Panasonic®

PANEL MOUNTED CONTROLLER

FP-e
User's Manual

FP-e User's Manual
ARCT1F369E-3 '06.2

Table of Contents

Precautions before using FP-e unit

Installation environment

Do not use the FP-e Control Unit in the places where it will be exposed to the followings:

- Direct sunlight and ambient temperature outside the range of 0ºC to 55ºC (32°F to 131°F).
- Ambient humidity outside the range of 30% to 85% RH(at 25ºC) and sudden temperature changes causing condensation.
- Inflammable or corrosive gas.
- Excessive vibration or shock.
- Excessive airborne dust, metal particles or salts.
- Water or oil in any from including spray or mist.
- Benzine, paint thinner, alcohol or other organic solvents or strong alkaline solutions such as ammonia or caustic soda.
- Influence from power transmission lines, high voltage equipment, power cables, power equipment, radio transmitters, or any other equipment that would generate high switching surges.

Static electricity

- Before touching the unit, always touch a grounded piece of metal in order to discharge static electricity.
- In dry locations, excessive static electricity can cause problems.

Cleaning

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

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.
- If using a power supply without a protective circuit, power should be supplied through a protective element such as a fuse.
- If an incorrect voltage is directly applied, the internal circuit may be damaged or destroyed.

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

Before turning on the power

When turning on the power for the first time, be sure to take the precautions as shown below.

- When performing installation, confirm that there are no scraps of wiring, particularly conductive fragments, adhering to the unit.
- Confirm 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 RUN/PROG. switch to PROG. mode.

Before entering a program

Be sure to perform a program clear operation before entering a program.

Operation procedure when using Windows software FPWIN GR Ver. 2

1. Press “CTRL” and “F2” keys at the same time to switch the display to “Online Monitor.”
2. Select [Edit (E)] → [Program Clear (L)] on the menu.
3. When the confirmation dialog box appears, click [Yes (Y)] to clear the program.

Storing a program

To prevent the accidental loss of programs, users are requested to take the following measures.

Drafting documents

To avoid accidentally losing programs, destroying files, or overwriting the contents of a file, documents should be printed out and then saved.

Specifying the password carefully

The passward 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 passward is forcibly cleared, the program is deleted. When spesifying the passward, note it in the spcifications or in another safe locaton in case it is forgotten at some point.

Battery

Do not install the battery when it is not used.

There is a possibility of leak if the battery remains discharged.

Programming tools

(As of Apr., 2004)

Type		Restrictions	Instruction used/Function restrictions
Windows software	FPWIN GR Ver. 2	Available.	Available from Ver. 2.2 or higher. *1)
	FPWIN GR Ver. 1	Not available.	Not available.
Windows software conforms to IEC 61131-3	FPWIN Pro Ver. 4	Available	Available from Ver. 4.1 or higher. *2)
MS-DOS software	NPST-GR Ver. 4	Not available.	Not available.
	NPST-GR Ver. 3		
Handy programming unit	AFP1113V2 AFP1114V2	Not available.	Instructions and functions described in *3 can not be used. Use FPWIN GR or FPWIN Pro.
	AFP1113 AFP1114	Not available.	Not available.
	AFP1111A AFP1112A AFP1111 AFP1112	Not available.	Not available.

Notes: Precautions concerning programming tools

*1) Customers who use FPWIN GR Ver. 2 can upgrade the version from our HP free of charge.
Use Ver. 2.3 or higher to set the COM. port to MODBUS S RTU.
(MODBUS S RTU is available from FP-e main unit Ver.1.2 or higher.)

*2) Customers who use FPWIN Pro Ver.4 can upgrade the version from our HP free of charge.
The COM. port cannot be set to MODBUS S RTU.
It will be available from FPWIN Pro Ver. 5.

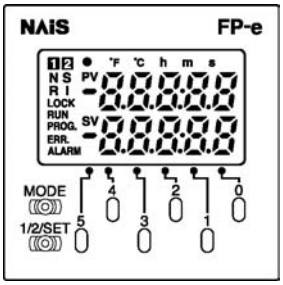
*3) Functions that can not be used using a handy programming unit (AFP1113V2 and AFP1114V2):
- Screen display registry instruction <F180 (SCR)>
- Screen display switch instruction <F181 (DSP)>
- Leading edge differential instruction (Initial execution type) <DFI>
- On-delay timer instruction <TML>
- Clear multiple steps instruction <SCLR>
- Floating-point type data instruction <F309> to <F338>
- PID processing instruction <F355>

Chapter 1

Features and Configurations

1.1 Features and Functions

1.1.1 Features



1. IP 66-compliant panel mounting type

Mounting panel front is waterproof and compliant with IP66, IEC standard.
Compact controller: 48 mm (H), 48 mm (W), 70 mm (D)

2. Indicator function

Simple characters and numerical values (with a minus sign) can be displayed up to 5 digits. *
4 modes (N, S, R, and I modes) can be selected.
Those 4 modes each have 2 selectable displays.
Data indication section can be displayed in red, green, or orange.

3. Operation switches

Set data can be changed.
This switch can be used as an input switch.

4. Control function

In addition to the functions of the programmable controller FP0 series, pulse output and high-speed counter functions are installed.
General-purpose communication COM. port is included as standard unit.
FP-e units with the calendar timer or thermocouple input function are also provided.

*Numerical values are displayed only in 16-bit. The data can be displayed in a bit, decimal, or hexadecimal system.

1.1.2 Functions

Item	Description
Power supply	24V DC
Input	8 points *1) (24V DC)
Output	6 points (5 points : Tr. NPN 0.5A, 1 point : Ry 2A)
Program capacity	2.7 k step
Operation speed	0.9 μ/step (Basic instruction)
I/O update and Base time	2 ms *2)
Pulse catch/Interrupt input	6 points in total (High-speed counter included)
High-speed counter	Single phase: 4 points (10 kHz in total) Dual phase: 2 points (2 kHz in total) *3)
Pulse output	2 points (10 kHz in total) *4)
COM. port	RS232C/RS485 (according to models) * Must be provided aside from tool ports

*1) Thermocouple input type: 6 points
*2) Thermocouple input type: 2 to 3 ms (Typical), Max: 15 ms. (The time takes longer every 250 ms.)
*3) Thermocouple input type: 5 kHz (Single phase), 1 kHz (Dual phase)
*4) Thermocouple input type: 5 kHz

