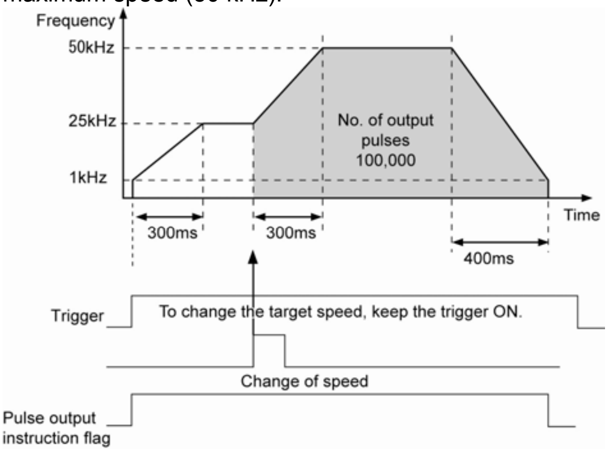
Data table

Control code	Trapezoidal control Incremental CW/CCW
Initial speed	1000 Hz
Target speed	7000 Hz → 5000 Hz
Acceleration time	450 ms
Deceleration time	300 ms
Target value	100,000 pulses

Type 1

The speed can be changed in the range up to the maximum frequency (50 kHz) during the trapezoidal control.

The acceleration time and deceleration time should be set to a time between the initial speed and maximum speed (50 kHz).

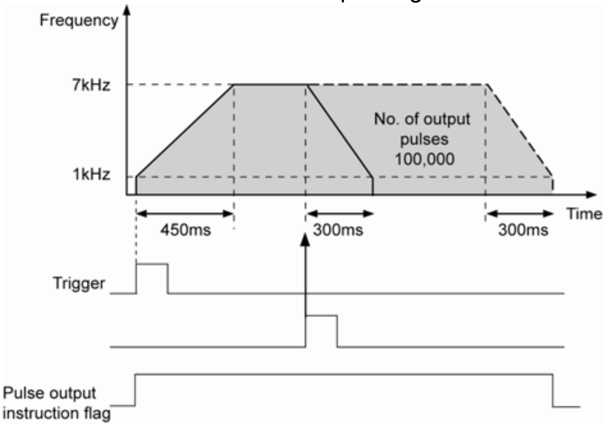


Data table

Control code	Trapezoidal control Incremental CW/CCW
Initial speed	1000 Hz
Target speed	25000 Hz → 50000 Hz
Acceleration time	600 ms
Deceleration time	400 ms
Target value	100,000 pulses

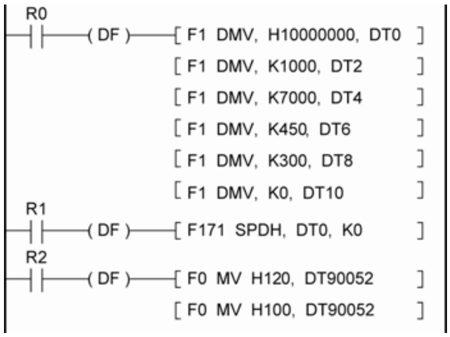
Deceleration stop

When the deceleration stop is requested during the trapezoidal control, deceleration will be performed with the slope specified for the deceleration time from the target speed.
Use the bit 5 of DT90052 for requesting the deceleration stop.



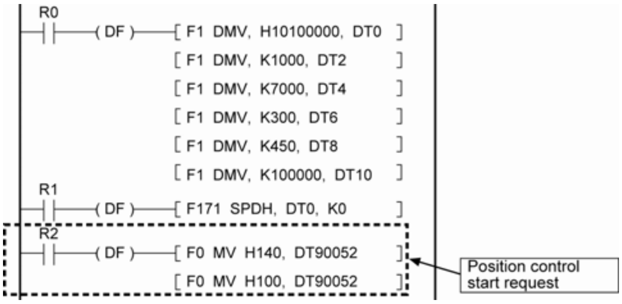
Data table

Control code	Trapezoidal control Incremental CW/CCW
Initial speed	1000 Hz
Target speed	7000 Hz
Acceleration time	450 ms
Deceleration time	300 ms
Target value	100,000 pulses



8.4.6 JOG Positioning Type 0 (F171) Instruction

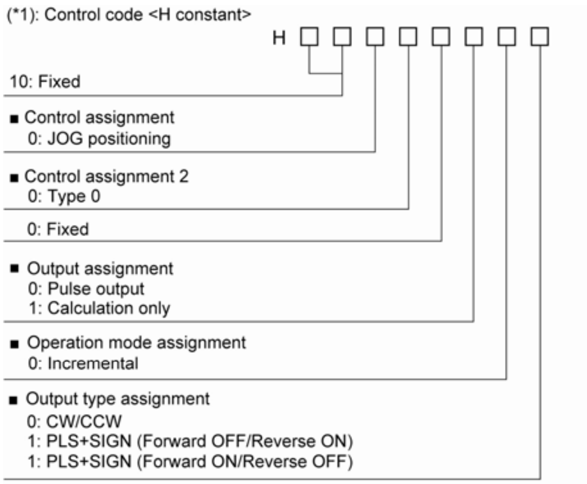
This instruction performs the deceleration stop outputting the specified number of pulses when the position control starting input is input externally or the position control start is requested internally during the pulse output. It is possible to change the target speed while the operation is running.



Pulses are output from Y0 at an initial speed of 1000 Hz, a target speed of 7000 Hz, an acceleration time of 300 ms, a deceleration time of 450 ms and a movement amount of 100,000 pulses.
During the pulse output, the number of pulses specified for the target value will be output from the time that the position control start is requested, and the deceleration stop will be performed.
When this program ie executed, the positioning table and the pulse output diagram will be as shown below.

Positioning data table

DT0	Control code *1	JOG positioning type 0 Incremental CW/CCW
DT2	Initial speed *2	1000 Hz
DT4	Target speed *2	7000 Hz
DT6	Acceleration time *3	300 ms
DT8	Deceleration time *3	400 ms
DT10	Target value *4	100,000 pulses



(*2) : Frequency (Hz) <K constant>
1 Hz to 50 kHz [K1 to K50000 (Unit: Hz)]

(*3) : Acceleration time and deceleration time <K constant>
K1 to K32760 (Unit: ms)
Acceleration time from the initial speed to the target speed, and deceleration time from the target speed to the initial speed

(*4) : Target value <K constant>
K-2147483648 to K2147483647

Note the following characteristics according to the specified initial speed.

1. When the initial speed is 1 or higher, and lower than 46Hz, the control up to the maximum frequency to the degree of 10kHz can be performed. If the frequency is higher than that, the speed error will be larger.
2. When the initial speed is 46 or higher, and lower than 184Hz, the control up to 50kHz can be performed.
3. When the initial speed is 184 or higher, the control up to 50kHz can be performed. The speed error around 50kHz will be smallest.

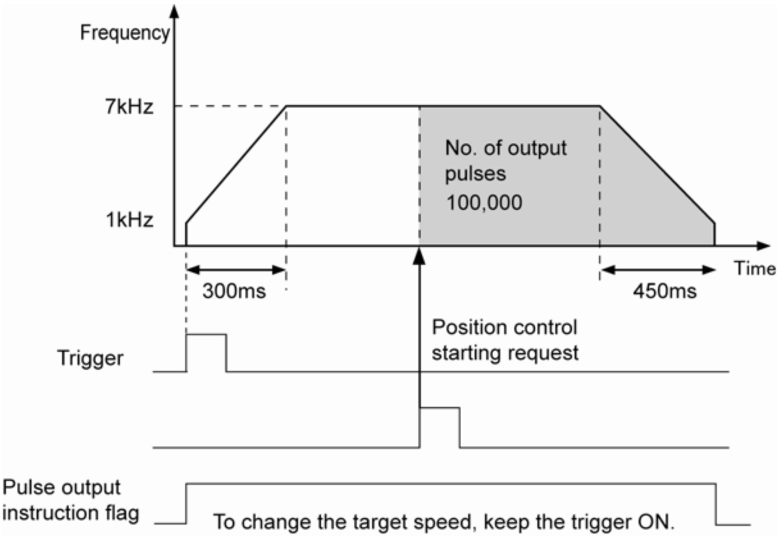
Change of speed during pulse output

1. If the target value is set to a value larger than 50kHz, it will be corrected to 50kHz.
2. If the elapsed value crosses over the acceleration forbidden area starting position during accelerating, acceleration cannot be performed. For information on the acceleration forbidden area starting position, check with the special registers (from DT90400).
3. For deceleration, the speed cannot be lower than the deceleration minimum speed. For information on the deceleration minimum speed, check with the special registers (from DT90400).

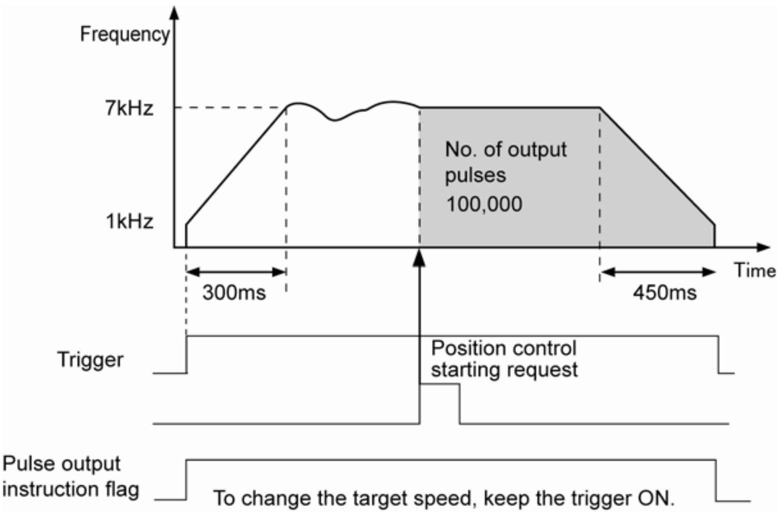
Explanation of pulse output operation

Pulses are output using a duty of 25% fixedly.
When outputting with the PULSE+SIGN method, pulses will be output approx. 300μs later after the output of direction signal. (The characteristics of a motor driver is considered.)

Pulse output diagram (when the target speed is not changed)

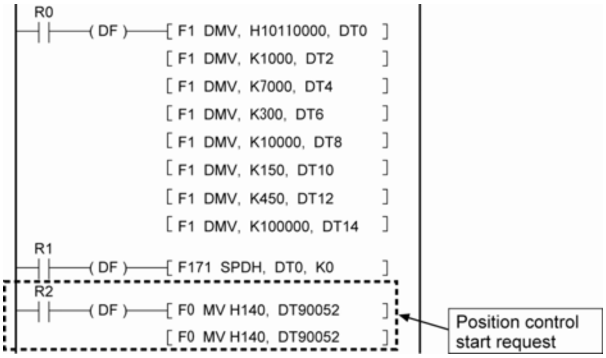


Pulse output diagram (when the target speed is changed)



8.4.7 JOG Positioning Type 1 (F171) Instruction

This instruction performs the deceleration stop outputting the specified number of pulses with the target speed being changed when the position control starting input is input externally or the position control start is requested internally during the pulse output. Two target speeds can be specified.

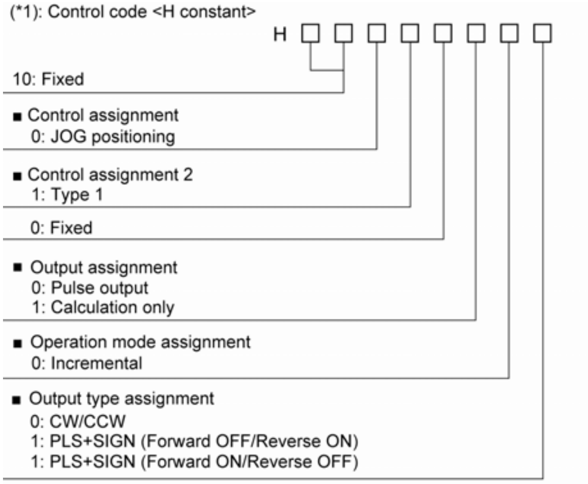


Pulses are output from Y0 at an initial speed of 1000 Hz, a target speed of 7000 Hz, and an acceleration time of 300 ms.
During the pulse output, the number of pulses specified for the target value will be output with the speed being changed to the target speed 2 from the time that the position control start is requested, and the deceleration stop will be performed.
When this program ie executed, the positioning table and the pulse output diagram will be as shown below.

Positioning data table

DT0	Control code *1	JOG positioning type 1 Incremental CW/CCW
DT2	Initial speed *2	1000 Hz
DT4	Target speed 1 *2	7000 Hz
DT6	Acceleration time *3	300 ms
DT8	Target speed 2 *2	10000 Hz
DT10	Change time *3	150 ms
DT12	Deceleration time *3	450 ms
DT14	Target value *4	100,000 pulses

(*1): Control code <H constant>



(*2) : Initial speed, target speed (Hz) <K constant>
1 Hz to 50 kHz [K1 to K50000 (Unit: Hz)]

(*3) : Acceleration time and deceleration time <K constant>
K1 to K32760 (Unit: ms)
Acceleration time from the initial speed to the target speed 1, change time from the target speed 1 to the target speed 2, and deceleration time from the target speed 2 to the initial speed

(*4) : Target value <K constant>
K-2147483648 to K2147483647

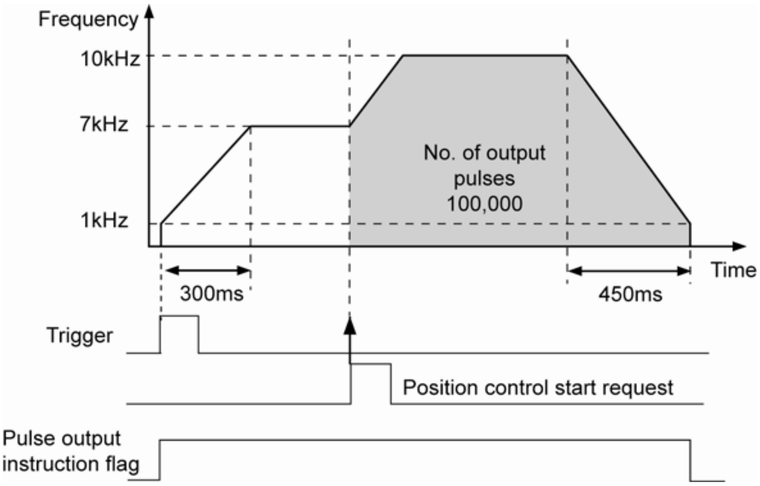
Note the following characteristics according to the specified initial speed.

1. When the initial speed is 1 or higher, and lower than 46Hz, the control up to the maximum frequency to the degree of 10kHz can be performed. If the frequency is higher than that, the speed error will be larger.
2. When the initial speed is 46 or higher, and lower than 184Hz, the control up to 50kHz can be performed.
3. When the initial speed is 184 or higher, the control up to 50kHz can be performed. The speed error around 50kHz will be smallest.

Explanation of pulse output operation

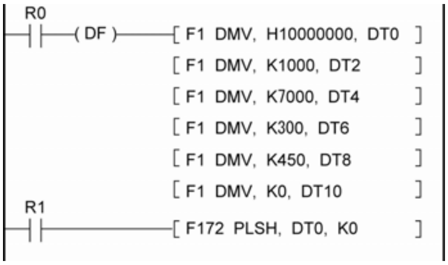
Pulses are output using a duty of 25% fixedly.
When outputting with the PULSE+SIGN method, pulses will be output approx. 300µs later after the output of direction signal. (The characteristics of a motor driver is considered.)

Pulse output diagram



8.4.8 JOG Operation (F172) Instruction

This instruction is used to output pulses of the specified parameter from the specified channel while the trigger (execution condition) is on. It is possible to change the target speed during the pulse output or perform the deceleration stop.
There are two kinds of control method, which are type 0 and type 1. Using the type 0 disable the setting of the target value, and using the type 1 enables the setting. When using the type 1, even if the trigger (execution condition) is on, the deceleration stop will be performed according to the target value.



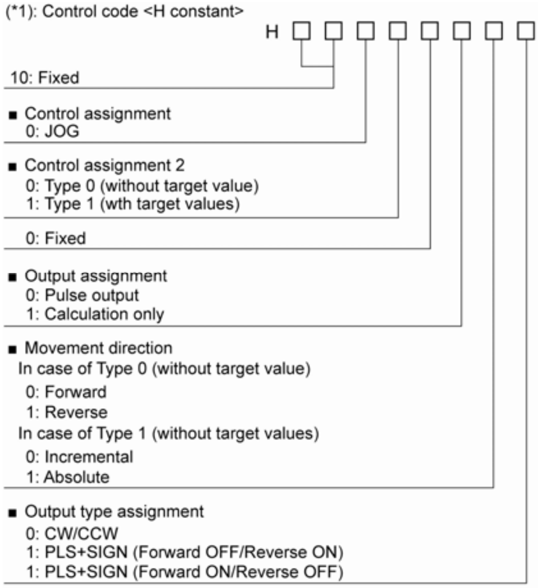
When the trigger (R1) is on, pulses are output from Y0 at an initial speed of 1000 Hz, a target speed of 7000 Hz and an acceleration time of 300 ms.
If the trigger (R1) is off, the deceleration stop will be performed with a deceleration time of 450 ms. However, if the trigger is turned on again, it will accelerate to the target speed again.

When this program ie executed, the positioning table and the pulse output diagram will be as shown below.

Positioning data table

DT0	Control code *1	JOG operation type 0 Forward CW/CCW
DT2	Initial speed *2	1000 Hz
DT4	Target speed *2	7000 Hz
DT6	Acceleration time *3	300 ms
DT8	Deceleration time *3	450 ms
DT10	Target value *4	0 pulse

(*1): Control code <H constant>



(*2) : Frequency (Hz) <K constant>
1 Hz to 50 kHz [K1 to K50000 (Unit: Hz)]

(*3) : Acceleration time and deceleration time <K constant>
K1 to K32760 (Unit: ms)
Acceleration time from the initial speed to 50kHz, and deceleration time from 50kHz to the initial speed

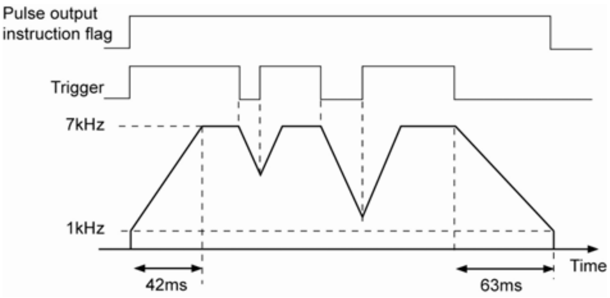
(*4) : Target value <K constant>
K-2147483648 to K2147483647

Note the following characteristics according to the specified initial speed.
1. When the initial speed is 1 or higher, and lower than 46Hz, the control up to the maximum frequency to the degree of 10kHz can be performed. If the frequency is higher than that, the speed error will be larger.
2. When the initial speed is 46 or higher, and lower than 184Hz, the control up to 50kHz can be performed.
3. When the initial speed is 184 or higher, the control up to 50kHz can be performed. The speed error around 50kHz will be smallest.

Change of speed during pulse output
1. If the target value is set to a value larger than 50kHz, it will be corrected to 50kHz.
2. If the elapsed value crosses over the acceleration forbidden area starting position during accelerating, acceleration cannot be performed. For information on the acceleration forbidden area starting position, check with the special registers (from DT90400).
3. For deceleration, the speed cannot be lower than the deceleration minimum speed. For information on the deceleration minimum speed, check with the special registers (from DT90400).

Explanation of pulse output operation
Pulses are output using a duty of 25% fixedly.
When outputting with the PULSE+SIGN method, pulses will be output approx. 300μs later after the output of direction signal. (The characteristics of a motor driver is considered.)

Pulse output diagram

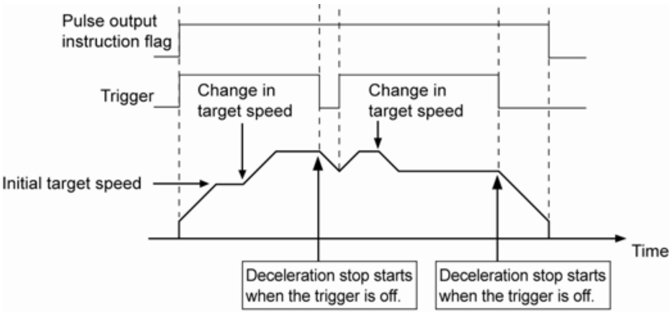


Operation mode of JOG operation

There are two operation modes for the FP0R JOG operation, which are type 0 and type 1. Those operation specifications for the specified target value vary.

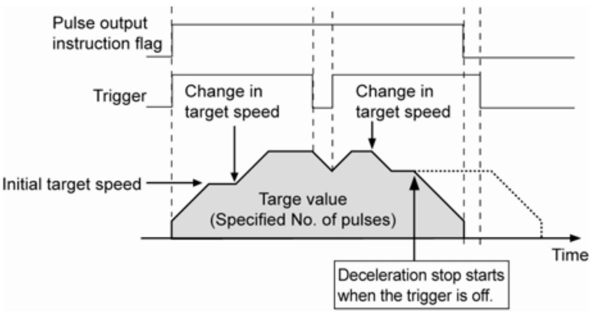
Type 0

Regardless of the settings for the target value, the JOG operation is performed when the trigger is on.



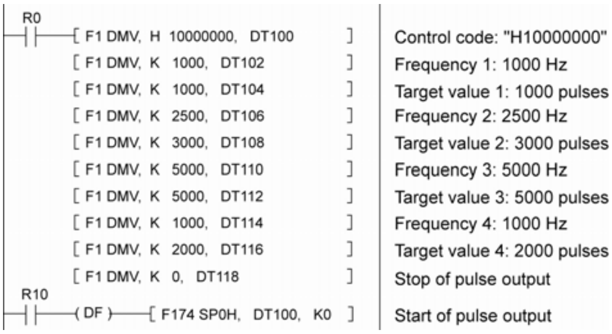
Type 1

Even if the trigger is on, the deceleration stop is performed according to the settings of the target value.



8.4.9 Arbitrary Data Table Control (F174) Instruction

Pulses are output from the specified cahnnel according to the specified data table.



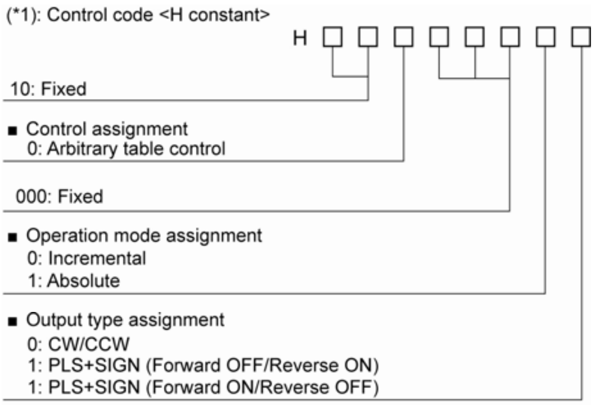
When the trigger (R10) is on, pulses at a frequency of 1000 Hz are output from Y0, and positioning will start.

Positioning is performed sequentially according to the values of data tables, and stops at the data table that the value of pulse output stop (K0) is written.

When this program is executed, the positioning table and the pulse output diagram will be as shown below.

Positioning data table

DT100	**Control code *1**	**Arbitrary table control Incremental CW/CCW**
DT102	Frequency 1 *2	1000 Hz
DT104	Target value 1 *3	1000 pulses
DT106	Frequency 2	2500 Hz
DT108	Target value 2	3000 pulses
DT110	Frequency 3	5000 Hz
DT112	Target value 3	5000 pulses
DT114	Frequency 4	1000 Hz
DT116	Target value 4	2000 pulses
DT118	Assignment of pulse output stop *4	K0



(*2) : Frequency (Hz) <K constant>
1 Hz to 50 kHz [K1 to K50000 (Unit: Hz)]

(*3) : Target value <K constant>
K-2147483648 to K2147483647

(*4) : Assignment of pulse output stop <K constant>
K0 Fixed

Note: If the target value is set to a value larger than 50kHz, it will be corrected to 50kHz.

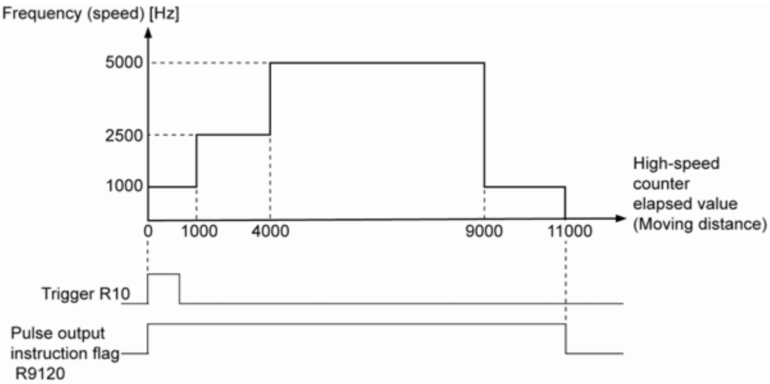
Note the following characteristics according to the specified initial speed.

1. When the initial speed is 1 or higher, and lower than 46Hz, the control up to the maximum frequency to the degree of 10kHz can be performed. If the frequency "n" is set to a value below 6Hz, it will be corrected to 6Hz.
2. When the initial speed is 46 or higher, and lower than 184Hz, the control up to 50kHz can be performed. If the frequency "n" is set to a value below 46Hz, it will be corrected to 46Hz.
3. When the initial speed is 184 or higher, the control up to 50kHz can be performed. If the frequency "n" is set to a value below 184Hz, it will be corrected to 184Hz.

Explanation of pulse output operation

Pulses are output using a duty of 25% fixedly.
When outputting with the PULSE+SIGN method, pulses will be output approx. 300μs later after the output of direction signal. (The characteristics of a motor driver is considered.)

Pulse output diagram (when the target speed is not changed)



8.4.10 Home Return (F177) Instruction

This instruction performs home return according to the specified data table. The elapsed value area is cleared to zero after the completion of home return.
There are two kinds of control method, which are type 0 and type 1.
With the type 0, the home input is effective regardless of it is performed before the near home input, during deceleration after the input or after the completion of deceleration.
With the type 1, the home input is effective only after delecerelation (started by near home input) has been completed.

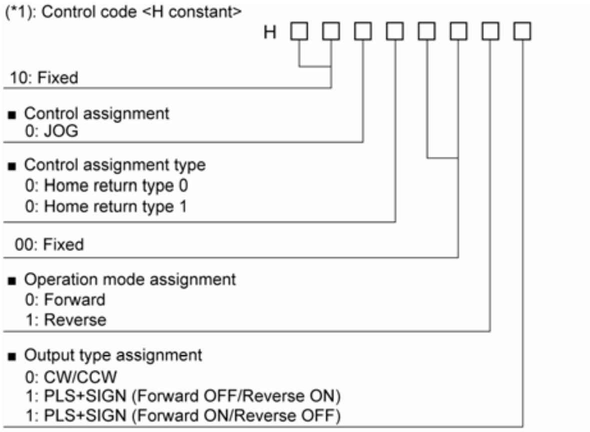
```
 R11
─┤├──( DF )──[ F1  DMV,  H10000000,  DT100 ]
              [ F1  DMV,  K500,  DT102      ]
              [ F1  DMV,  K10000,  DT104    ]
              [ F1  DMV,  K300,  DT106      ]
              [ F1  DMV,  K450,  DT108      ]
              [ F1  DMV,  K2000,  DT110     ]
              [ F1  DMV,  K0,  DT112        ]
              [ F177  HOME,  DT100,  K0     ]
```

Pulses are output at an initial speed of 200 Hz, a target speed of 2000 Hz, and an acceleration time of 300 ms when the trigger (R11) is on.

When this program is executed, the positioning table and the pulse output diagram will be as shown below.

Positioning data table

DT100	Control code *1	Home return type 0 Forward CW/CCW
DT102	Initial speed *2	500 Hz
DT104	Target speed *2	10000 Hz
DT106	Acceleration time *3	300 ms
DT108	Deceleration time *3	450 ms
DT110	Creep speed *2	2000 Hz
DT112	Deviation counter clear signal output time *4	None



(*2) : Initial speed, target speed (Hz) <K constant>
1 Hz to 50 kHz [K1 to K50000 (Unit: Hz)]

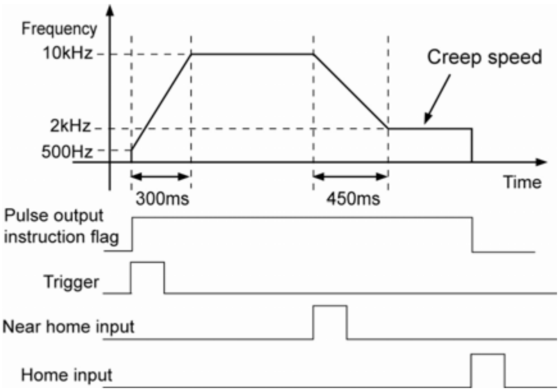
(*3) : Acceleration time and deceleration time <K constant>
K1 to K32760 (Unit: ms)
Acceleration time from the initial speed to the target speed, and deceleration time from the target speed to the creep speed

(*4) : Deviation counter clear signal output time (ms) <K constant>
K0 to K200 (x 0.5 ms)
Setting range: 0.5 ms to 100 ms
K0: Not output deviation counter clear signal

Note the following characteristics according to the specified initial speed.
1. When the initial speed is 1 or higher, and lower than 46Hz, the control up to the maximum frequency to the degree of 10kHz can be performed. If the frequency is higher than that, the speed error will be larger.
2. When the initial speed is 46 or higher, and lower than 184Hz, the control up to 50kHz can be performed.
3. When the initial speed is 184 or higher, the control up to 50kHz can be performed. The speed error around 50kHz will be smallest.

Explanation of pulse output operation
Pulses are output using a duty of 25% fixedly.
When outputting with the PULSE+SIGN method, pulses will be output approx. 300μs later after the output of direction signal. (The characteristics of a motor driver is considered.)

Pulse output diagram

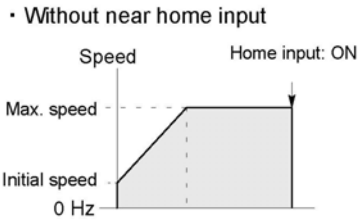


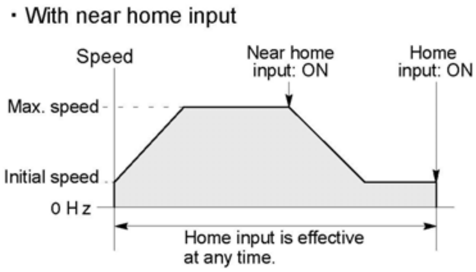
Home return operation modes

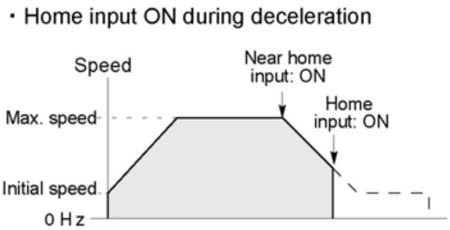
There are two operation modes for a home return with the FP0R: Type 0 and Type 1.

Type0

The home input is effective regardless of whether or not here is a near home input, whether deceleration is taking place, or whether deceleration has been completed.

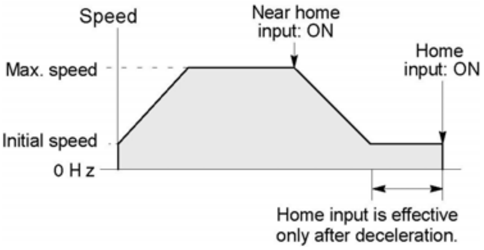






Type 1

In this mode, the home input is effective only after deceleration (started by near home input) has been completed. The operation stops when the home input has turned ON during the deceleration operation.



8.4.11 Linear Interpolation (F175) Instruction

This insturction is used to output pulses from 2 pulse output channels to make a linear path is followed to the targe position according to the specified paramter while the execution condition is on.
Linear interpolation of 2 systems can be executed on FP0R.

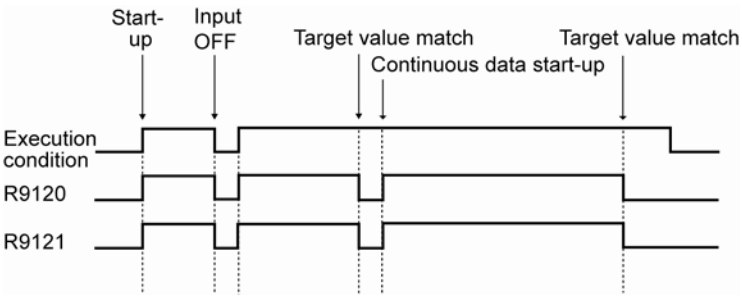
Precautions when programming

Special internal relay	Operations of relays	The uses of the relays in the program
Pulse output control flag R9120 (CH0) R9121 (CH1) R9122 (CH2) R9123 (CH3)	Turns on during execution of pulse output instructions that include a linear interpolation instruction and then maintains that state during pulse output from CH0 to CH3. This flag is the same for instructions F166 to F176.	Use this to prohibit the simultaneous execution of other high-speed counter instructions and pulse output instructions, and to verify completion of an action. The completion of linear interpolation operation is judged by the completion of each operation of X axis and Y axis.

Note:

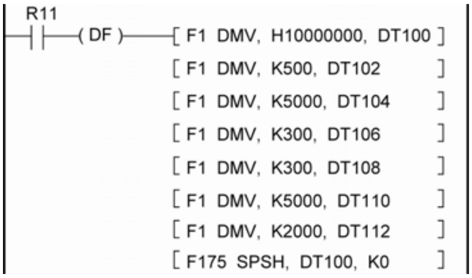
- The above flags vary during scanning.
  Example: If the above flags are used for more than one time as input conditions, there may be the different states in the same scan. Replace with internal relays at the beginning of the program as a measure.

Flag operation when the instruction is executed



Linear interpolation (F175) instruction

The linear interpolation controls positioning with two axes according to the specified data table. Execute F175 instruction for X axis (CH0 or CH2).



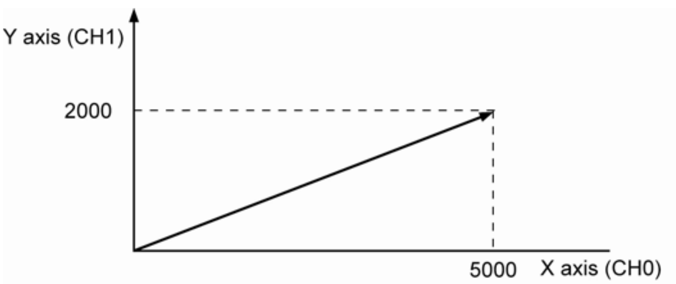
Pulses are output from the X axis (CH0) and the Y axis (CH1), so that the composite speed is an initial speed of 500 Hz, the maximum speed of 5000 Hz, and the acceleration/deceleration time of 300 ms. The two axes are controlled so that a linear path is followed to the target position.

When this program is executed, the positioning table and the pulse output diagram will be as shown below.

Positioning data table

DT100	Control code *1	Linear interpolation Incremental CW/CCW
DT102	Composite speed: Initial speed *2	500 Hz
DT104	Composite speed: Target speed	5000 Hz
DT106	Acceleration time *3	300 ms
DT108	Deceleration time	300 ms
DT110	X-axis target value *4	5000 pulses
DT112	Y-axis target value	2000 pulses
DT114	X-axis component speed: Initial speed *5	(Calculation result will be stored.)
DT116	X-axis component speed: Target speed *5	(Calculation result will be stored.)
DT118	Y-axis component speed: Initial speed	(Calculation result will be stored.)
DT220	Y-axis component speed: Target speed	(Calculation result will be stored.)

Positioning path



(*1): Control code <H constant>

H □□□□□□□□

10: Fixed

- Control assignment
  0: Interpolation
- Type
  0: Linear interpolation

0: Fixed

- Output assignment
  0: Pulse output
  1: Calculation only
- Operation mode assignment
  0: Increment
  1: Absolute
- Output type assignment
  0: CW/CCW
  1: PLS+SIGN (Forward OFF/Reverse ON)
  1: PLS+SIGN (Forward ON/Reverse OFF)

(*2) : Composite speed (Initial speed, target speed) (Hz) <K constant>

6 Hz to 50 kHz [K6 to K50000 (Unit: Hz)]
Specify composite speed to make the component speed of each axis become 6Hz or higher.
Also, specify composite speed (initial speed) 30 kHz or less.

Note) Precaution for the specification of composite speed (initial speed)
If each component speed (initial speed) of CH0 and CH2 which is calculated using the following formula is not 6.0 Hz or higher, the path may not be linear
* as the following formula is not set up.

$$f \geqq \frac{6.0\sqrt{(\Delta x^2 + \Delta y^2)}}{\Delta x}$$

(*3) : Acceleration time and deceleration time <K constant>

K1 to K32760 (Unit: ms)
Acceleration time from the initial speed to the target speed, and deceleration time from the target speed to the initial speed
* Specify the same value for the acceleration time and deceleration time in the linear interpolation control.

(*4) : Target value <K constant>

K-8388608 to K8388607
When operating only one axis,
a) In incremental mode, set the target value for the axis which will not be operated to 0.
b) In absolute mode, set the target value for the axis which will not be operated to the same as the current value.

(*5) : Component speed
(Initial speed and target speed of each axis)

This is stored as 2 words in real numbers type.

$$\text{X-axis component speed} = \frac{(\text{composite speed}) \times (\text{X-axis movement amount})}{\sqrt{((\text{X-axis movement amount})^2 + (\text{Y-axis movement amount})^2)}}$$

$$\text{Y-axis component speed} = \frac{(\text{composite speed}) \times (\text{Y-axis movement amount})}{\sqrt{((\text{X-axis movement amount})^2 + (\text{Y-axis movement amount})^2)}}$$

Component speed and correction

Note the following characteristics according to the component speed (initial speed) calculated using the above formula *5.

1. When the initial speed is 1 or higher, and lower than 46Hz, the control up to the maximum frequency to the degree of 10kHz can be performed. If the frequency is higher than that, the speed error will be larger.
2. When the initial speed is 46 or higher, and lower than 184Hz, the control up to 50kHz can be performed.
3. When the initial speed is 184 or higher, the control up to 50kHz can be performed. The speed error around 50kHz will be smallest.

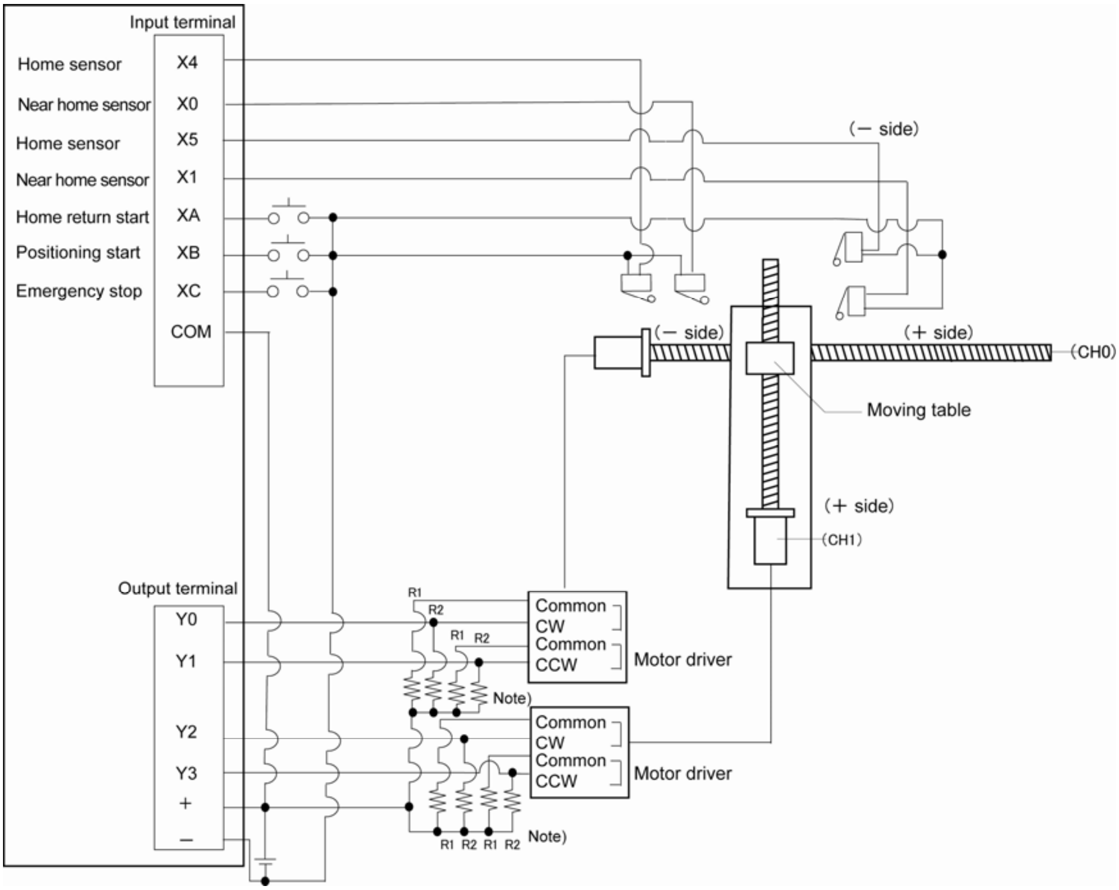
<u>Also, the intial speed may be corrected due to the calculation result.</u>
Note that the vector of the composite speed may be deviated at the time the pulse output starts or stops when the value has been corrected.
Compare with the correction speed of initial speed in the special registers (from DT90400) to check whether or not the specified initial speed is corrected.

Explanation of pulse output operation

Pulses are output using a duty of 25% fixedly.
When outputting with the PULSE+SIGN method, pulses will be output approx. 300μs later after the output of direction signal. (The characteristics of a motor driver is considered.)