1.2 Unit Name and Product Number

1.2.1 FP-e control unit

Name	Number of I/O points	Thermo-couple input	Calendar timer	COM port	Product No.
FP-e control unit (Standard type)	Input: 8/Output: 6 (Tr. NPN: 5, Ry: 1)	Not available	Not available	RS232C	AFPE224300
FP-e control unit (Calendar timer type)	Input: 8/Output: 6 (Tr. NPN: 5, Ry: 1)	Not available	Available	RS232C	AFPE224305
FP-e control unit (Thermocouple input type)	Input: 6/Output: 6 (Tr. NPN: 5, Ry: 1)	2 points	Available	RS232C	AFPE214325
FP-e control unit (Standard type)	Input: 8/Output: 6 (Tr. NPN: 5, Ry: 1)	Not available	Not available	RS485	AFPE224302
FP-e control unit (Thermocouple input type)	Input: 6/Output: 6 (Tr. NPN: 5, Ry: 1)	2 points	Not available	RS485	AFPE214322

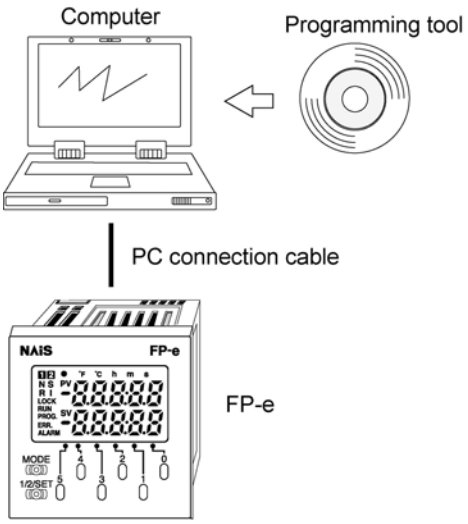
1.2.2 Related parts

Name	Description	Product No.
Terminal driver	Used for connecting a terminal	AFP0806
Rubber gasket	Used for a waterproof unit (included in a unit package)	ATC18002
Mounting frame	Used for mounting a unit. (included in a unit package)	ATA4811
Battery for FP Σ	Used for calendar timer and operation memory backup. (Included in calendar timer function-provided type and themocouple input type)	AFPG804
Protective cover	Oil resistant soft cover	AQM4803
Terminal socket set	Set of four types of terminal socket for FP-e (Maintenance parts)	AFPE804
Panel cover (20-pack)	Color: Black, with NAiS・FP-e mark	AFPE803
	Color: Ash gray, without NAiS・FP-e mark	AFPE805
	Color: Black, without NAiS・FP-e mark	AFPE806

1.3 Programming Tool

1.3.1 When using a tool software

- Tools needed for programming



1. Programming tool software

- The tool software can also be used with the FP series.
- The "FPWIN GR Ver. 2" or "FPWIN Pro Ver. 4" (for Windows) is used with FP-e controllers.
- Note that the earlier "FPWIN GR Ver. 1," "NPST-GR (DOS version), or "FP programmer" cannot be used.

2. PC connection cables

This cable is needed for connection between the FP-e unit and the computer.

Software environment and suitable cables

- Standard ladder diagram tool software "FPWIN GR Ver. 2"

Type of software		OS (Operating system)	Hard disc capacity	Product No.
FPWIN GR Ver. 2 English-language menu	Full type	WINDOWS 95 (OSR2 or higher)/ 98/Me/ NT (Ver. 4.0 or higher)/ 2000/XP	40 MB or more	AFPS10520
	Upgraded version			AFPS10520R
	Small type			AFPS11520

Note 1) To use the "FP-e," software Ver. 2.2 or higher is required.
The software Ver. 2.3 or higher is required to set the COM. port to MODBUS S RTU.
Customers who use the Ver.2 software can upgrade it through our HP free of charge.

Note 2) Customers who use the "FPWIN GR Ver.1" can use the "FPWIN GR Ver. 2" after purchasing the upgraded version software.
(The upgraded version software can be installed only when the "Ver.1.1" has been previously installed.

Note 3) Small type version can be used for the "FP-e," "FPΣ," "FP0," "FP1," and "FP-M" series.

- IEC61131-3-compliant programming tool software FPWIN Pro Ver.4

Type of software		OS (Operating system)	Hard disc capacity	Product No.
FPWIN Pro Ver.4 English-language menu	Full type	WINDOWS 95 (OSR2 or higher)/ 98/Me/ NT (Ver. 4.0 or higher)/ 2000/XP	100 MB or more	AFPS50540
	Small type			AFPS51540

Note 1)To use the "FP-e software Ver. 4.1 or higher is required.
Customers who use the Ver. 4 software can upgrade it through our HP free of charge.
The COM. port cannot be set to MODBUS S RTU. It will be available from FPWIN Pro Ver. 5

Note 2) Small type version can be used for the "FP-e," "FPΣ," "FP0," "FP1," and "FP-M" series.

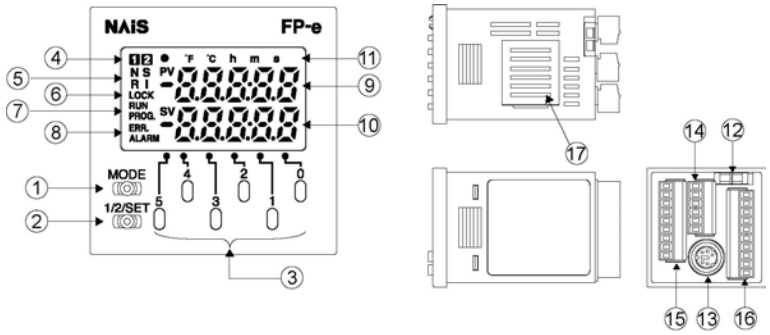
- Type of computer and suitable cables

Connecter	Connecter on PLC side	Product No.
D-Sub 9-pin	Mini DIN round 5-pin	AFC8503
	Mini DIN round 5-pin streight type	AFC8503S

Chapter 2

Functions and I/O specifications

2.1 Section Names and Functions



①Display mode switch

Changes the display mode to N, S, R, or I.
When the switch is pressed for 2 seconds or longer, the front switch key is locked. Pressing the switch once more for 2 seconds or longer unlocks the key.

②Screen changeover switch

Changes the display to 1st Screen or 2nd Screen.
When the numerical data is changed, pressing the switch for one second or longer determines the data.

③Front operation switch

Changes the data. This switch is also used as the input switch.
Pressing a switch of the digit for which you would like to change the numerical value during the data change adds one to the numerical value displayed.
(Data display blinks during the data change.)

④Display screen No.

Indicates the screen number used currently. "1st" or "2nd" is displayed.

⑤Display mode

Indicates "N," "S," "R," or "I."

⑥LOCK display

Shows that the switch is locked.
(This display is lit when "LOCK" using the front switch or "ALL LOCK" using the program is selected.)

⑦RUN/PROG. display

Displays the operation mode (RUN or PROG.).

⑧ERR./ALARM display

Indicates when an error or an alarm occurs.
ERR. : Lights up if an error is detected during the self-diagnostic function.
ALARM: Lights up if a hardware error occurs, or if operation slows because of the program, and the watchdog timer is activated.

⑨Data display (Upper section)

N and S modes

- Display the data registered using the F180 (SCR) command.
- Display the data in red, green, or orange.

R mode

- Displays the address in the memory area in green.

I mode

- Displays the external input monitor in green.

⑩Data display (Lower section)

N and S modes

- Display the data registered using the F180 (SCR) command.
- Blink when the numerical value is changed.
- Display the data in red, green, or orange.

R mode

- Displays the data in the memory area in green.

I mode

- Displays the external output monitor in green.

⑪Setting display

Indications (e.g.●, ºF, ºC, h, m, s, SV, and PV) and dot between the digits can be displayed individually by the ladder program.

⑫Mode switch (RUN/PROG.)

Changes the mode of the FP-e unit to RUN or PROG. Modes can also be changed from the programming tool.

When performing remote switching from the programming tool, the position of the mode switch and the actual mode of operation may differ.

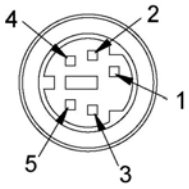
Verify the mode with the RUN/PROG. display on the front.

When power is supplied, the mode displayed is activated.

⑬Tool port (RS232C)

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.	Name	Abbr.	Signal direction
1	Signal ground	SG	-
2	Send data	SD	Unit → External device
3	Receive data	RD	Unit ← External device
4	(Not used)	-	-
5	+5V	+5V	Unit → External device

*The followings are default settings. Use the system register to change the settings.

Baud rate----------9600bps

Character bit length----------8 bit

Parity check----------Odd parity

Stop bit----------1 bit

ower supply/COM. port connector

nput connector

utput connector

attery cover

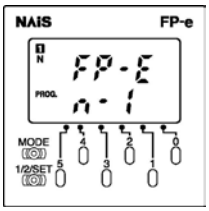
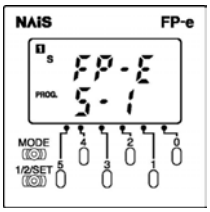
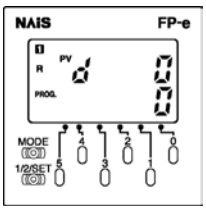
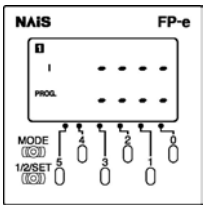
Note: Colors in the display section

④ to ⑦ and ⑪: green ⑧: red

⑨ and ⑩: red, green, or orange (N and S modes), green (R and I modes)

2.2 Display Modes and Functions

2.2.1 Display modes and functions

Mode	N mode (Normal mode)	S mode (Switch mode)	R mode (Register mode)	I mode (I/O monitor mode)
Screen	 Registered by F180 (SCR) command	 Registered by F180 (SCR) command	 Data monitor of the internal memory	 · External I/O monitor · Thermocouple input monitor
Number of screens	2	2	2	2
Display in the upper section	Arbitrary data display (Characters/Numerical values)	Arbitrary data display (Characters/Numerical values)	Address in the memory area	· Input status monitor ·Thermocouple input CH.0 monitor
Display in the lower section	Arbitrary data display (Characters/ Numerical values)	Arbitrary data display (Characters/ Numerical values)	Data in the memory area (Displayed in a decimal number system.)	· Output status monitor ·Thermocouple input CH.1 monitor
Operation switch	Used for changing numerical values	Used as the input switch	Used for changing numerical values	Used as the input switch
Example	Using the F180 (SCR) command, the elapsed value on the counter is displayed in the upper section, and the set value is displayed in the lower section. The set value can be changed with the front operation switch.	Using the F180 (SCR) command, the message is displayed in the upper section, and the data is displayed in the lower section. The display description can be changed with the input switch.	When program operation is checked, the data description can be checked by specifying the arbitrary memory area with the front operation switch. The data can also be changed with the front operation switch.	When program operation is checked, external I/O status is monitored. The front operation switch can be used as the input switch.(However, the input status of the front operation switch cannot be monitored.)

Note 1) Whenever the display mode switch is pressed, the mode displayed changes as follows: N→S→R→I→N. The display can also be switched from the program using the F180 (DSP) command.

Note 2) When the display mode switch is pressed for 2 seconds or longer, the front switch is locked. Pressing the switch once more for 2 seconds or longer unlocks the switch.

Note 3) Screen changeover switch changes the display to 1st Screen or 2nd Screen.

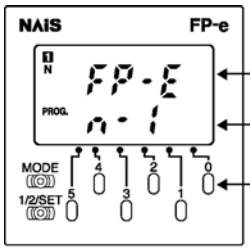
Note 4) When the numerical values are changed, pressing the screen changeover switch for one second or longer determines the data.

Note 5) The operation switches can also be used as input switches in all modes.

Reference: A.2 I/O Allocation

2.2.2 Mode Displays

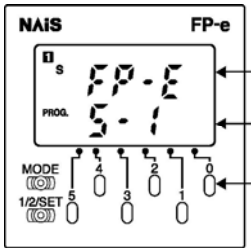
N (Normal) mode Screen is registered using the F180 (SCR) command.



Upper section: Arbitrary character data or numerical values *
(WX, WY, WR, SV, EV, DT, IX, IY)
Lower section: Arbitrary character data or numerical values *
(WY, WR, SV, EV, DT, IX, IY)
Operation switch: The numerical value in the lower section can be changed when displayed in a decimal or hexadecimal number system.

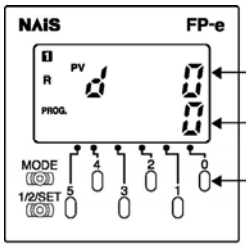
*Numerical values are displayed only in 16-bit. The data can be displayed in a bit, decimal, or hexadecimal system.