Sample program for interpolation control

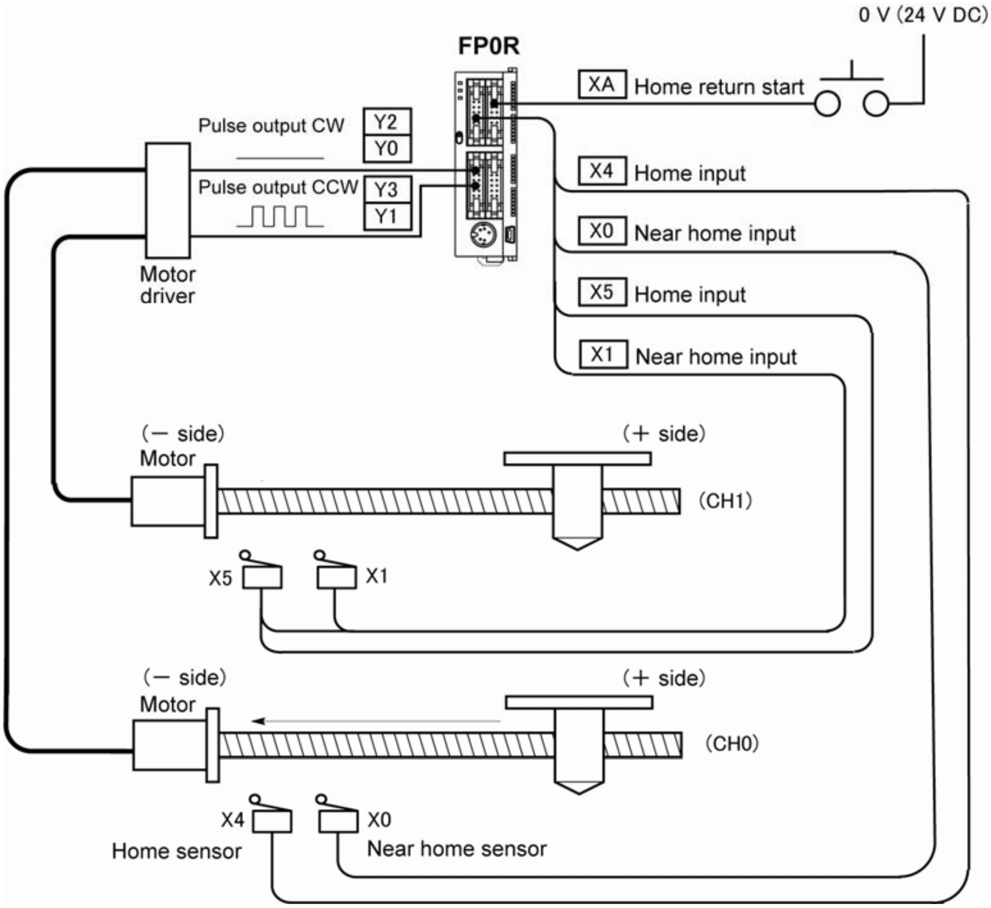
Wiring diagram



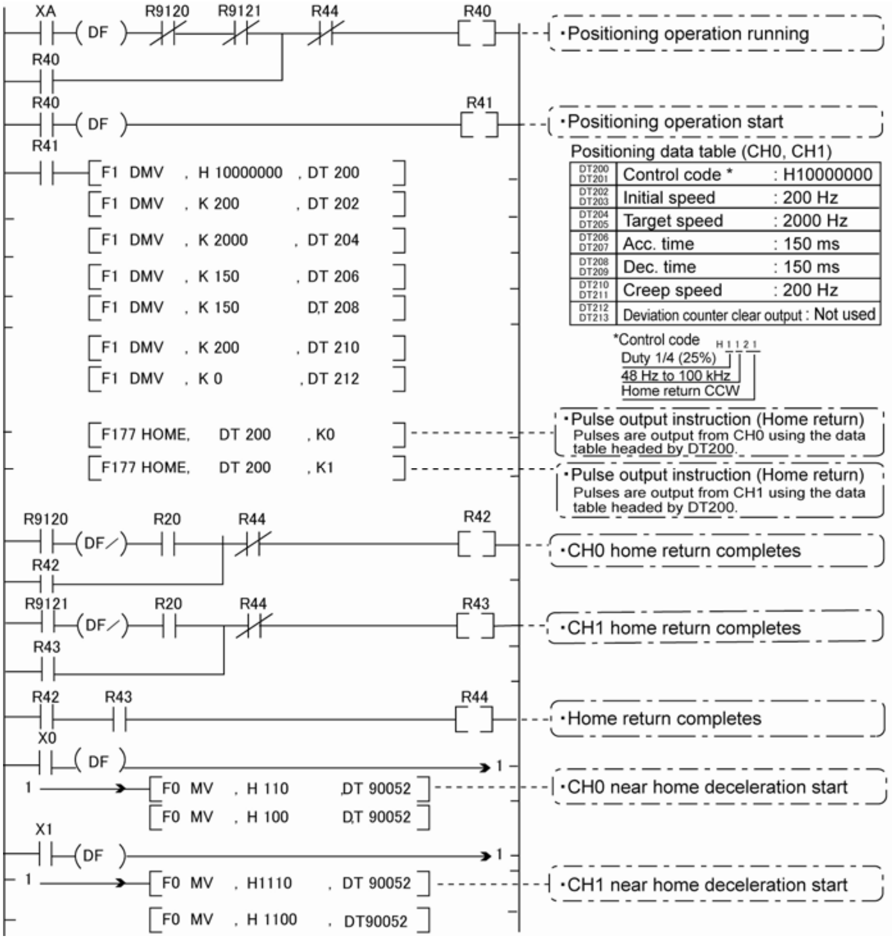
Note) If the input of the stepping motor is 5V photocoupler type, connect a resistor of 2kΩ(1/2 W) to R1, and connect a resistor of 2kΩ(1/2 W) – 470Ω(2 W) to R2.

Home return operation (Minus direction)

When XA turns on, the pulse is output from CCW output Y1 of the specified channel CH0 and CCW output Y3 of the specified channel CH1, and the return to home begins.
In CH0, when X0 turns on, deceleration begins, and when X4 turns on, home return is completed. After the return to home is completed, the elapsed value areas DT90400 and DT90401 are cleared to 0.
In CH1, when X3 turns on, deceleration begins, and when X5 turns on, home return is completed. After the return to home is completed, the elapsed value areas DT90410 and DT90411 are cleared to 0.
When the operations in both CHs is completed, the return to home completes.

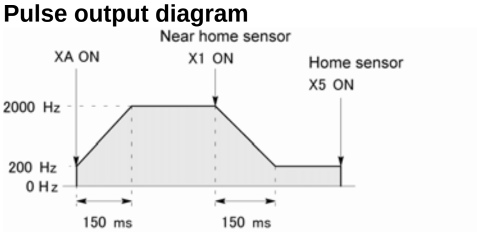


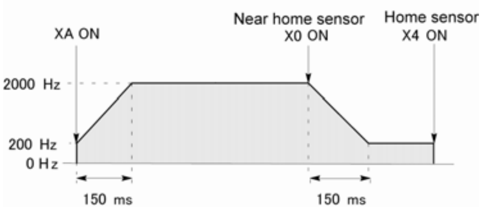
Program (Home return operation)



Key Point:
As there is no interpolation function for the home return, the home return should be executed for each channel. After the home return for both channels is completed, the positioning operation running program (R40) turns off.

Pulse output diagram





8.5 PWM Output Function

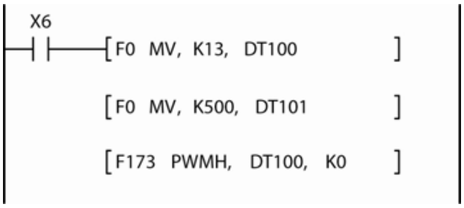
8.5.1 Overview

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 CH3 with system registers 400 and 401 to “High-speed counter not used”.

8.5.2 PWM Output Instruction F173



While X6 is on, a pulse with a period of 1 ms and duty ratio of 50% is output from Y0 of specified channel CH0.

When the program runs, the data table will be as shown below.

Data table

DT100	Control code *1	: K13
DT101	Duty *2	: 50%

***1: Specify the control code by setting the K constant.**

K	Frequency (Hz)	Period (ms)
K3	6	166.67
K4	7.5	133.33
K5	12.5	80.00
K6	25	40.00
K7	50	20.00
K8	100	10.00
K9	200	5.00
K10	400	2.50
K11	600	1.67
K12	800	1.25
K13	1.0 k	1.00
K14	1.2 k	0.83
K15	1.6 k	0.63
K16	2.0 k	0.50
K17	3.0 k	0.33
K18	4.8 k	0.21

***2: Specify the duty by setting the K constant.**
Duty: K0 to K999(1000 resolutions)

Note:

- If a value outside the specified range is written to the duty area while the instruction is being executed, a frequency corrected to the maximum value is output. If written when instruction execution is started, an operation error is occurred.

Chapter 9

Security Functions

9.1 Type of Security Functions

There are mainly Three functions as the security function of the FP0R.

1: Password protect function
It is used to restrict access to the programs in the FP0R from the programming tool by setting a password. Writing and reading ladder programs or system registers will be unperformable by setting a password and setting to the protect mode.
There are two types of passwords as below.

- **4-digit password: 4 characters of 16 characters that are “0” to “9” and “A” to “F” can be used.**
- **8-digit password: A maximum of 8 English one byte characters (case-sensitive) and symbols can be used.**

2: Upload protection
Ladder programs or system registers cannot be uploaded from the FP0R by setting that the program is not uploaded. As transferring programs to the master memory cassette as well as the programming tool will be unperformable, it ensures higher security.

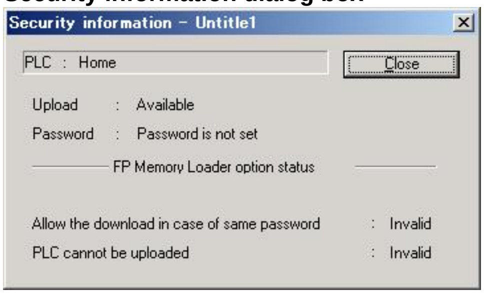
Password protection and upload protection functions
They are available for the FP memory loader Ver 2.0 or later.

Reference: <9.4 Setting Function for FP Memory Loader>

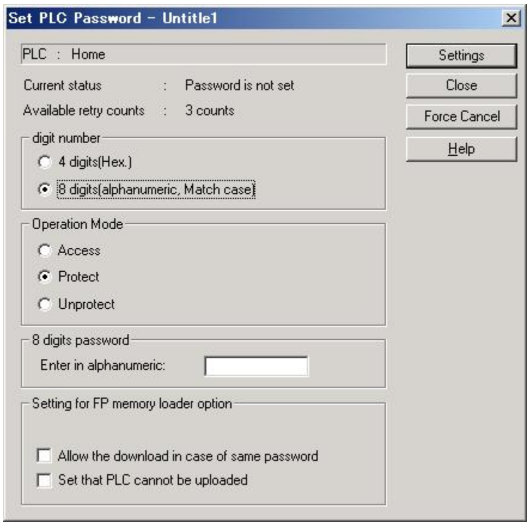
The state of the security can be checked with programming tools.
- Using FPWIN GR
1. Select [Online Edit Mode] under the [Online] on the menu bar, or press the [CTRL] and [F2] keys at the same time, to switch to the [Online] screen.
2. Select “Security information” or “Set PLC Password” under “Tool” on the menu bar.

The following displays will be shown.

Security information dialog box



Set PLC Password dialog box



9.2 Password Protect Function

This function is used to prohibit reading and writing programs and system registers by setting a password on the FP0R.
There are two ways to set a password as below.

1. Sets using the programming tool.
2. Sets using an instruction (SYS1 instruction).

Note: Precautions on the password setting

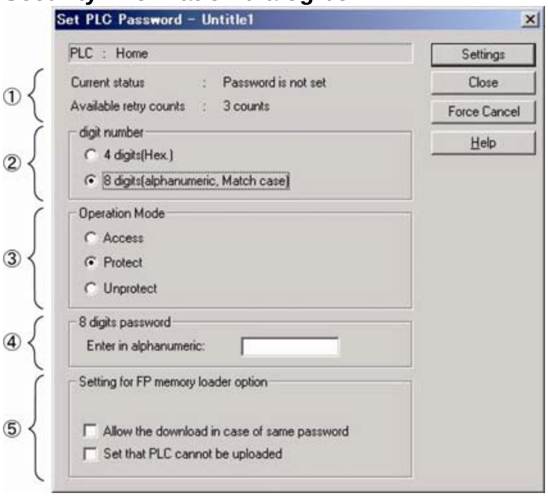
Do not forget your password. If you forget your password, you cannot read programs. (Even if you ask us for your password, we cannot crack it.)

9.2.1 Password Setting

Setting using FPWIN GR

1. Select [Online Edit Mode] under the [Online] on the menu bar, or press the [CTRL] and [F2] keys at the same time, to switch to the [Online] screen.
2. Select or “Set PLC Password” under “Tool” on the menu bar. The following display will be shown.

Security information dialog box



① Indicates the current status of the password setting.
② Specify the type of the password to be used.
③ Specify an operation mode.
Access: Accesses programs by inputting a password.
Protect: Sets a password.
Unprotect: Releases the password setting.
④ Input a password.
⑤ Those are the settins when using the FP memory loader (Ver 2.0 or later).

Confirmation the contents of the password setting
Confirm the settings indicated in the dialog box.

Current status

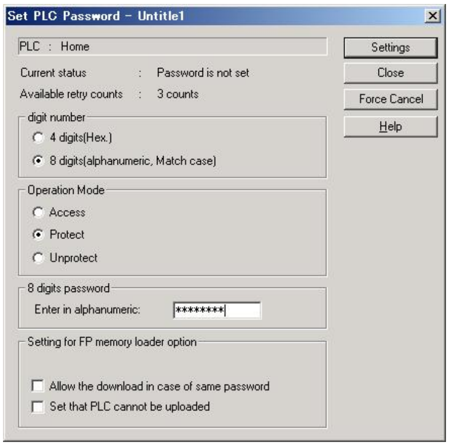
Indicates the current status of the password setting. There are following five statuses.

1. Password is not set	: Password is not set.
2. 4 digits Protect	: Four-digit password, and access is prohibited.
3. 4 digits Available to access	: Four-digit password, and access is allowed. (The status that inputting the password completes and that can access programs.)
4. 8 digits Protect	: Eight-digit password, and access is prohibited.
5. 8 digits Available to access	: Eight-digit password, and access is allowed. (The status that inputting the password completes and that can access programs.)

Available retry counts
This is the number of times that you can input the password in succession (up to 3 times). Every time incorrect password is input, the number will decrease.
If you fail to input the correct password for 3 times in succession, you cannot access the program.
Turn the power supply of the FP0R off and then on again to try to input the password again.

Note:
If the power supply of the PLC is turned on/off with the setting that the access is allowed, the setting will be that the PLC is protected again.

Setting to prohibit the access with a password



As the dialog box is shown, select as below.

Digit number:
Select “4 digits” or “8 digits”.

Operation Mode:
Select “Protect”.

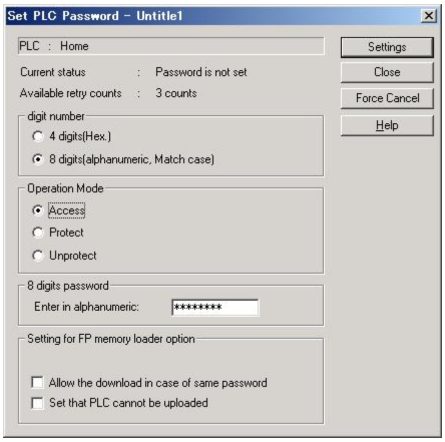
4 digits (or 8 digits) password:
Input a password to be set.

Click “Settings”.

Input the password for confirmation again, and click [OK].

The setting has completed.

Setting to allow the access with a password



As the dialog box is shown, select as below.

Digit number:
Select “4 digits” or “8 digits”.

Operation Mode:
Select “Access”.

4 digits (or 8 digits) password:
Input a password to be set.

Click “Settings”.

The setting has completed.

Note:

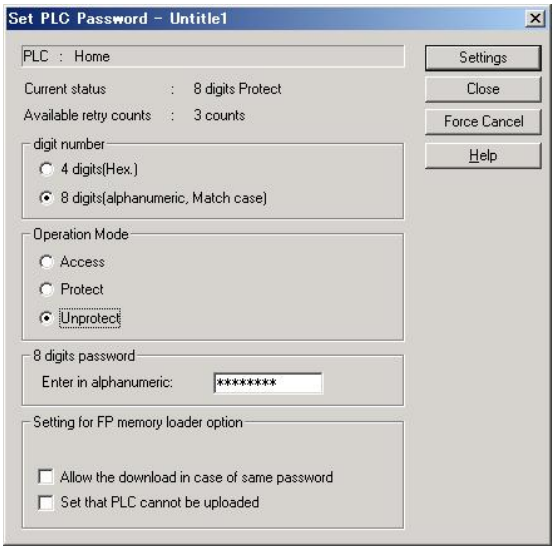
If the power supply of the PLC is turned on/off with the setting that the access is allowed, the setting will be that the PLC is protected again.

How to cancel the password setting

Following two methods are available to cancel the password setting.

	Description	Program
Unprotect	Cancels the registered password to be specified.	All programs are retained.
Force cancel	Erases all programs and security information to cancel the setting forcibly.	All programs are deleted. (The upload protection setting is also deleted.)

Releaseing the protect of PLC (Programs are retained.)



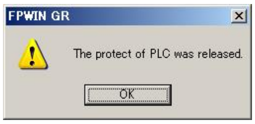
As the dialog box is shown, select as below.

Digit number:
  Select “4 digits” or “8 digits”.

Operation Mode:
  Select “Unprotect”.

4 digits (or 8 digits) password:
  Input a password to be set.

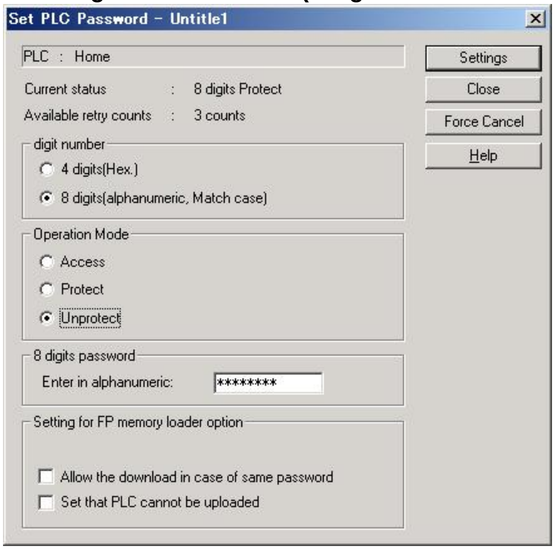
Click “Settings”.



The setting has completed.

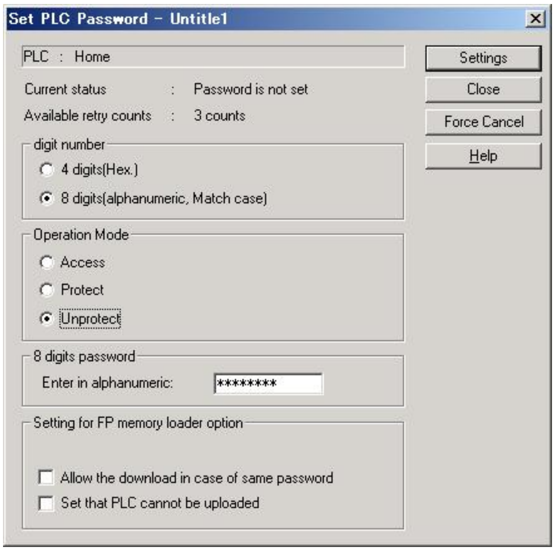
Note) The protection cannot be released if the access is not allowed.

Executing the force cancel (Programs and security information are all deleted.)



Click [Force cancel].

Click [Yes].



If the current status is “Password is not set”, this procedure has completed.
All programs and security information were deleted.

9.3 Upload Protection

This function is to prohibit reading programs and system registers by setting to disable program uploading.
If the upload protection is set, note that the ladder programs and system registers will be disalbed to be uploaded after that.
However, editing the files that are controlled with a PC can be carried out online using the programming tool. Note that the programs will be broken if the programs are not absolutely matched.
When using this function, store ladder programs as files without fail.

Unperformable operations on the FP0R set to prohibit uploading programs
1. Uploading ladder programs and system registers to PCs
2. Transferring programs to the memory loader
The setting for this function can be cancelled using the programming tool, however, all ladder programs, system registers and password information will be deleted when the setting is cancelled.

Note: When cancelling this setting forcibly:
All programs and security information will be deleted when the upload protection setting is cancelled.
We cannot restore the deleted programs even if you ask us.
We cannot read the data of the control units that are set to prohibit uploading.

Keeping your programs is your responsibility.

Interaction with the password protect function
The password setting can be specified for the FP0R that this function is set at the same time.
Also, this function can be specified for the FP0R that a password is set.

9.3.1 Upload Protection Setting

The upload protection is set in the control unit using the programming tool.

Setting using FPWIN GR
1. Select [Online Edit Mode] under the [Online] on the menu bar, or press the [CTRL] and [F2] keys at the same time, to switch to the [Online] screen.
2. Select or “Upload settings” under “Tool” on the menu bar. The following display will be shown.

Select “Set that PLC cannot be uploaded”.

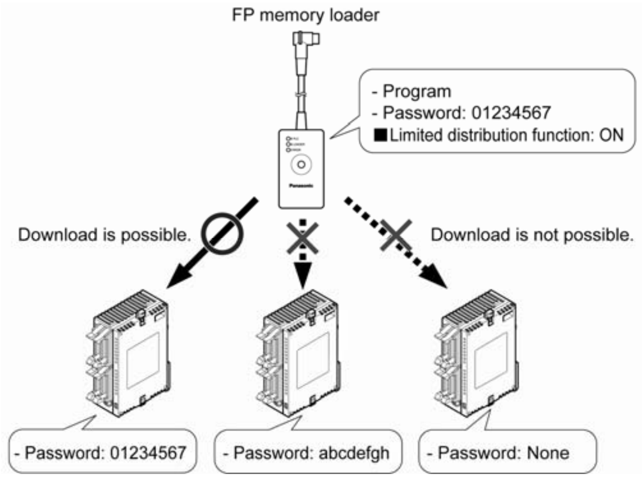
Click “Execute”.

9.4 Setting Function for FP Memory Loader

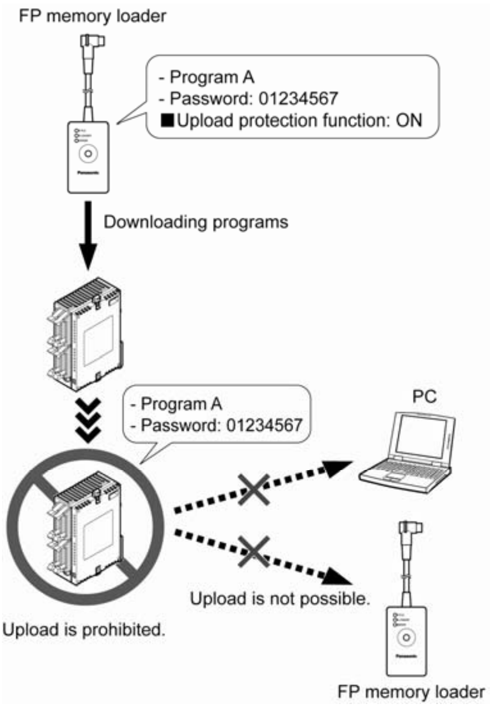
The following two functions of the FP memory loader (AFP8670/AFP8671) (*) can be set through the FP0R.
* Available for the FP memory loader Ver. 2.0 or later.

Limited distribution function
(Programs can be downloaded only to the units which the same password has been set.)

When downloading a program from the memory loader, the program can be downloaded only when the program stored in the memory loader matches the password set for the PLC with this function enabled.



Upload protection setting function
If this function is valid, the PLC will be in the upload protection state by downloading a program to the PLC from the FP memory loader.



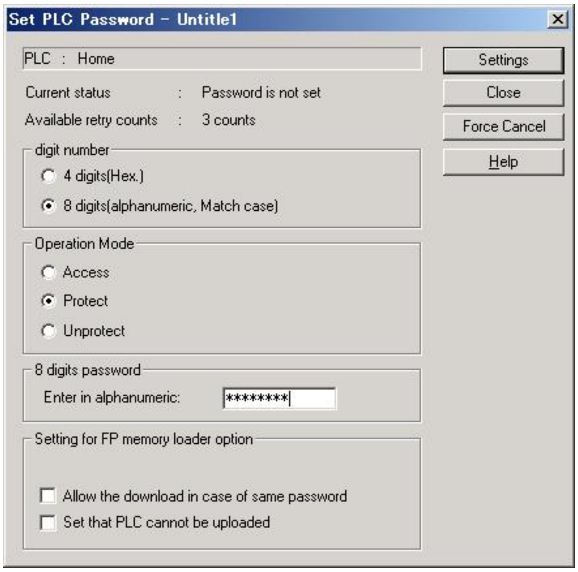
Precautions when downloading

When downloading a program to the FP0R from the FP memory loader, the password thta has been already set on the unit may be changed. Note the followings.

Status of FP memory loader	Password setting for FP0R after download
No password setting	The password will be cleared.
4-digit password setting	The password will be overwritten with a new 4-digit password.
8-digit password setting Limited distribution setting: Off	The password will be overwritten with a new 8-digit password.
8-digit password setting Limited distribution setting: On	The password will not change. (The program itself will not be downloaded.)

9.4.1 Setting with FPWIN GR

1. Select [Online Edit Mode] under the [Online] on the menu bar, or press the [CTRL] and [F2] keys at the samte time, to switch to the [Online] screen.
2. Select "Set PLC Password" under "Tool" on the menu bar.



1. Select "8 digits" for "Digit number".

2. Check the functions to be used of "Options for FP memory loader".

- Limited distribution function
 → "Allow the download in case of same password"

- Enable the upload protection setting.
 → "Set that PLC cannot be uploaded"

3. After setting the above check box, input a 8-digit password, and then click "Setting". The setting has completed.

* This function is available only when a 8-digit password has been set.

9.5 Table of Security Settings/Cancel

For the settings on the FP0R control unit

		Status of security			
		Security not set	**Upload protection**	**4-digit password**	**8-digit password**
Sets/ Cancels	Upload protection	A		A	A
	4-digit password	A	A		N/A
	8-digit password	A	A	N/A	

A: Available   N/A: Not available

Chapter 10

Other Functions

10.1 P13 (PICWT) Instruction

Data registers of 32765 words can be stored and used in the built-in ROM (F-ROM data area) control unit using the P13 (PICWT) instruction.

Note the followings for the use:

1. Restrictions on the number of writing

Writing can be performed within 10000 times. If writing continues for more than that, the correct operation cannot be guaranteed.

2.The power supply turns off when the P13 (PICWT) instruction is being executed.

If the power supply turns off during this instruction is being executed, the hold type area may not be kept. (Also, when the power is shut off during rewriting in the RUN mode, the same event may occur.)

10.2 Sampling Trance Function

10.2.1 Overview

The sampling trace function is available for the FP0R. Using this function enables to take samplings and record (accumulate) the state of arbitrary data of 16 bits + 3 data registered in the PLC at an arbitrary timing, and to examine the changes in the bit and data in details after stopping sampling at an arbitrary timing.

The sampling trace function is used by [Time chart monitor] under the online menu of the FPWIN GR.

The instructions, functions, special relays and special registers related to the sampling trace function are as below.
F155 (SMPL) sampling instruction
F156 (STRG) sampling stop trigger instruction
Time chart moitor of FPWIN GR

R902C	:Sample point flag	OFF = Sampling by instruction ON = Sampling at regular time intervals
R902D	:Sampling trace end flag	When sampling trace starts = 0 stops = 1
R902E	:Sampling trigger flag	Turns on when sampling stop trigger is on.
R902F	:Sampling enable flag	Turns on when sampling operation starts.
DT90028	:Interval of sampling trace	K0 = For sampling by instruction K1 to K3000 (10 ms to 30 seconds) For sampling at regular time intervals

10.2.2 Details of Sampling Trace Function

No. of data collectable at one sampling: 16 bits + 3 data
Sampling capacity (No. of samples accumulable): 300 samples (C10, C14, C16)
1000 samples (C32, T32, F32)
Types of sampling timing (When an instruction is executed, or at regular time intervals)
1: Sampling at regular time intervals From 10 ms
2: Sampling by F155 (SMPL) instruction

Sampling for every scan can be executed by the instruction.
Also, more than one sampling can be executed in one scan.
Timing for the execution of the F155 (SMPL) instruction can be set by the ladder sequence.

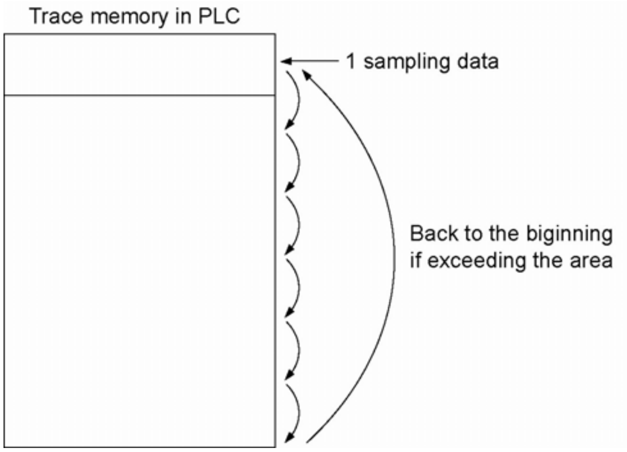
Note:
It is not possible to activate the sampling at regular time intervals and the sampling by the F155 (SMPL) instruction simultaneously.

How to stop sampling
Methods of the stop trigger (request): Following two methods are available.

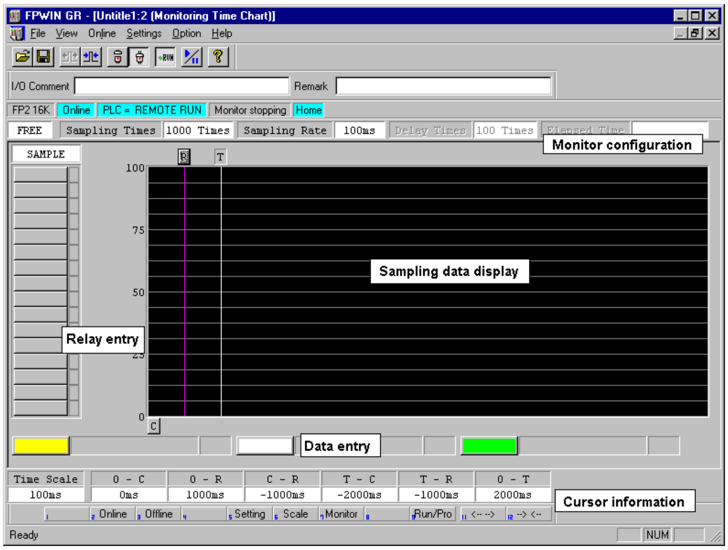
1: Deactivate request by the tool software
2: Deactivate request by the F156 (STRG) instruction

If the stop trigger activates, the PLC will continue to take samplings for the specified number of delay, and then stop the sampling operation.
Once the sampling operation stops, the data will be automatically retrieved by the tool software and will be indicated in a time chart.
It is possible to adjust whether to see before or after the trigger point by the setting of the number of delay.

Operation image of sampling trace



10.2.3 How to Use Sampling Trace



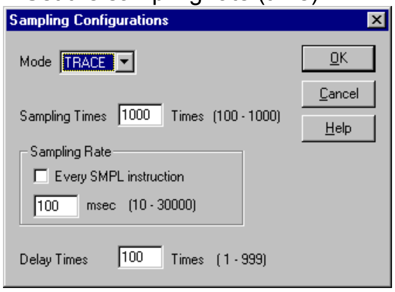
1. Sampling at regular time intervals

1) Register the bit/word device to be monitored by the time chart monitor function of FPWIN GR.

2) Specify the sampling configurations.

Set the mode of the sampling configurations to "TRACE".

Set the sampling rate (time).

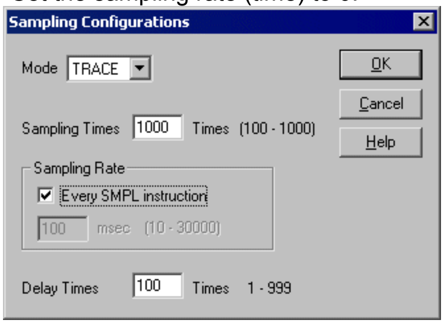


3) Start monitoring. Start with the button.

2. Sampling by instruction

1) Register the bit/word device to be monitored by the time chart monitor function of FPWIN GR.

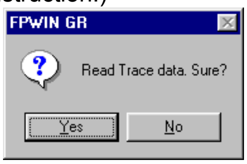
2) Specify the sampling configurations.
   Set the mode of the sampling configurations to " TRACE ".
   Set the sampling rate (time) to 0.

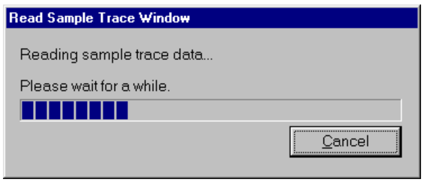


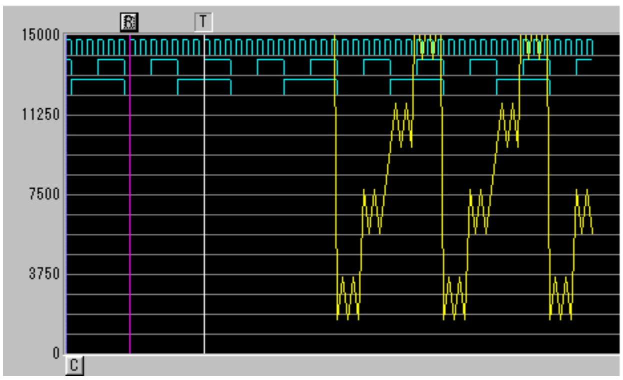
3. Read data by trigger

1) Stop sampling by stopping monitoring the trace that has been started in the above procedure 1 or 2 on the time chart display of FPWIN GR. The data will be indicated in the time chart.

Stop monitoring. (Stop wih the button, stop by the "Trigger Break" in the menu, or stop by the F156 instruction.)





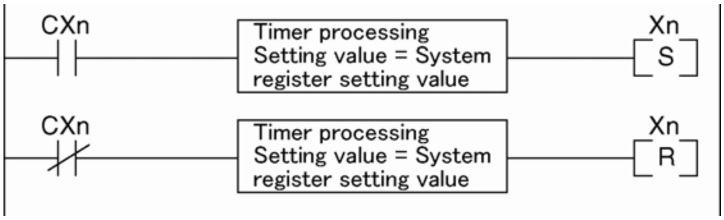


Reference: <FPWIN GR Help>

10.3 Time Constant Processing

The input time constants for 16 points of the CPU inptu X0 to XF can be set by the system registers 430 to 433.
If this setting is specified, an operation like the equivalent circuit below will be performed.
By the setting, the noises or chatterings of input will be removed.

CXn = Input signal of Xn contact
Xn = Image memory of input Xn



Note:
- The input signal of X contact is retrieved at the timing of the normal I/O update.
- If the partial update instruction is executed for the input in the time constant processing, the time constant processing will be invalid, and the input status at the time will be read out and set.
- The time constant processing can be performed for the input other than X0 to XF (add-on cassettes or expansion units) by the F182 (FILTR) instruction.
- The timer instruction is not used for the timer processing in this equivalent circuit.
- The time constant processing is invalid when the high-speed counter, pulse catch or interrupt has been specified.
- Only following settings are valid: C10: X0 to X5, C14/C16: X0 to X7, C32/T32/F32: X0 to XF

Chapter 11

Self-Diagnostic and Troubleshooting

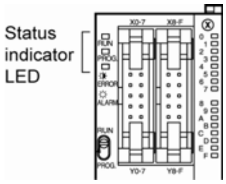
11.1 Self-Diagnostic function

11.1.1 LED Display for Status Condition

How to read status indicator LEDs on control unit

	LED status			Description	Operation statuss
	RUN	PROG.	ERROR/ ALARM		
Normal condition	Light (on)	Off	Off	Normal operation	Operation
	Off	Light (on)	Off	PROG. mode	Stop
	Flashes	Flashes	Off	Forcing input/output in Run mode	Operation
Abnormal condition	Light (on)	Off	Flashes	Self-diagnostic error (Operation is running.)	Operation
	Off	Light (on)	Flashes	Self-diagnostic error (Operation stops.)	Stop
	Light (on) or off	Light (on) or off	Light (on)	System watchdog timer has been activated	Stop

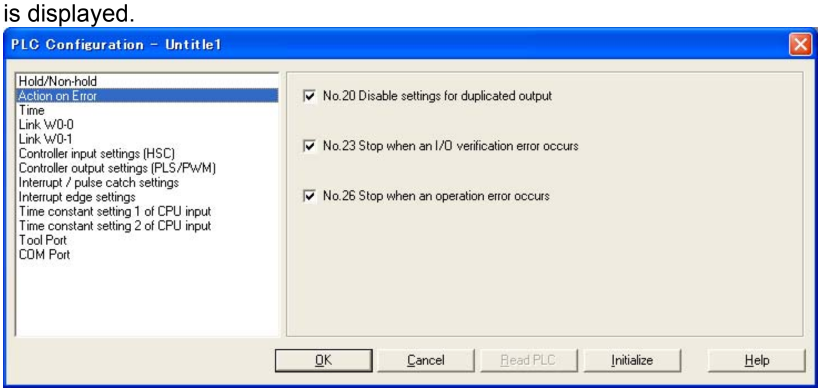
- The control unit has a self-diagnostic function which identifies errors and stops operation if necessary.
- When an error occurs, the status of the status indicator LEDs on the control unit vary, as shown in the table above.



11.1.2 Operation Mode When an Error Occurs

- Normally, when an error occurs, the operation stops.
- When the duplicated output error or operation error occurs, the user may select whether operation is to be continued or stopped by setting the system registers. You can set the error which operation is to be continued or stopped using the programming toolshoftware as shown below.

“PLC System Register” setting menue on programming tool software
To specify the steps to be taken by the FPWIN GR if a PLC error occurs, select “PLC System Register setting” under “Option” on the menu bar, and click on the “Action on Error” tab. The screen shown below is displayed.



Example1: When allowing duplicated output
Turn off the check box for No. 20. When operation is resumed, it will not be handled as an error.

Example2: When continuing operation even a calculation error has occurred
Turn off the check box for No. 26. When operation is resumed, it will be continued, but will be handled as an error.

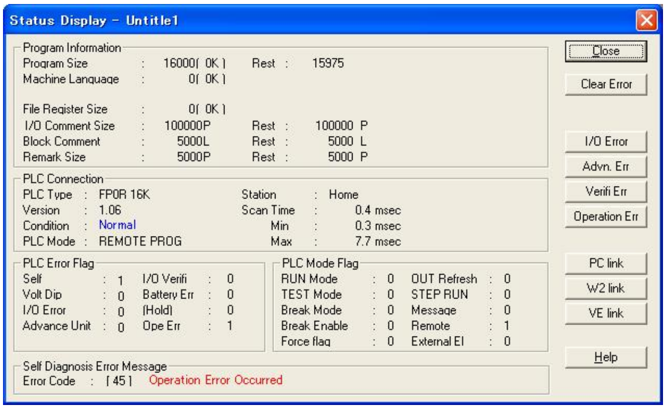
11.2 Troubleshooting

11.2.1 If ERROR/ALARM LED is Flashing

Condition: The self-diagnostic error occurs
Procedure 1
Check the error contents (error code) using the programming tool.

Using FPWIN GR
With the FPWIN GR, if a PLC error occurs during programming or debugging and the RUN mode is changed to the PROG. mode, the following status display dialog box is displayed automatically. Check the contents of the self-diagnosed error.

Status display dialog box

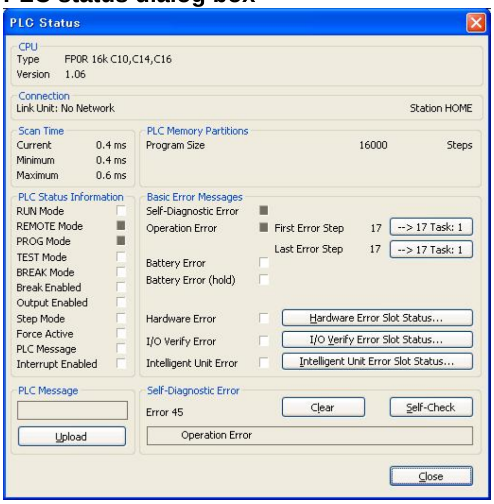


If the error is an operation error, the error address can be confirmed in this dialog box.

Key Point:
To display the status display dialog box, select “Status Display” under “Online” on the menu bar.

Using FPWIN Pro
With the FPWIN Pro, the contents of the self-diagnostic error can be echked in the following PLC status dialog box. Select "PLC status" under "Monitor" in the menu to display this dialog box.

PLC status dialog box



Procedure 2

<For error code is 1 to 9>

- Condition

There is a syntax error in the program.

- Operation 1

Change to PROG. mode and clear the error.

- Operation 2

Execute a total-check function using FPWIN GR to determine the location of the syntax error.
Or execute a check or compile using FPWIN Pro to determine the location of the syntax error.

<For error code is 20 or higher>

- Condition

A self-diagnostic error other than a syntax error has occurred.

- Operation

Use the programming tool in PROG. mode to clear the error.

Using FPWIN GR/FPWIN Pro

Click on the “Clear Error” button in the “Status display dialog box”. Error code 43 and higher can be cleared.

- In the 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 arecleared.
- An error can also be cleared by executing a self-diagnostic error set instruction F148 (ERR).

Key Point:

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, click on the “Operation Err” button in the “Status display dialog box” and confirm the address at which the error occurred before cancelling the error.

11.2.2 If ERROR LED is ON

Condition: The system watchdog timer has been activated and the operation of PLC has been activated.

Procedure 1
Set the mode selector of PLC from RUN to PROG. mode and turn the power off and then on.
- If the ERROR/ALARM LED is turned on again, there is probably an abnormality in the FP0R control unit. Please contact your dealer.
- If the ERROR/ALARm LED is flashed, go to chapter 11.2.1.

Procedure 2
Set the mode selector from PROG. to RUN mode.
- If the ERROR/ALARM LED is turned on, the program execution time is too long. Check the program.

Check
(1)Check if instructions such as “JMP” or “LOOP” are pgrogrammed in such a way that a scan never finish.
(2)Check if interrupt instructions are executed in succession.

11.2.3 ALL LEDs are OFF

Procedure 1
Check wiring of power supply.

Procedure 2
Check if the power supplied to the FP-X control unit is in the range of the rating.
- Be sure to check the fluctuation of the voltage.

Procedure 3
Disconnect the power supply wiring to the other devices if the power supplied to the FP-X control unit is shared with them.
- If the LED 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 questions.

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
Procedure 1
Check the wiring of the loads.
Procedure 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
Procedure 1
Monitor the output condition using a programming tool.
- If the output monitored is turned on, there is probably a duplicated output error.

Procedure 2
Forcing on the output using forcing input/output function.
- 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
Procedure 1
Check the wiring of the input devices.
Procedure 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 abnoramlity 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
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.

Check
(1)Check for the duplicated use of output. Check whether the output has been rewritten using the high-level instruction.
(2)Check the program flow when a control instruction such as MCR or JMP is used.

11.2.5 A Protect Error Message Appears

When a password function is used

Procedure

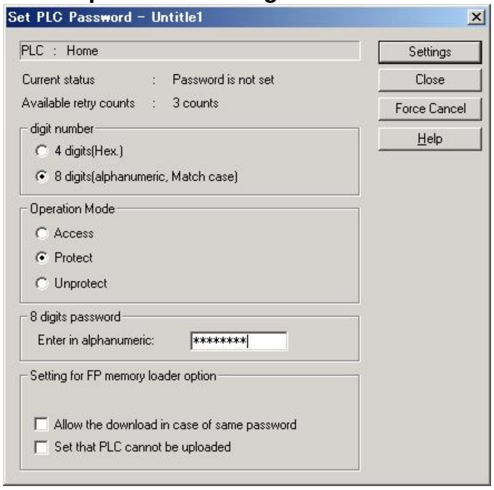
Enter a password in the “Set PLC Password” menu (FPWIN GR), “Security settings” menu (FPWIN Pro) and change it to the state to enable “Access”.

Using FPWIN GR

(1)Select “Set PLC Password” under “Tool” on the menu bar.

(2)The PLC password setting dialog box shown below is displayed. Turn on the radio button next to “Access”, enter a password, and click on the “Settings” button.

Set PLC password dialog box

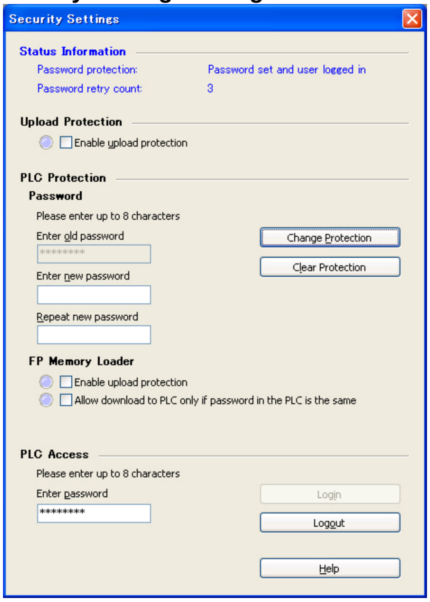


Using FPWIN Pro

(1) Select "Security Settings" under "Online" on the menu bar.

(2)The security setting dialog box shown below is displayed. Input the password in the field of "PLC access", and click the "Login" button.

Security Settings dialog box



11.2.6 PROG Mode does not Change to RUN

Condition: A syntax error or a self-diagnosed error that caused operation to stop has ocurred.

Procedure 1

Check if the ERROR/ALARM LED is flashing.

Example:

If the ERROR/ALARM LED is flashing, check <11.2.1 If ERROR/ALARM LED is Flashing >.

Procedure 2

Execute a total check (FPWIN GR) or check/compile (FPWIN Pro) to determine the location of the syntax error.

Using FPWIN GR

Select “Debug” on the menu bar, and select “Totally check program”. Click on the “Execute” button in the total check dialog box.

Using FPWIN Pro

Select "Compile All" under "Project", or "Check" under "Object" on the menu bar.
As the dialog box is displayed, check the contents.

Chapter 12

Precautions During Programming

12.1 Use of Duplicated Output

12.1.1 Duplicated Output

What is duplicated output?

- Duplicated output refers to repeatedly specifying the same outptu in a sequence program.
- If the same output is specified for the "OT" and "KP" instructions, it is considered to be duplicated output.
  (Even if the same output is used for multiple instructions, such as the SET, RST instruction or high-level instruction (such as data transfer), it is not regarded as duplicated output.)
- If you enter RUN mode while the duplicated output condition exists, it will be normally flagged as an error. (The ERROR/ALARM LED will flash and the self-diagnostic error flag R9000 will go on.)

How to check for duplicated use

You can check for duplicated outputs in the program using the programming tool, by the following method.

Using FPWIN GR

Select the "Debug" → ″Totally Check Program" in the menu bar, and click "Execute". If there are any duplicated outputs, an error message and the address will be displayed.

Using FPWIN Pro

If there are any duplicated outputs, an error message and the address will be displayed when compiling programs.

Enabling duplicated output

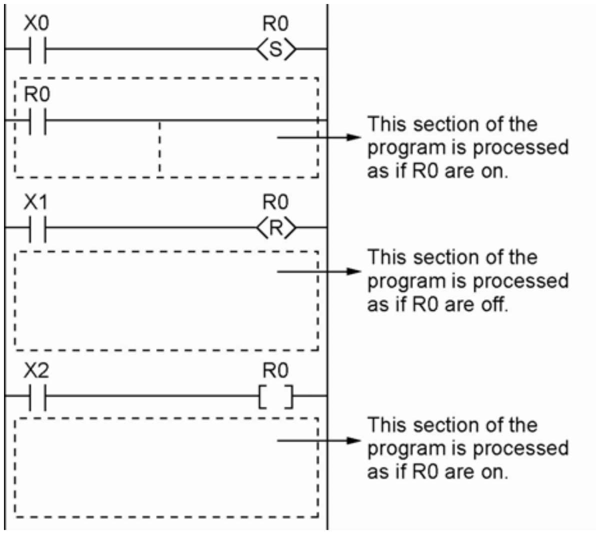
- If you need to use output repeatedly due to the content of the program, duplicated output can be enabled.
- In this case, change the settign of system register 20 to "enable".
- When this is done, an error will not occur when the program is executed.

12.1.2 When Output is Repeated with an OT, KP, SET or RST Instruction

Condition of internal and output relays during operation

- When instructions are repeatedly used which output to internal and output relays such as transfer instructions and OT, KP, SET and RST instructions, the contents are rewritten at each step during operation.

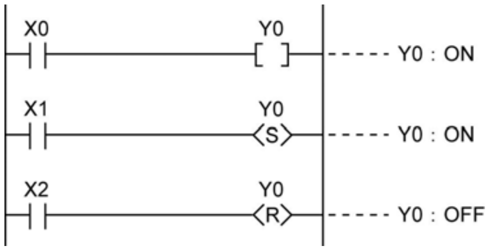
<Example> Processing when SET, RST and OT instructions are used (X0 to X2 are all on).



The output is determined by the final operation results

- If the same output is used by several instructions such as the OT, KP, SET, RST or data transfer functions, the output obtained at the I/O update is determined by the final results of the operation.

<Example> Output to the same output relay Y0 with OT, KP, SET and RST instructions.



When X0 to X2 are all on, Y0 is output as off at I/O update.

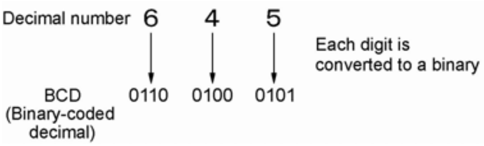
- If you need to outptu a result while processing is still in progress, use a partial I/O update instruction (F143).

12.2 Handling BCD Data

12.2.1 BCD Data

BCD is an acronym for binary-coded decimal, and means that each digit of a decimal number is expressed as a binary number.

<Example> Expressing a decimal number in BCD:

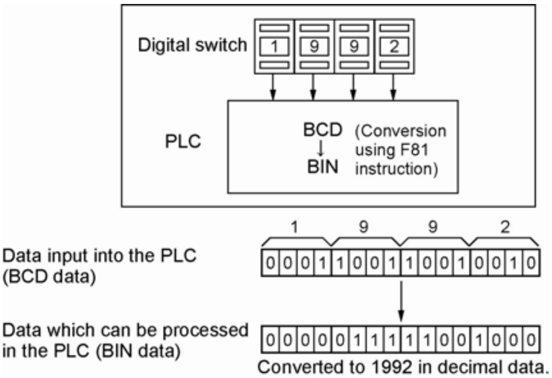


12.2.2 Handling BCD Data in the PLC

- When inputting data from a digital switch to the PLC or outputting data to a 7-segment display (with a decoder), the data must be in BCD form.
  In this case, use a data conversion instruction as shown in the examples below.
- BCD arithmetic instructions (F40 to F58) also exist which allow direct operation on BCD data, however, it is normally most convenient to use BIN operation instructions (F20 to F38) as operation in the PLC takes place binary.

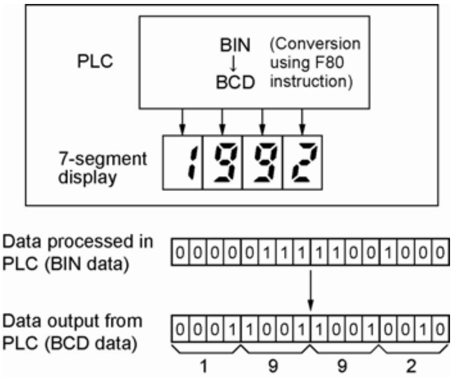
Input from a digital switch

Use the BCD-to-BIN conversion instruction F81.



Output to a 7-segment display (with decoder)

Use the BIN-to-BCD conversion instruction F80.

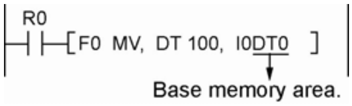


12.3 Handling Index Registers

12.3.1 Index Registers

- Like other registers, index registers have 14 points, I0 to ID, for reading and writing 16-bit data.
- Use an index register to indirectly specify a memory area number. (This is called index modification.)

<Example> Transferring the contents of data register DT100 to the number specified by the contents of an index register.

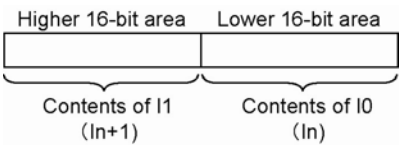


In this example, the number of the destination data register varies depending on the contents of I0 with DT0 acting as a base. For example, when I0 contains K10, the destination will be DT10, and when I0 is K20, the destination will be DT20.

- In this way, index registers allow the specification of multiple memory areas with a single instruction, and thus index registers are very convenient when handling large amounts of data.

12.3.2 Memory Areas Which can be Modified with Index Registers

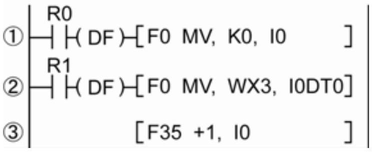
- Index registers can be used to modify other types of memory areas in addition to data registers DT.
  <Example> I0WX0, I0WY1, I0WR0, I0SV0, I0EV2, I0DT100
- Constants can be also modified.
  <Example> I0K10, I0H1001
- An index register cannot modify another index register.
  <Example> I0I0, I0I1
- When using index modification with an instruction which handles 32-bit data, specify with I0. In this case, I0 and I1 are handled together as 32-bit data.



12.3.3 Example of Using an Index Register

Repeatedly reading in external data

<Example> Writing the contents of input WX3 to a sequence of data registers beginnig from DT0.



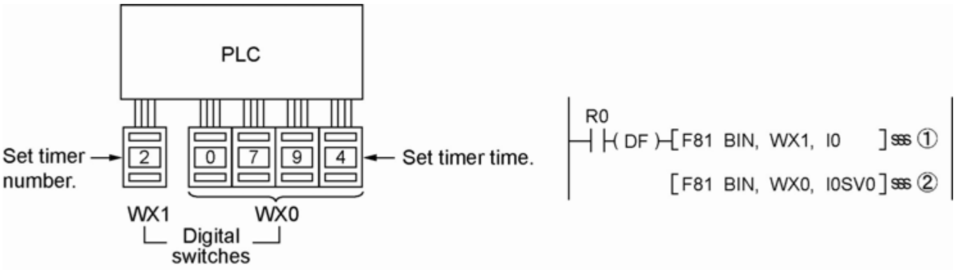
① When R0 turns on, 0 is written to index register I0.
② When the R1 turns on, the contents of input WX3 is transferred to the data register specified by I0DT0.
③ Add 1 to I0.

In this case, the contents of I0 will change successively, and the destination data register will be as follows.

Input times of R1	Contents of I0	Destination data register
1st	0	DT0
2nd	1	DT1
3rd	2	DT2
:	:	:

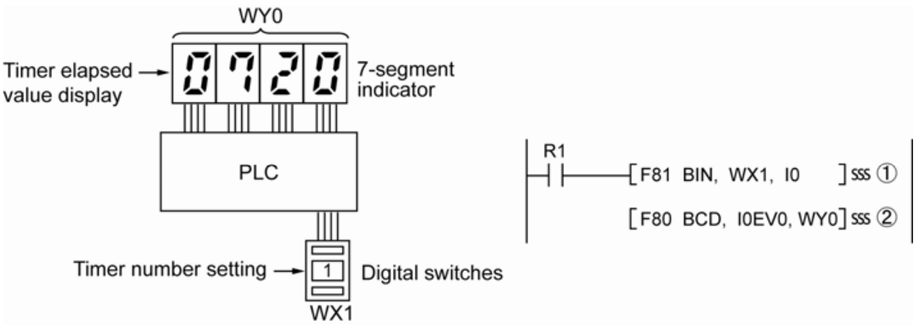
Inputting and outputting data based on a number specified by an input

<Example 1> Setting a timer number specified by a digital switch



① Convert the BCD timer number data in WX1 to binary and set it in index register I0.
② Convert the BCD timer set value in WX0 to binary and store in the timer set value area SV specified by contents of I0.

<Example 2> Taking external output of the elapsed value in a timer number specified by a digital switch



① Convert the BCD timer number data in WX1 to binary and set it in index register I0.
② Convert the elapsed value data EV in the timer specified by I0 to BCD, and output it to output relay WY0.

12.4 Operation Errors

12.4.1 Outline of Operation Errors

- An operation error is a condition in which operation is impossible when a high-level instruction is executed.
- When an operation error occurs, the ERROR/ALARM LED on the control unit will blink and the operation error flags (R9007 and R9008) will turn on.
- The operation error code "E45" is set at special data register DT90000.
- The error address is stored in special data registers DT90017 and DT90018.

Types of operation error
1. Address error
The memory address (number) specified by index modification is outside the area which can be used.
2. BCD data error
Operation is attempted on non-BCD data when an instruction handling BCD is executed, or BCD conversion is attempted on data which is not within the possible conversion range.
3. Parameter error
In an instruction requiring the specification of control data, the specified data is outside the possible range.
4. Over area error
The data manipulated by a block instruction exceeds the memory range.

12.4.2 Operation Mode When an Operation Error Occurs

- Normally, the operation stops when an operation error occurs.
- When you set system register 26 to "continuation", the control unit operates even if an operation error occurs.

Using FPWIN GR
1. Set the mode of the CPU to RPOG.
2. Select the ″Option" in "PLC Configuration" option from the menu bar.
3. On the "PLC Configuration" menu, select "Action on error". This displays system registers 20 to 26.
4. Remove the check of system register 26.
5. Press the "OK" to write the setting to the PLC.

Using FPWIN Pro
1. Change the mode to offline.
2. Select "Action on error" from the system register table of the project navigator.
3. Change the setting of No. 26.

12.4.3 Dealing with Operation Errors

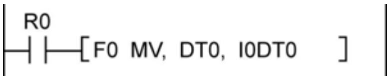
<Procedure>
1. Check the location of the error.
Check the address where the error occurred, which is stored in DT90017 and DT90018, and make sure the high-level instruction for that address is correct and appropriate.
2. Clear the error.
Use a programming tool to clear the error.
- When using FPWIN GR, select "Online" → "Status Display" in the menu bar. Execute "Clear Error".
- When using FPWIN Pro, select "Monitor" → "PLC Status". Press the "Error Clear" button.

- An error can be cleared by turning the power off and on in PROG. mode, however, the contents of the operation memory except the hold type data will be cleared.
- An error can also be cleared by executing a self-diagnostic error set instruction (F148).
- If the mode selector is set to "RUN", RUN will resume as soon as the error is cleared. So if the cause of the error is not removed, the error may seem not to be cleared.

12.4.4 Points to Check in Program

1. Check if an extraordinarily large value or negative value was stored in the index register.。

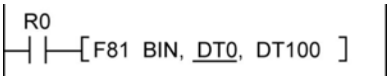
<Example> When a data register is modified using an index register



In this case, index register modifies the address of data register DT0. However, it my exceed the addressable range of the data register depending on the data in I0. If the value exceeds the range, an operation error will occur. The same is true when the contents of I0 are a negative value.

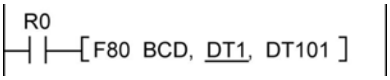
2. Is there any data which cannot be converted using BCD ↔ BIN data conversion?

<Example> When BCD-to-BIN conversion is attempted



In this case, if DT0 contains a hexadecimal number with one of the digits A through F such as 12A4, conversion will be impossible and an operation error will result.

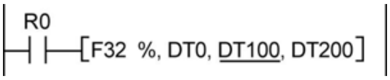
<Example> When BIN-to-BCD conversion is attempted



In this case, if DT1 contains a negative value or a value greater than K9999, an operation error will occur.

3. Check if the devisor of a division instruction is ″0″.

<Example>



In this case, if the content of DT100 is "0", an operation error will occur.

12.5 Instructions of Leading Edge Detection Method

12.5.1 Instructions of Leading Edge Detection Method

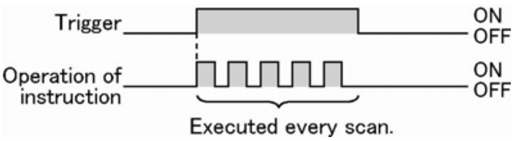
Instructions using the leading edge detection operation

1. DF (leading edge differential) instruction
2. Count input for CT (counter) instruction
3. Count input for F118 (UCD up-down counter) instruction
4. Shift input for SR (shift register) instruction
5. Shift input for F119 (LRSR left-right shift register) instruction
6. NSTP (next step) instruction
7. Differential execution type high-level instruction (P13)

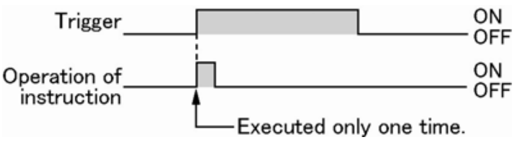
Leading edge detection method

- An instruction with a leading edge detection method operates only in the scan where its trigger (execution condition) is detected switching from off to on.

1. Standard operation



2. Leading edge detection operation



How to perform leading edge detection

The condition of the previous execution and the condition of the current execution are compared, and the instruction is executed only if the previous condition was off and the current condition is on. In any other case, the instruction is not executed.

Precautions when usign an instruction which performs leading edge detection

- When RUN begins, for example when the system is powered on, the off -> on change of the execution conditon (trigger) is not detected. Execution of the instruction will take place as explained on the next page.
- When used with one of the instructions indicated in instructions 1 to 6 belowwhich change the order of execution of instructions, the operation of hte instruction may change depending on input timing. Take care regarding this point.

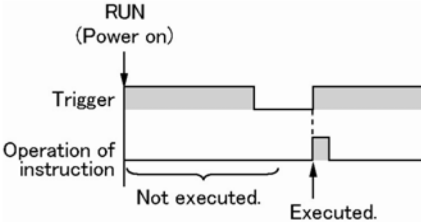
Be careful when using leading edge detection type instructions with control instructions, such as;

1. MC and MCE instructions
2. JP and LBL instructions
3. LOOP and LBL instructions
4. CNDE instruction
5. Step ladder instructions
6. Subroutine instructions

12.5.2 Operation and Precautions When RUN starts

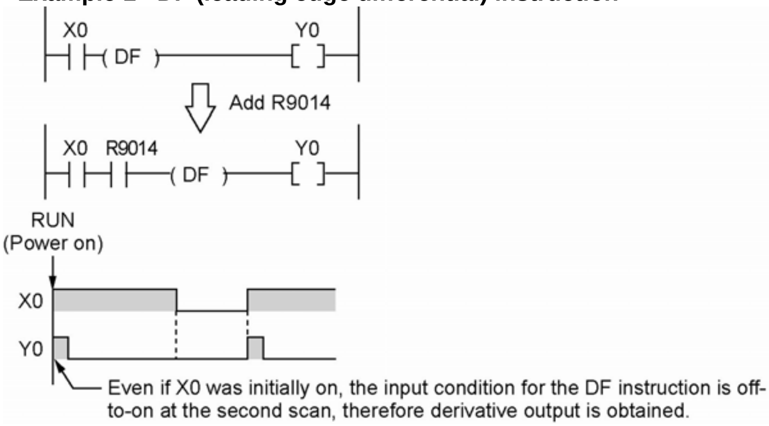
Operation of first scan after RUN begins

- The leading edge detection instruction is not executed when the mode has been switched to the RUN mode, or when the power supply is booted in the RUN mode, if the trigger (execution condition) is already on.

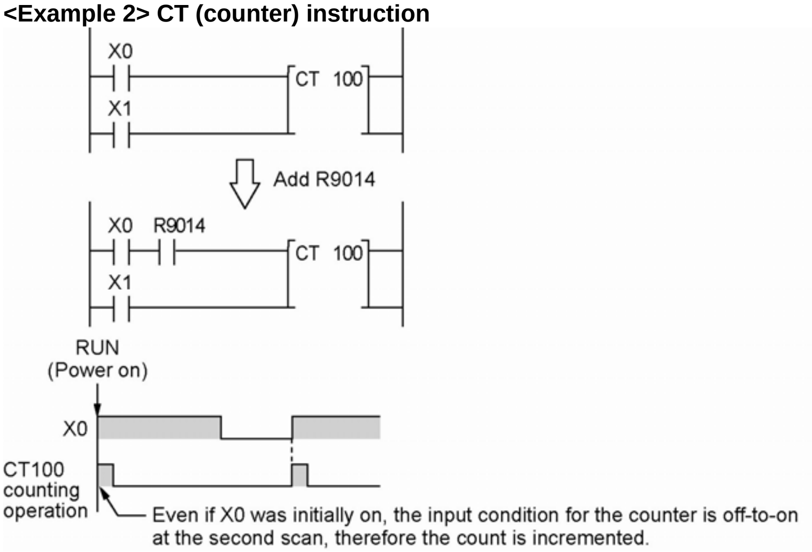


- If you need to execute an instruction when the trigger (execution condition) is on prior to switching to RUN mode, make a program as below using R9014 (initial pulse off relay). (R9014 is a special internal relay which is off during the first scan and turns on at the second scan.)

<Example 1> DF (leading edge differential) instruction



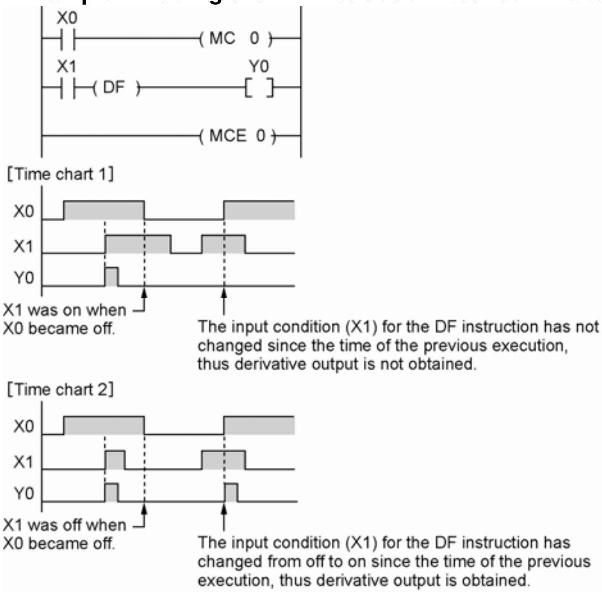
<Example 2> CT (counter) instruction



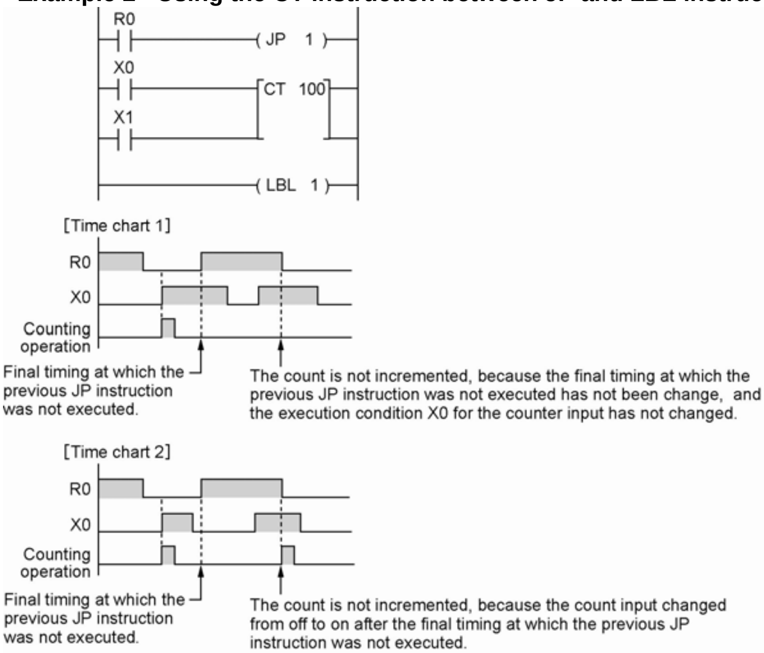
12.5.3 Precautions When Using a Control Instruction

- If a leading edge detection instruction is in a control instruction, it will be executed only under the following condition: The leading edge detection instruction was off when the execution condition of the previous control instruction was reset, and the leading edge detection instruction is on when the execution condition of the current control instruction becomes on.
- When a leading edge detection instruction is used with an instruction which changes the order of instruction execution such as MC, MCE, JP or LBL, the operation of the instruction may change as follows depending on input timing. Take care regarding this point.

<Example 1> Using the DF instruction between MC and MCE instructions



<Example 2> Using the CT instruction between JP and LBL instructions

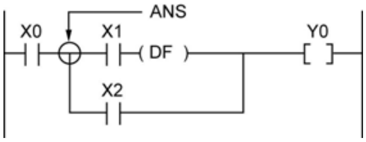


12.6 Precautions for Programming

Programs which are not executed correctly

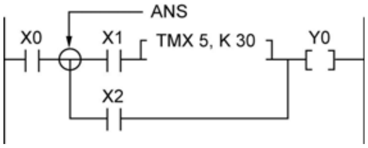
Do no write the following programs as they will not be executed correctly.

<Example 1>



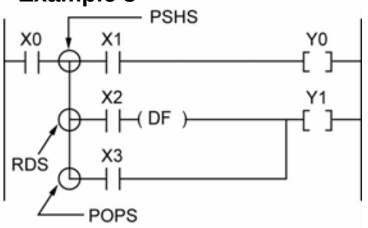
- When X1 was on prior to X0, Y0 will not be on even if X0 becomes on.

<Example 2>



- TMX5 will activate if X1 becomes on regardless of whether X0 is on or off.

<Example 3>

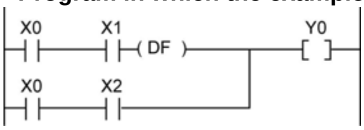


- When X2 was on prior to X0, Y1 will not be on even if X0 becomes on.

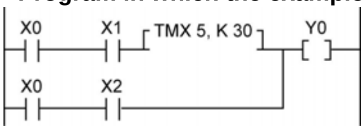
When a combination of contacts are set as the trigger (execution condition) of a differential instruction (DF) or timer instruction, do not use an AND stack (ANS) instruction, read stack (RDS) instruction, or pop stack (POPS) instruction.

Examples in which the above programs are rewritten correctly

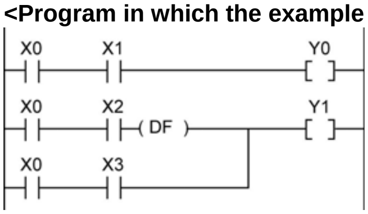
<Program in which the example 1 is rewritten>



<Program in which the example 2 is rewritten>



<Program in which the example 3 is rewritten>



12.7 Rewrite Function During RUN

12.7.1 Operation of Rewrite During RUN

How operation of rewrite during RUN is performed

Rewriting programs can be executed even in RUN mode. When a rewrite is attempted during RUN, the tool service time is temporarily extended, program rewriting is performed, and operation is resumed without the need to change the mode. For this reason, the tiem of the scan during the RUN rewrite extends from several ms to several hundreds of ms.

Operation during rewrite

1. External output (Y) is held.
2. External input (X) is ignored.
3. The timer (T) stops the clock.
4. Rise and fall changes in the inputs of differential instructions (DF), counter instructions (CT), and left/right sift registers are ignored.
5. Interrupt functions are stopped.
6. Internal clock relays (special internal relays) are also stopped.
7. Pulse output is stopped during the rewrite.

Set values for timer/counter instructions

All set values specified with decimal constants (K) in timer and counter instructions are preset in the corresponding set value areas (SV). Values in the elapsed value area (EV) do not change/

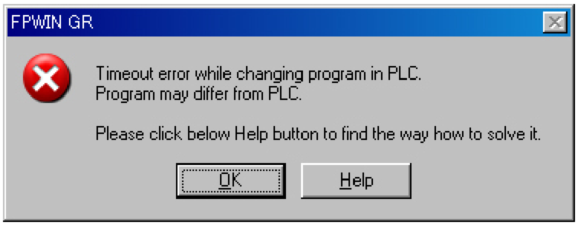
Operation of rewrite during RUN complete flag

The rewrite during RUN complete flag (R9034) is a special internal relay that goes on for only the first scan following the completion of rewriting in the RUN mode. It can be used instead of the initial pulse relay following a change in the program.

12.7.2 Cases Where Rewriting During Run is Not Possible

When the timeout error message is indicated:

Even if the timeout error message is indicated, it is highly possible that the program in PLC has been already rewritten. Carry out the following operations.



1. When ladder symbol mode

As a ladder editing is left, set it to the offline edit mode. Complete the program conversion in the tool software, and then change to the online edit mode to check.

2. When boolean mode

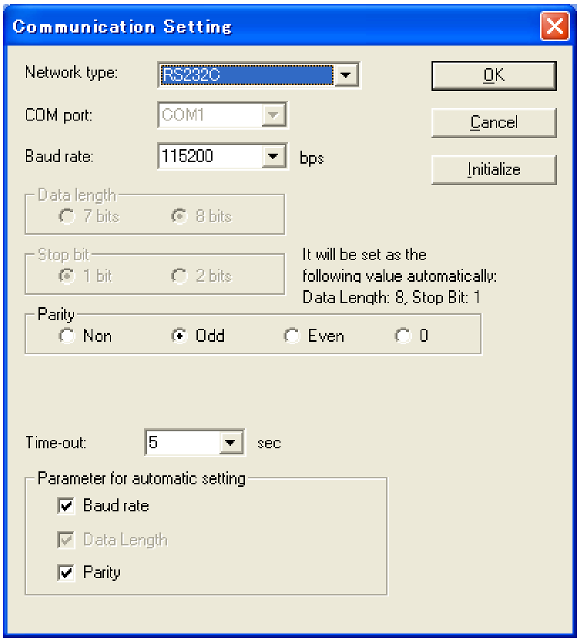
A ladder editing is cleared.

Set it to the offline edit mode and carry out the editing operation again. After the operation, change to the online edit mode to check.

When the timeout error occurs using the through mode in GT series programmable display

Extend the timeout time of the programmable display using the GTWIN.

(The default setting is 5 seconds.)



Select "Transfer" from "File" in the menu bar.
The "Transfer data" screen will open.
Select "Condition" to open "Communication Setting" screen.
Change the value for "Timeout".
Click "OK" button to complete the change of setting.

Cases where rewriting is not possible during RUN
1. When the result of rewriting is a syntax error.

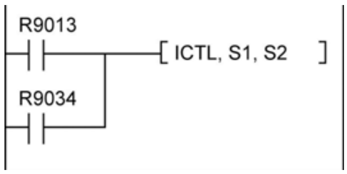
<Example>
When executing the rewriting which does not form the following pair of instructions.
1. Step ladder instructions (SSTP/STPE)
2. Subroutine instructions (SUB/RET)
3. Interrupt instructions (INT/IRET)
4. JP/LBL
5. LOOP/LBL
6. MC/MCE

Also, rewriting is not possible during RUN in case of other syntax error.

2. During the forced input/output operation

Interrupt restrictions
When using interrupt, high-speed counter, pulse output or PWM output functions, do not perform a rewrite during RUN.
If a rewrite during RUN is executed, the operation as below will be performed. Exercise caution.

1. Interrupt programs will be disabled.
Enable by executing an ICTL instruction once again.
<Example> Using R9034 (rewrite during RUN completed flag)



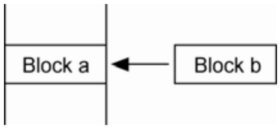
2. The high-speed counter will continue to count.
Target value match on/off instructions (F166/F167) will continue.
Coincidence interrupt programs will be disabled when the F166/F167 instruction is running.

3. Pulse output and PWM output will be stopped.

State	Instructon number	Name
Stop	F171(SPDH)	Pulse output (Trapezoidal control)
Stop	F171(SPDH)	Pulse output (JOG positioning Type 0)
Stop	F171(SPDH)	Pulse output (JOG positioning Type 1)
Stop	F172(PLSH)	Pulse output (JOG operation Type 0, Type 1)
Stop	F173(PWMH)	PWM output
Stop	F174(SP0H)	Pulse output (Selectable data table control operation)
Stop	F175(SPSH)	Pulse output (Linear interpolation)
Stop	F177(HOME)	Pulse output (Home return)

4. The regular sampling trace will not stop.

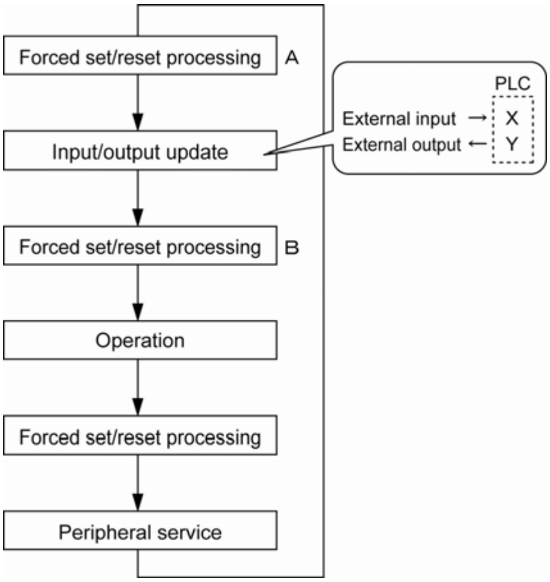
12.7.3 Procedures and Operation of Rewrite During RUN

Item		FPWIN GR Ladder symbol mode	FPWIN GR Boolean mode
Rewrite procedure		Maximum of 128 steps. Changes are performed by block. When PG conversion is executed online, the program will be rewritten.  	Rewriting performed by step. Caution is required as rewriting takes place simultaneously with the change.
Operation of each instruction	OT/KP	If an instruction written in block a is detected in block b, the condition before the rewrite will be held.	If an instruction written in block a is detected in block b, the condition before the rewrite will be held. Y contact relays which are on will be held in the on state. To turn them off in the RUN mode, use forced output. To turn them off in the RUN mode, use forced output.
	TM/CT	If an instruction written in block a is detected in block b, the condition before the rewrite will be held. Set values specified by K constants in TM/CT instructions are preset in all of the corresponding SV in the program. (Elapsed values EV do not change.)	If an instruction written in block a is detected in block b, the condition before the rewrite will be held. Set values specified by K constants in TM/CT instructions are preset in all of the corresponding SV in the program. (Elapsed values EV do not change.)
	Fun High-level instructions	If an instruction written in block a is detected in block b, the condition before the rewrite will be held.	・If deleted, the output memory area will be held.
	MC/ MCE	When writing MC/MEC instructions, be sure to write the instructions as a pair.	Writing or deleting a single instruction during RUN is not possible. Write or delete the instruction in FPWIN GR ladder symbol mode.
	CALL/ SUB/ RET	A subroutine is a program appearing between SUBn and RET instructions. Be sure to write it to an address which follows the ED instruction.	Write in the order: RET, SUB, CALL Delete in the order: CALL, SUB, RET
	INT/ IRET	An interrupt program is a program appearing between INTn and IRET instructions. Be sure to write it to an address which follows the ED instruction.	Write in the order: IRET, INT Delete in the order: INT, IRET

Item		FPWIN GR Ladder symbol mode	FPWIN GR Boolean mode
Operation of each instruction	SSTP/ STPE	A distance with the same number cannot be defined twice. An SSTP instruction cannot be written in a subprogram.	Writing and deletion of a single instruction is not possible for a program with no step ladder area. Write or delete both instructions simultaneously in FPWIN GR ladder symbol mode. In the case of an SSTP instruction only, writing and deletion of a single instruction is possible for a program with a step ladder area.
	JP/ LOOP/LBL	Be sure to write the instruction for setting the loop number before LBL-LOOP instructions.	Write in the order: JP-LBL or LOOP-LBL Delete in the order: LBL-JP or LBL-LOOP

12.8 Processing During Forced Input and Output

12.8.1 Processing When Forced Input/Output is Initiated During RUN



1. Processing of external input (X)

- Regardless of the state of the input from the input device, forced on/off operation will take precedence at a contact specified for forced input/output in the above procedure B. At this time, the input LED will not blink, however, the area of input X in the operation memory will be rewritten.
- As for contacts not specified, the on/off state will be read according to the input status from the input device.

2. Processing of external output (Y)

- Regardless of the state of the result of operation, forced on/off will take precedence at a contact specified for forced input/output in the above procedure A. At this time, the area of output Y in the operation memory will be forcibly rewritten. External output will take place according to the input/output update timing in the above diagram.
- The on/off state of contacts not specified will be determined by the operation result.

3. Processing of Timer (T) and Counter (C)

- Regardless of the timer/counter input condition, forced on/off operation will take precedence at a contact specified for forced input/output. At this time, the contact of the timer (T) or counter (C) in the operation memory will be rewritten. Timing and counting will not take place during control.
- The on/off state of contacts not specified will be determined by the operation result.

Operation during operation

For small-sized PLCs FP0, FP0R, FPΣ and FP-X

The internal relay R or output Y specified by OT or KP instruction is rewritten according to the results of operation. However, as the R or Y is set/reset again right before the peripheral service (as the above procedure C), the monitoring value with the tooling software or the output to external devices is forcibly rewritten to a specified value.

For medium-sized PLCs FP2, FP2SH

For the internal relay R and output Y specified by OT or KP instruction, the value of the forced processing has a priority. When rewritten by a high-level instruction, the result of the instruction has a priority.

Chapter 13

Specifications

13.1 Table of Specifications

13.1.1 General Specifications

Item	Description		
Rated operating voltage	24 V DC		
Operating voltage range	20.4 to 28.8 V DC		
Allowable momentary power off time	C10, C14, C16: 5 ms(at 20.4 V), 10 ms(at 21.6 V)		
	C32, T32, F32 : 10 ms(at 20.4 V)		
Fuse	Built-in (Not replaceable)		
Ambient temperature	0 to +55 °C		
Storage temperature	-40 to +70 °C (T32 only: -20 to +70 °C)		
Ambient humidity	10 to 95 % RH (at 25 °C, No condensation)		
Storage humidity	10 to 95 % RH (at 25 °C, No condensation)		
Breakdown voltage (Detection current: 5 mA)		Tr output type	Ry output type
	Between “input terminals” and “output terminals”	500 V AC for 1 minute	1500 V AC for 1 minute
	Between “output terminals” and “output terminals” (Between different commons)	-	1500 V AC for 1 minute
	Between “input terminals” and “power/ground terminals”	500 V AC for 1 minute	500 V AC for 1 minute
	Between “output terminals” and “power/ground terminals”	500 V AC for 1 minute	1500 V AC for 1 minute
	Between “ground terminal” and “power terminal”	500 V AC for 1 minute	500 V AC for 1 minute
Insulation resistance (Test voltage: 500 V DC)		Tr output type	Ry output type
	Between “input terminals” and “output terminals”	Over 100 MΩ	Over 100 MΩ
	Between “output terminals” and “output terminals” (Between different commons)	-	Over 100 MΩ
	Between “input terminals” and “power/ground terminals”	Over 100 MΩ	Over 100 MΩ
	Between “output terminals” and “power/ground terminals”	Over 100 MΩ	Over 100 MΩ
	Between “ground terminals” and “power terminal”	Over 100 MΩ	Over 100 MΩ
Vibration resistance	5 to 9 Hz, Single amplitude of 3.5 mm, 1 sweep/min., 9 to 150 Hz, Constant acceleration of 9.3 m/s^2, 1 sweep/min., 10 min. on 3 axes (Towards X,Y & Z directions)		
Shock resistance	147 m/s^2, 4 times on 3 axes (Towards X,Y & Z directions)		
Noise immunity	1000 V[P-P] with pulse width 50 ns, 1μs (using a noise simulator) (Power supply terminal)		
Operating condition	Must be free from corrosive gases and excessive dust		
Overvoltage category	Category II		
Pollution level	Pollution level 2		
Weight	C10: 100 g, C14: 105 g, C16: 85 g, C32: 115 g, T32: 115 g, F32: 120 g		

Unit's current consumption table

		Control unit current consumption	Expansion unit current consumption	Input circuit current consumption	Output circuit current consumption
		This is the current consumed from the control unit power supply connector. If expansion units or intelligent units are added, the current is increased by the value indicated below.	This is the current consumed from the expansion unit power supply connector. If a unit is not listed below, it means that it has no power supply connector	This is the current consumed by the input circuits of the various units. This value indicates the current that flows into the input circuit.	This is the current consumed by the output circuits of the various units. This value indicates the current used to drive the output circuits. This value does not include the load current value.
FP0R control unit	FP0R-C10	100 mA or less	–	15.9 mA or less	–
	FP0R-C14	120 mA or less	–	21.1 mA or less	–
	FP0R-C16	70 mA or less	–	21.1 mA or less	20 mA or less
	FP0R-C32 FP0R-T32 FP0R-F32	90 mA or less	–	42.2 mA or less	40 mA or less
FP0 expansion unit	FP0-E8X	10 mA or less		34.4 mA or less	–
	FP0-E8R	15 mA or less	50 mA or less	17.2 mA or less	–
	FP0-E8YR	10 mA or less	100 mA or less	–	–
	FP0-E8YT/P	15 mA or less	–	–	24 mA or less
	FP0-E16X	20 mA or less	–	68.8 mA or less	–
	FP0-E16R	20 mA or less	100 mA or less	34.4 mA or less	–
	FP0-E16T/P	25 mA or less	–	34.4 ma or less	24 mA or less
	FP0-E16YT/P	25 mA or less	–	–	48 mA or less
	FP0-E32T/P	40 mA or less	–	68.8 mA or less	48 mA or less
FP0 intelligent unit	FP0-A21	20 mA or less	100 mA or less	–	–
	FP0-A80	20 mA or less	60 mA or less	–	–
	FP0-A04V	20 mA or less	100 mA or less	–	–
	FP0-A04I	20 mA or less	130 mA or less	–	–
	FP0-TC4 FP0-TC8 FP0-RTD6	25 mA or less	–	–	–
	FP0-IOL	30 mA or less	40 mA or less	–	–
	FP0-CCLS	40 mA or less	40 mA or less	–	–
Programmable display GT01, GT01R (5 VDC, RS232C type)	AIGT0030 AIGT0230	80 mA or less	–	–	–
C-NET adapter S2	AFP15402	50 mA or less	–	–	–

13.1.2 Control Specifications

Item		C10, C14	C16	C32	T32	F32
Programming method		Relay symbol				
Control method		Cyclic operation				
Program memory	Built-in memory	Flash ROM				
	Memory capacity	16000 steps		32000 steps		
	Rewriting during RUN	Available (Simultaneous rewriting capacity: 512 steps)				
	Download during RUN	Available (All programs)				
	Security function	Password function (4-digit, 8-digit), Read protection setting				
Comment memory	Memory capacity	328 kbytes (All comments including I/O comments, annotations, interlinear comments)				
	Download during RUN	Available (All comments)				
I/O update time & base time		Without expansion units: 0.2 ms or less With expansion units: 0.2 ms or less + (1×the number of expansion unit) ms				
Operation speed	Up to 3k steps	Basic instruction: from 0.08 μs, Timer instruction: 2.2 μs, High-level instruction: from 0.32μs (MV instruction)				
	After 3k steps	Basic instruction: from 0.58 μs, Timer instruction: 3.66 μs, High-level instruction: from 1.62μs (MV instruction)				
Basic instruction		Approx. 110 types				
High-level instruction		Approx. 210 types				
External input (X)		1760 points				
External output (Y)		1760 points				
Internal Relay (R)		4096 points				
Special Internal Relay(R)		224 points				
Link Relay (L)		2048 points				
Timer/Counter (T/C)		1024 points (Factory default: Timer 1008 points: T0 to T1007, Counter 16 points: C1008 to C1023)				
Data register(DT)		12315 words		32765 words		
Special data register(DT)		440 words (DT90000 to DT90443)				
Link data register (LD)		256 words				
Index register (I0 to ID)		14 words				
Master control relay(MCR)		256 points				
Number of labels (JMP, LOOP)		256 labels				
Differential points		Number of points that is within the program capacity				
Number of step ladder		1000 stages				
Number of subroutines		500 subroutines				
Sampling trace		Avaialble Smapling by commands/Sampling at regular time intervals For one sampling: 16 bits + 3 words C10/C14/C16=300 samples C32/T32/F32=1000 samples				
High speed counter (HSC)		At single phase 6 points (Max. 50 kHz) or second phase 3 points (Max. 15 kHz) [*1]				
Pulse output		-	4 points (Max. 50 kHz) [*1 *2]			
PWM output		-	4 points (Max. 4.8 kHz) [*1 *2]			
Pulse catch input		8 points in total (including HSC and interrupt input)				
Interrupt program		Input: 8 programs (C10 only. Input: 6 programs) Periodical: 1 program Pulse match: 4 programs				
Periodical interrupt		0.5 ms unit: 0.5 ms to 1.5 s/10 ms unit: 10 ms to 30 s				
Constant scan		0.5 ms unit: 0.5 ms to 600 ms				

<table>
<tr><th colspan="2">Item</th><th>C10, C14</th><th>C16</th><th>C32</th><th>T32</th><th>F32</th></tr>
<tr><td rowspan="2">Flash ROM Backup *3</td><td>Backup by F12, P13Instruction</td><td colspan="5">All areas *4</td></tr>
<tr><td>Auto backup when power is OFF *4</td><td colspan="4">Counter: 16 points
Internal relay: 128 points
Data register : 315 words</td><td>-</td></tr>
<tr><td colspan="2">RAM backup</td><td colspan="3">-</td><td>All areas *5 (Built-in backup battery) *6</td><td>All areas *5</td></tr>
<tr><td colspan="2">Clock/Calendar *7</td><td colspan="3">-</td><td>Available</td><td>-</td></tr>
<tr><td colspan="2">Communication port</td><td colspan="5">Tool port/USB port/COM port (RS232C port) (Only type with C)</td></tr>
<tr><td colspan="2">Self-diagnosis functions</td><td colspan="5">Watchdog timer (Approx. 690 ms), program syntax checking</td></tr>
</table>

*1) The specification is when rated input voltage is at 24 V DC and temperature at 25 °C.
Frequency may decrease depending on voltage, temperature or operating condition.

*2) No. of channels: A total of 4 channels is available for pulse output and PWM output.
Frequency: Pulse output can be specified up to 50 kHz. PWM output can be specified up to 4.8 kHz.
An error on the pulse width that is a maximum of 40μs may occur for the setting value depending on voltage, temperature or operating condition.

*3) Guaranteed number of writing is up to 10000 times.

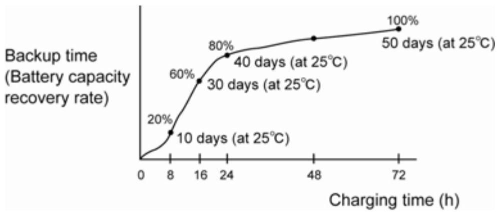
*4) Auto backup area when power is off

Type	C10, C14, C16	C32, T32
Backup area	C1008 to 1023 (C: Contact, EV: Elapsed value) R2480 to 255F DT12000 to 12314	C1008 to 1023 (C: Contact, EV: Elapsed value) R2480 to 255F DT32450 to 32764

*5) All the areas of timer/counter, internal relays, link relays, link registers and data registers can be held.
Non-hold areas and hold areas can be specified by the setting of system register.

*6) Notes about built-in backup battery (T32 only)
Secondary battery is used for this product.
It has not been charged when it is shipped from the factory. Energize and charge it before you use it.
The secondary battery does not have a function to notify the battery voltage reduction. However, if the battery is out of charge and the hold area becomes indefinite, the values in the hold areas will be cleared to 0 when the power is turned on next time.
(We recommend to add a program for clearing the data to 0 when the values in hold areas become indefinite.)