S (Switch) mode Screen is registered using the F180 (SCR) command.



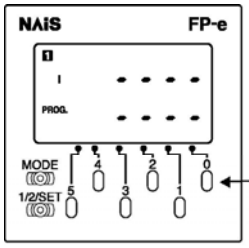
Upper section: Arbitrary character data or numerical values
(WX, WY, WR, SV, EV, DT, IX, IY)
Lower section: Arbitrary character data or numerical values
(WY, WR, SV, EV, DT, IX, IY)
Operation switch: Can be used as the input switch.

R (Register) mode Screen cannot be defined using the F180 (SCR) command.



Upper section: Device type (DT, WR, SV, or EV) and its address in the memory area
Lower section: Data in the memory area
Operation switch: Device type (DT, WR, SV, or EV), its address in the memory area, and data can be changed using this switch.

I (I/O monitor) mode Screen cannot be defined using the F180 (SCR) command.



1st Screen: Upper section: External input (WX0) monitor display
Lower section: External output (WY0) monitor display

2nd Screen: Upper section: Temperature display of the thermocouple input CH.0
Lower section: Temperature display of the thermocouple input CH.1

Operation Switch: Can be used as the input switch.

2.3 Input and Output Specifications

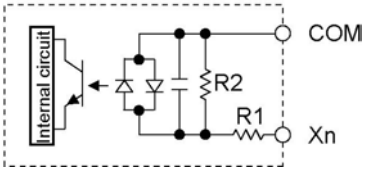
2.3.1 Input specifications

- DC input specifications (X0 toX7)

Item		Description
Number of input		8 points 6 points (thermocouple input type)
Insulation method		Optical coupler
Rated input voltage		24 V DC
Operating voltage range		21.6 to 26.4 V DC
Rated input current		Approx. 4.3 mA
Input points per common		8 points/common, 6 points/common (thermocouple input type) (Either the positive or negative of the input power supply can be connected to common terminal.)
ON voltage/ON current		19.2 V or less / 4 mA or less
OFF voltage/OFF current		2.4 V or more / 1 mA or more
Input impedance		Approx. 5.1 kΩ (X0, X1) Approx. 5.6 kΩ (X2 to X7)
Response time	**OFF to ON**	50 µs or less (X0, X1) Note) 100 µs or less (X2 to X5) Note) 2 ms or less (X6, X7)
	ON to OFF	50 µs or less (X0, X1) Note) 100 µs or less (X2 to X5) Note) 2 ms or less (X6, X7)
Operation indicator		LCD display (I/O monitor mode)

Note) X0 through X5 are inputs for the high-speed counter and have a fast response time. If used as normal inputs, you are recommend to insert a timer in the ladder program as chattering and noise may be interpreted as an input signal.
Also, the above specifications apply when the rated input voltage is 24V DC and the temperature is 25 ºC.

Internal circuit diagram



	R_1	R_2
X0 and X1	5.1 kΩ	3 kΩ
X2 to X5	5.6 kΩ	2 kΩ
X6 and X7	5.6 kΩ	1 kΩ

- Thermocouple input specifications

Item	Specifications
Number of input	2 points (CH0: WX1, CH1: WX2)
Temperature sensor type	Thermocouple type K
Input range	- 30.0 to 300.0 ºC *1) (- 22 to 572 ºF)
Accuracy	±0.5%FS±1.5 ºC (FS = -30 to 300 ºC)
Resolution	0.1 ºC
Conversion time	250 ms/2CH *2)
Insulation method	Between internal circuit and thermocouple input circuit: noninsulated *3) Between CH0 and CH1 of thermocouple input: PhotoMos insulation
Detection function of wire disconnection	Available

*****1)Temperature can be measured up to 330 ºC (626 ºF). When the measured temperature exceeds 330 ºC (626 ºF) or the thermocouple wiring is disconnected, "K20000" is written to the register.

*****2)Temperature conversion for thermocouple input is performed every 250 ms. The conversion data is updated on the internal data register after the scan is completed.

*****3)The internal circuit and thermocouple input circuit are not insulated. Therefore, use the nongrounding type thermocouples and sheath tubes.

Note:

- To prevent the influence of noise, use the shielded thermocouples and compensating lead wires after grounding them. When the shielding types are not used, thermocouples and compensating lead wires should be used less than 10 m.
- When the wire of the thermocouple is extended, be sure to use compensating lead wires according to the thermocouple type.
- It takes about 2 seconds until the input processing is completed after the power is supplied. Therefore, the input data is necessary to be valid after the temperature input completion flags X4E (CH0) and X4F (CH1) turn ON.
  After that, the temperature input completion flags turn on for only one scan at every time that the temperature conversion process has been completed (every 250ms approx).
- 1 to 50 times (Average) can be set using the system register 409. The initial setting is "0." (Average: 20 times)
  Set the value to 20 or more to prevent the fluctuation of the thermocouple input value.
- For accurate temperature measurement, we recommend to warm up the unit for 30 minutes after the power is supplied.
- Connecting/disconnecting the thermocouple input terminal block while the thermocouple unit is ON will lower accuracy temporarily. In that case, it is recommended to warm up the unit for at least 15 minutes.
- A rapid temperature change in the thermocouple unit might change the temperature data temporarily.
- Prevent a direct air (wind) from the cooling fan built in the control panel etc. The direct air (wind) to the thermocouple unit will lower accuracy.

Example of Input temperature and internal data processing

Input temperature	Internal data (WX1 and WX2)
- 30.0 ºC (- 22.0 ºF)	K-300 (K-220)
25.0 ºC (77.0 ºF)	K 250 (K 770)
200.0 ºC (392.0 ºF)	K2000 (K3920)

To display the temperature in the Fahrenheit scale (ºF), turn Y37 contact ON.