- Relation between charging time and backup time



- **Backup time**
When ambient temperature is 70 °C: 14 days
When ambient temperature is 25 °C: 50 days
When ambient temperature is -20 °C: 25 days

- Predicted backup life
When ambient temperature is 55 °C: 430 days
When ambient temperature is 45 °C: 1200 days
When ambient temperature is 40 °C: 2100 days
When ambient temperature is 35 °C: 3300 days
When ambient temperature is 34 °C or lower: 10 years
(The temperature when the power is off has little influence on the battery life.)

*7) Precision of Clock/Calendar (T32 only):
When ambient temperature is 0 °C: Less than 104 seconds per month
When ambient temperature is 25 °C: Less than 51 seconds per month
When ambient temperature is 55 °C: Less than 155 seconds per month

13.1.3 Communication Specifications

Tool port

	Description
Interface	RS232C
Transmission distance	15 m
Baud rate	2400,4800,9600,19200,38400,57600,115200 bit/s
Communication method	Half-duplex operation
Synchro system	Asynchronous communication method
Transmission format	Data length 7 bits / 8 bits
	Parity: None/Even/Odd
	Start code: STX / No STX
	End code: CR / CR+LF / None / ETX
	Stop bit: 1 bit / 2 bits
Order of data transmission	Transmits from bit 0 character by character.
Communication function	Computer link (Slave) Modem initialization General-purpose communication (In the RUN mode only)

USB port

	Description
Standard (Baud rate)	USB2.0 Fullspeed
Communication mode	Computer link (Slave)

COM port (RS232C port) (C10CR, C14CR, C16C, C32C, T32C, F32C)

	Description
Interface	RS232C
Transmission distance	15 m
Baud rate	2400,4800,9600,19200,38400,57600,115200 bit/s
Communication method	Half-duplex communication
Synchronous method	Start stop synchronous system
Communication format	Data length: 7 bits/8bits Parity: None/Even/Odd Start code: STX/No STX End code: CR/CR+LF/None/ETX Stop bit: 1 bit/2 bits
Order of data transmission	Transmits from bit 0 character by character.
Communication function	Computer link (Master/Slave) Modem initialization General-purpose communication MODBUS RTU (Master/Slave) PC(PLC) link (A maximum of 16 units can be connected by converting to RS485.)

Factory default

	Baud rate	Data length	Parity	Stop bit
Tool port	9600 bit/s	8 bits	Odd	1 bit
COM port (RS232C port)	9600 bit/s	8 bits	Odd	1 bit

13.2 I/O Number Allocation

13.2.1 I/O Numbers for FP0R Control Unit

The I/O allocation for the FP0R control unit is fixed.

Unit type	Allocation points	I/O No.
C10	Input: 6 points	X0 to X5
	Output: 4 points	Y0 to Y3
C14	Input: 8 points	X0 to X7
	Output: 6 points	Y0 to Y5
C16	Input: 8 points	X0 to X7
	Output: 8 points	Y0 to Y7
C32/T32/F32	Input: 16 points	X0 to XF
	Output: 16 points	Y0 to YF

13.2.2 I/O Numbers for FP0 Expansion Unit

- I/O numbers do not need to be set as I/O allocation is performed automatically by the PLC when an expansion I/O unit is added.
- The I/O allocation for expansion units is determined by the installation location.

Unit type		Allocation points	Expansion unit 1	Expansion unit 2	Expansion unit 3
FP0 expansion unit	FP0-E8X	Input: 8 points	X20 to X27	X40 to X47	X60 to X67
	FP0-E8R	Input: 4 points	X20 to X23	X40 to X43	X60 to X63
		Output: 4 points	Y20 to Y23	Y40 to Y43	Y60 to Y63
	FP0-E8YT/P FP0-E8YR	Output: 8 points	Y20 to Y27	Y40 to Y47	Y60 to Y67
	FP0-E16X	Input: 16 points	X20 to X2F	X40 to X4F	X60 to X6F
	FP0-E16R FP0-E16T/P	Input: 8 points	X20 to X27	X40 to X47	X60 to X67
		Output: 8 points	Y20 to Y27	Y40 to Y47	Y60 to Y67
	FP0-E16YT/P	Output: 16 points	Y20 to Y2F	Y40 to Y4F	Y60 to Y6F
	FP0-E32T/P	Input: 16 points	X20 to X2F	X40 to X4F	X60 to X6F
		Output: 16 points	Y20 to Y2F	Y40 to Y4F	Y60 to Y6F
FP0 analog I/O unit	FP0-A21	Input: 16 points (ch0)	WX2 (X20 to X2F)	WX4 (X40 to X4F)	WX6 (X60 to X6F)
		Input: 16 points (ch1)	WX3 (X30 to X3F)	WX5 (X50 to X5F)	WX7 (X70 to X7F)
		Output: 16 points	WY2 (Y20 to Y2F)	WY4 (Y40 to Y4F)	WY6 (Y60 to Y6F)
FP0 A/D converter unit FP0 thermocouple unit	FP0-A80 FP0-TC4 FP0-TC8	Input: 16 points (ch0, 2, 4, 6)	WX2 (X20 to X2F)	WX4 (X40 to X4F)	WX6 (X60 to X6F)
		Input: 16 points (ch1, 3, 5, 7)	WX3 (X30 to X3F)	WX5 (X50 to X5F)	WX7 (X70 to X7F)
FP0 D/A converter unit	FP0-A04V FP0-A04I	Input: 16 points	WX2 (X20 to X2F)	WX4 (X40 to X4F)	WX6 (X60 to X6F)
		Output: 16 points (ch0, 2)	WY2 (Y20 to Y2F)	WY4 (Y40 to Y4F)	WY6 (Y60 to Y6F)
		Output: 16 points (ch1, 3)	WY3 (Y30 to Y3F)	WY5 (Y50 to Y5F)	WY7 (Y70 to Y7F)
FP0 I/O link unit	FP0-IOL	Input: 32 points	X20 to X3F	X40 to X5F	X60 to X7F
		Output: 32 points	Y20 to Y3F	Y40 to Y5F	Y60 to Y7F
FP0 RTD unit	FP0-RTD	Input (16 points) CH0, 2, 4	WX2 (X20 to X2F)	WX4 (X40 to X4F)	WX6 (X60 to X6F)
		Input (16 points) CH1, 3, 5	WX3 (X30 to X3F)	WX5 (X50 to X5F)	WX7 (X70 to X7F)
		Output (16 points)	WY2 (Y20 to Y2F)	WY4 (Y40 to Y4F)	WY6 (Y60 to Y6F)

- The data of each channel for FP0 A/D converter unit (FP0-A80), FP0 thermocouple unit (FP0-TC4/FP0-TC8), FP0 D/A converter unit (FP0-A04V/P0-A04I) is switched and read/write using a program that includes the flag for switching converted data.
- Regarding FP0 CC-Link slave unit, please refer to the exclusive manual.

13.3 Relays, Memory Areas and Constants

	Item	Number of points and range of memory area available for use: C10, C14, C16	Number of points and range of memory area available for use: C32, T32, F32	Function
Relay	**External input [Note1)] (X)**	1760 points (X0 to X109F)		Turns on or off based on external input.
Relay	**External output [Note1)] (Y)**	1760 points (Y0 to Y109F)		Externally outputs on or off state
Relay	**Internal relay [Note2)] (R)**	4096 points (R0 to R255F)		Relay which turns on or off only within program.
Relay	**Link relay [Note2)] (L)**	2048 points (L0 to L127F)		This relay is a shared relay used for PLC link.
Relay	**Timer [Note2)] (T)**	1024 points (T0 to T1007/C1008 to C1023) [Note3)]		This goes on when the timer reaches the specified time. It corresponds to the timer number.
Relay	**Counter [Note2)] (C)**			This goes on when the counter increments. It corresponds to the counter number.
Relay	**Special internal relay (R)**	224 points (from R9000)		Relay which turns on or off based on specific conditions and is used as a flag.
Memory area	**External input [Note1)] (WX)**	110 words (WX0 to WX109)		Code for speciyfying 16 external input points as one word (16 bits) of data.
Memory area	**External output [Note1)] (WY)**	110 words (WY0 to WY109)		Code for specifying 16 external output points as one word (16 bits) of data.
Memory area	**Internal relay [Note2)] (WR)**	256 words (WR0 to WR255)		Code for specifying 16 internal relay points as one word (16 bits) of data.
Memory area	**Link relay (WL)**	128 words (WL0 to WL127)		Code for specifying 16 link relay points as one word (16 bits) of data.
Memory area	**Data register [Note2)] (DT)**	12315 words (DT0 to DT12314)	32765 words (DT0 to DT32764)	Data memory used in program. Data is handled in 16-bit units (one word).
Memory area	**Link register [Note2)] (LD)**	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).
Memory area	**Timer/Counter set value area [Note2)] (SV)**	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
Memory area	**Timer/Couner elapsed value area [Note2)] (EV)**	1024 words (EV0 to EV1023)		Data memory for storing the elapsed value during operation of a timer/counter. Stores by timer/counter number.
Memory area	**Special data register (DT)**	440 words (DT90000 to DT90439)		Data memory for storing specific data. Various settings and error codes are stored.
Memory area	**Index register (I)**	14 words (I0 to ID)		Register can be used as an address of memory area and constants modifier.
Control Instruction point	**Master control relay points (MCR)**	256 points		
Control Instruction point	**Number of labels (JP and LOOP)**	256 points		
Control Instruction point	**Number of step ladders**	1000 stages		
Control Instruction point	**Number of subroutines**	500 subroutines		
Control Instruction point	**Number of interrupt programs**	C10: 11 programs (6 external input points, 1 periodical interrupt point, 4-pulse match points) Other than C10: 13 programs (8 external input points, 1 periodical interrupt point, 4-pulse match points)		
Constant	**Decimal constants (Integer type) (K)**	K-32, 768 to K32, 767 (for 16-bit operation)		
Constant		K-2, 147, 483, 648 to K2, 147, 483, 647 (for 32-bit operation)		
Constant	**Hexadecimal constants (H)**	H0 to HFFFF (for 16-bit operation)		
Constant		H0 to HFFFFFFFF (for 32-bit operation)		
Constant	**Floating point type (F)**	F-1.175494 x 10^{-38} to F-3.402823 x 10^{38}		
Constant		F 1.175494 x 10^{-38} to F 3.402823 x 10^{38}		

Note1) The number of points noted above is the number reserved as the calculation memory. The actual number of points available for use is determined by the hardware configuration.

Note2) There are two types, one is the hold type that the last state is stored even if the power supply turns off or the mode is changed to PROG. mode from RUN mode, and the other is the non-hold type that the state is reset.

For C10/C14/C16/C32: The hold type areas and non-hold type areas are fixed. For information on the sections of each area, refer to the performance specifications.

For T32/F32: The settings of the hold type areas and non-hold type areas can be changed using the system registers.

On T32, if the battery has run out, the data in the hold area may be indefinite (Not cleared to 0)

Note3) The points for the timer and counter can be changed by the setting of system register 5. The number given in the table are the numbers when system register 5 is at its default setting.

13.4 Power Supply Unit and I/O Link Unit Specifications

13.4.1 Power Supply Unit Specifications (AFP0634)

Item		Description
Input	Rated operating voltage	100-240 V AC
	Operating voltage range	85-264 V AC
	Rated frequency	50/60 Hz
	Operating frequency	47 to 63 Hz
	The number of phase	Single phase
	Inrush current	30 A(0-p) or less (Cold start)
	Leakage current	0.75 mA or less
	Holding time	10 ms or more
Output	Rated voltage	24 V DC
	Voltage accuracy	±5%
	Rated current	0.7 A
	Operating output current	0 to 0.7 A
	Output ripple	500 mV or less
	Over current regulation	0.735 A or more
	Over voltage regulation	Possible
Life time		20000h (at 55 °C)

13.4.2 I/O Link Unit Specifications (AFP0732)

Item	Description
Communication method	Two-wire half-duplex communication
Synchronous method	Start stop synchronous system
Transmission line	Duplex cable (twsited-pair cable or VCTF 0.75 mm2 x 2C <JIS> or equivalent)
Transmission distance (Total length)	Max. 700 m (when using twisted-pair cable) Max. 400 m (when using VCTF cable)
Baud rate	0.5Mbps
No. of I/O points per one I/O link unit	64 points (Input: 32 points + Output: 32 points) Note)
Remote I/O map allocation	32X/32Y
Interface	RS485-compliant
Transmission error check	CRC method

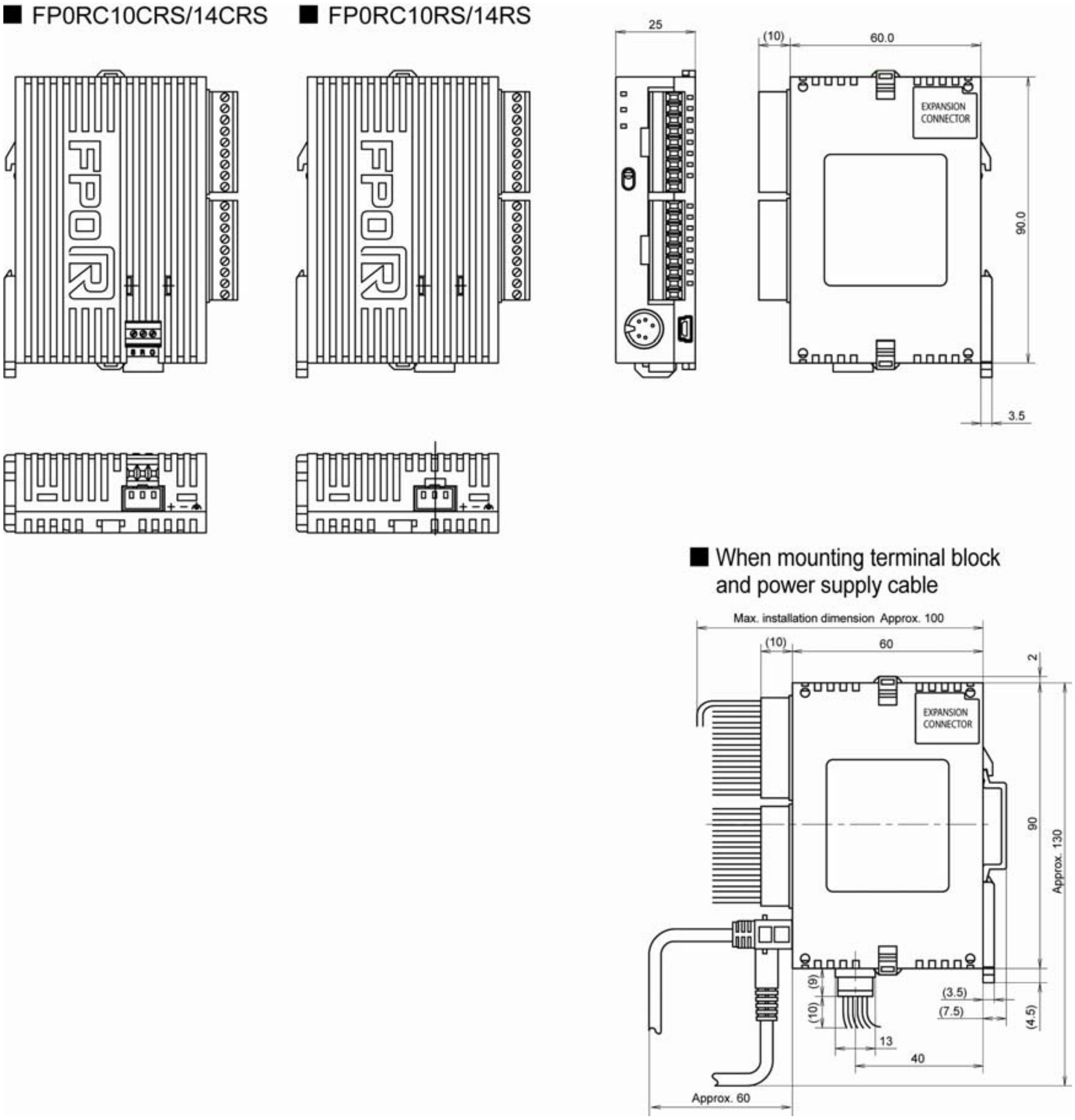
Note) Those numbers of points are the numbers that can be used for I/O link via a host computer and the network MEWNET-F. When setting the output of the I/O link error flag to ON (available), it is 63 points (31 input points & 32 input points).

Chapter 14

Dimensions and Others

14.1 Dimensions

14.1.1 C10/C14 Control Unit (Terminal Block)

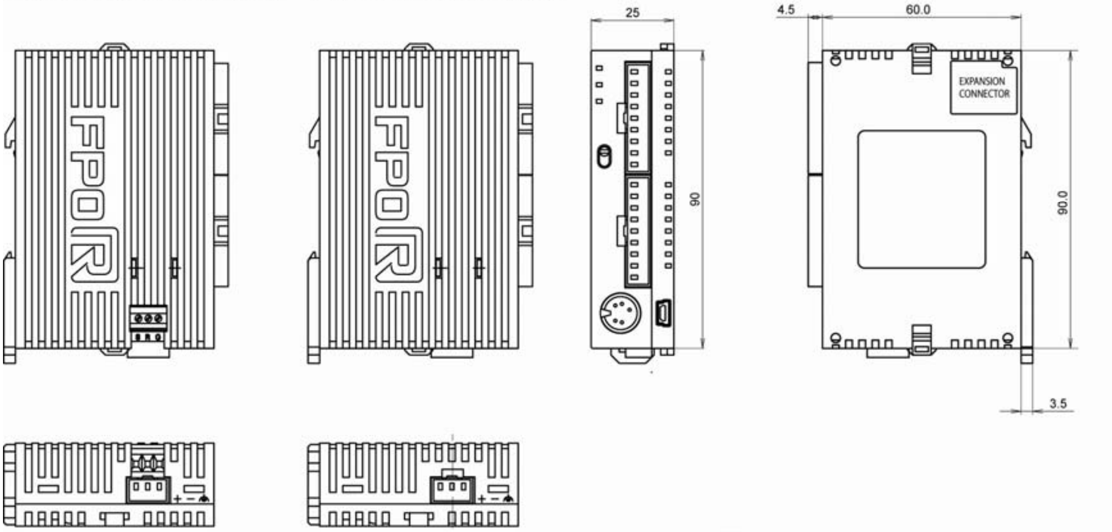


(Unit: mm)

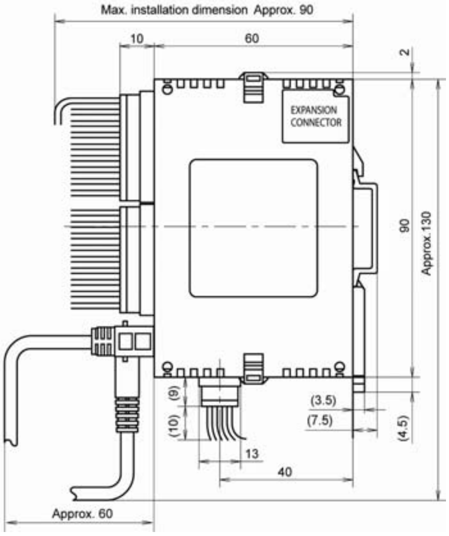
Note) As for the FP0 expansion unit, refer to the dimensions only.
Target FP0 expansion units: FP0-E8RS, E16RS

14.1.2 C10/C14 Control Unit (Molex Connector)

■ FP0RC10CRM/14CRM ■ FP0RC10RM/14RM



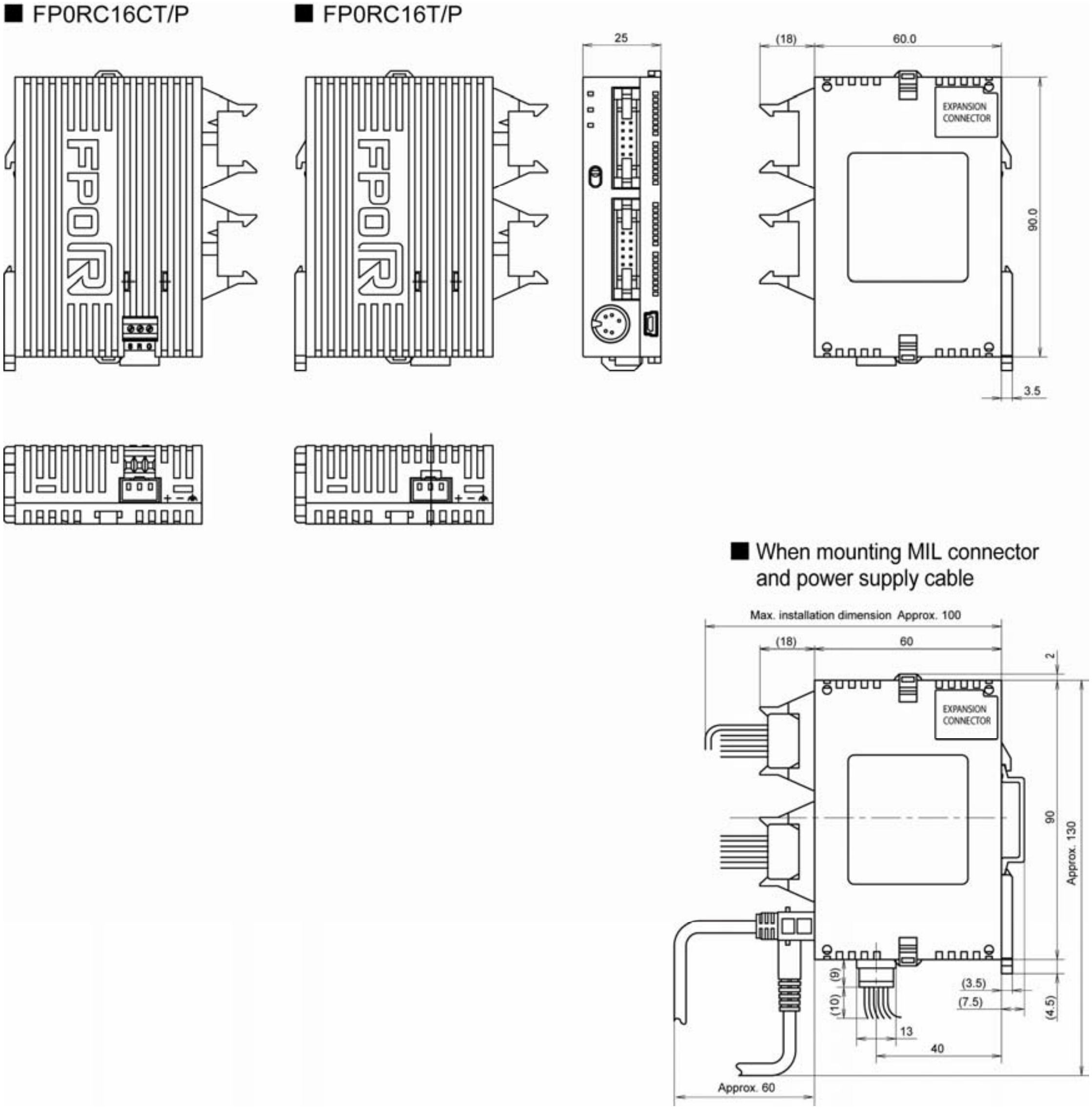
■ When mounting Molex connector and power supply cable



(Unit: mm)

Note) As for the FP0 expansion unit, refer to the dimensions only.
Target FP0 expansion units: FP0-E8RM,E16RM

14.1.3 C16 Control Unit (MIL Connector)



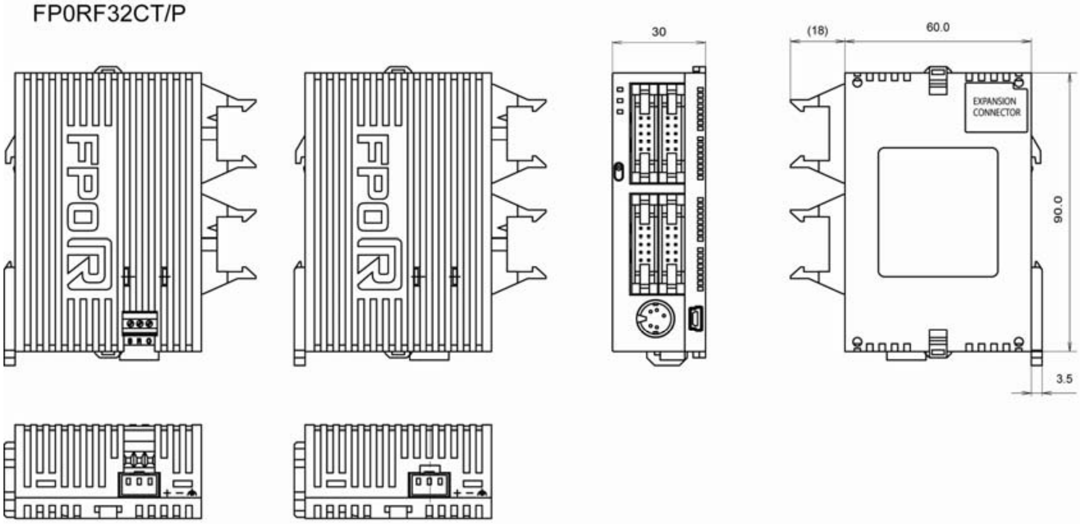
(Unit: mm)

Note) As for the FP0 expansion unit, refer to the dimensions only.
Target FP0 expansion units: FP0-E32T, E32P
FP0-E16X, E16YT, E16YP, E16T, E16P
FP0-E8X, E8YT, E8YP

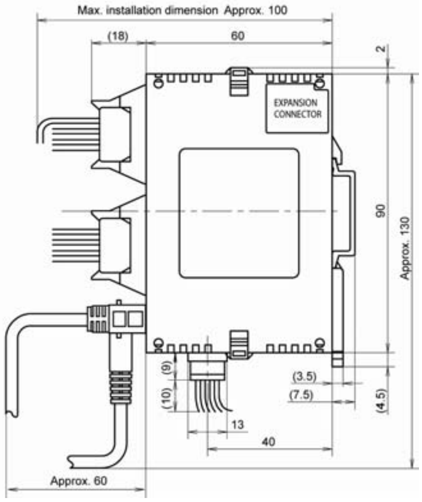
14.1.4 C32/T32/F32 Control Unit (MIL Connector)

■ FP0RC32CT/P
FP0RT32CT/P
FP0RF32CT/P

■ FP0RC32T/P



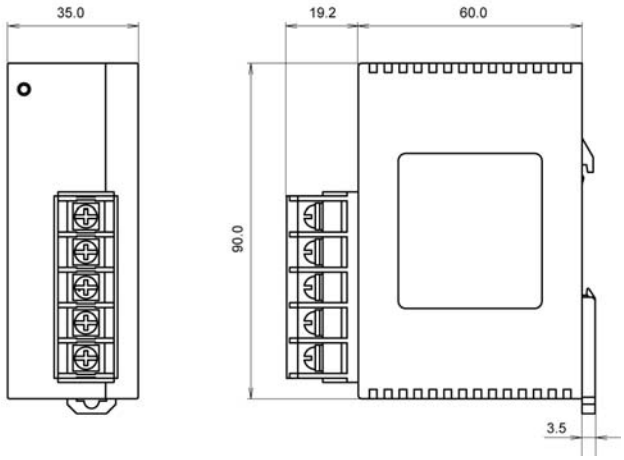
■ When mounting MIL connector and power supply cable



(Unit: mm)

14.1.5 Power Supply Unit

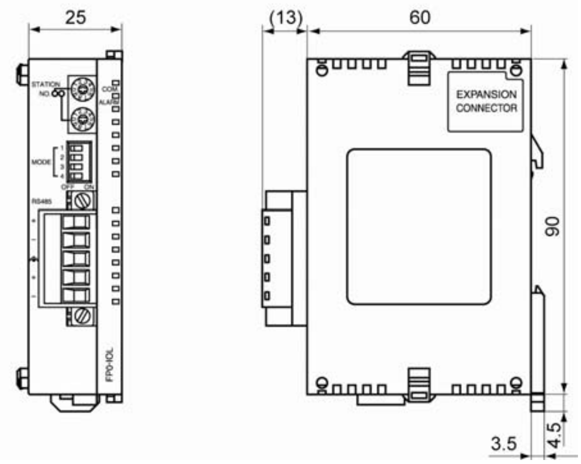
■ Power supply unit FP0-PSA4



(Unit: mm)

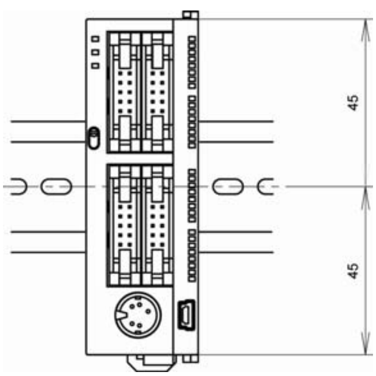
14.1.6 I/O Link Unit

■ I/O link unit (AFP0732)



(Unit: mm)

14.1.7 When Using DIN Rail



(Unit: mm)

14.2 Cable/Adapter Specifications

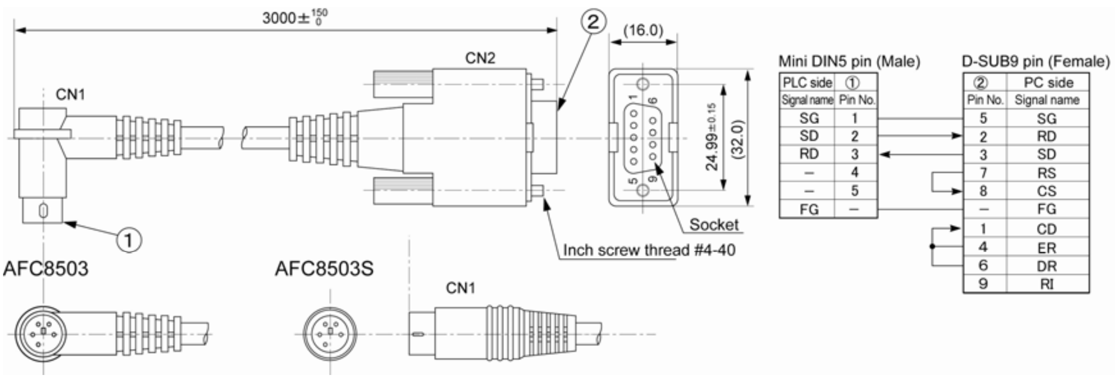
14.2.1 Type of Cables

Usable cables

Model No. of Cable	Usable model								
						EOL (end-of-life) models			
	FP-X	FP Σ	FP0 FP0R	FP-e	FP2/ FP2SH	FP10SH	FP-M	FP1	FP3
AFC8503 AFC8503S	A	A	A	A	A		A		
AFC8513	A	A	A	A	A		A		
AFC8521 AFC8523			A		A		A		
AFB85853					A	A	A	A	A
AFB85813					A	A	A	A	A
AFB85843					A	A	A	A	A
AFC85305 AFC8531 AFC8532	A	A	A	A	A		A		
AIP81862N					A	A	A	A	A
AFP15205 AFP1523								A	
AFP5520 AFP5523									A
AFP8550								A	A

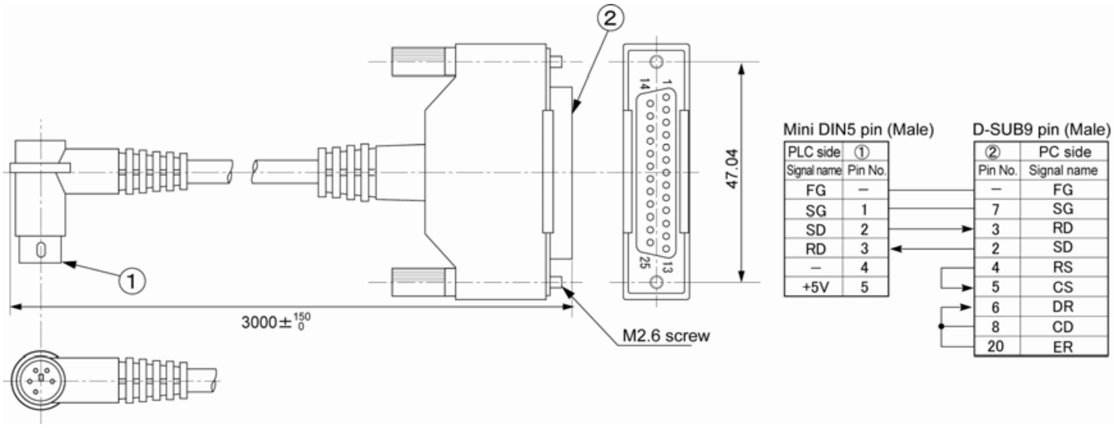
A: Available

14.2.2 AFC8503/AFC8503S (DOS/V PC)



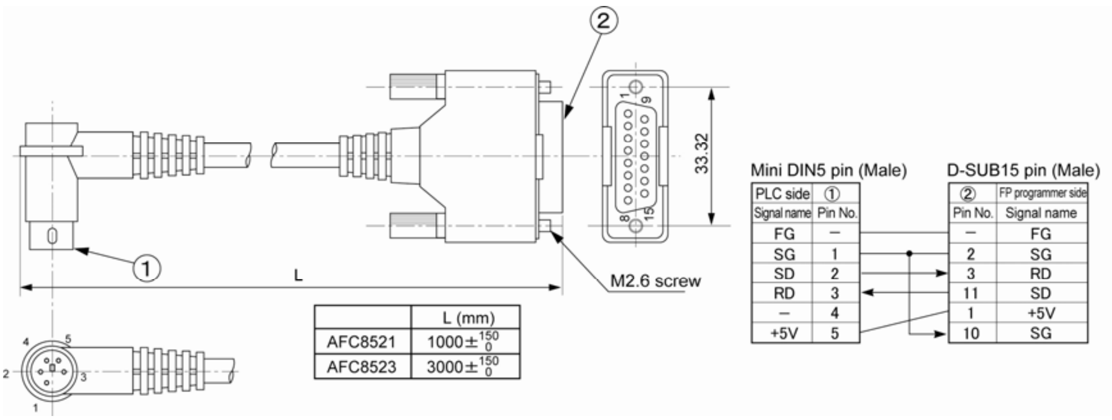
(Unit: mm)

14.2.3 AFC8513 (PC98 PC)



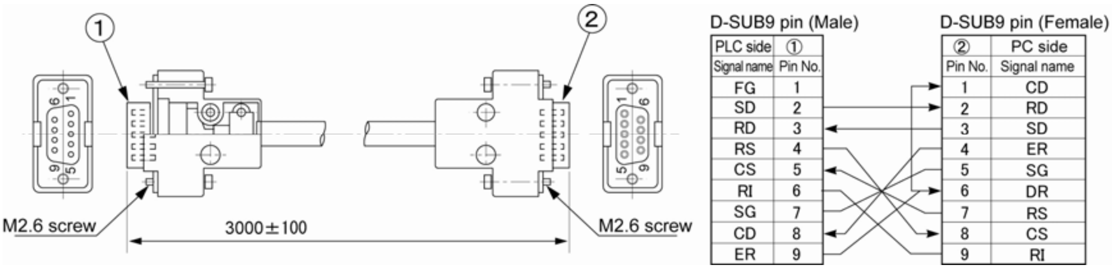
(Unit: mm)

14.2.4 AFC8521/AFC8523 (Programmer)



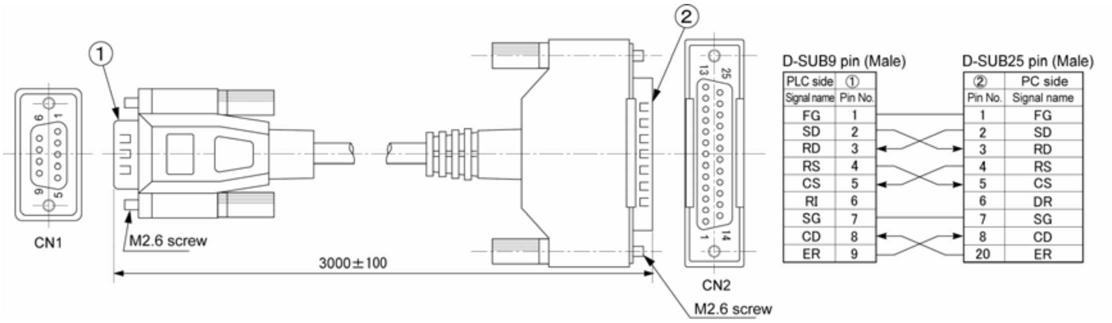
(Unit: mm)

14.2.5 AFC85853 (9-pin (male) – 9-pin (female)



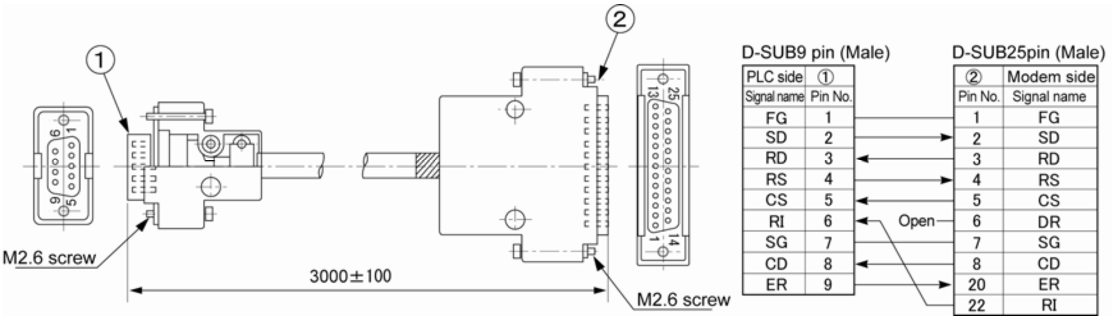
(Unit: mm)

14.2.6 AFB85813 (9-pin (male) – 25-pin (male)



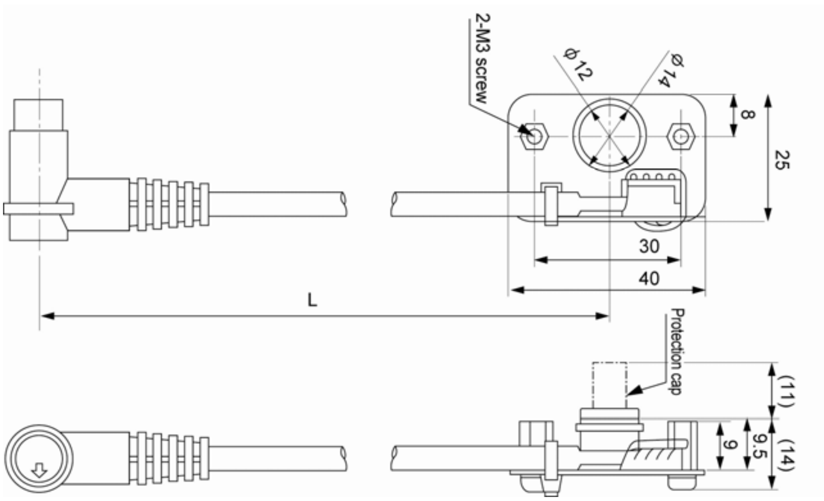
(Unit: mm)

14.2.7 **AFB85843 (Straight cable for connecting a modem: 9-pin (male) – 25-pin (male)**



(Unit: mm)

14.2.8 **AFC85305/AFC8531/AFC8532 (For extending for the tool port)**

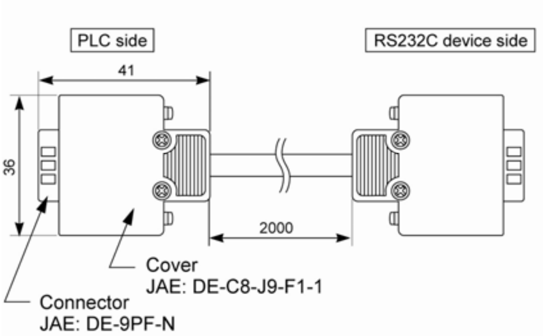


	L (mm)
AFC85305	$500\pm^{100}_{0}$
AFC8531	$1000\pm^{100}_{0}$
AFC8532	$2000\pm^{100}_{0}$

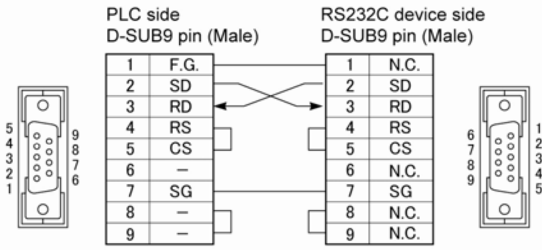
(Unit: mm)

14.2.9 AIP81862N (RS232 port)

- Dimensions (Unit: mm)

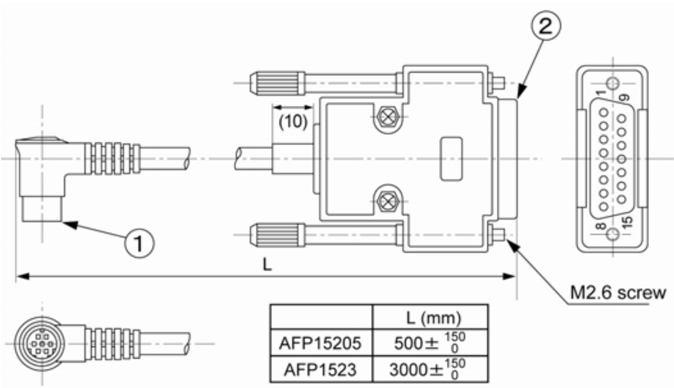


- Wiring diagram

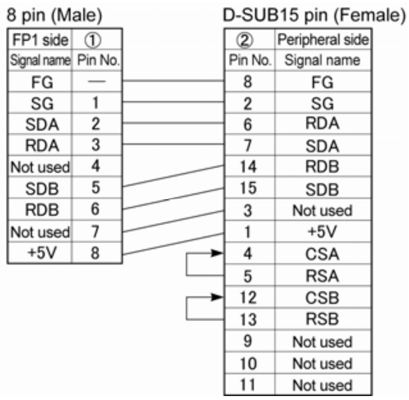


(Unit: mm)

14.2.10 AFP15205/AFP1523 (End-of-life (EOL) product)

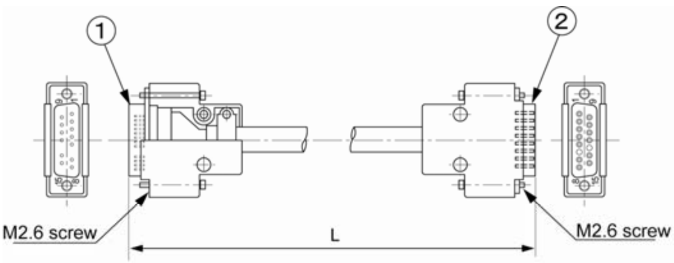


	L (mm)
AFP15205	$500\pm^{150}_{0}$
AFP1523	$3000\pm^{150}_{0}$

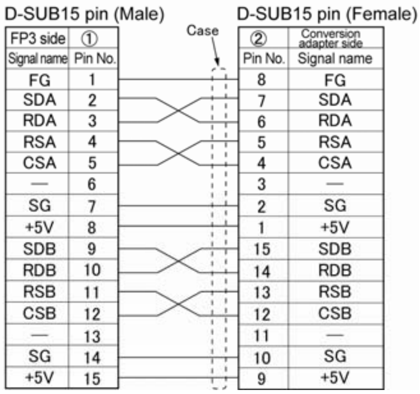


(Unit: mm)

14.2.11 AFP5520/AFP5523 (End-of-life (EOL) product)

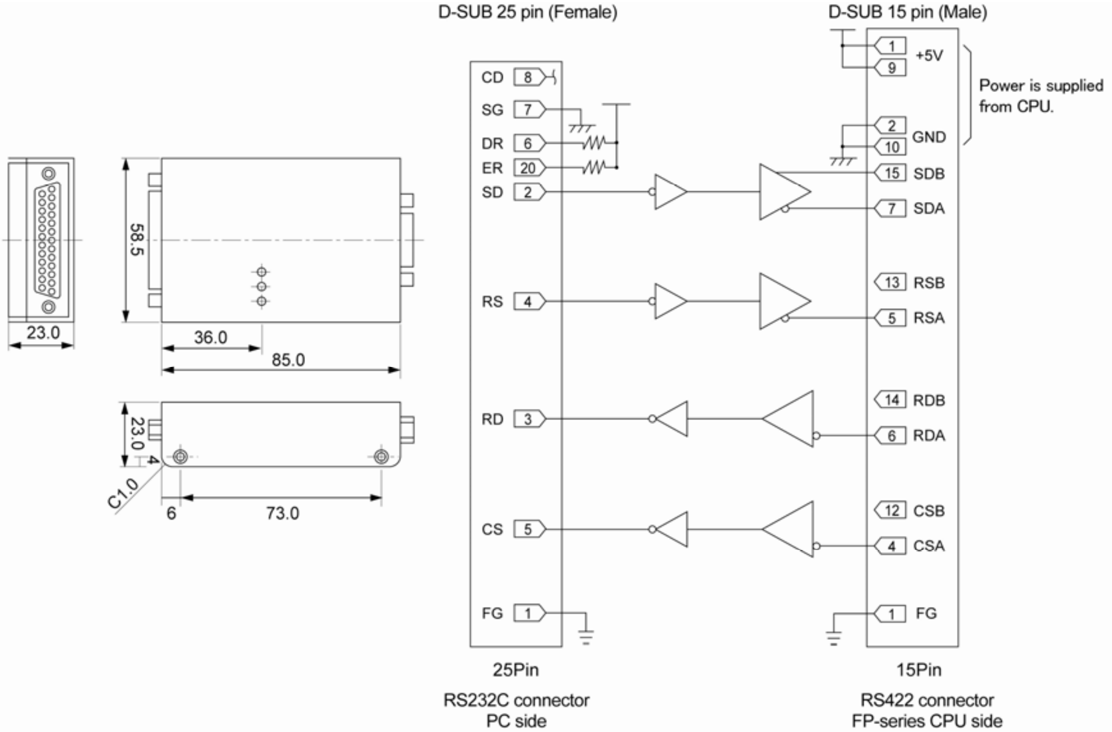


	L (mm)
AFP5520	$500\pm^{150}_{0}$
AFP5523	$3000\pm^{150}_{0}$



(Unit: mm)

14.2.12 AFP8550 (End-of-life (EOL) product)



(Unit: mm)

Chapter 15

Appendix

15.Appendix

15.1 System Registers / Special Internal Relays / Special Data Registers

Precation for System Registers

What is the system register area

- 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.

Type of system registers
The registers to be used depend on each PLC.

(1) Allocation of user memory (System registers 0, 1 and 2)
These registers set the size of the program area and file register area, allowing the user memory area to be configured for the environment used. The size of the memory area will vary depending on the type.
(2) Allocation of timers and counters (System register 5)
The number of timers and counters is set by specifying the starting counter number.
(3) Hold/non-hold type setting (System registers 6 to 18)
When these registers are set to “hold type”, the values in the relays and data memory will be retained even if the system is switched to PROG. mode or the power is turned off. If set to “non-hold type”, the values will be cleared to “0”.
(4) Operation mode setting on error (System registers 4, 20 to 28)
Set the operation mode when errors such as battery error, duplicated use of output, I/O verification error and operation error occur.
(5) Time settings (System registers 30 to 34)
Set time-out error detection time and the constant scan time.
(6) Remote I/O operation settings (System registers 35 and 36)
These registers are used to select whether or not to wait for a slave station connection when the remote I/O is started, and the remote I/O update timing.
(7) MEWNET-W0/MEWNET-W/P PLC link settings (System registers 40 to 47, 50 to 55, and 57)
These settings are for using link relays and link registers for MEWNET-W0/MEWNET-W/P PC(PLC) link communication.
Note) The default value setting is “no PC(PLC) link communication”.
(8) MEWNET-H PC(PLC) link settings (System register 49)
Set the data size to be processed during one scan in the MEWNET-H PC(PLC) link communication.
(9) Input settings (System registers 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.
(10) Input time constant settings (FP1/FP-M System registers 404 to 407)
Changing the input signal width to be loaded enables to prevent the malfunctions caused by chattering or noises.
(11) Number of temperature input averaging process settings (System register 409)
The number of averaging times can be set in order to even out the variation in the input thermocouple values. For normal use it, set the number of times to t least twenty. For default value “0”, the number of average processing times is 20.
(12) Tool and COM. ports 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, PC(PLC) link, and modem communication.Note that the default setting is computer link mode.

Checking and changing the set value of system register

If you are going to use a value which is already set(the value which appears when read), there is no need write it again.

Using programming tool software

Produce:

1. Set the control unit in the PROG mode.
2. Option ->PLC Configuration
3. When the function for which setting are to be entered is selected in the PLC Configuration dialog box,the value and setting status for the selected system register are displayed.
   To change the value and setting status,write in the new value and /or select the setting status.
4. To register these settings,choose OK

Precautions for system register setting

-System register settings are effective from the time they are set.
  However, input settings,tool port,COM port,and modem connection 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 initialized operation is performed, all set system register values (parameters) will be initialized

15.1.1 Table of System Registers for FP0R

	No.	Name	Default value	Descriptions
Hold/ Non-hold 1	5	Starting number setting for counter	1008	0 to 1024
	6	Hold type area starting number setting for timer and counter (T32/F32)	1008	0 to 1024
	7	Hold type area starting number setting for internal relays (T32/F32)	248	0 to 256
	8	Hold type area starting number setting for data registers (T32/F32)	0	0 to 32765
	14	Hold or non-hold setting for step ladder process (T32/F32)	Non-hold	Hold/Non-hold
	4	Previous value is held for a leading edge detection instruction (DF instrucion) with MC Note)	Hold	Hold/ Non-hold
Hold/ Non-hold 2	10	Hold type area starting word number for PC(PLC) link relays (for PC(PLC) link 0) (T32/F32)	0	0 to 64
	11	Hold type area starting word number for PC(PLC) link relays (for PC(PLC) link 1) (T32/F32)	64	64 to 128
	12	Hold type area starting number for PC(PLC) link registers (for PC(PLC) link 0) (T32/F32)	0	0 to 128
	13	Hold type area starting number for PC(PLC) link registers (for PC(PLC) link 1) (T32/F32)	128	128 to 256
Action on error	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
Time set-ting	31	Wait time setting for multi-frame communication	6500.0 ms	10 to 81900 ms
	32	Communication timeout setting for SEND/RECV, RMRD/RMWT commands	10000.0 ms	10 to 81900 ms
	34	Constant value settings for scan time	Normal scan	0: Normal scan 0 to 600 ms: Scans once each specified time interval

	No.	Name	Default value	Descriptions
PC (PLC) link 0 set-ting	40	Range of link relays used for PC(PLC) link	0	0 to 64 words
	41	Range of link data registers used for PC(PLC) link	0	0 to 128 words
	42	Starting word 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 127 words
	46	PC(PLC) link switch flag	Normal	Normal/reverse
	47	Maximum unit number setting for MEWNET-W0 PC(PLC) link	16	1 to 16
PC (PLC) link 1 set-ting)	50	Range of link relays used for PC(PLC) link	0	0 to 64 words
	51	Range of link data registers used for PC(PLC) link	0	0 to 128 words
	52	Starting word 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 127 words
	57	Maximum unit number setting for MEWNET-W0 PC(PLC) link	16	1 to 16

		No.	Name	Default value	Descriptions	
Controller input settings 1	**High-speed counter**	**400**	**High-speed counter operation mode settings (X0 to X2)**	CH0: Do not set input X0 as high-speed counter	CH0	Do not set input X0 as high-speed counter. Two-phase input (X0, X1) Two-phase input (X0, X1), Reset input (X2) Incremental input (X0) Incremental input (X0), Reset input (X2) Decremental input (X0) Decremental input (X0), Reset input (X2) Individual input (X0, X1) Individual input (X0, X1), Reset input (X2) Incremental/decremental control input (X0, X1) Incremental/decremental control input (X0, X1), Reset input (X2)
				CH1: Do not set input X1 as high-speed counter	CH1	Do not set input X1 as high-speed counter. Incremental input (X1) Incremental inptu (X1), Reset input (X2) Decremental input (X1) Decremental input (X1), Reset input (X2)
		400	**High-speed counter operation mode settings (X3 to X5)**	CH2: Do not set input X3 as high-speed counter	CH2	Do not set input X3 as high-speed counter. Two-phase input (X3, X4) Two-phase input (X3, X4), Reset input (X5) Incremental input (X3) Incremental input (X3), Reset input (X5) Decremental input (X5) Decremental input (X5), Reset input (X5) Individual input (X3, X4) Individual input (X3, X4), Reset input (X5) Incremental/decremental control (X3, X4) Incremental/decremental control (X3, X4), Reset input (X5)
				CH3: Does not set input X4 as high-speed counter	CH3	Does not set input X4 as high-speed counter. Incremental input (X4) Incremental input (X4), Reset input (X5) Decremental input (X4) Decremental input (X4), Reset input (X5)
Controller input settings 2	**High-speed counter**	**401**	**High-speed counter/ pulse output settings (X6 to X7)**	CH4: Do not set input X6 as high-speed counter	CH4	Do not set input X6 as high-speed counter. Incremental input (X6) Decremental input (X6) Two-phase input (X6, X7) Individual input (X6, X7) Incremental/decremental control input (X6, X7)
				CH5: Do not set input X7 as high-speed counter	CH5	Do not set input X7 as high-speed counter. Incremental input (X7) Decremental input (X7)

Note1) If the operation mode is set to Two-phase, incremental/decremental, or incremental/decremental control, the setting for CH1 or CH3 is invalid in system register 400 and the setting for CH5 is invalid in system register 401.

Note2) If reset input settings overlap, the CH1 setting takes precedence in system register 400 and the CH3 setting takes precedence in system register 401.

Note3) If system register 400 to 403 have been set simultaneously for the same input relay, the follwing precedence order is effective: [High-speed counter]→[Pulse catch]→[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.

<table>
<tr><th colspan="2"></th><th>No.</th><th>Name</th><th>Default value</th><th>Descriptions</th></tr>
<tr><td rowspan="4">Transistor type C16 or over</td><td rowspan="4">Controller output settings 2 (PLS/PWM)</td><td rowspan="4">402</td><td rowspan="4">Pulse/
PWM output settings
(Y0 to Y7)</td><td>CH0:
Normal output</td><td>Normal output (Y0, Y1)
Pulse output (Y0, Y1)
Pulse output (Y0, Y1)/Home input X4
Pulse output (Y0, Y1)/Home input X4/Position control starting input X0
PWM output (Y0), Normal output (Y1)</td></tr>
<tr><td>CH1:
Normal output</td><td>Normal output (Y2, Y3)
Pulse output (Y2, Y3)
Pulse output (Y2, Y3)/Home input X5
Pulse output (Y3, Y4)/Home input X5/Position control starting input X1
PWM output (Y2), Normal output (Y3)</td></tr>
<tr><td>CH2:
Normal output</td><td>Normal output (Y4, Y5)
Pulse output (Y4, Y5)
Pulse output (Y4, Y5)/Home input X6
Pulse output (Y4, Y5)/Home input X6/Position control starting input X2
PWM output (Y4), Normal output (Y5)</td></tr>
<tr><td>CH3:
Normal output</td><td>Normal output (Y6, Y7)
Pulse output (Y6, Y7)
Pulse output (Y6, Y7)/Home input X7
Pulse output (Y6, Y7)/Home input X7/Position control starting input X3
PWM output (Y6), Normal output (Y7)</td></tr>
<tr><td colspan="2" rowspan="2">Inter-rupt/ Pulse catch settings</td><td>403</td><td>Pulse catch input settings</td><td>Not set</td><td>X0 X1 X2 X3 X4 X5 X6 X7
Controller input
The pressed contact is set for the pulse catch.</td></tr>
<tr><td>404</td><td>Interrupt input settings</td><td>Not set</td><td>X0 X1 X2 X3 X4 X5 X6 X7
Controller input
The pressed contact is set for the interrupt input.</td></tr>
<tr><td colspan="2">Inter-rupt edge settings</td><td>405</td><td>Interrupt edge setting for controller input</td><td>Leading edge</td><td>X0 X1 X2 X3 X4 X5 X6 X7
Leading edge
X0 X1 X2 X3 X4 X5 X6 X7
Trailing edge
The pressed contact is up and set to trailing edge.</td></tr>
</table>

Note1) When using the pulse output/PWM output, the controller output settings must be specified.
The output that has been set to the pulse output/PWM output cannot be used as the normal output.

Note2) X4 to X7 can be used as the home input of the pulse output CH0 to CH3.
When using the home return function of the pulse output, always set the home input. In that case, X4 to X7 cannot be set as the high-speed counter.

Note3) C16 type:
- For performing the home return for the pulse output CH0 with deviation counter clear, the above Y6 should be set to the normal output to use Y6 for the deviation counter clear signal.
- For performing the home return for the pulse output CH1 with deviation counter clear, the above Y7 should be set to the normal output to use Y7 for the deviation counter clear signal.
- The home return cannot be performed for the pulse output CH2 with deviation counter clear.

Note4) C32/T32/F32 type:
When performing theo home return with deviation counter clear, the deviation counter clear signals corresponding to each CH are used fixedly as follows; CH0=Y8, CH1=Y9, CH2=YA, CH3=YB
For performing the home return for each type,
it is necessary to specify the home input corresponding to each channel to be used for the home return in the system register 401.
Home input corresponding to each channel: CH0=4, CH1=X5, CH2=X6, CH3=X7
For performing the JOG positioning for each type,
it is necessary to specify the position control starting input signal corresponding to each channel to be used for the JOG positioning.

Note3) The settings for pulse catch and interrupt input can only be specified in system registers 403 to 405.

	No.	Name	Default value	Descriptions
Tool port setting	410	**Unit No. setting**	1	1 to 99
	412	**Communication mode setting**	Computer link	Computer link General-purpose communications Note2)
		Selection of modem connection	Disabled	Enabled/Disabled
	413	**Communication format setting**	Data lenght bit: 8 bits Parity check: “with odd” Stop bit: 1 bit	Enter the settings for the various items. - Data lenght 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/ETX - Header: STX not exist/STX exist
	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**	4096	0 to 32764
	421	**Buffer capacity setting for data received of general (serial data) communication mode**	2048	0 to 2048
COM port setting	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
	413	**Communication format setting**	Data lenght bit: 8 bits Parity check: Odd Stop bit: 1 bit	Enter the settings for the various items. - Data lenght 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/ETX - Header: STX not exist/STX exist
	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

Note1) The communication format in a PLC link is fixed at the following settings:
Data length is 8 bits, odd parity, stop bit is 1.
The communication speed (baud rate) is fixed at 115200 bps.

Note2) The general-purpose communication with the tool port is available only in RUN mode. In PROG mode, the computer link mode must be used regardless of settings.

Item	Add-ress	Name	Default value	Description
Cont-roller input time cons-tant set-tings	**430**	**Controller input time constant setting 1 X0 to X3**	1 ms	None 0.1 ms 0.5 ms 1 ms 2 ms 4 ms 8 ms 16 ms 32 ms 64 ms
	431	**Controller input time constant setting 1 X4 to X7**		
	432	**Controller input time constant setting 2 X8 to XB (C32/T32/F32)**		
	433	**Controller input time constant setting 2 XC to XF (C32/T32/F32)**		

Note) X6 and X7 is invalid for C10.

15.1.2 Table of Special Internal Relays for FP0R

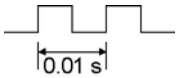
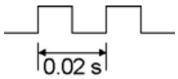
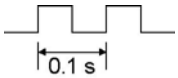
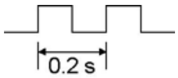
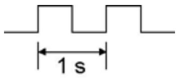
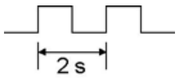
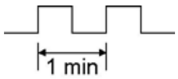
The special internal relays turn on and off under special conditions. The on and off states are not output externally. Writing is not possible with a programming tool or an instruction.

WR900 FP0R

Relay No.	Name	Description
R9000	**Self-diagnostic error flag**	Turns on when a self-diagnostic error occurs. ⇒ The content of self-diagnostic error is stored in DT90000.
R9001	**Not used**	
R9002	**Not used**	
R9003	**Not used**	
R9004	**I/O verification error flag**	Turns on when an I/O verification error occurs.
R9005	**Not used**	
R9006	**Not used**	
R9007	**Operation error flag (hold)**	Turns on and keeps the on state shen an operation error occurs. ⇒The address where the error occurred is stored in DT90017. (indicates the first operation error which occurred).
R9008	**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	**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	**> Flag**	Turns on for an instant when the compared results become larger in the comparison instructions (F60 to F63).
R900B	**= Flag**	Turns on for an instant, - when the compared results are equal in the comparison instructions (F60 to F63). - when the calculated results become 0 in the arithmetic instructions.
R900C	**< Flag**	Turns on for an instant when the compared results become smaller in the comparison instructions (F60 to F63).
R900D	**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	**Tool port communication error**	Turns on when communication error at tool port is occurred.
R900F	**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.

A: Available, N/A: Not available

WR901 FP0R

Relay No.	Name	Description
R9010	**Always on relay**	Always on.
R9011	**Always off relay**	Always off.
R9012	**Scan pulse relay**	Turns on and off alternately at each scan.
R9013	**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	**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	**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	**Not used**	
R9017	**Not used**	
R9018	**0.01 s clock pulse relay**	Repeats on/off operations in 0.01 sec. cycles. 
R9019	**0.02 s clock pulse relay**	Repeats on/off operations in 0.02 s. cycles. 
R901A	**0.1 s clock pulse relay**	Repeats on/off operations in 0.1 s. cycles. 
R901B	**0.2 s clock pulse relay**	Repeats on/off operations in 0.2 s. cycles. 
R901C	**1 s clock pulse relay**	Repeats on/off operations in 1 s. cycles. 
R901D	**2 s clock pulse relay**	Repeats on/off operations in 2 s. cycles. 
R901E	**1 min clock pulse relay**	Repeats on/off operations in 1 min. cycles. 
R901F	**Not used**	

A: Available, N/A: Not available

WR902 FP0R

Relay No.	Name	Description
R9020	**RUN mode flag**	Turns off while the mode selector is set to PROG. Turns on while the mode selector is set to RUN.
R9021	**Not used**	
R9022	**Not used**	
R9023	**Not used**	
R9024	**Not used**	
R9025	**Not used**	
R9026	**Message flag**	Turns on while the F149 (MSG) instruction is executed.
R9027	**Not used**	
R9028	**Not used**	
R9029	**Forcing flag**	Turns on during forced on/off operation for input/output relay timer/counter contacts.
R902A	**Interrupt enable flag**	Turns on while the external interrupt trigger is enabled by the ICTL instruction.
R902B	**Interrupt error flag**	Turns on when an interrupt error occurs.
R902C	**Sample point flag**	Sampling by the instruction=0 Sampling at constant time intervals=1
R902D	**Sampling trace end flag**	When the sampling operation stops=1, When the sampling operation starts=0
R902E	**Sampling stop trigger flag**	When the sampling stop trigger activates=1 When the sampling stop trigger stops=0
R902F	**Sampling enable flag**	When sampling starts=1 When sampling stops=0

A: Available, N/A: Not available

WR903 FP0R

Relay No.	Name	Description
R9030	Not used	
R9031	Not used	
R9032	COM port communication mode flag	- Turns on when the general-purpose communication function is being used - Goes off when the MEWTOCOL-COM or the PLC link function is being used.
R9033	Print instruction execution flag	Off: Printing is not executed. On: Execution is in progress.
R9034	RUN overwrite complete flag	Goes on for ony the first scan following completion of a rewrite during the RUN operation.
R9035	Not used	
R9036	Not used	
R9037	COM port communication error flag	- Goes on is a transmission error occurs during data communication. - Goes off when a request is made to send data, using the F159 (MTRN) instruction.
R9038	COM port reception done flag during general purpose communication	- Turns on when the terminator is received during general -purpose serial communication.
R9039	COM 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	Not used	
R903B	Not used	
R903C	Not used	
R903D	Not used	
R903E	TOOL port reception done flag during general purpose communication	- Turns on the terminator is received during general -purpose serial communication.
R903F	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.

A: Available, N/A: Not available

Note) R9030 to R9030F can be changed during 1 scan.

WR904 FP0R

Relay No.	Name	Description
R9040	**TOOL port operation mode flag**	- Turns on when the general-purpose communication function is being used - Goes off when the computer link function is being used.
R9041	**COM port PLC link flag**	Turn on while the PLC link function is used.
R9042	**Not used**	
R9043	**Not used**	
R9044	**COM port SEND/RECV instruction execution flag**	Monitors whether the F145 (SEND) or F146 (RECV) instructions can be executed or not. Off: None of the above mentioned instructions can be executed. (During executing the instruction) On: One of the above mentioned instructions can be executed.
R9045	**COM 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 as follows: Off: No abonormality detected. On: An abnormality detected. (communication error) End code: DT90124
R9046	**Not used**	
R9047	**Not used**	
R9048	**Not used**	
R9049	**Not used**	
R904A	**Not used**	
R904B	**Not used**	
R904C to R904F	**Not used**	

A: Available, N/A: Not available

Note) R9040 to R904F can be changed during 1 scan.

WR905 FP0R

Relay No.	Name	Description
R9050	**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	**Not used**	

WR906 FP0R

Relay No.	Name		Description
R9060	**MEWNET-W0 PC(PLC) link 0 trans-mission assurance relay**	**Unit No.1**	Turns on when Unit No. 1 is communicating properly in PC(PLC) link 0 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 0 mode.
R9061		**Unit No.2**	Turns on when Unit No. 2 is communicating properly in PC(PLC) link 0 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 0 mode.
R9062		**Unit No.3**	Turns on when Unit No. 3 is communicating properly in PC(PLC) link 0 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 0 mode.
R9063		**Unit No.4**	Turns on when Unit No. 4 is communicating properly in PC(PLC) link 0 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 0 mode.
R9064		**Unit No.5**	Turns on when Unit No. 5 is communicating properly in PC(PLC) link 0 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 0 mode.
R9065		**Unit No.6**	Turns on when Unit No. 6 is communicating properly in PC(PLC) link 0 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 0 mode.
R9066		**Unit No.7**	Turns on when Unit No. 7 is communicating properly in PC(PLC) link 0 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 0 mode.
R9067		**Unit No.8**	Turns on when Unit No. 8 is communicating properly in PC(PLC) link 0 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 0 mode.
R9068		**Unit No.9**	Turns on when Unit No. 9 is communicating properly in PC(PLC) link 0 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 0 mode.
R9069		**Unit No.10**	Turns on when Unit No. 10 is communicating properly in PC(PLC) link 0 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 0 mode.
R906A		**Unit No.11**	Turns on when Unit No. 11 is communicating properly in PC(PLC) link 0 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 0 mode.
R906B		**Unit No.12**	Turns on when Unit No. 12 is communicating properly in PC(PLC) link 0 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 0 mode.
R906C		**Unit No.13**	Turns on when Unit No. 13 is communicating properly in PC(PLC) link 0 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 0 mode.
R906D		**Unit No.14**	Turns on when Unit No. 14 is communicating properly in PC(PLC) link 0 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 0 mode.
R906E		**Unit No.15**	Turns on when Unit No. 15 is communicating properly in PC(PLC) link 0 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 0 mode.
R906F		**Unit No.16**	Turns on when Unit No. 16 is communicating properly in PC(PLC) link 0 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 0 mode.

A: Available, N/A: Not available

WR907 FP0R

Relay No.	Name		Description
R9070	**MEWNET-W0 PC(PLC) link 0 operation mode relay**	**Unit No.1**	Turns on when Unit No. 1 is in the RUN mode. Turns off when Unit No. 1 is in the PROG. mode.
R9071		**Unit No.2**	Turns on when Unit No. 2 is in the RUN mode. Turns off when Unit No. 2 is in the PROG. mode.
R9072		**Unit No.3**	Turns on when Unit No. 3 is in the RUN mode. Turns off when Unit No. 3 is in the PROG. mode.
R9073		**Unit No.4**	Turns on when Unit No. 4 is in the RUN mode. Turns off when Unit No. 4 is in the PROG. mode.
R9074		**Unit No.5**	Turns on when Unit No. 5 is in the RUN mode. Turns off when Unit No. 5 is in the PROG. mode.
R9075		**Unit No.6**	Turns on when Unit No. 6 is in the RUN mode. Turns off when Unit No. 6 is in the PROG. mode.
R9076		**Unit No.7**	Turns on when Unit No. 7 is in the RUN mode. Turns off when Unit No. 7 is in the PROG. mode.
R9077		**Unit No.8**	Turns on when Unit No. 8 is in the RUN mode. Turns off when Unit No. 8 is in the PROG. mode.
R9078		**Unit No.9**	Turns on when Unit No. 9 is in the RUN mode. Turns off when Unit No. 9 is in the PROG. mode.
R9079		**Unit No.10**	Turns on when Unit No. 10 is in the RUN mode. Turns off when Unit No. 10 is in the PROG. mode.
R907A		**Unit No.11**	Turns on when Unit No. 11 is in the RUN mode. Turns off when Unit No. 11 is in the PROG. mode.
R907B		**Unit No.12**	Turns on when Unit No. 12 is in the RUN mode. Turns off when Unit No. 12 is in the PROG. mode.
R907C		**Unit No.13**	Turns on when Unit No. 13 is in the RUN mode. Turns off when Unit No. 13 is in the PROG. mode.
R907D		**Unit No.14**	Turns on when Unit No. 14 is in the RUN mode. Turns off when Unit No. 14 is in the PROG. mode.
R907E		**Unit No.15**	Turns on when Unit No. 15 is in the RUN mode. Turns off when Unit No. 15 is in the PROG. mode.
R907F		**Unit No.16**	Turns on when Unit No. 16 is in the RUN mode. Turns off when Unit No. 16 is in the PROG. mode.

A: Available, N/A: Not available

WR908 FP0R

Relay No.	Name		Description
R9080	MEWNET-W0 PC(PLC) link 1 trans-mission assurance relay	Unit No.1	Turns on when Unit No. 1 is communicating properly in PC(PLC) link 1 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 1 mode.
R9081		Unit No.2	Turns on when Unit No. 2 is communicating properly in PC(PLC) link 1 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 1 mode.
R9082		Unit No.3	Turns on when Unit No. 3 is communicating properly in PC(PLC) link 1 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 1 mode.
R9083		Unit No.4	Turns on when Unit No. 4 is communicating properly in PC(PLC) link 1 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 1 mode.
R9084		Unit No.5	Turns on when Unit No. 5 is communicating properly in PC(PLC) link 1 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 1 mode.
R9085		Unit No.6	Turns on when Unit No. 6 is communicating properly in PC(PLC) link 1 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 1 mode.
R9086		Unit No.7	Turns on when Unit No. 7 is communicating properly in PC(PLC) link 1 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 1 mode.
R9087		Unit No.8	Turns on when Unit No. 8 is communicating properly in PC(PLC) link 1 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 1 mode.
R9088		Unit No.9	Turns on when Unit No. 9 is communicating properly in PC(PLC) link mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link mode.
R9089		Unit No.10	Turns on when Unit No. 10 is communicating properly in PC(PLC) link 1 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 1 mode.
R908A		Unit No.11	Turns on when Unit No. 11 is communicating properly in PC(PLC) link 1 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 1 mode.
R908B		Unit No.12	Turns on when Unit No. 12 is communicating properly in PC(PLC) link 1 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 1 mode.
R908C		Unit No.13	Turns on when Unit No. 13 is communicating properly in PC(PLC) link 1 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 1 mode.
R908D		Unit No.14	Turns on when Unit No. 14 is communicating properly in PC(PLC) link 1 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 1 mode.
R908E		Unit No.15	Turns on when Unit No. 15 is communicating properly in PC(PLC) link 1 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 1 mode.
R908F		Unit No.16	Turns on when Unit No. 16 is communicating properly in PC(PLC) link 1 mode. Turns off when operation is stopped, when an error occurs, or when not in the PC(PLC) link 1 mode.

A: Available, N/A: Not available

WR909 FP0R

Relay No.	Name		Description
R9090	MEWNET-W0 PC(PLC) link 1 operation mode relay	Unit No.1	Turns on when Unit No. 1 is in the RUN mode. Turns off when Unit No. 1 is in the PROG. mode.
R9091		Unit No.2	Turns on when Unit No. 2 is in the RUN mode. Turns off when Unit No. 2 is in the PROG. mode.
R9092		Unit No.3	Turns on when Unit No. 3 is in the RUN mode. Turns off when Unit No. 3 is in the PROG. mode.
R9093		Unit No.4	Turns on when Unit No. 4 is in the RUN mode. Turns off when Unit No. 4 is in the PROG. mode.
R9094		Unit No.5	Turns on when Unit No. 5 is in the RUN mode. Turns off when Unit No. 5 is in the PROG. mode.
R9095		Unit No.6	Turns on when Unit No. 6 is in the RUN mode. Turns off when Unit No. 6 is in the PROG. mode.
R9096		Unit No.7	Turns on when Unit No. 7 is in the RUN mode. Turns off when Unit No. 7 is in the PROG. mode.
R9097		Unit No.8	Turns on when Unit No. 8 is in the RUN mode. Turns off when Unit No. 8 is in the PROG. mode.
R9098		Unit No.9	Turns on when Unit No. 9 is in the RUN mode. Turns off when Unit No. 9 is in the PROG. mode.
R9099		Unit No.10	Turns on when Unit No. 10 is in the RUN mode. Turns off when Unit No. 10 is in the PROG. mode.
R909A		Unit No.11	Turns on when Unit No. 11 is in the RUN mode. Turns off when Unit No. 11 is in the PROG. mode.
R909B		Unit No.12	Turns on when Unit No. 12 is in the RUN mode. Turns off when Unit No. 12 is in the PROG. mode.
R909C		Unit No.13	Turns on when Unit No. 13 is in the RUN mode. Turns off when Unit No. 13 is in the PROG. mode.
R909D		Unit No.14	Turns on when Unit No. 14 is in the RUN mode. Turns off when Unit No. 14 is in the PROG. mode.
R909E		Unit No.15	Turns on when Unit No. 15 is in the RUN mode. Turns off when Unit No. 15 is in the PROG. mode.
R909F		Unit No.16	Turns on when Unit No. 16 is in the RUN mode. Turns off when Unit No. 16 is in the PROG. mode.

A: Available, N/A: Not available

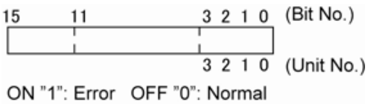
WR910 FP0R

Relay No.	Name		Description
R9110	**High-speed counter control flag**	**HSC-CH0**	- Turns on the channel of high-speed counter during the control using F165(CAM0), F166(HC1S), F167(HC1R), F178(PLSM) instructions. - Turns off when the control is cleared or this instruction is completed.
R9111		**HSC-CH1**	
R9112		**HSC-CH2**	
R9113		**HSC-CH3**	
R9114		**HSC-CH4**	
R9115		**HSC-CH5**	
R9116 to R911F	**Not used**		
R9120	**Pulse output instruction flag**	**PLS-CH0**	- Turns on while the pulses are being output using F171(SPDH), F172 (PLSH), F173(PWMH), F174 (SP0H), F175(SPSH), F177(HOME) instructions.
R9121		**PLS-CH1**	
R9122		**PLS-CH2**	
R9123		**PLS-CH3**	
R9124 to R912F	**Not used**		
R9130	**Pulse output control flag**	**PLS-CH0**	- Turns on the channel of pulse output during the control using F166(HC1S), F167(HC1R) instructions. - Turns off when the control is cleared or this instruction is completed.
R9131		**PLS-CH1**	
R9132		**PLS-CH2**	
R9133		**PLS-CH3**	
R9134 to R913F	**Not used**		

A: Available, N/A: Not available

15.1.3 Table of Special Data Registers for FP0R

FP0R (A: Available, N/A: Not available)

Address	Name	Description	Read-ing	Writ-ing
DT90000	**Self-diagnostic error code**	The self-diagnostic error code is stored here when a self-diagnostic error occurs.	A	N/A
DT90001	**Not used**	-	N/A	N/A
DT90002	**Not used**		N/A	N/A
DT90003	**Not used**	-	N/A	N/A
DT90004	**Not used**	-	N/A	N/A
DT90005	**Not used**	-	N/A	N/A
DT90006	**Not used**	-	N/A	N/A
DT90007	**Not used**	-	N/A	N/A
DT90008	**Not used**	-	N/A	N/A
DT90009	**Not used**	-	N/A	N/A
DT90010	**Extension (right side) I/O verify error unit [0 to 3]**	When the state of installation of FP0 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.  	A	N/A
DT90011	**Not used**	-	N/A	N/A
DT90012	**Not used**	-	N/A	N/A
DT90013	**Not used**	-	N/A	N/A

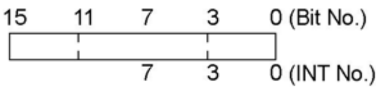
FP0R (A: Available, N/A: Not available)

Address	Name	Description	Read-ing	Writ-ing
DT90014	**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	**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 F0(MV) instruction.	A	A
DT90016			A	A
DT90017	**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	**Operation error address (latest type)**	The address where an operation error occurred is stored. Each time an error occurs, the new address overwrites the previous address.	A	N/A
DT90019	**2.5 ms ring counter** Note1)	The data stored here is increased by one every 2.5 ms. (H0 to HFFFF) Difference between the values of the two points (absolute value) x 2.5 ms = Elapsed time between the two points.	A	N/A
DT90020	**10 μs ring counter** Note1) Note2)	The data stored here is increased by one every 10.67 μs. (H0 to HFFFF) Difference between the values of the two points (absolute value) x 10.67 μs = Elapsed time between the two points. Note) The exact value is 10.67 μs.	A	N/A
DT90021	**Not used**	-	N/A	N/A

Note1) It is renewed once at the beginning of each one scan.

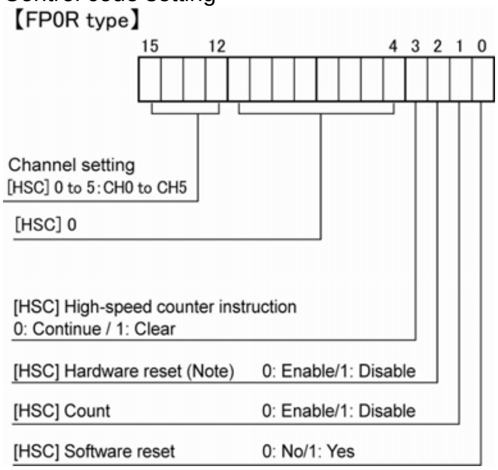
Note2) As DT90020 is renewed even if F0(MV), DT90020 and D instruction is being executed, it can be used to measure the block time.

FP0R (A: Available, N/A: Not available)

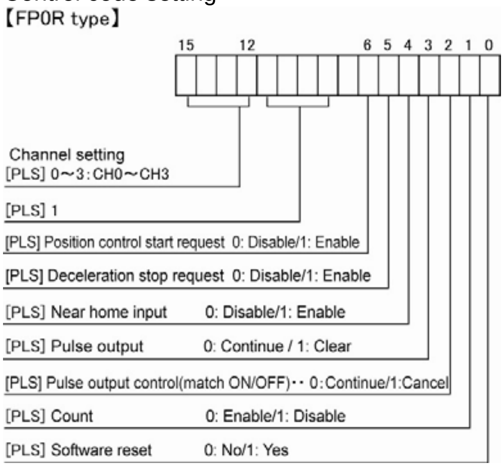
Address	Name	Description	Read-ing	Writ-ing
DT90022	**Scan time (current value)** Note)	The current scan time is stored here. Scan time is calculated using the formula: Scan time (ms) = stored data (decimal) x 0.1 ms Example: K50 indicates 5 ms.	A	N/A
DT90023	**Scan time (minimum value)** Note)	The minimum 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	**Scan time (maximum value)** Note)	The maximum scan time is stored here. The scan time is calculated using the formula: Scan time (ms) = stored data (decimal) x 0.1 ms Example: K125 indicates 12.5 ms.	A	N/A
DT90025	**Mask condition monitoring register for interrupts (INT0 to 11)**	The mask conditions of interrupts using the instruction can be stored here. Monitor using binary display.  0: interrupt disabled 1: interrupt enabled	A	N/A
DT90026	**Not used**	-	N/A	N/A
DT90027	**Periodical interrupt interval (INT24)**	The value set by ICTL instruction is stored. K0: periodical interrupt is not used. K1 to K3000: 0.5ms to 1.5s or 10ms to 30s	A	N/A
DT90028	**Sample trace interval**	K0: Sampling by the SMPL instruction K1 to K3000 (x 10 ms): 10 ms to 30 s	A	N/A
DT90029	**Not used**	-	N/A	N/A
DT90030 **DT90031** **DT90032** **DT90033** **DT90034** **DT90035**	**Character storage by F149 MSG instruction**	The contents of the specified message (Data length) are stored in these special data registers when F149 (MSG) instruction is executed.	A	N/A
DT90036	**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.

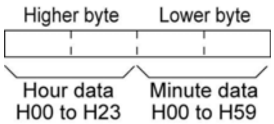
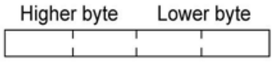
FP0R (A: Available, N/A: Not available)

Address	Name	Description	Read-ing	Writ-ing
DT90037	**Work1 for SRC instructions**	The number of data that match the searched data is stored here when F96 (SRC) insturction is executed.	A	N/A
DT90038	**Work2 for SRC instructions**	The position of the first matching data is stored here when an F96 (SRC) instruction is executed.	A	N/A
DT90039	**Not used**	-	N/A	N/A
DT90040	**Not used**	-	N/A	N/A
DT90041	**Not used**	-	N/A	N/A
DT90042	**Not used**	-	N/A	N/A
DT90043	**Not used**	-	N/A	N/A
DT90044	**Not used**	-	N/A	N/A
DT90045	**Not used**	-	N/A	N/A
DT90046	**Not used**	-	N/A	N/A
DT90047	**Not used**	-	N/A	N/A
DT90048	**Not used**	-	N/A	N/A
DT90049	**Not used**	-	N/A	N/A
DT90050	**Not used**	-	N/A	N/A
DT90051	**Not used**	-	N/A	N/A
DT90052	**High-speed counter control flag**	The pulse output instruction can be continued or cleared by writing a value with MV instruction (F0). Control code setting 	A	A

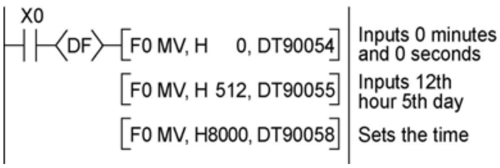
FP0R (A: Available, N/A: Not available)

Address	Name	Description	Read-ing	Writ-ing
DT90052	**Pulse output control flag**	A value can be written with F0 (MV) instruction to reset the high-speed counter, disable counting, continue or clear high-speed counter instruction. Control code setting 	A	A

FP0R (A: Available, N/A: Not available)

<table>
<tr><th>Address</th><th>Name</th><th>Description</th><th>Read-ing</th><th>Writ-ing</th></tr>
<tr><td>DT90053</td><td>Clock/calender monitor (hour/minute) (T32 only)</td><td>Hour and minute data of the clock/calender 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</td><td>Clock/calender setting (minute/second) (T32 only)</td><td rowspan="4">The year, month, day, hour, minute, second and day-of-the-week data for the clock/calender is stored. The built-in clock/calender will operate correctly through the year 2099 and supports leap years. The clock/calender can be set by writing a value using a programming tool software or a program that uses the F0 (MV) instruction.(see example for DT90058)
<table><tr><td>DT90054</td><td>Minute data (H00 to H59)</td><td>Second data (H00 to H59)</td></tr><tr><td>DT90055</td><td>Day data (H01 to H31)</td><td>Hour data (H00 to H23)</td></tr><tr><td>DT90056</td><td>Year data (H00 to H99)</td><td>Month data (H01 to H12)</td></tr><tr><td>DT90057</td><td>—</td><td>Day-of-the-week (H00 to H06)</td></tr></table>
As a day of the week is not automatially set on FPWIN GR, fix what day is set to 00, and set each value for 00 to 06.</td><td rowspan="4">A</td><td rowspan="4">A</td></tr>
<tr><td>DT90055</td><td>Clock/calender setting (day/hour) (T32 only)</td></tr>
<tr><td>DT90056</td><td>Clock/calender setting (year/month) (T32 only)</td></tr>
<tr><td>DT90057</td><td>Clock/calender setting (day-of-the-week) (T32 only)</td></tr>
</table>

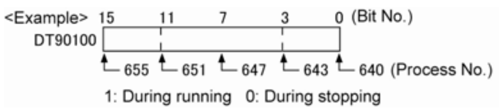
FP0R (A: Available, N/A: Not available)

Address	Name	Description	Read-ing	Writ-ing
DT90058	**Clock/calender setting and 30 seconds correction register (T32 only)**	The clock/calender is adjusted as follows. **When setting the clock/calender by program** By setting the highest bit of DT90058 to 1, the time becomes that written to DT90054 to DT90057 by F0 (MV) instruction. After the time is set, DT90058 is cleared to 0. (Cannot be performed with any instruction other than F0 (MV) instruction.) <Example> Set the time to 12:00:00 on the 5th day when the 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 the correcting times less than 30 seconds** By setting the lowest bit of DT90058 to 1, the value will be moved up or down and become exactly 0 seconds. After the correction is completed, DT90058 is cleared to 0. Example: Correct to 0 seconds with X0: on  At the time of coorection, if between 0 and 29 seconds, it will be moved down, and if between 30 and 59 seconds, it will be moved up. In the example above, if the time was 5 minutes 29 seconds, it will become 5 minutes 0 seconds;and, if the time was 5 minutes 35 seconds, it will become 6 minutes 0 seconds.	A	A
DT90059	**Communication error code**	Error code is sotred here when a communication error occurs.	N/A	N/A

FP0R (A: Available, N/A: Not available)

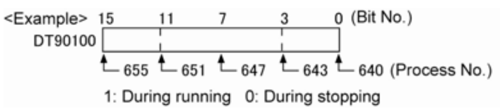
<table>
<tr><th>Address</th><th>Name</th><th>Description</th><th>Read-
ing</th><th>Writ-
ing</th></tr>
<tr><td>**DT90060**</td><td>**Step ladder process (0 to 15)**</td><td rowspan="22">Indicates the startup condition of the step ladder process. When the process starts up, the bit corresponding to the process number turns on.

Monitor using binary display.



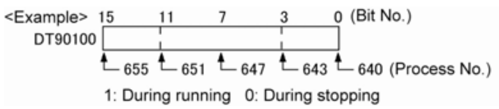
Note) A programming tool software can be used to write data.</td><td rowspan="22">A</td><td rowspan="22">A
Note)</td></tr>
<tr><td>**DT90061**</td><td>**Step ladder process (16 to 31)**</td></tr>
<tr><td>**DT90062**</td><td>**Step ladder process (32 to 47)**</td></tr>
<tr><td>**DT90063**</td><td>**Step ladder process (48 to 63)**</td></tr>
<tr><td>**DT90064**</td><td>**Step ladder process (64 to 79)**</td></tr>
<tr><td>**DT90065**</td><td>**Step ladder process (80 to 95)**</td></tr>
<tr><td>**DT90066**</td><td>**Step ladder process (96 to 111)**</td></tr>
<tr><td>**DT90067**</td><td>**Step ladder process (112 to 127)**</td></tr>
<tr><td>**DT90068**</td><td>**Step ladder process (128 to 143)**</td></tr>
<tr><td>**DT90069**</td><td>**Step ladder process (144 to 159)**</td></tr>
<tr><td>**DT90070**</td><td>**Step ladder process (160 to 175)**</td></tr>
<tr><td>**DT90071**</td><td>**Step ladder process (176 to 191)**</td></tr>
<tr><td>**DT90072**</td><td>**Step ladder process (192 to 207)**</td></tr>
<tr><td>**DT90073**</td><td>**Step ladder process (208 to 223)**</td></tr>
<tr><td>**DT90074**</td><td>**Step ladder process (224 to 239)**</td></tr>
<tr><td>**DT90075**</td><td>**Step ladder process (240 to 255)**</td></tr>
<tr><td>**DT90076**</td><td>**Step ladder process (256 to 271)**</td></tr>
<tr><td>**DT90077**</td><td>**Step ladder process (272 to 287)**</td></tr>
<tr><td>**DT90078**</td><td>**Step ladder process (288 to 303)**</td></tr>
<tr><td>**DT90079**</td><td>**Step ladder process (304 to 319)**</td></tr>
<tr><td>**DT90080**</td><td>**Step ladder process (320 to 335)**</td></tr>
<tr><td>**DT90081**</td><td>**Step ladder process (336 to 351)**</td></tr>
</table>

FP0R (A: Available, N/A: Not available)

Address	Name	Description	Read-ing	Writ-ing
DT90082	**Step ladder process (352 to 367)**	Indicates the startup condition of the step ladder process. When the process starts up, the bit corresponding to the process number turns on . Monitor using binary display.  Note) A programming tool software can be used to write data.	A	A Note)
DT90083	**Step ladder process (368 to 383)**			
DT90084	**Step ladder process (384 to 399)**			
DT90085	**Step ladder process (400 to 415)**			
DT90086	**Step ladder process (416 to 431)**			
DT90087	**Step ladder process (432 to 447)**			
DT90088	**Step ladder process (448 to 463)**			
DT90089	**Step ladder process (464 to 479)**			
DT90090	**Step ladder process (480 to 495)**			
DT90091	**Step ladder process (496 to 511)**			
DT90092	**Step ladder process (512 to 527)**			
DT90093	**Step ladder process (528 to 543)**			
DT90094	**Step ladder process (544 to 559)**			
DT90095	**Step ladder process (560 to 575)**			
DT90096	**Step ladder process (576 to 591)**			
DT90097	**Step ladder process (592 to 607)**			

<table>
<tr><th>Address</th><th>Name</th><th>Description</th><th>Read-ing</th><th>Writ-ing</th></tr>
<tr><td>DT90098</td><td>Step ladder process (608 to 623)</td><td rowspan="25">Indicates the startup condition of the step ladder process. When the process starts up, the bit corresponding to the process number turns on.