F = C x 9/5 + 32

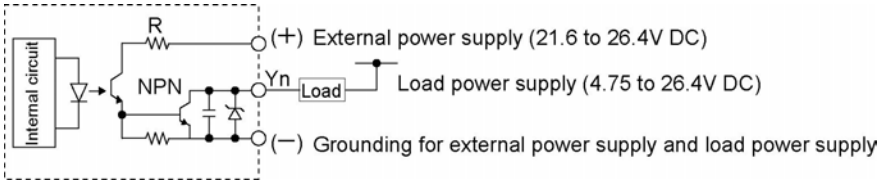
F: Fahrenheit, C: Celsius, 0 ºC = 32 ºF, 100 ºC = 212 ºF

2.3.2 Output specifications

-Transistor output specifications (For Y0 to Y4)

Item		Description (NPN)
Number of output		5 points
Insulation method		Optical coupler
Output type		Open collector
Rated load voltage		5 to 24 V DC
Operating load voltage range		4.75 to 26.4 V DC
Max. load current		0.5 A
Max. surge current		1 A
Output points per common		5 points/common
OFF state leakage current		100 μA or less
ON state voltage drop		1.5 V or less
Response time	**OFF to ON**	50 μs or less (For Y0 and Y1) 1 ms or less (For Y2,Y3 and Y4)
	ON to OFF	50 μs or less (For Y0 and Y1) 1 ms or less (For Y2,Y3 and Y4)
External power supply (For driving internal circuit)	**Voltage**	21.6 to 26.4 V DC
	Current	6 mA/point (For Y0 and Y1) 3 mA/point (For Y2, Y3, and Y4)
Surge absorber		Zener diode
Operation indicator		LCD display (I/O monitor mode)

Internal circuit diagram

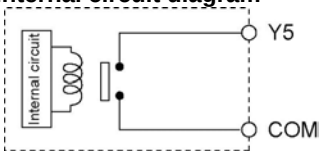


- Relay output specifications (Y5)

Item		Description
Number of output		1 point
Output type		Normally open (1 Form A)
Rated control capacity		2 A 250 V AC, 2 A 30 V DC Note1)
Output points per common		1point/common
Response time	**OFF to ON**	Approx. 10 ms
	ON to OFF	Approx. 8 ms
Life time	**Mechanical**	Min. 20,000,000 operations
	Electrical	Min. 100,000 operations (resistive load) Note2)
Surge absorber		None
Operation indicator		LCD display (I/O monitor mode)

Note1) Resistance load
Note2) Open/Close frequency: 20 times/min (at the rated control capacity)

Internal circuit diagram



2.4 Display/Front Operation Switch Specifications

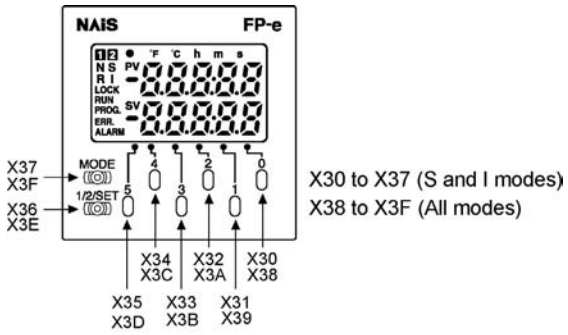
- Display section specifications

Item	Description
Data display	5 digits with a decimal point. (Minus sign can also be used.) Note) 7-segment, color selectable display (Green, red, or orange)
Mark display	PV SV (Green, red, or orange) ● ºF ºC h m s (Green)
Display mode	4 modes (Green) N : Normal mode---Simple characters, data display, data setting/data input switch S : Switch mode----Simple characters, data setting/PLC external input switch R : Register mode---Internal data, timer/counter value reading and writing modes I : I/O monitor mode---I/O status display/PLC external input switch
Screen No.	1 2 (Green)
Status display	LOCK, RUN and PROG. (Green) ERR ALARM (Red)
Switch input	8 points For mode switching 1 point For screen switching 1 point For data setting or external input 6 points *Refer to the input address (below) for external input.
Display	Negative backlight LCD (Colors in the numerical section can be changed: green, red, or orange
Size of the characters	7-segment 6.7 mm PV SV 1.6 mm N S R I 1.7 mm ● ºF ºC h m s 1.6 mm LOCK, ERR, ALARM 1.4 mm

Note: Numerical values are displayed only in 16-bit. The data can be displayed in a bit, decimal, or hexadecimal system.

- Front operation switch (External input address)

When the front operation switch is used for external input, use the allocated addresses as shown below.



Example: When “0” is pressed during the S mode, “X30” and “X38” turn ON at the same time.

Reference: A.2 I/O allocation

2.5 Calendar timer

2.5.1 Area for calendar timer

With the clock/calendar function, data indicating the hour, minute, second, day, year and other information stored in the special data registers DT9053 to DT9057 can be read using the transmission instruction and used in sequence programs.

Special data Register No.	Upper byte	Lower byte	Reading	Writing
DT9053	Hour data H00 to H23	Minute data H00 to H59	Available	Not available
DT9054	Minute data H00 to H59	Second data H00 to H59	Available	Available
DT9055	Day data H01 to H31	Hour data H00 to H23	Available	Available
DT9056	Year data H00 to H99	Month data H01 to H12	Available	Available
DT9057	—	Day- of - the-week data H00 to H06	Available	Available

Note:

1. The area above is available for the FP-e unit with a calendar timer function.
2. The value is not fixed initially when the battery is connected. Set the appropriate value to the calendar timer.
   Lithium battery is included in the FP-e unit, but it is not connected to the unit. Connect the battery to the unit before using the FP-e controller.
3. Put in a new battery within a minute after removing the old battery.
4. A calendar timer is available only when a battery is installed.

2.5.2 Setting of calendar timer function

There are two ways to set the calendar timer function as described below.

- Setting using FPWIN GR

1. Press the **[CTRL]** and **[F2]** keys at the same time, to switch the screen to **[Online].**
2. Select “Set PLC Date and Time” under “Tool” on the menu bar.

PLC Date and Time setting dialog box

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

- Setting and changing using program

1. The values written to the special data registers DT9054 to DT9057, which are allocated as the calendar timer setting area, are transferred.
2. A value of H8000 is written to DT9058.

Example: showing the date and time being written
Set the time to 12:30:00 on the 5th day of October, 2002 when the X0 turns ON.