Monitor using binary display



A programming tool software can be used to write data.</td><td rowspan="25">A</td><td rowspan="25">A</td></tr>
<tr><td>DT90099</td><td>Step ladder process (624 to 639)</td></tr>
<tr><td>DT90100</td><td>Step ladder process (640 to 655)</td></tr>
<tr><td>DT90101</td><td>Step ladder process (656 to 671)</td></tr>
<tr><td>DT90102</td><td>Step ladder process (672 to 687)</td></tr>
<tr><td>DT90103</td><td>Step ladder process (688 to 703)</td></tr>
<tr><td>DT90104</td><td>Step ladder process (704 to 719)</td></tr>
<tr><td>DT90105</td><td>Step ladder process (720 to 735)</td></tr>
<tr><td>DT90106</td><td>Step ladder process (736 to 751)</td></tr>
<tr><td>DT90107</td><td>Step ladder process (752 to 767)</td></tr>
<tr><td>DT90108</td><td>Step ladder process (768 to 783)</td></tr>
<tr><td>DT90109</td><td>Step ladder process (784 to 799)</td></tr>
<tr><td>DT90110</td><td>Step ladder process (800 to 815)</td></tr>
<tr><td>DT90111</td><td>Step ladder process (816 to 831)</td></tr>
<tr><td>DT90112</td><td>Step ladder process (832 to 847)</td></tr>
<tr><td>DT90113</td><td>Step ladder process (848 to 863)</td></tr>
<tr><td>DT90114</td><td>Step ladder process (864 to 879)</td></tr>
<tr><td>DT90115</td><td>Step ladder process (880 to 895)</td></tr>
<tr><td>DT90116</td><td>Step ladder process (896 to 911)</td></tr>
<tr><td>DT90117</td><td>Step ladder process (912 to 927)</td></tr>
<tr><td>DT90118</td><td>Step ladder process (928 to 943)</td></tr>
<tr><td>DT90119</td><td>Step ladder process (944 to 959)</td></tr>
<tr><td>DT90120</td><td>Step ladder process (960 to 975)</td></tr>
<tr><td>DT90121</td><td>Step ladder process (976 to 991)</td></tr>
<tr><td>DT90122</td><td>Step ladder process (992 to 999) (higher byte is not used.)</td></tr>
</table>

FP0R (A: Available, N/A: Not available)

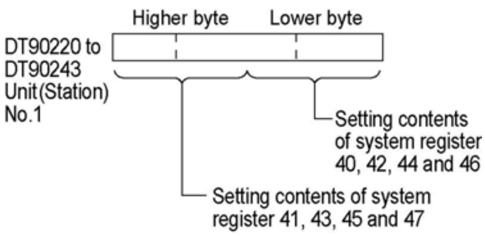
Address	Name	Description	Read-ing	Writ-ing
DT90123	**Not used**	-	N/A	N/A
DT90124	**COM SEND/RECV instruction end code**	For details, refer to Programming Manual (F145 and F146).	N/A	N/A
DT90125	**Not used**	-	N/A	N/A
DT90126	**Forced ON/OFF operating station display**	Used by the system	N/A	N/A
DT90127 to DT90139	**Not used**	-	N/A	N/A
DT90140	**MEWNET-W0 PC(PLC) link 0 status**	The number of times the receiving operation is performed.	A	N/A
DT90141		The current interval between two receiving operations: value in the register x 2.5ms		
DT90142		The minimum inerval between two receiving operations: value in the register x 2.5ms		
DT90143		The maximum interval between two receiving operations: value in the register x 2.5ms		
DT90144		The number of times the sending operation is performed.		
DT90145		The current interval between two sending operations: value in the register x 2.5ms		
DT90146		The minimum interval between two sending operations: value in the register x 2.5ms		
DT90147		The maximum interval between two sending operations: value in the register x 2.5ms		
DT90148	**MEWNET-W0 PC(PLC) link 1 status**	The number of times the receiving operation is performed.	A	N/A
DT90149		The current interval between two receiving operations: value in the register x 2.5ms		
DT90150		The minimum inerval between two receiving operations: value in the register x 2.5ms		
DT90151		The maximum interval between two receiving operations: value in the register x 2.5ms		
DT90152		The number of times the sending operation is performed.		
DT90153		The current interval between two sending operations: value in the register x 2.5ms		
DT90154		The minimum interval between two sending operations: value in the register x 2.5ms		
DT90155		The maximum interval between two sending operations: value in the register x 2.5ms		
DT90156	**MEWNET-W0 PC(PLC) link 0 status**	Area used for measurement of receiving interval.	A	N/A
DT90157		Area used for measurement of sending interval.		

FP0R (A: Available, N/A: Not available)

Address	Name	Description	Reading	Writing
DT90158	**MEWNET-W0 PC(PLC) link 1 status**	Area used for measurement of receiving interval.	A	N/A
DT90159		Area used for measurement of sending interval.		
DT90160	**MEWNET-W0 PC(PLC) link 0 unit No.**	Stores the unit No. of PC(PLC) link 0.	A	N/A
DT90161	**MEWNET-W0 PC(PLC) link 0 error flag**	Stores the error contents of PC(PLC) link 0.	A	N/A
DT90162 to DT90169	**Not used**	-	N/A	N/A
DT90170	**MEWNET-W0 PC(PLC) link 0 status**	Duplicated destination for PC(PLC) inter-link address	A	N/A
DT90171		Counts how many times a token is lost.		
DT90172		Counts how many times two or more tokens are detected.		
DT90173		Counts how many times a signal is lost.		
DT90174		No. of times underfined commands have been received.		
DT90175		No. of times sum check errors have occurred during reception.		
DT90176		No. of times format errors have occurred in received data.		
DT90177		No. of times transmission errors have occurred.		
DT90178		No. of times procedural errors have occurred.		
DT90179		No. of times overlapping parent units have occurred.		
DT90180 to DT90189	**Not used**	-	N/A	N/A
DT90190	**Not used**	-	N/A	N/A
DT90191	**Not used**	-	N/A	N/A
DT90192	**Not used**	-	N/A	N/A
DT90193	**Not used**	-	N/A	N/A
DT90194 to DT90218	**Not used**	-	N/A	N/A

FP0R (A: Available, N/A: Not available)

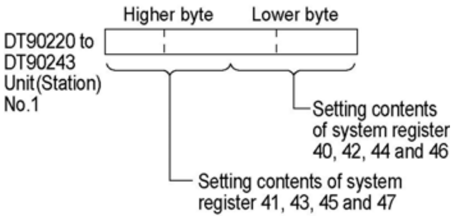
<table>
<tr><th>Address</th><th colspan="2">Name</th><th>Description</th><th>Reading</th><th>Writing</th></tr>
<tr><td>DT90219</td><td colspan="2">Unit No. (Station No.) selection for DT90220 to DT90251</td><td>0: Unit No. (Station No.) 1 to 8,
1: Unit No. (Station No.) 9 to 16</td><td>A</td><td>A</td></tr>
<tr><td>DT90220</td><td rowspan="4">PC(PLC) link Unit (station) No. 1 or 9</td><td>System register 40 and 41</td><td rowspan="20">The contents of the system register settings partaining to the PLC inter-link function for the various unit numbers are stored as shown below.

<Example>
When DT90219 is 0


• When the system register 46 in the home unit is in the standard setting, the values in the home unit are copied in the system registers 46 and 47.
When the system register 46 in the home unit is in the reverse setting, the registers 40 to 45 and 47 corresponding to the home unit mentioned in the left column will be changed to 50 to 55 and 57, and the system register 46 will be set as it is.
Also, the system registers 40 to 45 corresponding to other units will be changed to the values which the received values are corrected, and the registers 46 and 57 in the home unit are set for the registers 46 and 47.</td><td rowspan="20">A</td><td rowspan="20">N/A</td></tr>
<tr><td>DT90221</td><td>System register 42 and 43</td></tr>
<tr><td>DT90222</td><td>System register 44 and 45</td></tr>
<tr><td>DT90223</td><td>System register 46 and 47</td></tr>
<tr><td>DT90224</td><td rowspan="4">PC(PLC) link Unit (station) No. 2 or 10</td><td>System register 40 and 41</td></tr>
<tr><td>DT90225</td><td>System register 42 and 43</td></tr>
<tr><td>DT90226</td><td>System register 44 and 45</td></tr>
<tr><td>DT90227</td><td>System register 46 and 47</td></tr>
<tr><td>DT90228</td><td rowspan="4">PC(PLC) link Unit (station) No. 3 or 11</td><td>System register 40 and 41</td></tr>
<tr><td>DT90229</td><td>System register 42 and 43</td></tr>
<tr><td>DT90230</td><td>System register 44 and 45</td></tr>
<tr><td>DT90231</td><td>System register 46 and 47</td></tr>
<tr><td>DT90232</td><td rowspan="4">PC(PLC) link Unit (station) No. 4 or 12</td><td>System register 40 and 41</td></tr>
<tr><td>DT90233</td><td>System register 42 and 43</td></tr>
<tr><td>DT90234</td><td>System register 44 and 45</td></tr>
<tr><td>DT90235</td><td>System register 46 and 47</td></tr>
<tr><td>DT90236</td><td rowspan="4">PC(PLC) link Unit (station) No. 5 or 13</td><td>System register 40 and 41</td></tr>
<tr><td>DT90237</td><td>System register 42 and 43</td></tr>
<tr><td>DT90238</td><td>System register 44 and 45</td></tr>
<tr><td>DT90239</td><td>System register 46 and 47</td></tr>
</table>

FP0R (A: Available, N/A: Not available)

<table>
<tr><th>Address</th><th colspan="2">Name</th><th>Description</th><th>Read-ing</th><th>Writ-ing</th></tr>
<tr><td>DT90240</td><td rowspan="4">PC(PLC) link Unit (station) No. 6 or 14</td><td>System register 40 and 41</td><td rowspan="12">The contents of the system register settings partaining to the PLC inter-link function for the various unit numbers are stored as shown below.

<Example> when DT90219 is 0.

• When the system register 46 in the home unit is in the standard setting, the values in the home unit are copied in the system registers 46 and 47.
When the system register 46 in the home unit is in the reverse setting, the registers 40 to 45 and 47 corresponding to the home unit mentioned in the left column will be changed to 50 to 55 and 57, and the system register 46 will be set as it is.
Also, the system registers 40 to 45 corresponding to other units will be changed to the values which the received values are corrected, and the registers 46 and 57 in the home unit are set for the registers 46 and 47.</td><td rowspan="12">A</td><td rowspan="12">N/A</td></tr>
<tr><td>DT90241</td><td>System register 42 and 43</td></tr>
<tr><td>DT90242</td><td>System register 44 and 45</td></tr>
<tr><td>DT90243</td><td>System register 46 and 47</td></tr>
<tr><td>DT90244</td><td rowspan="4">PC(PLC) link Unit (station) No. 7 or 15</td><td>System register 40 and 41</td></tr>
<tr><td>DT90245</td><td>System register 42 and 43</td></tr>
<tr><td>DT90246</td><td>System register 44 and 45</td></tr>
<tr><td>DT90247</td><td>System register 46 and 47</td></tr>
<tr><td>DT90248</td><td rowspan="4">PC(PLC) link Unit (station) No. 8 or 16</td><td>System register 40 and 41</td></tr>
<tr><td>DT90249</td><td>System register 42 and 43</td></tr>
<tr><td>DT90250</td><td>System register 44 and 45</td></tr>
<tr><td>DT90251</td><td>System register 46 and 47</td></tr>
<tr><td>DT90252</td><td colspan="2">Not used</td><td></td><td rowspan="4">N/A</td><td rowspan="4">N/A</td></tr>
<tr><td>DT90253</td><td colspan="2">Not used</td><td></td></tr>
<tr><td>DT90254</td><td colspan="2">Not used</td><td></td></tr>
<tr><td>DT90255</td><td colspan="2">Not used</td><td></td></tr>
<tr><td>DT90256</td><td colspan="2">Not used</td><td></td><td>N/A</td><td>N/A</td></tr>
</table>

FP0R (A: Available, N/A: Not available)

Address	Name			Description	Reading	Writing
DT90300	Elapsed value area	Lower words	HSC-CH0	Counting area for input (X0) or (X0, X1) of the main unit.	A	A Note)
DT90301		Higher words			A	A Note)
DT90302	Target value area	Lower words		The target value is set when instructions F166 (HC1S) and F167 (HC1R) are executed.	A	A Note)
DT90303		Higher words			A	A Note)
DT90304	Elapsed value area	Lower words	HSC-CH1	Counting area for input (X1) of the main unit.	A	A Note)
DT90305		Higher words			A	A Note)
DT90306	Target value area	Lower words		The target value is set when instructions F166 (HC1S) and F167 (HC1R) are executed.	A	A Note)
DT90307		Higher words			A	A Note)
DT90308	Elapsed value area	Lower words	HSC-CH2	Counting area for input (X2) or (X2, X3) of the main unit.	A	A Note)
DT90309		Higher words			A	A Note)
DT90310	Target value area	Lower words		The target value is set when instructions F166 (HC1S) and F167 (HC1R) are executed.	A	A Note)
DT90311		Higher words			A	A Note)
DT90312	Elapsed value area	Lower words	HSC-CH3	Counting area for input (X3) of the main unit.	A	A Note)
DT90313		Higher words			A	A Note)
DT90314	Target value area	Lower words		The target value is set when instructions F166 (HC1S) and F167 (HC1R) are executed.	A	A Note)
DT90315		Higher words			A	A Note)
DT90316	Elapsed value area	Lower words	HSC-CH4	Counting area for input (X4) or (X4, X5) of the main unit.	A	A Note)
DT90317		Higher words			A	A Note)
DT90318	Target value area	Lower words		The target value is set when instructions F166 (HC1S) and F167 (HC1R) are executed.	A	A Note)
DT90319		Higher words			A	A Note)

Note) Writing in the elapsed value area is available by F1 (DMV) instruction only.
Writing in the target value area is available by F166 (HC1S) and F167 (HC1R) instructions only.

FP0R (A: Available, N/A: Not available)

Address	Name			Description	Reading	Writing
DT90320	Elapsed value area	Lower words	HSC-CH5	Counting area for input (X5) of the main unit.	A	A Note1)
DT90321		Higher words			A	A Note1)
DT90322	Target value area	Lower words		The target value is set when instructions F166 (HC1S) and F167 (HC1R) are executed.	A	A Note1)
DT90323		Higher words			A	A Note1)
DT90324	Not used				N/A	N/A
DT90325	Not used				N/A	N/A
DT90326	Not used				N/A	N/A
DT90327	Not used				N/A	N/A
DT90328	Not used				N/A	N/A
DT90329	Not used				N/A	N/A
DT90330	Not used				N/A	N/A
DT90331	Not used				N/A	N/A
DT90332	Not used				N/A	N/A
DT90333	Not used				N/A	N/A
DT90334	Not used				N/A	N/A
DT90335	Not used				N/A	N/A
DT90336	Not used				N/A	N/A
DT90337	Not used				N/A	N/A
DT90338	Not used				N/A	N/A
DT90339	Not used				N/A	N/A
DT90340	Not used				N/A	N/A
DT90341	Not used				N/A	N/A
DT90342	Not used				N/A	N/A
DT90343	Not used				N/A	N/A
DT90344	Not used				N/A	N/A
DT90345	Not used				N/A	N/A
DT90346	Not used				N/A	N/A
DT90347	Not used				N/A	N/A
DT90348	Not used				N/A	N/A
DT90349	Not used				N/A	N/A
DT90350	Not used				N/A	N/A
DT90351	Not used				N/A	N/A
DT90352	Not used				N/A	N/A
DT90353	Not used				N/A	N/A
DT90354	Not used				N/A	N/A
DT90355	Not used				N/A	N/A
DT90356	Not used				N/A	N/A
DT90357	Not used				N/A	N/A
DT90358	Not used				N/A	N/A
DT90359	Not used				N/A	N/A
DT90360	Not used				N/A	N/A
DT90361	Not used				N/A	N/A
DT90362	Not used				N/A	N/A
DT90363	Not used				N/A	N/A

Note1) Writing in the elapsed value area is available by F1 (DMV) instruction only.
Writing in the target value area is available by F166 (HC1S) and F167 (HC1R) instructions only.

FP0R (A: Available, N/A: Not available)

Address	Name		Description	Read-ing	Writ-ing
DT90370	**Control flag monitor area**	**HSC-CH0**	When HSC control is executed by F0 (MV)S, DT90052 instruction, the setting value for the target CH is stored in each CH.	A	N/A
DT90371		**HSC-CH1**		A	N/A
DT90372		**HSC-CH2**		A	N/A
DT90373		**HSC-CH3**		A	N/A
DT90374		**HSC-CH4**		A	N/A
DT90375		**HSC-CH5**		A	N/A
DT90376	**Not used**		-	N/A	N/A
DT90377	**Not used**		-	N/A	N/A
DT90378	**Not used**		-	N/A	N/A
DT90379	**Not used**		-	N/A	N/A
DT90380	**Control flag monitor area (Transistor output type only)**	**PLS-CH0**	When pulse output control is executed by F0 (MV)S, DT90052 instruction, the setting value for the target CH is stored in each CH.	A	N/A
DT90381		**PLS-CH1**		A	N/A
DT90382		**PLS-CH2**		A	N/A
DT90383		**PLS-CH3**		A	N/A
DT90384	**Not used**		-	N/A	N/A
DT90385	**Not used**		-	N/A	N/A
DT90386	**Not used**		-	N/A	N/A
DT90387	**Not used**		-	N/A	N/A
DT90388	**Not used**		-	N/A	N/A
DT90389	**Not used**		-	N/A	N/A

FP0R (A: Available, N/A: Not available)

Address	Name			Description	Read-ing	Writ-ing
DT90400	Elapsed value area	Lower words	PLS-CH0	Available for the transistor output type only. Note) When controlling the pulse output CH by F166(HC1S), F167(HC1R) instructions, the target value is stored. The target value for match ON/OFF is stored.	A	A
DT90401		Higher words			A	A
DT90402	Target value area	Lower words			A	N/A
DT90403		Higher words			A	N/A
DT90404	Target value area for match ON/OFF	Lower words			A	N/A
DT90405		Higher words			A	N/A
DT90406	Corrected speed of initial speed	Lower words		The initial speed of the calculated result is stored.	A	N/A
DT90407	Deceleration minimum speed			The minimum speed for the change of speed.	A	N/A
DT90408	Acceleration forbidden area starting position	Lower words		If the elapsed value corsses over this position when changing the speed, acceleration cannot be performed.	A	N/A
DT90409		Higher words			A	N/A
DT90410	Elapsed value area	Lower words	PLS-CH1	Available for the transistor output type only. Note) When controlling the pulse output CH by F166(HC1S), F167(HC1R) instructions, the target value is stored. The target value for match ON/OFF is stored.	A	A
DT90411		Higher words			A	A
DT90412	Target value area	Lower words			A	N/A
DT90413		Higher words			A	N/A
DT90414	Target value area for match ON/OFF	Lower words			A	N/A
DT90415		Higher words			A	N/A
DT90416	Corrected speed of initial speed	Lower words		The initial speed of the calculated result is stored.	A	N/A
DT90417	Deceleration minimum speed			The minimum speed for the change of speed.	A	N/A
DT90418	Acceleration forbidden area starting position	Lower words		If the elapsed value corsses over this position when changing the speed, acceleration cannot be performed.	A	N/A
DT90419		Higher words			A	N/A

FP0R (A: Available, N/A: Not available)

Address	Name			Description	Read-ing	Writ-ing
DT90420	**Elapsed value area**	**Lower words**	**PLS-CH2**	Available for the transistor output type only. Note) When controlling the pulse output CH by F166(HC1S), F167(HC1R) instructions, the target value is stored. The target value for match ON/OFF is stored.	A	A
DT90421		**Higher words**			A	A
DT90422	**Target value area**	**Lower words**			A	N/A
DT90423		**Higher words**			A	N/A
DT90424	**Target value area for match ON/OFF**	**Lower words**			A	N/A
DT90425		**Higher words**			A	N/A
DT90426	**Corrected speed of initial speed**	**Lower words**		The initial speed of the calculated result is stored.	A	N/A
DT90427	**Deceleration minimum speed**			The minimum speed for the change of speed.	A	N/A
DT90428	**Acceleration forbidden area starting position**	**Lower words**		If the elapsed value corsses over this position when changing the speed, acceleration cannot be performed.	A	N/A
DT90429		**Higher words**			A	N/A
DT90430	**Elapsed value area**	**Lower words**	**PLS-CH3**	Available for the transistor output type only. Note) When controlling the pulse output CH by F166(HC1S), F167(HC1R) instructions, the target value is stored. The target value for match ON/OFF is stored.	A	A
DT90431		**Higher words**			A	A
DT90432	**Target value area**	**Lower words**			A	N/A
DT90433		**Higher words**			A	N/A
DT90434	**Target value area for match ON/OFF**	**Lower words**			A	N/A
DT90435		**Higher words**			A	N/A
DT90436	**Corrected speed of initial speed**	**Lower words**		The initial speed of the calculated result is stored.	A	N/A
DT90437	**Deceleration minimum speed**			The minimum speed for the change of speed.	A	N/A
DT90438	**Acceleration forbidden area starting position**	**Lower words**		If the elapsed value corsses over this position when changing the speed, acceleration cannot be performed.	A	N/A
DT90439		**Higher words**			A	N/A

15.2 Table of Basic Instructions

Name	Boolean	Symbol	Description	Steps *3	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
Sequence basic instructions											
Start	**ST**	X, Y, R, T, C, L, P, E	Begins a logic operation with a Form A (normally open) contact.	1 (2)	○	○	○	○	○	○	○
Start Not	**ST/**	X, Y, R, T, C, L, P, E	Begins a logic operation with a Form B (normally closed) contact.	1 (2)	○	○	○	○	○	○	○
Out	**OT**	Y, R, L, E	Outputs the operated result to the specified output.	1 (2)	○	○	○	○	○	○	○
Not	**/**	/	Inverts the operated result up to this instruction.	1	○	○	○	○	○	○	○
AND	**AN**	X, Y, R, T, C, L, P, E	Connects a Form A (normally open) contact serially.	1 (2)	○	○	○	○	○	○	○
AND Not	**AN/**	X, Y, R, T, C, L, P, E	Connects a Form B (normally closed) contact serially.	1 (2)	○	○	○	○	○	○	○
OR	**OR**	X, Y, R, T, C, L, P, E	Connects a Form A (normally open) contact in parallel.	1 (2)	○	○	○	○	○	○	○
OR Not	**OR/**	X, Y, R, T, C, L, P, E	Connects a Form B (normally closed) contact in parallel.	1 (2)	○	○	○	○	○	○	○
Leading edge start	**ST↑**	X, Y, R, T, C, L, P, E	Begins a logic operation only for one scan when the leading edge of the trigger is detected.	2	×	×	○	△ *2	△ *2	○	○
Trailing edge start	**ST↓**	X, Y, R, T, C, L, P, E	Begins a logic operation only for one scan when the trailing edge of the trigger is detected.	2	×	×	○	△ *2	△ *2	○	○
Leading edge AND	**AN↑**	X, Y, R, T, C, L, P, E	Connects a Form A (normally open) contact serially only for one scan when the leading edge of the trigger is detected.	2	×	×	○	△ *2	△ *2	○	○
Trailing edge AND	**AN↓**	X, Y, R, T, C, L, P, E	Connects a Form A (normally open) contact serially only for one scan when the trailing edge of the trigger is detected.	2	×	×	○	△ *2	△ *2	○	○
Leading edge OR	**OR↑**	X, Y, R, T, C, L, P, E	Connects a Form A (normally open) contact in parallel only for one scan when the leading edge of the trigger is detected.	2	×	×	○	△ *2	△ *2	○	○
Trailing edge OR	**OR↓**	X, Y, R, T, C, L, P, E	Connects a Form A (normally open) contact in parallel only for one scan when the trailing edge of the trigger is detected.	2	×	×	○	△ *2	△ *2	○	○
Leading edge out	**OT↑**	P	Outputs the operated result to the specified output only for one scan when leading edge of the trigger is detected. (for pulse relay)	2	×	×	×	×	×	○	○
Trailing edge out	**OT↓**	P	Outputs the operated result to the specified output only for one scan when trailing edge of the trigger is detected. (for pulse relay)	2	×	×	×	×	×	○	○
Alterna-tive out	**ALT**	Y, R, L, E	Inverts the output condition (on/off) each time the leading edge of the trigger is detected.	3	×	×	○	○	○	○	○
AND stack	**ANS**		Connects the multiple instruction blocks serially.	1	○	○	○	○	○	○	○
OR stack	**ORS**		Connects the multiple instruction blocks in parallel.	1	○	○	○	○	○	○	○

○: Available, ×: Not available, △: Not available partially

*1) The type of the devices that can be specified depends on the models.

*2) This instruction is available for FP-X Ver. 2.0 or later, and FPΣ Ver. 3.10 or later.

*3) In the FP2/FP2SH/10SH, when using X1280, Y1280, R1120 (special internal relay included), L1280, T256, C256 or anything beyond for the ST, ST/, OT, AN, AN/, OR and OR/ instructions, the number of steps is shown in parentheses. Also, in the FP2/FP2SH/FP10SH, when a relay number has an index modifier, the number of steps is shown in parentheses. For the FPΣ and FP-X, the number of steps varies according to the relay number to be used.

Name	Boolean	Symbol	Description	Steps *5 *6	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
Push stack	**PSHS**		Stores the operated result up to this instruction. *2	1	○	○	○	○	○	○	○
Read stack	**RDS**		Reads the operated result stored by the PSHS instruction. *2	1	○	○	○	○	○	○	○
Pop stack	**POPS**		Reads and clears the operated result stored by the PSHS instruction	1	○	○	○	○	○	○	○
Leading edge differential	**DF**	—(DF)—	Turns on the contact for only one scan when the leading edge of the trigger is detected.	1	○	○	○	○	○	○	○
Trailing edge differential	**DF/**	—(DF/)—	Turns on the contact for only one scan when the trailing edge of the trigger is detected.	1	○	○	○	○	○	○	○
Leading edge differ-ential (initial execution type)	**DFI**	—(DFI)—	Turns on the contact for only one scan when the leading edge of the trigger is detected. The leading edge detection is possible on the first scan.	1	×	×	○	○	○	○	○
Set	**SET**	Y, R, L, E ⟨S⟩	Output is set to and held at on.	3	○	○	○	○	○	○	○
Reset	**RST**	Y, R, L, E ⟨R⟩	Output is set to and held at off.	3	○	○	○	○	○	○	○
Keep	**KP**	Set Reset KP	Outputs at set trigger and holds until reset trigger turns on.	1 (2)	○	○	○	○	○	○	○
No operation	**NOP**	—●—	No operation.	1	○	○	○	○	○	○	○
Basic function instructions											
On-delay timer	**TML**	TMa, n	After set value “n” x 0.001 seconds, timer contact “a” is set to on.	3 (4)	○	○	○	○	○	○	○ *3
	TMR		After set value “n” x 0.01 seconds, timer contact “a” is set to on.	3 (4)	○	○	○	○	○	○	○ *3
	TMX		After set value “n” x 0.1 seconds, timer contact “a” is set to on.	3 (4)	○	○	○	○	○	○	○ *3
	TMY		After set value “n” x 1 second, timer contact “a” is set to on.	4 (5)	○	○	○	○	○	○	○ *3
Auxiliary timer (16-bit)	**F137 (STMR)**	Y,R,L,E F137 STMR, S, D	After set value “S” x 0.01 seconds, the specified output and R900D are set to on.	5	○	○	○	○	○	○	○
Auxiliary timer (32-bit)	**F183 (DSTM)**	Y,R,L,E F183 DSTM, S, D	After set value “S” x 0.01 seconds, the specified output and R900D are set to on.	7	○	○	○	○	○	○	○
Time constant processing	**F182**	F182 FILTR S1, S2, S3, D	Executes the filter processing for the specified input.	9	×	×	○	△ *4	△ *4	×	×
Counter	**CT**	Count Reset CT n	Decrements from the preset value “n”	3 (4)	○	○	○	○ *3	○ *3	○	○ *3

○: Available, ×: Not available, △: Not available partially

*1) The type of the devices that can be specified depends on the models.

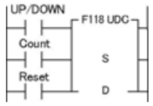
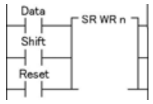
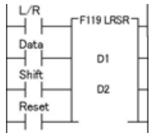
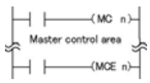
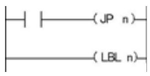
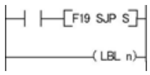
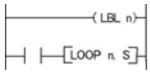
*2) The allowable number of using the PSHS and RDS instruction depends on the models.

*3) For FP2SH, FP10SH and FP-X Ver2.0 or later, any device can be set for the setting value of counter or timer instruction.

*4) This instruction is available for FP-X Ver. 2.0 or later.

*5) In the FP2/FP2SH/FP10SH, when using Y1280, R1120 (special internal relay included), L1280 or anything beyond for the KP instruction, the number of steps is shown in parentheses. Also, in the FP2/FP2SH/FP10SH, when a relay number has an index modifier, the number of steps is shown in parentheses.

*6) In the FP2/FP2SH/FP10SH, when timer 256 or higher, or counter 255 or lower, is used, the number of steps is the number in parentheses. Also, in the FP2/FP2SH/FP10SH, when a timer number or counter number has an index modifier, the number of steps is the number in parentheses. For the FPΣ and FP-X, the number of steps varies according to the specified timer number or counter number.

Name	Boolean	Symbol	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
UP/DOWN counter	**F118 (UDC)**		Increments or decrements from the preset value “S” based on up/donw input.	5	○	○	○	○	○	○	○
Shift register	**SR**		Shifts one bit of 16-bit [word internal relay (WR)] data to the left.	1 (2) *1	○	○	○	○	○	○	○
Left/right shift register	**F119 (LRSR)**		Shifts one bit of 16-bit data range specified by “D1” and “D2” to the left or to the right.	5	○	○	○	○	○	○	○
Control instructions											
Master control relay	**MC**		Starts the master control program.	2	○	○	○	○	○	○	○
Master control relay end	**MCE**		Ends the master control program.	2	○	○	○	○	○	○	○
Jump **Label**	**JP** **LBL**		The program jumps to the label instruction and continues from there.	2 (3) *2 1	○	○	○	○	○	○	○
Auxiliary jump **Label**	**F19 (SJP)** **LBL**		The program jumps to the label instruction specified by “S” and continues from there.	3 1	×	×	×	×	×	○	○
Loop **Label**	**LOOP** **LBL**		The program jumps to the label instruction and continues from there (the number of jumps is set in “S”).	4 (5) *3 1	○	○	○	○	○	○	○
Break	**BRK**		Stops program execution when the predetermined trigger turns on in the TEST/RUN mode only.	1	×	×	×	×	×	○	○

○: Available, ×: Not available, △: Not available partially

*1) In the FP2/FP2SH/FP10SH, when internal relay WR240 or higher is used, the number of steps is the number in parentheses. Also, in the FP2/FP2SH/FP10SH, when the specified internal relay number (word address has an index modfier, the number of steps is the number in parentheses.

*2) In the FP2/FP2SH/FP10SH, when the number “n” in a jump instruction has an index modifier, the number of steps isthenumber in parentheses.

*3) In the FP2/FP2SH/FP10SH, when the number “n” in a loop instruction has an index modifier, the number of steps is the number in parentheses.

Name	Boolean	Symbol	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
End	**ED**	(ED)	The operation of program is ended. Indicates the end of a main program.	1	○	○	○	○	○	○	○
Conditional end	**CNDE**	(CNDE)	The operation of program is ended when the trigger turns on.	1	○	○	○	○	○	○	○
Eject	**EJECT**	(EJECT)	Adds page break fo ruse when printing.	1	×	×	○	○	○	○	○
Step ladder instructions											
Start step	**SSTP**	(SSTP n)	The start of program “n” for process control	3	○	○	○	○	○	○	○
Next step	**NSTL**	(NSTL n)	Start the specified process “n” and clear the process currently started. (Scan execution type)	3	○	○	○	○	○	○	○
	NSTP	(NSTP n)	Start the specified process “n” and clear the process currently started. (Pulse execution type)	3	○	○	○	○	○	○	○
Clear step	**CSTP**	(CSTP n)	Resets the specified process “n”.	3	○	○	○	○	○	○	○
Clear multi-ple steps	**SCLR**	[SCLR n1, n2]	Resets multiple processes specified by “n1” and “n2”.	5	○	×	○	○	○	○	○
Step end	**STPE**	(STPE)	End of step ladder area	1	○	○	○	○	○	○	○
Subroutine instructions											
Subroutine call	**CALL**	(CALL n)	When the trigger is on: Executes the subroutine. When the trigger is off: Not execute the subroutine. The output in the subroutine is maintained.	2 (3) *1	○	○	○	○	○	○	○
Output off type subroutine call	**FCAL**	(FCAL n)	When the trigger is on: Executes the subroutine. When the trigger is off: Not execute the subroutine. But, the output in the subroutine is cleared.	4 (5) *1	×	×	×	×	×	×	○
Subroutine entry	**SUB**	(SUB n)	Indicates the start of the subroutine program “n”.	1	○	○	○	○	○	○	○
Subroutine return	**RET**	(RET)	Ends the subroutine program.	1	○	○	○	○	○	○	○
Interrupt instructions											
Interrupt	**INT**	(INT n)	Indicates the start of the interrupt program “n”.	1	○	○	○	○	○	○	○
Interrupt return	**IRET**	(IRET)	Ends the interrupt program.	1	○	○	○	○	○	○	○
Interrupt control	**ICTL**	(DF) [ICTL S1, S2]	Select interrupt enable/disable or clear in “S1” and “S2” and execute.	5	○	○	○	○	○	○	○

○: Available, ×: Not available, △: Not available partially

*1) In the FP2/FP2SH/FP10SH, when the number “n” of a subroutine program has an index modifier, the number of steps is the number in parentheses.

Name	Boolean	Symbol	Description	Steps	FP-e	FP0	FP0 (FP0R mode)	FPΣ	FP-X	FP2	FP2SH/FP10SH
Special setting instructions											
Communica-tion condi-tions setting	**SYS1**		Change the communication conditions for the COM port or tool port based on the contents specified by the character constant.		×	×	○	○ *1	○ *1	×	×
Password setting			Change the password specified by the PLC based on the contents specified by the character constant.		×	×	○	○ *2	○ *2	×	×
Interrupt setting			Set the interrupt input based on the contents specified by the character constant.		×	×	○	○	○	×	×
PLC link time setting		(DF) [SYS1, M]	Set the system setting time when a PLC link is used, based on the contents specified by the character constant.	13	×	×	○	○	○	×	×
MEWTOCOL-COM response control			Change the communication conditions of the COM. port or tool port for MEWTOCOL-COM based on the contents specified by the character constant.		×	×	○	○	○	×	×
High-speed counter operation mode changing			Change the operation mode of the high-speed counter, based on the contents specified by the character constant.		×	×	○	○ *3	○ *3	×	×
System registers “No. 40 to No. 47” changing	**SYS2**	[SYS2, S, D1, D2]	Change the setting value of the system register for the PLC link function.	7	×	×	○	○	○	×	×

○: Available, ×: Not available, △: Not available partially

*1) With FP-X Ver2.0 or later, and FPΣ Ver 3.10 or later, the baud rate can be selected from 300, 600 or 1200 bps.

*2) With FPΣ 32k type, the 8-digit password can be selected.

*3) With FPΣ 32k type and FP-X Ver1.10 or later, it can be used.

Name	Boolean	Symbol	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
Data compare instructions											
16-bit data compare (Start)	**ST=**	= S1, S2	Begins a logic operation by comparing two 16-bit data in the comparative condition “S1=S2”.	5	○	○	○	○	○	○	○
	ST<>	< > S1, S2	Begins a logic operation by comparing two 16-bit data in the comparative condition “S1<S2” or “S1>S2”.	5	○	○	○	○	○	○	○
	ST>	> S1, S2	Begins a logic operation by comparing two 16-bit data in the comparative condition “S1>S2”.	5	○	○	○	○	○	○	○
	ST>=	>= S1, S2	Begins a logic operation by comparing two 16-bit data in the comparative condition “S1>S2” or “S1=S2”.	5	○	○	○	○	○	○	○
	ST<	< S1, S2	Begins a logic operation by comparing two 16-bit data in the comparative condition “S1<S2”.	5	○	○	○	○	○	○	○
	ST<=	<= S1, S2	Begins a logic operation by comparing two 16-bit data in the comparative condition “S1<S2” or “S1=S2”.	5	○	○	○	○	○	○	○
16-bit data compare (AND)	**AN=**	= S1, S2	Connects a Form A (normally open) contact serially by comparing two 16-bit data in the comparative condition “S1=S2”.	5	○	○	○	○	○	○	○
	AN<>	< > S1, S2	Connects a Form A (normally open) contact serially by comparing two 16-bit data in the comparative condition “S1<S2” or “S1>S2”.	5	○	○	○	○	○	○	○
	AN>	> S1, S2	Connects a Form A (normally open) contact serially by comparing two 16-bit data in the comparative condition “S1>S2”.	5	○	○	○	○	○	○	○
	AN>=	>= S1, S2	Connects a Form A (normally open) contact serially by comparing two 16-bit data in the comparative condition “S1>S2” or “S1=S2”.	5	○	○	○	○	○	○	○
	AN<	< S1, S2	Connects a Form A (normally open) contact serially by comparing two 16-bit data in the comparative condition “S1<S2”.	5	○	○	○	○	○	○	○
	AN<=	<= S1, S2	Connects a Form A (normally open) contact serially by comparing two 16-bit data in the comparative condition “S1<S2” or “S1=S2”.	5	○	○	○	○	○	○	○
16-bit data compare (OR)	**OR=**	= S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 16-bit data in the comparative condition “S1=S2”.	5	○	○	○	○	○	○	○
	OR<>	< > S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 16-bit data in the comparative condition “S1<S2” or “S1>S2”.	5	○	○	○	○	○	○	○
	OR>	> S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 16-bit data in the comparative condition “S1>S2”.	5	○	○	○	○	○	○	○
	OR>=	>= S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 16-bit data in the comparative condition “S1>S2” or “S1=S2”.	5	○	○	○	○	○	○	○
	OR<	< S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 16-bit data in the comparative condition “S1<S2”.	5	○	○	○	○	○	○	○
	OR<=	<= S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 16-bit data in the comparative condition “S1<S2” or “S1=S2”.	5	○	○	○	○	○	○	○

○: Available, ×: Not available, △: Not available partially

Name	Boolean	Symbol	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
32-bit data compare (Start)	**STD=**	D= S1, S2	Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)=(S2+1, S2)”.	9	○	○	○	○	○	○	○
	STD<>	D<> S1, S2	Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)” or “(S1+1, S1)>(S2+1, S2)”.	9	○	○	○	○	○	○	○
	STD>	D> S1, S2	Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)>(S2+1, S2)”.	9	○	○	○	○	○	○	○
	STD>=	D>= S1, S2	Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)>(S2+1, S2)” or “(S1+1, S1)=(S2+1, S2)”.	9	○	○	○	○	○	○	○
	STD<	D< S1, S2	Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)”.	9	○	○	○	○	○	○	○
	STD<=	D<= S1, S2	Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)” or “(S1+1, S1)=(S2+1, S2)”.	9	○	○	○	○	○	○	○
32-bit data compare (AND)	**AND=**	D= S1, S2	Connects a Form A (normally open) contact serially by comparing two 32-bit data in the comparative condition “(S1+1, S1)=(S2+1, S2)”.	9	○	○	○	○	○	○	○
	AND<>	D<> S1, S2	Connects a Form A (normally open) contact serially by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)” or “(S1+1, S1)>(S2+1, S2)”.	9	○	○	○	○	○	○	○
	AND>	D> S1, S2	Connects a Form A (normally open) contact serially by comparing two 32-bit data in the comparative condition “(S1+1, S1)>(S2+1, S2)”.	9	○	○	○	○	○	○	○
	AND>=	D>= S1, S2	Connects a Form A (normally open) contact serially by comparing two 32-bit data in the comparative condition “(S1+1, S1)>(S2+1, S2)” or “(S1+1, S1)=(S2+1, S2)”.	9	○	○	○	○	○	○	○
	AND<	D< S1, S2	Connects a Form A (normally open) contact serially by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)”.	9	○	○	○	○	○	○	○
	AND<=	D<= S1, S2	Connects a Form A (normally open) contact serially by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)” or “(S1+1, S1)=(S2+1, S2)”.	9	○	○	○	○	○	○	○
32-bit data compare (OR)	**ORD=**	D= S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 32-bit data in the comparative condition “(S1+1, S1)=(S2+1, S2)”.	9	○	○	○	○	○	○	○
	ORD<>	D<> S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)” or “(S1+1, S1)>(S2+1, S2)”.	9	○	○	○	○	○	○	○
	ORD>	D> S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 32-bit data in the comparative condition “(S1+1, S1)>(S2+1, S2)”.	9	○	○	○	○	○	○	○
	ORD>=	D>= S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 32-bit data in the comparative condition “(S1+1, S1)>(S2+1, S2)” or “(S1+1, S1)=(S2+1, S2)”.	9	○	○	○	○	○	○	○
	ORD<	D< S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)”.	9	○	○	○	○	○	○	○
	ORD<=	D<= S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)” or “(S1+1, S1)=(S2+1, S2)”.	9	○	○	○	○	○	○	○

○: Available, ×: Not available, △: Not available partially

Name	Boolean	Symbol	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
Floating point type real number data compare (Start)	**STF=**	F= S1, S2	Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)=(S2+1, S2)”.	9	×	×	○	△ *1	△ *1	×	×
	STF<>	F<> S1, S2	Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)” or “(S1+1, S1)>(S2+1, S2)”.	9	×	×	○	△ *1	△ *1	×	×
	STF>	F> S1, S2	Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)>(S2+1, S2)”.	9	×	×	○	△ *1	△ *1	×	×
	STF>=	F>= S1, S2	Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)>(S2+1, S2)” or “(S1+1, S1)=(S2+1, S2)”.	9	×	×	○	△ *1	△ *1	×	×
	STF<	F< S1, S2	Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)”.	9	×	×	○	△ *1	△ *1	×	×
	STF<=	F<= S1, S2	Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)” or “(S1+1, S1)=(S2+1, S2)”.	9	×	×	○	△ *1	△ *1	×	×
Floating point type real number data compare (AND)	**ANF=**	F= S1, S2	Connects a Form A (normally open) contact serially by comparing two 32-bit data in the comparative condition “(S1+1, S1)=(S2+1, S2)”.	9	×	×	○	△ *1	△ *1	×	×
	ANF<>	F<> S1, S2	Connects a Form A (normally open) contact serially by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)” or “(S1+1, S1)>(S2+1, S2)”.	9	×	×	○	△ *1	△ *1	×	×
	ANF>	F> S1, S2	Connects a Form A (normally open) contact serially by comparing two 32-bit data in the comparative condition “(S1+1, S1)>(S2+1, S2)”.	9	×	×	○	△ *1	△ *1	×	×
	ANF>=	F>= S1, S2	Connects a Form A (normally open) contact serially by comparing two 32-bit data in the comparative condition “(S1+1, S1)>(S2+1, S2)” or “(S1+1, S1)=(S2+1, S2)”.	9	×	×	○	△ *1	△ *1	×	×
	ANF<	F< S1, S2	Connects a Form A (normally open) contact serially by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)”.	9	×	×	○	△ *1	△ *1	×	×
	ANF<=	F<= S1, S2	Connects a Form A (normally open) contact serially by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)” or “(S1+1, S1)=(S2+1, S2)”.	9	×	×	○	△ *1	△ *1	×	×
Floating point type real number data compare (OR)	**ORF=**	F= S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 32-bit data in the comparative condition “(S1+1, S1)=(S2+1, S2)”.	9	×	×	○	△ *1	△ *1	×	×
	ORF<>	F<> S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)” or “(S1+1, S1)>(S2+1, S2)”.	9	×	×	○	△ *1	△ *1	×	×
	ORF>	F> S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 32-bit data in the comparative condition “(S1+1, S1)>(S2+1, S2)”.	9	×	×	○	△ *1	△ *1	×	×
	ORF>=	F>= S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 32-bit data in the comparative condition “(S1+1, S1)>(S2+1, S2)” or “(S1+1, S1)=(S2+1, S2)”.	9	×	×	○	△ *1	△ *1	×	×
	ORF<	F< S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)”.	9	×	×	○	△ *1	△ *1	×	×
	ORF<=	F<= S1, S2	Connects a Form A (normally open) contact in parallel by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)” or “(S1+1, S1)=(S2+1, S2)”.	9	×	×	○	△ *1	△ *1	×	×

○: Available, ×: Not available, △: Not available partially

*1) This instruction is available for FP-X V1.10 or later and FPΣ 32k type

15.3 Table of High-level Instructions

The high-level instructions are expressed by the prefixes “F” or “P” with numbers. For most of the high-level instructions, “F” and “P” types are available. The differences between the two types are explained as follows:
- Instructions with the prefix “F” are executed in every scan while its trigger is in the on.
- Instructions with the prefix “P” are executed only when the leading edge of its trigger is detected.

For the FP0/FP0R/FPΣ/FP-X, the P type high-level instructions are not available.

Num-ber	Name	Boo-lean	Ope-rand	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
Data transfer instructions												
F0 **P0**	**16-bit data move**	**MV** **PMV**	S, D	(S)→(D)	5	○	○	○	○	○	○	○
F1 **P1**	**32-bit data move**	**DMV** **PDMV**	S, D	(S+1, S)→(D+1, D)	7	○	○	○	○	○	○	○
F2 **P2**	**16-bit data invert and move**	**MV** **PMV/**	S, D	(S)→(D)	5	○	○	○	○	○	○	○
F3 **P3**	**32-bit data invert and move**	**DMV/** **PDMV/**	S, D	$\overline{(S+1, S)}$→(D+1, D)	7	○	○	○	○	○	○	○
F4 **P4**	**Reading of head word No. of the specified slot**	**GETS** **PGETS**	S, D	The head word No. of the specified slot is read.	5	×	×	×	×	×	△ *1	△ *1
F5 **P5**	**Bit data move**	**BTM** **PBTM**	S, n, D	The specified one bit in “S” is transferred to the specified one bit in “D”. The bit is specified by “n”.	7	○	○	○	○	○	○	○
F6 **P6**	**Hexadecimal digit (4-bit) data move**	**DGT** **PDGT**	S, n, d	The specified one digit in “S” is transferred to the specified one digit in “D”. The digit is specified by “n”.	7	○	○	○	○	○	○	○
F7 **P7**	**Two 16-bit data move**	**MV2** **PMV2**	S1, S2, D	(S1)→(D), (S2)→(D+1)	7	×	×	○	○	○	○	○
F8 **P8**	**Two 32-bit data move**	**DMV2** **PDMV2**	S1, S2, D	(S1+1, S1)→(D+1, D), (S2+1, S2)→(D+3, D+2)	11	×	×	○	○	○	○	○
F10 **P10**	**Block move**	**BKMV** **PBKMV**	S1, S2, D	The data between “S1” and “S2” is transferred to the area starting at “D”.	7	○	○	○	○	○	○	○
F11 **P11**	**Block copy**	**COPY** **PCOPY**	S, D1, D2	The data of “S” is transferred to the all area between “D1” and “D2”.	7	○	○	○	○	○	○	○
F12	**Data read from EEP-ROM**	**ICRD**	S1, S2, D	The data stored in the expansion memory of the EEP-ROM specified by “S1” and “S2” are transferred to the area startign at “D”.	11	○	○ *2	×	×	×	×	×
P13	**Data write to EEP-ROM**	**PICWT**	S1, S2, D	The data specified by “S1” and “S2” are transferred to the EEP-ROM starting at “D”.	11	○	○ *2	×	×	×	×	×
F12	**Data read from F-ROM**	**ICRD**	S1, S2, D	The data stored in the expansion memory of the F-ROM specified by “S1” and “S2” are transferred to the area startign at “D”.	11	×	×	○	○	○	×	×
P13	**Data write to F-ROM**	**PICWT**	S1, S2, D	The data specified by “S1” and “S2” are transferred to the F-ROM starting at “D”.	11	×	×	○	○	○	×	×
F12 **P12**	**Data read from IC card**	**ICRD** **PICRD**	S1, S2, D	The data stored in the expansion memory of the IC card specified by “S1” and “S2” are transferred to the area startign at “D”.	11	×	×	×	×	×	×	○
F13 **P13**	**Data write to IC card**	**ICWT** **PICWT**	S1, S2, D	The data specified by “S1” and “S2” are transferred to the IC card expansion memory area starting at “D”.	11	×	×	×	×	×	×	○
F14 **P14**	**Program read from IC memory card**	**PGRD** **PPGRD**	S	The program specified using “S” is transferred into the CPU from IC memory card and executes it.	3	×	×	×	×	×	×	○

○: Available, ×: Not available, △: Not available partially

*1) This instruction is available for FP2/FP2SH Ver. 1.5 or later.FP10SH cannot be used

*2) This instruction is available for FP0 Ver. 2.0 or later.

Num-ber	Name	Boo-lean	Ope-rand	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
F15 P15	**16-bit data exchange**	**XCH PXCH**	D1, D2	(D1)→(D2), (D2)→(D1)	5	○	○	○	○	○	○	○
F16 P16	**32-bit data exchange**	**DXCH PDXCH**	D1, D2	(D1+1, D1)→(D2+1, D2) (D2+1, D2)→(D1+1, D1)	5	○	○	○	○	○	○	○
F17 P17	**Higher/lower byte in 16-bit data exchange**	**SWAP PSWAP**	D	The higher byte and lower byte of “D” are exchanged.	3	○	○	○	○	○	○	○
F18 P18	**16-bit data block exchange**	**BXCH PBXCH**	D1, D2, D3	Exchange the data between “D1” and “D2” with the data specified by “D3”.	7	×	×	○	○	○	○	○
Control instruction												
F19	**Auxiliary jump**	**SJP**	S	The program jumps to the label instruction specified by “S” and continues from there.	3	×	×	×	×	×	○	○
Binary arithmetic instructions												
F20 P20	**16-bit data addition**	**+ P+**	S, D	(D)+(S)→(D)	5	○	○	○	○	○	○	○
F21 P21	**32-bit data addition**	**D+ PD+**	S, D	(D+1, D)+(S+1, S)→(D+1, D)	7	○	○	○	○	○	○	○
F22 P22	**16-bit data addition**	**+ P+**	S1, S2, D	(S1)+(S2)→(D)	7	○	○	○	○	○	○	○
F23 P23	**32-bit data addition**	**D+ PD+**	S1, S2, D	(S1+1, S1)+(S2+1, S2)→(D+1, D)	11	○	○	○	○	○	○	○
F25 P25	**16-bit data subtraction**	**- P-**	S, D	(D)-(S)→(D)	5	○	○	○	○	○	○	○
F26 P26	**32-bit data subtraction**	**D- PD-**	S, D	(D+1, D)-(S+1, S)→(D+1, D)	7	○	○	○	○	○	○	○
F27 P27	**16-bit data subraction**	**- P-**	S1, S2, D	(S1)-(S2)→(D)	7	○	○	○	○	○	○	○
F28 P28	**32-bit data subtraction**	**D- PD-**	S1, S2, D	(S1+1, S1)-(S2+1, S2)→(D+1, D)	11	○	○	○	○	○	○	○
F30 P30	**16-bit data multiplication**	*** P***	S1, S2, D	(S1)X(S2)→(D+1, D)	7	○	○	○	○	○	○	○
F31 P31	**32-bit data multiplication**	**D* PD***	S1, S2, D	(S1+1, S1)X(S2+1, S2)→(D+3, D+2, D+1, D)	11	○	○	○	○	○	○	○
F32 P32	**16-bit data division**	**% P%**	S1, S2, D	(S1)÷(S2)→quotient (D) remainder (DT9015)	7	○	○	○	○	○	○	○
F33 P33	**32-bit data division**	**D% PD%**	S1, S2, D	(S1+1, S1)÷(S2+1, S2)→quotient (D+1, D) remainder (DT9016, DT9015)	11	○	○	○	○	○	○	○
F34 P34	**16-bit data multiplication (result in 16 bits)**	***W P*W**	S1, S2, D	(S1)X(S2)→(D)	7	×	×	○	○	○	○	○
F35 P35	**16-bit data increment**	**+1 P+1**	D	(D)+1→(D)	3	○	○	○	○	○	○	○
F36 P36	**32-bit data increment**	**D+1 PD+1**	D	(D+1, D)+1→(D+1, D)	3	○	○	○	○	○	○	○
F37 P37	**16-bit data decrement**	**-1 P-1**	D	(D)-1→(D)	3	○	○	○	○	○	○	○
F38 P38	**32-bit data decrement**	**D-1 PD-1**	D	(D+1, D)-1→(D+1, D)	3	○	○	○	○	○	○	○
F39 P39	**32-bit data multiplication (result in 32 bits)**	**D*D PD*D**	S1, S2, D	(S1+1, S1)x(S2+1, S2)→(D+1, D)	11	×	×	○	○	○	○	○

○: Available, ×: Not available, △: Not available partially

Num-ber	Name	Boo-lean	Ope-rand	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
BCD arithmetic instructions												
F40 **P40**	**4-digit BCD data addition**	**B+** **PB+**	S, D	(D)+(S)→(D)	5	○	○	○	○	○	○	○
F41 **P41**	**8-digit BCD data addition**	**DB+** **PDB+**	S, D	(D+1, D)+(S+1, S)→(D+1, D)	7	○	○	○	○	○	○	○
F42 **P42**	**4-digit BCD data addition**	**B+** **PB+**	S1, S2, D	(S1)+(S2)→(D)	7	○	○	○	○	○	○	○
F43 **P43**	**8-digit BCD data addition**	**DB+** **PDB+**	S1, S2, D	(S1+1, S1)+(S2+1, S2)→(D+1, D)	11	○	○	○	○	○	○	○
F45 **P45**	**4-digit BCD data subtraction**	**B-** **PB-**	S, D	(D)-(S)→(D)	5	○	○	○	○	○	○	○
F46 **P46**	**8-digit BCD data subtraction**	**DB-** **PDB-**	S, D	(D+1, D)-(S+1, S)→(D+1, D)	7	○	○	○	○	○	○	○
F47 **P47**	**4-digit BCD data subtraction**	**B-** **PB-**	S1, S2, D	(S1)-(S2)→(D)	7	○	○	○	○	○	○	○
F48 **P48**	**8-digit BCD data subraction**	**DB-** **PDB-**	S1, S2, D	(S1+1, S1)-(S2+1, S2)→(D+1, D)	11	○	○	○	○	○	○	○
F50 **P50**	**4-digit BCD data multiplication**	**B*** **PB***	S1, S2, D	(S1)X(S2)→(D+1, D)	7	○	○	○	○	○	○	○
F51 **P51**	**8-digit BCD data multiplication**	**DB*** **PDB***	S1, S2, D	(S1+1, S1)X(S2+1, S2)→(D+3, D+2, D+1, D)	11	○	○	○	○	○	○	○
F52 **P52**	**4-digit BCD data division**	**B%** **PB%**	S1, S2, D	(S1)÷(S2)→quotient (D) remainder (DT9015)	7	○	○	○	○	○	○	○
F53 **P53**	**8-digit BCD data division**	**DB%** **PDB%**	S1, S2, D	(S1+1, S1)÷(S2+1, S2)→quotient (D+1, D) remainder (DT9016, DT9015)	11	○	○	○	○	○	○	○
F55 **P55**	**4-digit BCD data increment**	**B+1** **PB+1**	D	(D)+1→(D)	3	○	○	○	○	○	○	○
F56 **P56**	**8-digit BCD data increment**	**DB+1** **PDB+1**	D	(D+1, D)+1→(D+1, D)	3	○	○	○	○	○	○	○
F57 **P57**	**4-digit BCD data decrement**	**B-1** **PB-1**	D	(D)-1→(D)	3	○	○	○	○	○	○	○
F58 **P58**	**8-digit BCD data decrement**	**DB-1** **PDB-1**	D	(D+1, D)-1→(D+1, D)	3	○	○	○	○	○	○	○
Data compare instructions												
F60 **P60**	**16-bit data compare**	**CMP** **PCMP**	S1, S2	(S1)>(S2)→R900A: on (S1)=(S2)→R900B: on (S1)<(S2)→R900C: on	5	○	○	○	○	○	○	○
F61 **P61**	**32-bit data compare**	**DCMP** **PDCMP**	S1, S2	(S1+1, S1)>(S2+1, S2)→R900A: on (S1+1, S1)=(S2+1, S2)→R900B: on (S1+1, S1)<(S2+1, S2)→R900C: on	9	○	○	○	○	○	○	○
F62 **P62**	**16-bit data band compare**	**WIN** **PWIN**	S1, S2, S3	(S1)>(S3)→R900A: on (S2)< or=(S1)< or=(S3)→R900B: on (S1)<(S2)→R900C: on	7	○	○	○	○	○	○	○

○: Available, ×: Not available, △: Not available partially

Number	Name	Boolean	Operand	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
F63 P63	**32-bit data band compare**	**DWIN PDWIN**	S1, S2, S3	(S1+1, S1)>(S3+1, S3)→R900A: on (S2+1, S2)< or=(S1+1, S1)< or=(S3+1, S3)→R900B: on (S1+1, S1)<(S2+1, S2)→R900C: on	13	○	○	○	○	○	○	○
F64 P64	**Block data compare**	**BCMP PBCMP**	S1, S2, S3	Compares the two blocks beginning with "S2" and "S3" to see if they are equal.	7	○	○	○	○	○	○	○
Logic operation instructions												
F65 P65	**16-bit data AND**	**WAN PWAN**	S1, S2, D	(S1) AND (S2)→(D)	7	○	○	○	○	○	○	○
F66 P66	**16-bit data OR**	**WOR PWOR**	S1, S2, D	(S1) OR (S2)→(D)	7	○	○	○	○	○	○	○
F67 P67	**16-bit data exclusive OR**	**XOR PXOR**	S1, S2, D	$\{(S1)\ AND\ \overline{(S2)}\}\ OR\ \{\overline{(S1)}\ AND\ (S2)\}\rightarrow(D)$	7	○	○	○	○	○	○	○
F68 P68	**16-bit data exclusive NOR**	**XNR PXNR**	S1, S2, D	$\{(S1)\ AND\ (S2)\}\ OR\ \{\overline{(S1)}\ AND\ \overline{(S2)}\}\rightarrow(D)$	7	○	○	○	○	○	○	○
F69 P69	**16-bit data unite**	**WUNI PWUNI**	S1, S2, S3, D	$([S1]\ AND\ [S3])\ OR\ ([S2]\ AND\ \overline{[S3]})\rightarrow(D)$ When (S3) is H0, (S2)→(D) When (S3) is HFFFF, (S1) →(D)	9	×	×	○	○	○	○	○
Data conversion instructions												
F70 P70	**Block check code calculation**	**BCC PBCC**	S1, S2, S3, D	Creates the code for checking the data specified by "S2" and "S3" and stores it in "D". The calculation method is specified by "S1".	9	○	○	○	○	○	○	○
F71 P71	**Hexadecimal data → ASCII code**	**HEXA PHEXA**	S1, S2, D	Converts the hexadecimal data specified by "S1" and "S2" to ASCII code and stores it in "D". Example: HABCD→ H 42 41 44 43 B A D C	7	○	○	○	○	○	○	○
F72 P72	**ASCII code → Hexadecimal data**	**AHEX PAHEX**	S1, S2, D	Converts the ASCII code specified by "S1" and "S2" to hexadecimal data and stores it in "D". Example: H 44 43 42 41 → HCDAB D C B A	7	○	○	○	○	○	○	○
F73 P73	**4-digit BCD data → ASCII code**	**BCDA PBCDA**	S1, S2, D	Converts the four digits of BCD data specified by "S1" and "S2" to ASCII code and stores it in "D". Example: H1234→ H 32 31 34 33 2 1 4 3	7	○	○	○	○	○	○	○
F74 P74	**ASCII code → 4-digit BCD data**	**ABCD PABCD**	S1, S2, D	Converts the ASCII code specified by "S1" and "S2" to four digits of BCD data and stores it in "D". Example: H 34 33 32 31 → H3412 4 3 2 1	9	○	○	○	○	○	○	○
F75 P75	**16-bit binary data → ASCII code**	**BINA PBINA**	S1, S2, D	Converts the 16 bits of binary data specified by "S1" to ASCII code and stores it in "D" (area of "S2" bytes). Example: K-100→ H 30 30 31 2D 20 20 0 0 1 -	7	○	○	○	○	○	○	○

○: Available, ×: Not available, △: Not available partially

Num-ber	Name	Boo-lean	Ope-rand	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
F76 P76	**ASCII code → 16-bit binary data**	**ABIN PABIN**	S1, S2, D	Converts the ASCII code specified by “S1” and “S2” to 16 bits of binary data and stores it in “D”. Example: H $\underset{0}{\underline{30}}$ $\underset{0}{\underline{30}}$ $\underset{1}{\underline{31}}$ $\underset{-}{\underline{2D}}$ $\underline{20}$ $\underline{20}$ → K-100	7	○	○	○	○	○	○	○
F77 P77	**32-bit binary data → ASCII code**	**DBIA PDBIA**	S1, S2, D	Converts the 32 bits of binary data (S1+1, S1) to ASCII code and stores it in D (area of “S2” bytes).	11	○	○	○	○	○	○	○
F78 P78	**ASCII code → 32-bit binary data**	**DABI PDABI**	S1, S2, D	Converts the ASCII code specified by “S1” and “S2” to 32 bits of binary data and stores it in (D+1, D).	11	○	○	○	○	○	○	○
F80 P80	**16-bit binary data → 4-digit BCD data**	**BCD PBCD**	S, D	Converts the 16 bits of binary data specified by “S” to four digits of BCD data and stores it in “D”. Example: K100 → H100	5	○	○	○	○	○	○	○
F81 P81	**4-digit BCD data → 16-bit binary data**	**BIN PBIN**	S, D	Converts the four digits of BCD data specified by “S” to 16 bits of binary data and stores it in “D”. Example: H100 → K100	5	○	○	○	○	○	○	○
F82 P82	**32-bit binary data → 8-digit BCD data**	**DBCD PDBCD**	S, D	Converts the 32 bits of binary data specified by (S+1, S) to eight digits of BCD data and stores it in (D+1, D).	7	○	○	○	○	○	○	○
F83 P83	**8-digit BCD data → 32-bit binary data**	**DBIN PDBIN**	S, D	Converts the eight digits of BCD data specified by (S+1, S) to 32 bits of binary data and stores it in (D+1, D).	7	○	○	○	○	○	○	○
F84 P84	**16-bit data invert (com-plement of 1)**	**INV PINV**	D	Inverts each bit of data of “D”.	3	○	○	○	○	○	○	○
F85 P85	**16-bit data complement of 2**	**NEG PNEG**	D	Inverts each bit of data of “D” and adds 1 (inverts the sign).	3	○	○	○	○	○	○	○
F86 P86	**32-bit data complement of 2**	**DNEG PDNEG**	D	Inverts each bit of data of (D+1, D) and adds 1 (inverts the sign).	3	○	○	○	○	○	○	○
F87 P87	**16-bit data absolute**	**ABS PABS**	D	Gives the absolute value of the data of “D”.	3	○	○	○	○	○	○	○
F88 P88	**32-bit data absolute**	**DABS PDABS**	D	Gives the absolute value of the data of (D+1, D).	3	○	○	○	○	○	○	○
F89 P89	**16-bit data sign extension**	**EXT PEXT**	D	Extends the 16 bits of data in “D” to 32 bits in (D+1, D).	3	○	○	○	○	○	○	○
F90 P90	**Decode**	**DECO PDECO**	S, n, D	Decodes part of the data of “S” and stores it in “D”. The part is specified by “n”.	7	○	○	○	○	○	○	○
F91 P91	**7-segment decode**	**SEGT PSEGT**	S, D	Converts the data of “S” for use in a 7-segment display and stores it in (D+1, D).	5	○	○	○	○	○	○	○
F92 P92	**Encode**	**ENCO PENCO**	S, n, D	Encodes part of the data of “S” and stores it in “D”. The part is specified by “n”.	7	○	○	○	○	○	○	○
F93 P93	**16-bit data combine**	**UNIT PUNIT**	S, n, D	The least significant digit of each of the “n” words of data beginning at “S” are stored (united) in order in “D”.	7	○	○	○	○	○	○	○

○: Available, ×: Not available, △: Not available partially

Number	Name	Boolean	Operand	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
F94 P94	**16-bit data distribute**	**DIST PDIST**	S, n, D	Each of the digits of the data of “S” are stored in (distriuted to) the least significant digits of the areas beginning at “D”.	7	○	○	○	○	○	○	○
F95 P95	**Character→ ASCII code**	**ASC PASC**	S, D	Twelve characters of the characer constants of “S” are converted to ASCII code and stored in “D” to “D+5”.	15	○	○	○	○	○	○	○
F96 P96	**16-bit table data search**	**SRC PSRC**	S1, S2, S3	The data of “S1” is searched for in the areas in the range “S2” to “S3” and the result is stored in DT9037 and DT9038	7	○	○	○	○	○	○	○
F97 P97	**32-bit table data search**	**DSRC PDSRC**	S1, S2, S3	The data of (S1+1, S1) is searched for in the 32-bit data designated by “S3”, beginning from “S2”, and the result if stored in DT90037 and DT90038.	11	×	×	○	○	○	○	○
Data shift instructions												
F98 P98	**Data table shift-out and compress**	**CMPR PCMPR**	D1, D2, D3	Transfer “D2” to “D3”. Any parts of the data between “D1” and “D2” that are 0 are compressed, and shifted in order toward “D2”.	7	×	×	○	○	○	○	○
F99 P99	**Data table shift-in and compress**	**CMPW PCMP W**	S, D1, D2	Transfer “S” to “D1”. Any parts of the data between “D1” and “D2” that are 0 are compressed, and shifted in order toward “D2”.	7	×	×	○	○	○	○	○
F100 P100	**Right shift of multiple bits (n bits) in a 16-bit data**	**SHR PSHR**	D, n	Shifts the “n” bits of “D” to the right.	5	○	○	○	○	○	○	○
F101 P101	**Left shift of multiple bits (n bits) in a 16-bit data**	**SHL PSHL**	D, n	Shifts the “n” bits of “D” to the left.	5	○	○	○	○	○	○	○
F102 P102	**Right shift of n bits in a 32-bit data**	**DSHR PDSHR**	D, n	Shifts the “n” bits of the 32-bit data area specified by (D+1, D) to the right.	5	×	×	○	○	○	○	○
F103 P103	**Left shift of n bits in a 32-bit data**	**DSHL PDSHL**	D, n	Shifts the “n” bits of the 32-bit data area specified by (D+1, D) to the left.	5	×	×	○	○	○	○	○
F105 P105	**Right shift of one hexadecimal digit (4-bit)**	**BSR PBSR**	D	Shifts the one digit of data of “D” to the right.	3	○	○	○	○	○	○	○
F106 P106	**Left shift of one hexade-cimal digit (4-bit)**	**BSL PBSL**	D	Shifts the one digit of data of “D” to the left.	3	○	○	○	○	○	○	○
F108 P108	**Right shift of multiple bits (n bits)**	**BITR PBITR**	D1, D2, n	Shifts the “n” bits of data range by “D1” and “D2” to the right.	7	×	×	○	○	○	○	○
F109 P109	**Left shift of multiple bits (n bits)**	**BITL PBITL**	D1, D2, n	Shifts the “n” bits of data range by “D1” and “D2” to the left.	7	×	×	○	○	○	○	○
F110 P110	**Right shift of one word (16-bit)**	**WSHR PWSHR**	D1, D2	Shifts the one word of the areas by “D1” and “D2” to the right.	5	○	○	○	○	○	○	○
F111 P111	**Left shift of one word (16-bit)**	**WSHL PWSHL**	D1, D2	Shifts the one word of the areas by “D1” and “D2” to the left.	5	○	○	○	○	○	○	○
F112 P112	**Right shift of one hexade-cimal digit (4-bit)**	**WBSR PWBSR**	D1, D2	Shifts the one digit of the areas by “D1” and “D2” to the right.	5	○	○	○	○	○	○	○
F113 P113	**Left shift of one hexade-cimal digit (4-bit)**	**WBSL PWBSL**	D1, D2	Shifts the one digit of the areas by “D1” and “D2” to the left.	5	○	○	○	○	○	○	○

○: Available, ×: Not available, △: Not available partially

Num-ber	Name	Boo-lean	Ope-rand	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
FIFO instructions												
F115 P115	**FIFO buffer define**	**FIFT PFIFT**	n, D	The “n” words beginning from “D” are defined in the buffer.	5	×	×	○	○	○	○	○
F116 P116	**Data read from FIFO buffer**	**FIFR PFIFR**	S, D	The oldest data beginning from “S” that was written to the buffer is read and stored in “D”.	5	×	×	○	○	○	○	○
F117 P117	**Data write into FIFO buffer**	**FIFW PFIFW**	S, D	The data of “S” is written to the buffer starting from “D”.	5	×	×	○	○	○	○	○
Basic function instructions												
F118	**UP/DOWN counter**	**UDC**	S, D	Counts up or down from the value preset in “S” and stores the elapsed value in “D”.	5	○	○	○	○	○	○	○
F119	**Left/right shift register**	**LRSR**	D1, D2	Shifts one bit to the left or right with the area between “D1” and “D2” as the register.	5	○	○	○	○	○	○	○
Data rotate instructions												
F120 P120	**16-bit data right rotate**	**ROR PROR**	D, n	Rotate the “n” bits in data of “D” to the right.	5	○	○	○	○	○	○	○
F121 P121	**16-bit data left rotate**	**ROL PROL**	D, n	Rotate the “n” bits in data of “D” to the left.	5	○	○	○	○	○	○	○
F122 P122	**16-bit data right rotate with carry flag (R9009) data**	**RCR PRCR**	D, n	Rotate the “n” bits in 17-bit area consisting of “D” plus the carry flag (R9009) data to the right.	5	○	○	○	○	○	○	○
F123 P123	**16-bit data left rotate with carry flag (R9009) data**	**RCL PRCL**	D, n	Rotate the “n” bits in 17-bit area consisting of “D” plus the carry flag (R9009) data to the left.	5	○	○	○	○	○	○	○
F125 P125	**32-bit data right rotate**	**DROR PDROR**	D, n	Rotate the number of bits specified by “n” of the double words data (32 bits) specified by (D+1, D) to the right.	5	×	×	○	○	○	○	○
F126 P126	**32-bit data left rotate**	**DROL PDROL**	D, n	Rotate the number of bits specified by “n” of the double words data (32 bits) specified by (D+1, D) to the left.	5	×	×	○	○	○	○	○
F127 P127	**32-bit data right rotate with carry flag (R9009) data**	**DRCR PDRCR**	D, n	Rotate the number of bits specified by “n” of the double words data (32 bits) specified by (D+1, D) to the right together with carry flag (R9009) data.	5	×	×	○	○	○	○	○
F128 P128	**32-bit data left rotate with carry flag (R9009) data**	**DRCL PDRCL**	D, n	Rotate the number of bits specified by “n” of the double words data (32 bits) specified by (D+1, D) to the left together with carry flag (R9009) data.	5	×	×	○	○	○	○	○
Bit manipulation instructions												
F130 P130	**16-bit data bit set**	**BTS PBTS**	D, n	Set the value of bit position “n” of the data of “D” to 1.	5	○	○	○	○	○	○	○
F131 P131	**16-bit data bit reset**	**BTR PBTR**	D, n	Set the value of bit position “n” of the data of “D” to 0.	5	○	○	○	○	○	○	○
F132 P132	**16-bit data invert**	**BTI PBTI**	D, n	Invert the value of bit position “n” of the data of “D”.	5	○	○	○	○	○	○	○
F133 P133	**16-bit data bit test**	**BTT PBTT**	D, n	Test the value of bit position “n” of the data of “D” and output the result to R900B.	5	○	○	○	○	○	○	○
F135 P135	**Number of on (1) bits in 16-bit data**	**BCU PBCU**	S, D	Store the number of on bits in the data of “S” in “D”.	5	○	○	○	○	○	○	○

○: Available, ×: Not available, △: Not available partially

Num -ber	Name	Boo- lean	Ope- rand	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
F136 P136	**Number of on (1) bits in 32-bit data**	**DBCU PDBCU**	S, D	Store the number of on bits in the data of (S+1, S) in “D”.	7	○	○	○	○	○	○	○
Basic function instruction												
F137	**Auxiliary timer (16-bit)**	**STMR**	S, D	Turn on the specified output and R900D after 0.01 s × set value.	5	○	○	○	○	○	○	○
Special instructions												
F138 P138	**Hours, min- utes and sec- onds to seconds data**	**HMSS PHMSS**	S, D	Converts the hour, minute and second data of (S+1, S) to seconds data, and the converted data is stored in (D+1, D).	5	○	△ *1	○	○	○	○	○
F139 P139	**Seconds to hours, minutes and seconds data**	**SHMS PSHMS**	S, D	Converts the seconds data of (S+1, S) to hour, minute and second data, and the converted data is stored in (D+1, D).	5	○	△ *1	○	○	○	○	○
F140 P140	**Carry flag (R9009) set**	**STC PSTC**	-	Turns on the carry flag (R9009).	1	○	○	○	○	○	○	○
F141 P141	**Carry flag (R9009) reset**	**CLC PCLC**	-	Turns off the carry flag (R9009).	1	○	○	○	○	○	○	○
F142 P142	**Watching dog timer update**	**WDT PWDT**	S	The time (allowable scan time for the system) of watching dog timer is changed to “S” × 0.1 (ms) for that scan.	3	×	×	×	×	×	×	○
F143 P143	**Partial I/O update**	**IORF PIORF**	D1, D2	Updates the I/O from the number specified by “D1” to the number specified by “D2”.	5	○	○	○	○	○	○	○
F144	**Serial data communica- tion control**	**TRNS**	S, n	The COM port received flag (R9038) is set to off to enable reception. Beginning at “S”, “n” bytes of the data registers are sent from the COM port.	5	○	○ *4	×	×	×	○	○
F145 P145	**Data send**	**SEND PSEND**	S1, S2, D, N	Sends the data to another station in the network (MEWNET). (via link unit)	9	×	×	×	×	×	○	○
F146 P146	**Data receive**	**RECV PRECV**	S1, S2, N, D	Receives the data to another station in the network (MEWNET). (via link unit)	9	×	×	×	×	×	○	○
F145 P145	**Data send**	**SEND**	S1, S2, D, N	Sends the data to the slave station as the MOD bus master. (via COM port)	9	×	×	○	△ *2	○	×	×
F146 P146	**Data receive**	**RECV**	S1, S2, N, D	Receives the data from the slave station as the MOD bus master. (via COM port)	9	×	×	○	△ *2	○	×	×
F145 P145	**Data send**	**SEND**	S1, S2, D, N	Sends the data to the slave station of the MOD bus master, type II.	9	×	×	○	△ *3	△ *3	×	×
F146 P146	**Data receive**	**RECV**	S1, S2, N, D	Receives the data from the slave station of the MOD bus master, type II.	9	×	×	○	△ *3	△ *3	×	×
F145 P145	**Data send**	**SEND**	S1, S2, D, N	Sends the data to the slave station as the MEWTOCOL master. (via COM port)	9	×	×	○	△ *2	△ *2	×	×
F146 P146	**Data receive**	**RECV**	S1, S2, N, D	Receives the data from the slave station as the MEWTOCOL master. (via COM port)	9	×	×	○	△ *2	△ *2	×	×
F147	**Printout**	**PR**	S, D	Converts the ASCII code data in the area starting with “S” for printing, and outputs it to the word external output relay WY specified by “D”.	5	○	○	○	○	○	○	○
F148 P148	**Self- diagnostic error set**	**ERR PERR**	n (n: k100 to K299)	Stores the self-diagnostic error number “n” in (DT9000), turns R9000 on, and turns on the ERROR LED.	3	○	○	○	○	○	○	○
F149 P149	**Message display**	**MSG PMSG**	S	Displays the character constant of “S” in the connected programming tool.	13	○	○	○	○	○	○	○

○: Available, ×: Not available, △: Not available partially

*1) The instruction is available for FP0 T32 type (V2.3 or later).

*2) This instruction is available for FP-X V1.20 or later and FPΣ 32k type.

*3) This instruction is available for FP-X V2.50 or later and FPΣ V3.20 or later.

*4) This instruction is available for FP0 V1.20 or later.

Num-ber	Name	Boolean	Ope-rand	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
F150 P150	**Data read from intelli-gent unit**	**READ PREAD**	S1, S2, n, D	Reads the data from the intelligent unit.	9	×	×	×	△ *3	×	○	○
F151 P151	**Data write into intelli-gent unit**	**WRT PWRT**	S1, S2, n, D	Writes the data into the intelligent unit.	9	×	×	×	△ *3	×	○	○
F152 P152	**Data read from MEWNET-F slave station**	**RMRD PRMRD**	S1, S2, n, D	Reads the data from the intelligent unit at the MEWNET-F (remote I/O) slave station.	9	×	×	×	×	×	○	○
F153 P153	**Data write into MEWNET-F slave station**	**RMWT PRMWT**	S1, S2, n, D	Writes the data into the intelligent unit at the MEWNET-F (remote I/O) slave station.	9	×	×	×	×	×	○	○
F155 P155	**Sampling**	**SMPL PSMPL**	-	Starts sampling data.	1	×	×	○	△ *5	△ *4	○	○
F156 P156	**Sampling trigger**	**STRG PSTRG**	-	When the trigger of this instruction turns on, the sampling trace stops.	1	×	×	○	△ *5	△ *4	○	○
F157 P157	**Time addition**	**CADD PCADD**	S1, S2, D	The time after (S2+1, S2) elapses from the time of (S1+2, S1+1, S1) is stored in (D+2, D+1, D).	9	○	△ *1	○	○	○	○	○
F158 P158	**Time substruction**	**CSUB PCSUB**	S1, S2, D	The time that results from subtracting (S2+1, S2) from the time (S1+2, S1+1, S1) is stored in (D+2, D+1, D).	9	○	△ *1	○	○	○	○	○
F159 P159	**Serial port communication**	**MTRN PMTRN**	S, n, D	This is used to send data to an external device through the specified CPU COM port or MCU COM port.	7	×	×	○	○	○	△ *2	△ *2
F161 P161	**MCU serial port reception**	**MRCV PMRCV**	S, D1, D2	Data is received from external equipment via the COM port of the specified MCU.	7	×	×	×	×	×	△ *2	△ *2
BIN arithmetic instruction												
F160 P160	**Double word (32-bit) data square root**	**DSQR PDSQR**	S, D	$\sqrt{(S)} \rightarrow (D)$	7	×	×	○	○	○	○	○
High speed counter/Pulse output instruction for FP0, FP-e												
F0	**High-speed counter and Pulse output controls**	**MV**	S, DT9052	Performs high-speed counter and Pulse output controls according to the control code specified by “S”. The control code is stored in DT9052.	5	○	○					
1	**Change and read of the elapsed value of high-speed counter and Pulse output**	**DMV**	S, DT9044	Transfers (S+1, S) to high-speed counter and Pulse output elapsed value area.	7	○	○					
			DT9044, D	Transfers value in high-speed counter and Pulse output elapsed value area to (D+1, D).	7	○	○					
F166	**High-speed counter output set (with channel specification)**	**HC1S**	n, S, Yn	Turns output Yn on when the elapsed value of the built-in high-speed counter reaches the target value of (S+1, S).	11	○	○					

○: Available, ×: Not available, △: Not available partially

*1) The instruction is available for FP0 T32 type (V2.3 or later).

*2) The instruction is available for FP2/FP2SH Ver. 1.5 or later, and the pulse execution type can be specified. FP10SH cannot be used.

*3) This instruction is available for FPΣ Ver. 2.0 or later.

*4) This instruction is only available for FP-X Ver.2.0 or later.

*5) This instruction is available for FPΣ Ver. 3.10 or later.

Num-ber	Name	Boo-lean	Operand	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
F167	**High-speed counter output reset (with channel specification)**	**HC1R**	n, S, Yn	Turns output Yn off when the elapsed value of the built-in high-speed counter reaches the target value of (S+1, S).	11	○	○					
F168	**Positioning control (with channel specification)**	**SPD1**	S, n	Outputs a positioning pulse from the specified output (Y0 or Y1) according to the contents of the data table beginning at “S”.	5	○	○					
F169	**Pulse output (with channel specification)**	**PLS**	S, n	Outputs a pulse from the specified output (Y0 or Y1) according to the contents of the data table beginning at “S”.	5	○	○					
F170	**PWM output (with channel specification)**	**PWM**	S, n	Performs PWM output from the specified outptu (Y0 or Y1) according to the contents of the data table beginning at “S”.	5	○	○					
High speed counter/Pulse output instruction for FP0R												
F0	**High-speed counter and Pulse output controls**	**MV**	S, DT90052	Performs high-speed counter and Pulse output controls according to the control code specified by “S”. The control code is stored in DT90052.	5			○				
F1	**Change and read of the elapsed value of high-speed counter and Pulse output**	**DMV**	S, DT90300	Transfers (S+1, S) to high-speed counter and Pulse output elapsed value area (DT90045, DT90044).	7			○				
			DT90300, D	Transfers value in high-speed counter and Pulse output elapsed value area (DT90045, DT90044) to (D+1, D).	7			○				
F165	**Cam control**	**CAM0**	S	Controls cam operation (on/off patterns of each cam output) according to the elapsed value of the high-speed counter.	3			○				
F166	**Target value much on (with channel specification) (High-speed counter control/Pulse output control)**	**HC1S**	n, S, D	Turns output Yn on when the elapsed value of the high-speed counter or pulse output reaches the target value of (S+1, S).	11			○				
F167	**Target value much off (with channel specification) (High-speed counter control/Pulse output control)**	**HC1R**	n, S, D	Turns output Yn off when the elapsed value of the high-speed counter or pulse output reaches the target value of (S+1, S).	11			○				
F171	**Pulse output (JOG positioning type 0/1) (Trapezoidal control)**	**SPDH**	S, n	Positioning pulses are output from the specified channel, in accordance with the contents of the data table that starts with S.	5			○				
F172	**Pulse output (JOG operation 0 and 1)**	**PLSH**	S, n	Pulse strings are output from the specified output, in accordance with the contents of the data table that starts with S.	5			○				
F173	**PWM output (with channel specification)**	**PWMH**	S, n	PWM output is output from the specified output, in accordance with the contents of the data table that starts with S.	5			○				

Num-ber	Name	Boo-lean	Operand	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
F174	**Pulse output (Selectable data table control operation)**	**SP0H**	S, n	Outputs the pulses from the specified channel according to the data table specified by S.	5			○				
F175	**Pulse output (Linear interpolation)**	**SPSH**	S, n	Pulses are output from channel, in accordance with the designated data table, so that the path to the target position forms a straight line.	5			○				
F176	**Pulse output (Circular interpolation)**	**SPCH**	S, n	Pulses are output from channel, in accordance with the designated data table, so that the path to the target position forms an arc.	5			×				
F177	**Pulse output (Home return)**	**HOME**	S, n	Performs the home return according to the specified data table.	7			○				
F178	**Input pulse measurement (No. of pulses, cycle for input pulses)**	**PLSM**	S1, S2, D	Measures the number of pulses and cycle of pulses to be input to the high-speed counter of the specified channel.	5			○				

Number	Name	Boolean	Operand	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
High speed counter/Pulse output instruction for FPΣ/FP-X												
F0	**High-speed counter and Pulse output controls**	**MV**	S, DT90052	Performs high-speed counter and Pulse output controls according to the control code specified by “S”. The control code is stored in DT90052.	5	/	/	/	○	○	/	/
F1	**Change and read of the elapsed value of high-speed counter and Pulse output**	**DMV**	FPΣ: S, DT90044 FP-X: S, DT90300	Transfers (S+1, S) to high-speed counter and Pulse output elapsed value area (DT90045, DT90044).	7	/	/	/	○	○	/	/
			FPΣ: DT90044, D FP-X: DT90300, D	Transfers value in high-speed counter and Pulse output elapsed value area (DT90045, DT90044) to (D+1, D).	7	/	/	/	○	○	/	/
F166	**Target value much on (with channel specification)**	**HC1S**	n, S, D	Turns output Yn on when the elapsed value of the built-in high-speed counter reaches the target value of (S+1, S).	11	/	/	/	○	○	/	/
F167	**Target value much off (with channel specification)**	**HC1R**	n, S, D	Turns output Yn off when the elapsed value of the built-in high-speed counter reaches the target value of (S+1, S).	11	/	/	/	○	○	/	/
F171	**Pulse output (with channel specification) (Trapezoidal control and home return)**	**SPDH**	S, n	Positioning pulses are output from the specified channel, in accordance with the contents of the data table that starts with S.	5	/	/	/	○	○	/	/
F172	**Pulse output (with channel specification) (JOG operation)**	**PLSH**	S, n	Pulse strings are output from the specified output, in accordance with the contents of the data table that starts with S.	5	/	/	/	○	○	/	/
F173	**PWM output (with channel specification)**	**PWMH**	S, n	PWM output is output from the specified output, in accordance with the contents of the data table that starts with S.	5	/	/	/	○	○	/	/
F174	**Pulse output (with channel specification) (Selectable data table control operation)**	**SP0H**	S, n	Outputs the pulses from the specified channel according to the data table specified by S.	5	/	/	/	○	○	/	/

○: Available, ×: Not available, △: Not available partially

*1) The elapsed value area differs depending on used channels.

Num -ber	Name	Boolean	Ope- rand	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
F175	**Pulse output (Linear interpolation)**	**SPSH**	S, n	Pulses are output from channel, in accordance with the designated data table, so that the path to the target position forms a straight line.	5				△ *3			
F176	**Pulse output (Circular interpolation)**	**SPCH**	S, n	Pulses are output from channel, in accordance with the designated data table, so that the path to the target position forms an arc.	5				△ *3			
Screen display instructions												
F180	**FP-e screen display registration**	**SCR**	S1, S2, S3, S4	Register the screen displayed on the FP-e.	9	○	×	×	×	×	×	×
F181	**FP-e screen display switching**	**DSP**	S	Specify the screen to be displayed on the FP-e.	3	○	×	×	×	×	×	×
Basic function instruction												
F182	**Time constant processing**	**FILTR**	S1, S2, S3, D	Executes the filter processing for the specified input.	9	×	×	○	△ *5	△ *4	×	×
F183	**Auxiliary timer (32-bit)**	**DSTM**	S, D	Turn on the specified output and R900D after 0.01 s. × set value.	7	○	○	○	○	○	○	○ *7
Data transfer instructions												
F190 P190	**Three 16-bit data move**	**MV3 PMV3**	S1, S2, S3, D	(S1)→(D), (S2)→(D+1), (S3)→(D+2)	10	×	×	○	○	○	○	○
F191 P191	**Three 32-bit data move**	**DMV3 PDMV3**	S1, S2, S3, D	(S1+1, S1)→(D+1, D), (S2+1, S2)→(D+3, D+2), (S3+1, S3)→(D+5, D+4)	16	×	×	○	○	○	○	○
Logic operation instructions												
F215 P215	**32-bit data AND**	**DAND PDAND**	S1, S2, D	(S1+1, S1) AND (S2+1, S2)→(D+1, D)	7	×	×	○	○	○	○	○
F216 P216	**32-bit data OR**	**DOR PDOR**	S1, S2, D	(S1+1, S1) OR (S2+1, S2)→(D+1, D)	12	×	×	○	○	○	○	○
F217 P217	**32-bit data XOR**	**DXOR PDXOR**	S1, S2, D	{(S1+1, S1) AND $\overline{\text{(S2+1, S2)}}$} OR {(S1+1, S1) AND (S2+1, S2)}→(D+1, D)	12	×	×	○	○	○	○	○
F218 P218	**32-bit data XNR**	**DXNR PDXNR**	S1, S2, D	{(S1+1, S1) AND (S2+1, S2)} OR {(S1+1, S1) AND (S2+1, S2)}→(D+1, D)	12	×	×	○	○	○	○	○
F219 P219	**Double word (32-bit) data unites**	**DUNI PDUNI**	S1, S2, S3, D	{(S1+1, S1) AND (S3+1, S3)} OR {(S2+1, S2) AND (S3+1, S3)}→(D+1, D)	16	×	×	○	○	○	○	○
Data conversion instructions												
F230 P230	**Time data → second conversion**	**TMSEC PTMSEC**	S, D	The specified time data (a date and time) is changed to the second data.	6	×	×	○	△ *2	△ *6	△ *1	△ *1
F231 P231	**Second data→ time conversion**	**SECTM PSECTM**	S, D	The specified second data is changed into time data (a date and time).	6	×	×	○	△ *2	△ *6	△ *1	△ *1

○: Available, ×: Not available, △: Not available partially

*1) This instruction is available for FP2/FP2SH Ver. 1.5 or later.FP10SH cannot be used.
*2) This instruction is available for FPΣ 32k type.
*3) This instruction is available for FPΣ C32T2, C28P2, C32T2H and C28P2H.
*4) This instruction is only available for FP-X Ver.2.0 or later. *5) This instruction is available for FPΣ Ver. 3.10 or later.
*6) This instruction is available for FP-X Ver. 1.13 or later.
*7) This instruction is available for FP10SH Ver. 3.10 or later.