2.5.3 Accuracy of calendar timer

Accuracy
200 s / month (0 ºC)
70 s / month (25 ºC)
240 s /month (55 ºC)

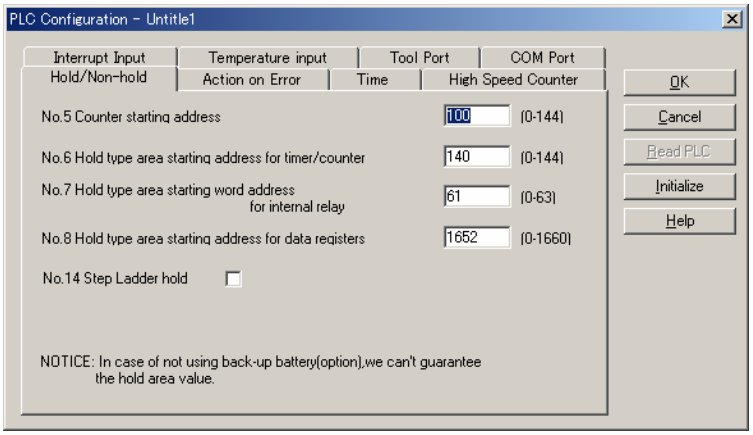
2.6 Limitations in data hold/non-hold function

Setting a system register can expand the data hold area. In this case, however, a back-up battery must be previously installed.

Product No.	Settings Note 1	Data
AFPE224300 AFPE224302 AFPE224322 Note 2	System register setting	Non-hold
AFPE224305 AFPE214325	System register setting with a back-up battery	Hold
	System register setting without a back-up battery	Non-hold

Note 1: System register settings are effective only when a back-up battery is installed in the FP-e control unit.(A set value will be returned to the default value.)
Note 2: A back-up battery cannot be installed in this type of product.

System register setting screen – (Hold/Non-hold)
Areas for Nos. 6, 7, 8 and 14 can be expanded.



Note: “NOTICE” in the screen above is described for the FPWIN GR Ver. 2.24 or higher.

Note: System register initial values on Hold/Non-hold tab are within the ones that can be backed up with a ROM.

Chapter 3

Installation and Wiring

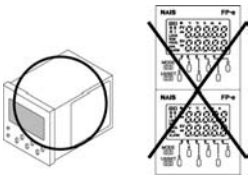
3.1 Installation

3.1.1 Operating environment

Avoid mounting the unit in the following locations:
-Ambient temperatures outside the range of 0 ºC to 55 ºC.
-Ambient humidity outside the range of 30 % to 85 %RH (at 25 ºC, non-condensing).
-Sudden temperature changes causing condensation
-Corrosive and inflammable gases
-Excessive airborne dust, metal particle, or salts
-Benzine, thinner, alcohol or other organic solvents, or strong alkaline solutions such as ammonia or caustic soda
-Excessive vibration or shock
-Direct sunlight
-Water, oil, or chemicals in any form including spray or mist

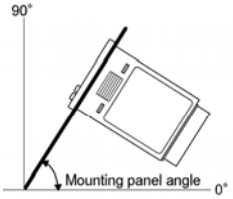
Measures regarding noise:
-The unit should be installed apart from the high voltage cables, high voltage equipment, power cables, power equipment, or any other equipment that would generate high switching surges.
-The unit should also be installed apart from the devices which have radio transmitters.
-If noise occurs in the power supply line even after the above countermeasures are taken, you are recommended to supply power through an insulation transformer, noise filter, or like.

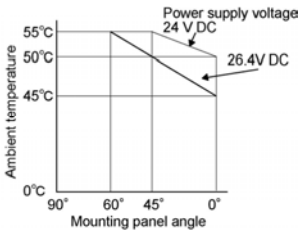
Measures regarding heat discharge:
-Always amount the unit oriented with the LCD facing upward in order to prevent the generation of heat. Do not amount the units vertically as shown below.



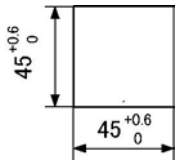
-Do not install the unit as shown below.

-Do not amount the unit above which generate large heat such as heaters, transformers, or large scale resisters.
Note that the ambient temperature and electrical voltage are restricted when the mounting panel is installed at the angle of 0 (horizontal) to 60.



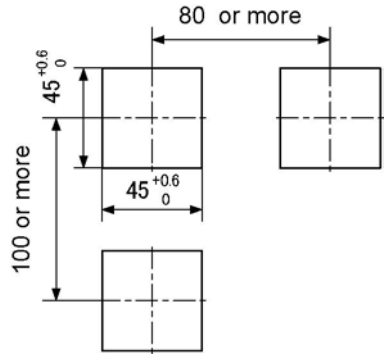


Mounting panel cut size (Unit: mm)
- Standard mounting panel cut size



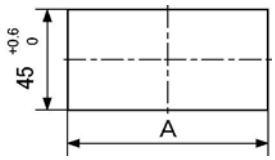
Mounting panel cut size is shown in the diagram on the left.
(Panel thickness: 1 to 5 mm)

-When using two or more units:



Make holes in the specified size as shown in the diagram on the left.

-When mounting units in a row

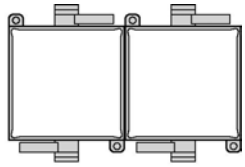


Units can be mounted horizontally in a row. In that case, however, waterproofing property on the unit will be lost.

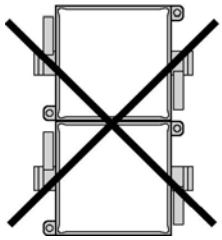
When "n" units are mounted in a row, "A" should be:

$$A = (48 \times n - 2.5)\ ^{+0.6}_{0}$$

Note: When mounting the units horizontally in a row:



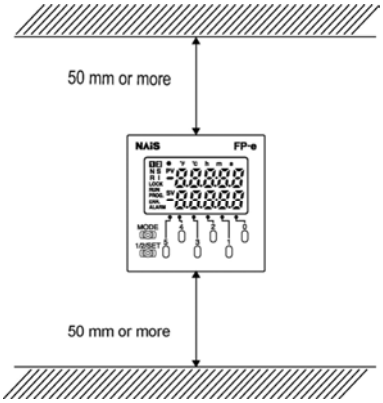
Mount the units oriented with the molded spring sections of the mounting flame facing upward and downward.



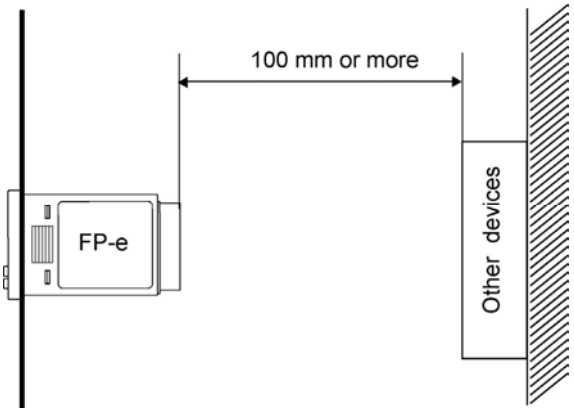
Do not mount the units vertically in a row in order to prevent the generation of heat.