Num-ber	Name	Boolean	Ope-rand	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
F235 P235	**16-bit binary data → Gray code conversion**	**GRY PGRY**	S, D	Converts the 16-bit binary data of “S” to gray codes, and the converted result is stored in the “D”.	6	×	×	○	○	○	○	○
F236 P236	**32-bit binary data → Gray code conversion**	**DGRY PDGRY**	S, D	Converts the 32-bit binary data of (S+1, S) to gray code, and the converted result is stored in the (D+1, D).	8	×	×	○	○	○	○	○
F237 P237	**16-bit gray code → binary data conversion**	**GBIN PGBIN**	S, D	Converts the gray codes of “S” to binary data, and the converted result is stored in the “D”.	6	×	×	○	○	○	○	○
F238 P238	**32-bit gray code → binary data conversion**	**DGBIN PDGBIN**	S, D	Converts the gray codes of (S+1, S) to binary data, and the converted result is stored in the (D+1, D).	8	×	×	○	○	○	○	○
F240 P240	**Bit line to bit column conversion**	**COLM PCOLM**	S, n, D	The values of bits 0 to 15 of “S” are stored in bit “n” of (D to DC+15).	8	×	×	○	○	○	○	○
F241 P241	**Bit column to bit line conversion**	**LINE PLINE**	S, n, D	The values of bit “n” of (S) to (S+15) are stored in bits 0 to 15 of “D”.	8	×	×	○	○	○	○	○
F250	**Binary data → ASCII conversion**	**BTOA**	S1, S2, n, D	Converts multiple binary data to multiple ASCII data.	12	×	×	○	△ *1	○	×	×
F251	**ASCII → binary data conversion**	**ATOB**	S1, S2, n, D	Converts multiple ASCII data to multiple binary data.	12	×	×	○	△ *1	○	×	×
F252	**ASCII data check**	**ACHK**	S1, S2, n	Checks the ASCII data strings to be used in F251 (ATOB) instruction.	10	×	×	○	△ *3	△ *2	×	×
Character strings instructions												
F257 P257	**Comparing character strings**	**SCMP**	S1, S2	These instructions compare two specified character strings and output the judgment results to a special internal relay.	10	×	×	○	○	○	○	○
F258 P258	**Character string coupling**	**SADD**	S1, S2, D	These instructions couple one character string with another.	12	×	×	○	○	○	○	○
F259 P259	**Number of characters in a character string**	**LEN**	S, D	These instructions determine the number of characters in a character string.	6	×	×	○	○	○	○	○
F260 P260	**Search for character string**	**SSRC**	S1, S2, D	The specified character is searched in a character string.	10	×	×	○	○	○	○	○
F261 P261	**Retrieving data from character strings (right side)**	**RIGHT**	S1, S2, D	These instructions retrieve a specified number of characters from the right side of the character string.	8	×	×	○	○	○	○	○
F262 P262	**Retrieving data from character strings (left side)**	**LEFT**	S1, S2, D	These instructions retrieve a specified number of characters from the left side of the character string.	8	×	×	○	○	○	○	○
F263 P263	**Retrieving a character string from a character string**	**MIDR**	S1, S2, S3, D	These instructions retrieve a character string consisting of a specified number of characters from the specified position in the character string.	10	×	×	○	○	○	○	○
F264 P264	**Writing a character string to a character string**	**MIDW**	S1, S2, D, n	These instructions write a specified number of characters from a character string to a specified position in the character string.	12	×	×	○	○	○	○	○
F265 P265	**Replacing character strings**	**SREP**	S, D, p, n	A specified number of characters in a character string are rewritten, starting from a specified position in the character string.	12	×	×	○	○	○	○	○

○: Available, ×: Not available, △: Not available partially
*1) This instruction is available for FPΣ 32k type.
*2) This instruction is only available for FP-X Ver.2.0 or later.
*3) This instruction is available for FPΣ Ver. 3.10 or later.

Num-ber	Name	Boolean	Ope-rand	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
Integer type data processing instructions												
F270 P270	**Maximum value (word data (16-bit))**	**MAX PMAX**	S1, S2, D	Searches the maximum value in the word data table between the “S1” and “S2”, and stores it in the “D”. The address relative to “S1” is stored in “D+1”.	8	△ *1	×	○	○	○	○	○
F271 P271	**Maximum value (double word data (32-bit))**	**DMAX PDMAX**	S1, S2, D	Searches for the maximum value in the double word data table between the area selected with “S1” and “S2”, and stores it in the “D”. The address relative to “S1” is stored in “D+2”.	8	△ *1	×	○	○	○	○	○
F272 P272	**Minimum value (word data (16-bit))**	**MIN PMIN**	S1, S2, D	Searches for the minimum value in the word data table between the area selected with “S1” and “S2”, and stores it in the “D”. The address relative to “S1” is stored in “D+1”.	8	△ *1	×	○	○	○	○	○
F273 P273	**Minimum value (double word data (32-bit))**	**DMIN PDMIN**	S1, S2, D	Searches for the minimum value in the double word data table between the area selected with “S1” and “S2”, and stores it in the “D”. The address relative to “S1” is stored in “D+2”.	8	△ *1	×	○	○	○	○	○
F275 P275	**Total and mean values (word data (16-bit))**	**MEAN PMEAN**	S1, S2, D	The total value and the mean value of the word data with sign from the area selected with “S1” to “S2” are obtained and stored in the “D”.	8	△ *1	×	○	○	○	○	○
F276 P276	**Total and mean values (double word data (32-bit))**	**DMEAN PDMEAN**	S1, S2, D	The total value and the mean value of the double word data with sign from the area selected with “S1” to “S2” are obtained and stored in the “D”.	8	△ *1	×	○	○	○	○	○
F277 P277	**Sort (word data (16-bit))**	**SORT PSORT**	S1, S2, S3	The word data with sign from the area specified by “S1” to “S2” are sorted in ascending order (the smallest word is first) or descending order (the largest word is first).	8	△ *1	×	○	○	○	○	○
F278 P278	**Sort (double word data (32-bit))**	**DSORT PDSORT**	S1, S2, S3	The double word data with sign from the area specified b “S1” ato “S2” are sorted in ascending order (the smallest word is first) or descending order (the largest word is first).	8	△ *1	×	○	○	○	○	○
F282 P282	**Scaling of 16-bit data**	**SCAL PSCAL**	S1, S2, D	The toutptu value Y is found for the input value X by performing scaling for the given data table.	8	△ *1	×	○	○	○	○	○
F283 P283	**Scaling of 32-bit data**	**DSCAL PDSCAL**	S1, S2, D	The toutptu value Y is found for the input value X by performing scaling for the given data table.	10	×	×	○	○	○	○	○
F284 P284	**Inclination output of 16-bit data**	**RAMP**	S1, S2, S3, D	Executes the linear output for the specified time from the specified initial value to the target value.	10	×	×	○	△ *2	△ *2	×	×
Integer type non-linear function instructions												
F285 P285	**Upper and lower limit control (16-bit data)**	**LIMT PLIMT**	S1, S2, S3, D	When S1>S3, S1→D When S1<S3, S2→D When S1<or = S3<or = S2, S3→D	10	△ *1	×	○	○	○	○	○

○: Available, ×: Not available, △: Not available partially

*1) This instruction is available for FP-e Ver.1.2 or later.

*2) This instruction is only available for FP-X Ver.2.0 or later, and FPΣ Ver. 3.10 or later.

Number	Name	Boolean	Operand	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
F286 **P286**	**Upper and lower limit control (32-bit data)**	**DLIMT** **PDLIMT**	S1, S2, S3, D	When (S1+1, S1)>(S3+1, S3), (S1+1, S1)→(D+1, D) When (S2+1, S2)<(S3+1, S3), (S2+1, S2)→(D+1, D) When (S1+1, S1)<or = (S3+1, S3)<or = (S2+1, S2), (S3+1, S3)→(D+1, D)	16	△ *1	×	○	○	○	○	○
F287 **P287**	**Deadband control (16-bit data)**	**BAND** **PBAND**	S1, S2, S3, D	When S1>S3, S3–S1→D When S2<S3, S3–S2→D When S1<or = S3<or = S2, 0→D	10	△ *1	×	○	○	○	○	○
F288 **P288**	**Deadband control (32-bit data)**	**DBAND** **PDBAND**	S1, S2, S3, D	When (S1+1, S1)>(S3+1, S3), (S3+1, S3)–(S1+1, S1)→(D+1, D) When (S2+1, S2)<(S3+1, S3), (S3+1, S3)–(S2+1, S2)→(D+1, D) When (S1+1, S1)<or = (S3+1, S3)<or = (S2+1, S2),0→(D+1, D)	16	△ *1	×	○	○	○	○	○
F289 **P289**	**Zone control (16-bit data)**	**ZONE** **PZONE**	S1, S2, S3, D	When S3<0, S3+S1→D When S3=0, 0→D When S3>0, S3+S2→D	10	△ *1	×	○	○	○	○	○
F290 **P290**	**Zone control (32-bit data)**	**DZONE** **PDZONE**	S1, S2, S3, D	When (S3+1, S3)<0, (S3+1, S3)+(S1+1, S1)→(D+1, D) When (S3+1, S3)=0, 0→(D+1, D) When (S3+1, S3)>0, (S3+1, S3)+(S2+1, S2)→(D+1, D)	16	△ *1	×	○	○	○	○	○
BCD type real number operation instructions												
F300 **P300**	**BCD type sine operation**	**BSIN** **PBSIN**	S, D	SIN(S1+1, S1)→(D+1, D)	6	×	×	×	×	×	○	○
F301 **P301**	**BCD type cosine operation**	**BCOS** **PBCOS**	S, D	COS(S1+1, S1)→(D+1, D)	6	×	×	×	×	×	○	○
F302 **P302**	**BCD type tangent operation**	**BTAN** **PBTAN**	S, D	TAN(S1+1, S1)→(D+1, D)	6	×	×	×	×	×	○	○
F303 **P303**	**BCD type arcsine operation**	**BASIN** **PBASIN**	S, D	SIN^{-1}(S1+1, S1)→(D+1, D)	6	×	×	×	×	×	○	○
F304 **P304**	**BCD type arccosine operation**	**BACOS** **PBACOS**	S, D	COS^{-1}(S1+1, S1)→(D+1, D)	6	×	×	×	×	×	○	○
F305 **P305**	**BCD type arctangent operation**	**BATAN** **PBATAN**	S, D	TAN^{-1}(S1+1, S1)→(D+1, D)	6	×	×	×	×	×	○	○
Floating-point type real number operation instructions												
F309 **P309**	**Floating-point type data move**	**FMV** **PFMV**	S, D	(S+1, S)→(D+1, D)	8	○ *2	○ *2	○	○	○	○	○
F310 **P310**	**Floating-point type data addition**	**F+** **PF+**	S1, S2, D	(S1+1, S1)+(S2+1, S2)→(D+1, D)	14	○ *2	○ *2	○	○	○	○	○
F311 **P311**	**Floating-point type data subtraction**	**F-** **PF-**	S1, S2, D	(S1+1, S1)–(S2+1, S2)→(D+1, D)	14	○ *2	○ *2	○	○	○	○	○
F312 **P312**	**Floating-point type data multiplication**	**F*** **PF***	S1, S2, D	(S1+1, S1)×(S2+1, S2)→(D+1, D)	14	○ *2	○ *2	○	○	○	○	○
F313 **P313**	**Floating-point type data division**	**F%** **PF%**	S1, S2, D	(S1+1, S1)÷(S2+1, S2)→(D+1, D)	14	○ *2	○ *2	○	○	○	○	○

○: Available, ×: Not available, △: Not available partially

*1) This instruction is available for FP-e Ver.1.2 or later.

*2) This instruction is available for FP-e Ver.1.21 or later, FP0 V2.1 or later.

Num-ber	Name	Boo-lean	Ope-rand	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
F314 P314	**Floating-point type data sine operation**	**SIN PSIN**	S, D	SIN(S+1, S)→(D+1, D)	10	○ *1	○ *1	○	○	○	○	○
F315 P315	**Floating-point type data cosine operation**	**COS PCOS**	S, D	COS(S+1, S)→(D+1, D)	10	○ *1	○ *1	○	○	○	○	○
F316 P316	**Floating-point type data tangent operation**	**TAN PTAN**	S, D	TAN(S+1, S)→(D+1, D)	10	○ *1	○ *1	○	○	○	○	○
F317 P317	**Floating-point type data arcsine operation**	**ASIN PASIN**	S, D	SIN^{-1}(S+1, S)→(D+1, D)	10	○ *1	○ *1	○	○	○	○	○
F318 P318	**Floating-point type data arccosine operation**	**ACOS PACOS**	S, D	COS^{-1}(S+1, S)→(D+1, D)	10	○ *1	○ *1	○	○	○	○	○
F319 P319	**Floating-point type data arctangent operation**	**ATAN PATAN**	S, D	TAN^{-1}(S+1, S)→(D+1, D)	10	○ *1	○ *1	○	○	○	○	○
F320 P320	**Floating-point type data natural logarithm**	**LN PLN**	S, D	LN(S+1, S)→(D+1, D)	10	○ *1	○ *1	○	○	○	○	○
F321 P321	**Floating-point type data exponent**	**EXP PEXP**	S, D	EXP(S+1, S)→(D+1, D)	10	○ *1	○ *1	○	○	○	○	○
F322 P322	**Floating-point type data logarithm**	**LOG PLOG**	S, D	LOG(S+1, S)→(D+1, D)	10	○ *1	○ *1	○	○	○	○	○
F323 P323	**Floating-point type data power**	**PWR PPWR**	S1, S2, D	(S1+1, S1) ^ (S2+1, S2)→(D+1, D)	14	○ *1	○ *1	○	○	○	○	○
F324 P324	**Floating-point type data square root**	**FSQR PFSQR**	S, D	$\sqrt{(S+1, S)}$→(D+1, D)	10	○ *1	○ *1	○	○	○	○	○
F325 P325	**16-bit integer data to floating-point type data conversion**	**FLT PFLT**	S, D	Converts the 16-bit integer data with sign specified by "S" to real number data, and the converted data is stored in "D".	6	○ *1	○ *1	○	○	○	○	○
F326 P326	**32-bit integer data to floating-point type data conversion**	**DFLT PDFLT**	S, D	Converts the 32-bit integer data with sign specified by (S+1, S) to real number data, and the converted data is stored in (D+1, D).	8	○ *1	○ *1	○	○	○	○	○
F327 P327	**Floating-point type data to 16-bit integer con-version (the largest inte-ger not ex-ceeding the floating-point type data)**	**INT PINT**	S, D	Converts real number data specified by (S+1, S) to the 16-bit integer data with sign (the largest integer not exceeding the floating-point data), and the converted data is stored in "D".	8	○ *1	○ *1	○	○	○	○	○
F328 P328	**Floating-point type data to 32-bit integer con-version (the largest inte-ger not ex-ceeding the floating-point type data)**	**DINT PDINT**	S, D	Converts real number data specified by (S+1, S) to the 32-bit integer data with sign (the largest integer not exceeding the floating-point data), and the converted data is stored in (D+1, D).	8	○ *1	○ *1	○	○	○	○	○

○: Available, ×: Not available, △: Not available partially

*1) This instruction is available for FP-e Ver.1.21 or later, FP0 V2.1 or later.

Num-ber	Name	Boolean	Ope-rand	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
F329 **P329**	**Floating-point type data to 16-bit integer con-version (rounding the first decimal point down to integer)**	**FIX** **PFIX**	S, D	Converts real number data specified by (S+1, S) to the 16-bit integer data with sign (rounding the first decimal point down), and the converted data is stored in “D”.	8	○ *1	○ *1	○	○	○	○	○
F330 **P330**	**Floating-point type data to 32-bit integer con-version (rounding the first decimal point down to integer)**	**DFIX** **PDFIX**	S, D	Converts real number data specified by (S+1, S) to the 32-bit integer data with sign (rounding the first decimal point down), and the converted data is stored in (D+1, D).	8	○ *1	○ *1	○	○	○	○	○
F331 **P331**	**Floating-point type data to 16-bit integer con-version (rounding the first decimal point off to integer)**	**ROFF** **PROFF**	S, D	Converts real number data specified by (S+1, S) to the 16-bit integer data with sign (rounding the first decimal point off), and the converted data is stored in “D”.	8	○ *1	○ *1	○	○	○	○	○
F332 **P332**	**Floating-point type data to 32-bit integer con-version (rounding the first decimal point off to integer)**	**DROFF** **PDROFF**	S, D	Converts real number data specified by (S+1, S) to the 32-bit integer data with sign (rounding the first decimal point off), and the converted data is stored in (D+1, D).	8	○ *1	○ *1	○	○	○	○	○
F333 **P333**	**Floating-point type data round-ding the first decimal point down**	**FINT** **PFINT**	S, D	The decimal part of the real number data specified in (S+1, S) is rounded down, and the result is stored in (D+1, D).	8	○ *1	○ *1	○	○	○	○	○
F334 **P334**	**Floating-point type data round-ding the first decimal point off**	**FRINT** **PFRINT**	S, D	The decimal part of the real number data stored in (S+1, S) is rounded off, and the result is stored in (D+1, D).	8	○ *1	○ *1	○	○	○	○	○
F335 **P335**	**Floating-point type data sign changes**	**F+/-** **PF+/-**	S, D	The real number data stored in (S+1, S) is changed the sign, and the result is stored in (D+1, D).	8	○ *1	○ *1	○	○	○	○	○
F336 **P336**	**Floating-point type data absolute**	**FABS** **PFABS**	S, D	Takes the absolute value of real number data specified by (S+1, S), and the result (absolute value) is stored in (D+1, D).	8	○ *1	○ *1	○	○	○	○	○
F337 **P337**	**Floating-point type data degree → radian**	**RAD** **PRAD**	S, D	The data in degrees of an angle specified in (S+1, S) is converted to radians (real number data), and the result is stored in (D+1, D).	8	○ *1	○ *1	○	○	○	○	○
F338 **P338**	**Floating-point type data radian → degree**	**DEG** **PDEG**	S, D	The angle data in radians (real number data) specified in (S+1, S) is converted to angle data in degrees, and the result is stored in (D+1, D).	8	○ *1	○ *1	○	○	○	○	○
Floating-point type real number data processing instructions												
F345 **P345**	**Floating-point type data compare**	**FCMP** **PFCMP**	S1, S2	(S1+1, S1)>(S2+1, S2)→ R900A: on (S1+1, S1)=(S2+1, S2)→ R900B on (S1+1, S1)<(S2+1, S2)→ R900C: on	10	×	×	○	○	○	○	○
F346 **P346**	**Floating-point type data band compare**	**FWIN** **PFWIN**	S1, S2, S3	(S1+1, S1)>(S3+1, S3)→ R900A: on (S2+1, S2)<or =(S1+1, S1)<or =(S3+1, S3) → R900B on (S1+1, S1)<(S2+1, S2)→ R900C: on	14	×	×	○	○	○	○	○

○: Available, ×: Not available, △: Not available partially

*1) This instruction is available for FP-e Ver.1.21 or later, FP0 V2.1 or later.

Num-ber	Name	Boolean	Ope-rand	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
F347 P347	**Floating-point type data upper and lower limit control**	**FLIMT PFLIMT**	S1, S2, S3, D	When (S1+1, S1)>(S3+1, S3), (S1+1, S1) →(D+1, D) When (S2+1, S2)<(S3+1, S3), (S2+1, S2) → (D+1, D) When (S1+1, S1)<or = (S3+1, S3)<or =(S2+1, S2), (S3+1, S3)→(D+1, D)	17	×	×	○	○	○	○	○
F348 P348	**Floating-point type data dead-band control**	**FBAND PFBAND**	S1, S2, S3, D	When (S1+1, S1)>(S3+1, S3), (S3+1, S3)–(S1+1, S1)→(D+1, D) When (S2+1, S2)<(S3+1, S3), (S3+1, S3)–(S2+1, S2)→ (D+1, D) When (S1+1, S1)<or = (S3+1, S3)<or =(S2+1, S2), 0.0→(D+1, D)	17	×	×	○	○	○	○	○
F349 P349	**Floating-point type data zone control**	**FZONE PFZONE**	S1, S2, S3, D	When (S3+1, S3)<0.0, (S3+1, S3)+(S1+1, S1)→(D+1, D) When (S3+1, S3)=0.0, 0.0→ (D+1, D) When (S3+1, S3)>0.0, (S3+1, S3)+(S2+1, S2) →(D+1, D)	17	×	×	○	○	○	○	○
F350 P350	**Floating-point type data maxi-mum value**	**FMAX PFMAX**	S1, S2, D	Searches the maximum value in the real number data table between the area selected with "S1" and "S2", and stores it in the (D+1, D). The address relative to "S1" is stored in (D+2).	8	×	×	×	×	×	○	○
F351 P351	**Floating-point type data mini-mum value**	**FMIN PFMIN**	S1, S2, D	Searches the minimum value in the real number data table between the area selected with "S1" and "S2", and stores it in the (D+1, D). The address relative to "S1" is stored in (D+2).	8	×	×	×	×	×	○	○
F352 P352	**Floating-point type data total and mean values**	**FMEAN PFMEAN**	S1, S2, D	The total value and the mean value of the real number data from the area selected with "S1" to "S2" are obtained. The total value is stored in the (D+1, D) and the mean value is stored in the (D+3, D+2).	8	×	×	×	×	×	○	○
F353 P353	**Floating-point type data sort**	**FSORT PFSORT**	S1, S2, S3	The real number data from the area speciified by "S1" to "S2" are stored in ascending order (the smallest word is first) or descending order (the largest word is first).	8	×	×	×	×	×	○	○
F354 P354	**Scaling of real number data**	**FSCAL PFSCAL**	S1, S2, D	Scaling (linearization) on a real number data table is performed, and the output (Y) to an input value (X) is calculated.	12	×	×	○	△ *2	△ *3	△ *1	△ *1

○: Available, ×: Not available, △: Not available partially

*1) This instruction is available for FP2/FP2SH Ver. 1.5 or later. FP10SH cannot be used.

*2) This instruction is available for FPΣ 32k type.

*3) This instruction is available for FP-X Ver. 1.13 or later.

Num-ber	Name	Boolean	Ope-rand	Description	Steps	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH/FP10SH
Time series processing instruction												
F355	**PID processing**	**PID**	S	PID processing is performed depending on the control value (mode and parameter) specified by (S to S+2) and (S+4 to S+10), and the result is stored in the (S+3).	4	○	○ *3	○	○	○	○	○
F356	**Eaay PID**	**EZPID**	S1, S2, S3, S4	Temperature control (PID) can be easily performed using the image of a temperautre controller.	10	×	×	○	△ *2	△ *2	×	×
Compare instructions												
F373 P373	**16-bit data revision detection**	**DTR PDTR**	S, D	If the data in the 16-bit area specified by “S” has changed since the previous execution, internal relay R9009 (carry flag) will turn on. “D” is used to store the data of the previous execution.	6	×	×	○	○	○	○	○
F374 P374	**32-bit data revision detection**	**DDTR PDDTR**	S, D	If the data in the 32-bit area specified by (S+1, S) has changed since the previous execution, internal relay R9009 (carry flag) will turn on. (D+1, D) is used to store the data of the previous execution.	6	×	×	○	○	○	○	○
Index register bank processing instructions												
F410 P410	**Setting the index regis-ter bank number**	**SETB PSETB**	n	Index register (I0 to ID) bank number change over.	4	×	×	×	×	×	×	○
F411 P411	**Changing the index regis-ter bank number**	**CHGB PCHGB**	n	Index register (I0 to ID) bank number change over with remembering preceding bank number.	4	×	×	×	×	×	×	○
F412 P412	**Restoring the index regis-ter bank number**	**POPB PPOPB**	-	Changes index register (I0 to ID) bank number back to the bank before F411 (CHGB)/P411 (PCHGB) instruction.	2	×	×	×	×	×	×	○
File register bank processing instructions												
F414 P414	**Setting the file register bank number**	**SBFL PSBFL**	n	File register bank number change over.	4	×	×	×	×	×	×	△ *1
F415 P415	**Changing the file register bank number**	**CBFL PCBFL**	n	File register bank number change over with remembering preceding bank number.	4	×	×	×	×	×	×	△ *1
F416 P416	**Restoring the file register bank number**	**PBFL PPBFL**	-	Changes file register bank number back to the bank before F415 (CBFL)/P415 (PCBFL) instruction.	2	×	×	×	×	×	×	△ *1

○: Available, ×: Not available, △: Not available partially

*1) This instruction is not available for FP10SH.

*2) This instruction is available for FP-X V.1.20 or later, and FPΣ 32k type.

*3) This instruction is available for FP0 V2.1 or later.

15.4 Table of Error codes

■ Difference in ERROR display

There are differences in the way errors are displayed depending on the model.

Model	Display		Display method
FP1,FP-M,FP2,FP3,FP10SH	LED	ERROR.	Continually lit
FPΣ,FP0, FP0R, FP-X	LED	ERROR/ALARM	Flashes/contunually lit
FP-e	Screen display	ERR.	Continually lit

■ Error Confirmation When ERROR Turns ON

When the “ERROR” on the control unit (CPU unit) turns on or flashes, a self-diagnostic error or syntax check error has occurred. Confirm the contents of the error and take the appopriate steps.

-Error Confirmation Method

Procedure:1.Use the programming tool software to call up the error code.
By executing the “STATUS DISPLAY”, the error code and content of error are displayed.
2.Check the error contents in the table of error codes using the error code ascertained above.

-Syntax check error

This is an error detected by the total check function when there is a syntax error or incorrect setting written in the program. When the mode selector is switched to the RUN mode, the total check function automatically activates and eliminates the possibility of incorrect operation from syntax errors in the program.

When a syntax check error is detected

-ERROR turns on or flashes.
-Operation will not begin even after swirching to the RUN mode.
-Remote operation cannot be used to change to RUN mode.

Clearing a syntax check error

By changing to the PROG.mode, the error will clear and the ERROR will turn off.

Steps to take for syntax error

Change to the PROG. mode, and then execute the total check function while online mode with the programming tool connected. This will call up the content of error and the address where the error occurred.
Correct the program while referring to the content of error.

-Self-diagnostic Error
This error occurs when the control unit (CPU unit) self-diagnostic function detects the occurrence of an abnormality in the system. The self-diagnostic function monitors the memory abnormal detection, I/O abnomal detection, and other devices.

When a self-diagnostic error occurs
- The ERROR turns on or flashes.
- The operation of the control unit (CPU unit) might stop depending on the contect of error and the system
register setting.
- The error codes will be stored in the special data register DT9000(DT90000).
- In the case of operation error, the error address will stored in the DT9017(DT90017) and DT9018(DT90018).

Clearing the self-diagnostic error
At the “STATUS DISPLAY”, execute the “error clear”. Error codes 43 and higher can be cleared.
-You can use the initialize/test switch to clear an error. However, this will also clear the contents of operation memory.
-Errors can also be cleared by turning off and on the power while in the PROG.mode.
However, the contents of operation memory, not stored with the hold type data, will also be cleared.
-The error can also be cleared depending on the self-diagnostic error set instruction F148(ERR).

Steps to take for self-diagnostic error
The steps to be taken will differ depending on the error contents. For more details, use the error code obtained above and consult the table of aself-diagnostic error codes.

■ 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.

■ Table of Syntax Check Error

Error code	Name	Opera-tion status	Description and steps to take	FP-e	FP0	FP0R	FP Σ	FP-X	FP2	FP2SH	FP10SH
E1	**Syntax error**	Stops	A program with a syntax error has been written. ⇒ Change to PROG. mode and correct the error.	A	A	A	A	A	A	A	A
E2 (Note)	**Duplicated output error**	Stops	Two or more OT(Out) instructions and KP(Keep) instructions are programmed using the same relay.Also occurs when using the same timer/counter number. ⇒ Change to PROG. mode and correct the program so that one relay is not used for two or more OT instructions,Or, set the duplicated output to “enable” in system register20. A timer/counter instructon double definition error will be detected even if double output permission has been selected.	A	A	A	A	A	A	A	A
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.	A	A	A	A	A	A	A	A
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.	A	A	A	A	A	A	A	A
E5 (Note)	**Program area error**	Stops	An instruction which must be written in 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.	A	A	A	A	A	A	A	A

A:Available

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.

Error code	Name	Operation status	Description and steps to take	FP-e	FP0	FP0R	FP Σ	FP-X	FP2	FP2SH	FP10SH
E6	**Compile memory full error**	Stops	The program is too large to compile in the program memory. ⇒ Change to PROG. mode and reduce the total number of steps for the program. -FP10SH If memory expansion is possible,compilation will become possible when the memory is expanded.	A	A	A	A	A		A	A
E7	**High-level instruction type error**	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.			A	A	A	A	A	A
E8	**High-level instruction operand combina-tion 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.	A	A	A	A	A	A	A	A
E9	**No program error**	Stops	Program may be damaged. ⇒Try to send the program again.							A	A
E10	**Rewrite during RUN syntax error**	Conti-nues	When inputting with the programming tool software,a delection,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.						A	A	A

A:Available

■ Table of Self-Diagnostic Error

Error code	Name	Opera-tion status	Description and steps to take	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH	FP10SH
E20	**CPU error**	Stops	Probably a hardware abnormality ⇒Please contact your dealer.						A	A	A
E21	**RAM error1**	Stops	Probably an abnormality in the internal RAM. ⇒Please contact your dealer.						A	A	A
E22	**RAM error2**										
E23	**RAM error3**										
E24	**RAM error4**										
E25	**RAM error5**										
E25	**Master memory model unmatch error**	Stops	The models of master memories are different. Use the master memories created with the same model.					A *1)			
E26	**User's ROM error**	Stops	FP-e,FP0,FP0R,FPΣ,and FP1 C14,C16:Probably a hardware abnormality. ⇒ Please contact your dealer. FP-X: When the master memory cassette is mounted, the master memor cassette may be damaged. Remove the master memory, and check whether the ERROR turns off. When the ERROR turned off, rewrite the master memory as its contents are damaged, and use it again. When the ERROR does not turn off, please contact your dealer. FP1 C24,C40,C56,C72,and FP-M: Probably an abnormality in the memory unit ⇒Program the memory unit again and try to operate. If the same error is detected, try to operate with another memory unit. FP2,FP2SH,FP10SH,and FP3: There may be a problem with the installed ROM. -ROM is not installed. -ROM contens are damaged. -Program size stored on the ROM is larger than the capacity of the ROM ⇒Check the contents of the ROM	A	A	A	A	A	A	A	A
E27	**Unit installation error**	Stops	Units installed exceed the limitations.(i.e.,4 or more link units) ⇒ Turn off the power and re-configure units referring to the hardware manual.			A	A	A	A	A	A
E28	**System register error**	Stops	Probably an abnormality in the system register. ⇒ Check the system register setting or initialize the system registers.						A		

*1) This error occurs on FP-X Ver2.0 or later.

A:Available

Error code	Name	Operation status	Description and steps to take	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH	FP10SH
E29	**Configuration parameter error**	Stops	A parameter error was detected in the MEWNET-W2 configuration area. Set a correct parameter.						A	A	
E30	**Interrupt error 0**	Stops	Probably a hardware abnormality. ⇒ Please contact your dealer.								
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.	A	A	A	A	A	A	A	A
E32	**Interrupt error 2**	Stops	There is no interrupt program for an interrupt which occurred. ⇒ Check the number of the interrupt program and change it to agree with the interrrupt request..	A	A	A	A	A	A	A	A
E33	**Multi-CPU data unmatch error**	CPU2 Stops	This error occurs when a FP3/FP10SH is used as CPU2 for a multi-CPU system. ⇒Refer to "Multi-CPU system Manual".							A	A
E34	**I/O status error**	Stops	An abnormal unit is installed. -FPΣ, FP0R(FP0R mode),FP-X, FP2,FP2SH and FP10SH: Check the contents of special data register DT90036 and locate the abnormal unit.Then turn off the power and replace the unit with a new one. -FP3: Check the contents of special data register DT9036 and locate the abnormal unit. Then turn off the power and replace the unit with a new one.			A	A	A		A	A
E35	**MEWNET-F 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.						A	A	A
E36	**MEWNET-F (remore I/O) limitation error**	Stops	The number of slots or I/O points used for MEWNET-F(remote I/O) system exceeds the limitation. ⇒Re-configure the system so that the number of slots and I/O points is within the specified range.						A	A	A
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						A	A	A

A:Available

Error code	Name	Opera-tion status	Description and steps to take	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH	FP10SH
E38	**MEWNET-F slave I/O terminal mapping error**	Stops	I/O mapping for remote I/O terminal boards,remote I/O terminal units and I/O link is not correct. ⇒Re-configure the I/O map for slave stations according to the I/O points of the slave stations.						A	A	A
E39	**IC card read error**	Stops	When reading in the program from the IC memory card(due to automatic reading because of the dip switch 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 proterly recorded and execute the read once again.							A	A
E40	**I/O error**	Sele-ctable	Abnormal I/O unit. FPΣ, FP-X: Check the contents of special data register DT90002 and abnormal FPΣ expansion unit (application cassette for FP-X). Then check the unit. FP2 and FP2SH: Check the contents of special data registers DT90002,DT90003 and abnormal I/O unit.Then check the unit. Selection of operation status using system register21: -to continue operation,set 1 -to stop operation,set 0 Verification is possible in FPWIN GR/Pro at"I/O error" in the status display function. MEWNET-TR communication error FP3 and FP10SH: Check the contents of special data registers(FP3:DT9002,DT9003,FP10SH:DT90002,DT90003) and the erroneous master unit and abnormal I/O unit. Then check the unit. Selection of operation status using system register21: -to continue operation,set 1 -to stop operation,set 0 Verification is possible in FPWIN GR/Pro at"I/O error" in the status display function.				A	A	A	A	A

A:Available

Error code	Name	Opera-tion status	Description and steps to take	FP-e	FP0	FP0R	FP Σ	FP-X	FP2	FP2SH	FP10SH
E41	**Intelligent unit error**	Selec-table	An abnormality in an intelligent unit. FPΣ, FP-X: Check the contetns of special data register “DT90006” and locate the abnormal FP intelligent unit (application cassette for FP-X). FP2,FP2SH,and FP10SH: Check the contents of special data registers DT90006,DT90007 and locate the abnormal intelligent unit.Then check the unit referring to its manual.. Selection of operation status using system register22: -to continue operation,set 1 -to stop operation,set 0 FP3: Check the contents of special data registers DT9006,DT9007 and locate the abnormal intelligent unit.Then check the unit referring to its manual.. Selection of operation status using system register22: -to continue operation,set 1 -to stop operation,set 0 Verification is possible in FPWIN GR/Pro at”I/O error” in the status display function.				A	A	A	A	A
E42	**I/O unit verify error**	Selec-table	I/O unit(Expansion unit) wiring condition has changed compared to that at time fo power-up. ⇒ Check the contents of special data register (FP0: DT9010, FPΣ, FP-X: DT90010,DT90011) and locate the erroneous expansion unit. It checks whether an expansion connector is in agreement. ⇒ Check the contents of special data register (FP2,FP2SH,and FP10SH:DT90010,DT90011,FP3 DT9010,DT9011) Selection of operation status using system register23: -to continue operation,set 1 -to stop operation,set 0 Verification is possible in FPWIN GR/Pro at”I/O error” in the status display function.		A	A	A	A	A	A	A

A:Available

Error code	Name	Opera-tion status	Description and steps to take	FP-e	FP0	FP0R	FPΣ	FP-X	FP2	FP2SH	FP10SH
E43	**System watching dog timer error**	Selec-table	Scan time required for program execution exceeds the setting of the system watching dog timer. ⇒ Check the program and modify it so that the program can execute a scan within the specified time. Selection of operation status using system register24: -to continue operation,set 1 -to stop operation,set 0							A	A
E44	**Slave staiton connecting time error for MEWNET-F system**	Selec-table	The time required for slave station connection exceeds the setting of the system register 35. Selection of operation status using system register25: -to continue operation,set 1 -to stop operation,set 0						A	A	A
E45	**Operation error**	Selec-table	Operation became impossible when a high-level instruction was executed. Selection of operation status using system register26: -to continue operation,set K1 -to stop operation,set K0 The address of operation error can be confirmed in either special data registers DT9017 and DT9018, or DT90017 and DT90018. (It varies according to the model to be used.) DT9017, DT9018: FP-e, FP0, FP0R(FP0 mode) DT90017, DT90018: FPΣ, FP-X, FP0R(FP0R mode), FP2, FP2SH, FP10SH Verification is possible in FPWIN GR/Pro at"I/O error" in the status display function.	A	A	A	A	A	A	A	A

A:Available

Error code	Name	Opera-tion status	Description and steps to take	FP-e	FP0	FP0R	FP Σ	FP-X	FP2	FP2SH	FP10SH
E46	**Remote I/O commu-nication error**	Selec-table	S-LINK error Occurs only in FP0-SL1 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 register27: -to continue operation,set K1 -to stop operation,set K0		A						
		Selec-table	MEWNET-F communication error A communication abnormally was caused by a transmission cable or during the power-down of a slave station. FP2, FP2SH, and FP10SH: Check the contents of special data registers DT90131 to DT90137 and locate the abnormal slave station and recover the communication condition. FP3: Check the contents of special data registers DT9131 to DT9137 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						A	A	A
E47	**MEW-NET-F attribute error**	Selec-table	In the unit on the slave station, an abnormallty such as: -missing unit -abnormal intelligent unit was detected. FP2, FP2SH, and FP10SH: Check the contents of special data registers DT90131 to DT90137 and locate the abnormal slave station and recover the slave condition. FP3: Check the contents of special data registers DT9131 to DT9137 and locate the abnormal slave station and recover the slave condition. Selection of operation status using system register28: -to continue operation,set 1 -to stop operation,set 0						A	A	A
E49	**Expansion unit power supply sequence error**	Stops	The power supply for the expansion unit was turned on after the control unit. Turn on the power supply for the expansion unit at the same time or before the control unit is turend on.					A			
E50	**Backup battery errror**	Conti-nues	The voltage of the backup battery lowered or the backup battery of conrol unit is not installed. ⇒ Check the installation of the backup battery and then replace battery if necessary. By setting the system register 4, you can disregard this self-diagnostic error.				A	A	A	A	A

Error code	Name	Operation status	Description and steps to take	FP-e	FP0	FP0R	FP Σ	FP-X	FP2	FP2SH	FP10SH
E51	**MEWNET-F terminal station error**	Conti-nues	Terminal station setting was not properly performed. Check stations at both ends of the communication path,and set them in the terminal station using the dip switches.						A	A	A
E52	**MEWNET-F I/O update synchro-nous error**	Conti-nues	Set the INITIALIZE/TEST selecto1inmjvbgycfrde892 r to the INITIALIZE position while keeping the mode selector in the RUN position.If the same error occurs after this,please contact your dealer.						A	A	A
E53	**Multi-CPU I/O regis-tration error (CPU2 only)**	Conti-nues	Abnormality was detected when the multi-CPU system ws used. Please contact your dealer.								A
E54	**IC memory card back-up battery error**	Conti-nues	The voltage of the backup battery for the IC memory card lowered. The BATT.LED does not turn on. Charge or replace the backup battry of IC memory card.(The contents of the IC memory card cannot be guaranteed.)							A	A
E55	**IC memory card back-up battery error**	Cont-inues	The voltage of the backup battery for IC memory card lowers.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.)							A	A
E56	**Incompat-ible IC memory card error**	Cont-inues	The IC memory card installed is not compatible. Replace the IC memory card compatible with FP2SH/FP10SH.							A	A
E57	**No unit for the configu-ration**	Conti-nues	MEWNET-W2/MCU The MEWNET-W2 link unit or MCU(Multi communication unit) is not installed in the slot specified using the configuration data. Either install a unit in the specified slot or change the parameter.						A	A	
E100 to E199	**Self-diagnostic error set by F148 (ERR)/P148 (PERR) instruction**	Stop	The error specified by the F148 (ERR)/P148(PERR) instruction is occurred. ⇒ Take steps to clear the error condition according to the specification you chose.	A	A	A	A	A	A		
E200 to E299		Conti-nues		A	A	A	A	A	A		

A:Available

Table of MEWTOCOL-COM Communication Error

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 received data.
!41	**Format error**	A command was received that does not fit the format.
!42	**No support error**	A command was received that is not supported.
!43	**Multiple frames procedure error**	A different command was received when processing multiple frames.
!50	**Link setting error**	A route number that does not exist was spacified. Verify the route number by designating the transmission station.
!51	**Transmission time-out error**	Transmission to anather device not possible because transmissition buffer is congested.
!52	**Transmit disable error**	Transmission processing to another device is not possible.(Link unit runaway,etc.)
!53	**Busy error**	Command process cannot be received because of multiple frame processing.Or,cannot be received because command being processed is congested.
!60	**Parameter error**	Content of spacified parameter does not exist or cannot be used.
!61	**Data error**	There was a mistake in the contact,data area,data number desigination,size designation,range,or format designation.
!62	**Registration over error**	Operation was does 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.

Error code	Name	Description
!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.
!65	**Protect error**	A program or system register write operation was executed when theb 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. Alsi.when exceeded or insufficient of 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 was attempted of data that was not registered.
!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.

15.5 MEWTOCOL-COM Communication Commands

Table of MEWTOCOL-COM commands

Command name	Code	Description
Read contact area	RC (RCS) (RCP) (RCC)	Reads the on and off status of contact. - 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 ellapsed 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 using the code “MC or MD”.
Preset contact area (fill command)	SC	Embeds the areaof 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.

15.6 Hexadecimal/Binary/BCD

Decimal	Hexadecimal	Binary data	BCD data (Binary Coded Decimal)
0	0000	00000000 00000000	0000 0000 0000 0000
1	0001	00000000 00000001	0000 0000 0000 0001
2	0002	00000000 00000010	0000 0000 0000 0010
3	0003	00000000 00000011	0000 0000 0000 0011
4	0004	00000000 00000100	0000 0000 0000 0100
5	0005	00000000 00000101	0000 0000 0000 0101
6	0006	00000000 00000110	0000 0000 0000 0110
7	0007	00000000 00000111	0000 0000 0000 0111
8	0008	00000000 00001000	0000 0000 0000 1000
9	0009	00000000 00001001	0000 0000 0000 1001
10	000A	00000000 00001010	0000 0000 0001 0000
11	000B	00000000 00001011	0000 0000 0001 0001
12	000C	00000000 00001100	0000 0000 0001 0010
13	000D	00000000 00001101	0000 0000 0001 0011
14	000E	00000000 00001110	0000 0000 0001 0100
15	000F	00000000 00001111	0000 0000 0001 0101
16	0010	00000000 00010000	0000 0000 0001 0110
17	0011	00000000 00010001	0000 0000 0001 0111
18	0012	00000000 00010010	0000 0000 0001 1000
19	0013	00000000 00010011	0000 0000 0001 1001
20	0014	00000000 00010100	0000 0000 0010 0000
21	0015	00000000 00010101	0000 0000 0010 0001
22	0016	00000000 00010110	0000 0000 0010 0010
23	0017	00000000 00010111	0000 0000 0010 0011
24	0018	00000000 00011000	0000 0000 0010 0100
25	0019	00000000 00011001	0000 0000 0010 0101
26	001A	00000000 00011010	0000 0000 0010 0110
27	001B	00000000 00011011	0000 0000 0010 0111
28	001C	00000000 00011100	0000 0000 0010 1000
29	001D	00000000 00011101	0000 0000 0010 1001
30	001E	00000000 00011110	0000 0000 0011 0000
31	001F	00000000 00011111	0000 0000 0011 0001
.	.	.	.
.	.	.	.
.	.	.	.
63	003F	00000000 00111111	0000 0000 0110 0011
.	.	.	.
.	.	.	.
.	.	.	.
255	00FF	00000000 11111111	0000 0010 0101 0101
.	.	.	.
.	.	.	.
.	.	.	.
9999	270F	00100111 00001111	1001 1001 1001 1001

15.7 ASCII Codes

								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
b7	b6	b5	b4	b3	b2	b1	b0	R \ C	0	1	2	3	4	5	6	7
				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

Record of changes

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Please contact ....

Panasonic Electric Works Co., Ltd.

Automation Controls Business Unit

■Head Office: 1048, Kadoma, Kadoma-shi, Osaka 571-8686, Japan

■Telephone: +81-6-6908-1050

■Facsimile: +81-6-6908-5781

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