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.

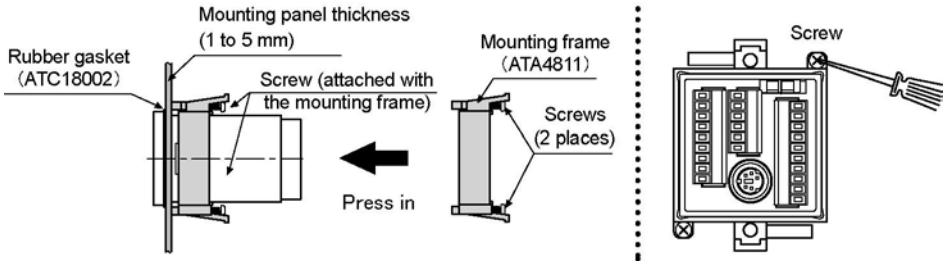


- Maintain 100 mm or more space between the unit and other devices in order to allow room for programming tool connections and wiring, or to avoid radiated noise and heat from other devices.



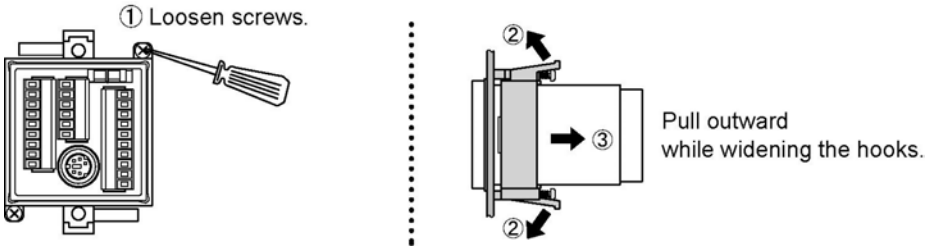
3.1.2 Mounting and Removing the Unit

Mounting the unit
Insert the unit into the mounting panel opening from its front and mount the mounting frame from the unit's rear all the way not to have any space with the mounting panel. In addition, secure the mounting frame using screws.



Precautions for mounting
The front of the unit is waterproof, but do not forget to fix the mounting frame using screws to make coherent a unit, rubber gasket and panel front sufficiently.
(Check the both screws are tightened to the same extent and are stable. Tightening too much might remove the mounting frame.)
Always mount a unit with a rubber gasket to keep the unit front section's waterproof.

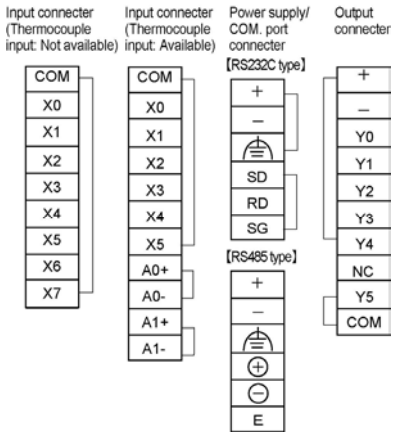
Removing the unit
Loosen the screws for the mounting frame. Then, pull outward the frame while widening the hooks.

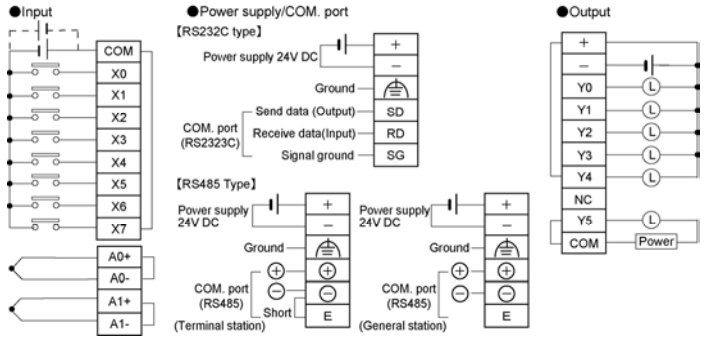


3.2 Terminal Layout Diagram and Terminal Block Wiring

3.2.1 Terminal layout diagram

-Terminal layout diagram **-Wiring diagram**

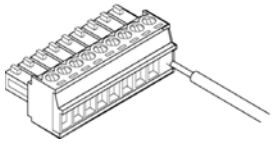




3.2.2 Terminal block wiring

Terminal block used and suitable wire

A screw-down terminal block (from Phoenix Contact Co.) or equivalent is used. The suitable wires are shown below.



-Suitable wires

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

For the COM. port and analog input section of the thermocouple input type, the suitable wire size is AWG#28 to 16 (0.08 mm^2 to 1.25 mm^2).

-Pole terminal with a compatible insulation sleeve

When a pole terminal is used, use the following models from Phoenix Contact Co.

Manufacturer	Cross-sectional area	Nominal cross-sectional area	Parts No.
Phoenix Contact Co.	0.25 mm^2	AWG#24	AI 0.25-6YE
	0.50 mm^2	AWG#20	AI 0.5-6WH
	0.75 mm^2	AWG#18	AI 0.75-6GY
	1.00 mm^2	AWG#18	AI 1-6RD
	0.5 mm^2 X 2	AWG#20 X 2	AI-TWIN2 X 0.5-8WH

-Pressure welding tool for pole terminals

Manufacturer	Model No.	
	Parts No.	Product No.
Phoenix Contact Co.	CRIMPFOX UD 6	12 04 43 6

Suitable screwdriver

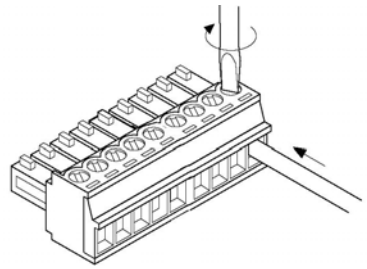
When tightening the terminals of the terminal block, use a screwdriver (Phoenix Contact Co. Product No.1205037) with a blade size of 0.4 X 2.5 (Model No. SZS 0.4 X 2.5)
The tightening torque should be 0.22Nm to 0.25 Nm (2.3 kgfcm to 2.5 kgfcm)

Manufacturer	Model No.		Order product No.
	Parts No.	Product No.	
Phoenix Contact Co.	SZS0.4 X 2.5	1205037	AFP0806

Wiring

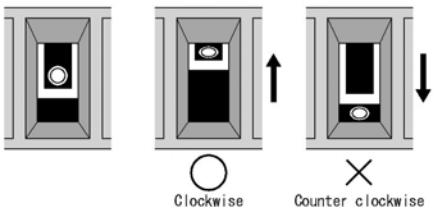
1. Remove a portion of the wire's insulation.

2. Insert the wire into the terminal block until it contacts the back of the terminal block. Then, tighten the screw clockwise to fix the wire in place.



Notes

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



3.3 Power Supply Wiring

3.3.1 Power supply wiring

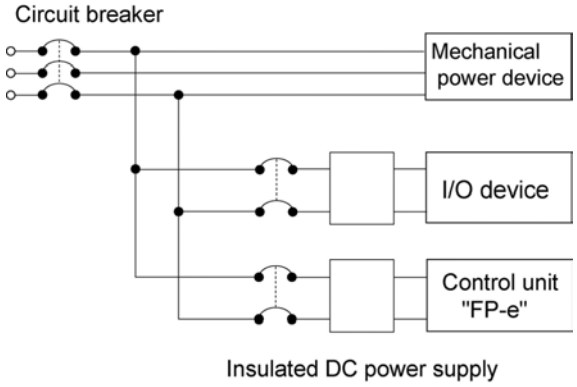
Power supply wire
To minimize adverse effects from noise, twist the wires of the power supply cable.

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 FP-e is a non-insulated type.
-When using a power supply device without an internal protective circuit, male sure power is supplied to the unit through a protective element such as a fuse.

Power supply voltage

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

Wiring system
Isolate the wiring systems to the control unit, input/output devices, and mechanical power devises.



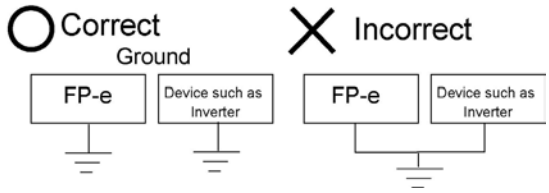
Power supply sequence

-The power supply sequence should be set so that power to the FP-e is tuned off before the input/output power turns off.
-If the input/output power supply turns off before the power to the FP-e turns off, the FP-e will detect the input fluctuations and may start an unscheduled sequential operation.

3.3.2 Grounding

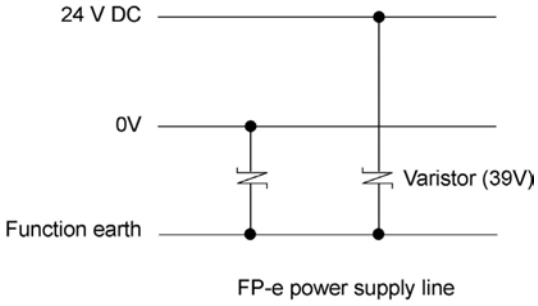
Grounding to prevent noise
Under normal conditions, the inherent noise resistance is sufficient. However, in situations of excessive noise, ground the instrument to increase noise suppression.

Use an exclusive ground
- For grounding purpose, use wiring with a minimum of 2 mm^2. The grounding connection should have a resistance of less than100Ω.
- The point of grounding should be as close to the FP-e unit as possible. The ground wire should be as short as possible.
- If two devices share a single ground point, it may produce an adverse effect. Be sure to use an exclusive ground for each device.

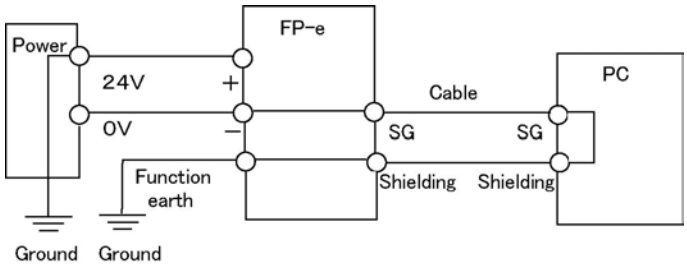


Note: Depending on the surroundings in which the FP-e unit is used, grounding may cause problems.

Example: The power supply line of the FP-e unit is connected to the function earth through a varistor. If there is an irregular potential between the power supply line and the earth, the varistor may be shortened.



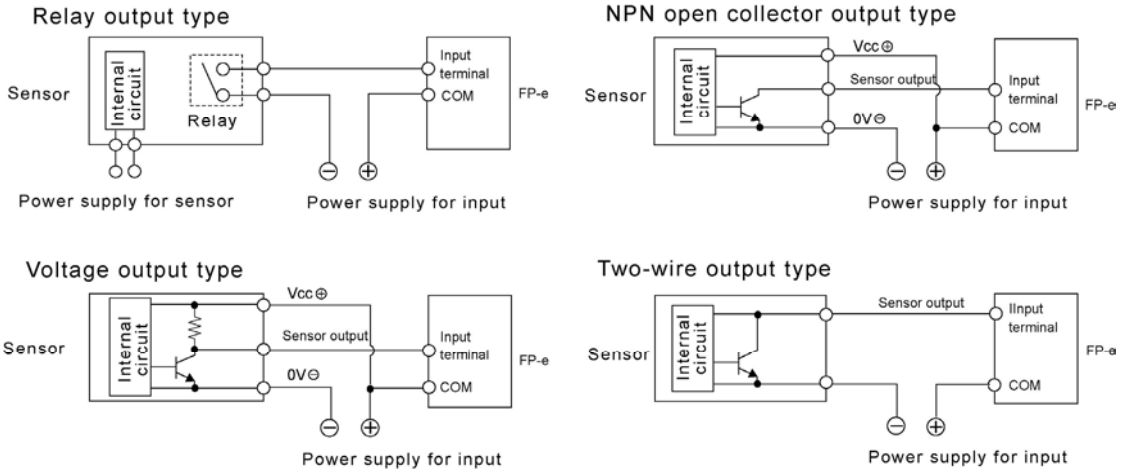
Do not ground an FP-e function earth terminal when grounding a plus (+) terminal of the power
The FP-e tool port shielding and function earth terminal are connected.
In some computers, the SG terminal of RS232C port and connector shielding are connected.
When the FP-e is connected to a computer with a plus (+) terminal grounded, therefore, an FP-e's minus (-) terminal is connected with the function earth terminal. As a result, short circuit occurs which may lead to the breakage of FP-e and its neighboring parts.



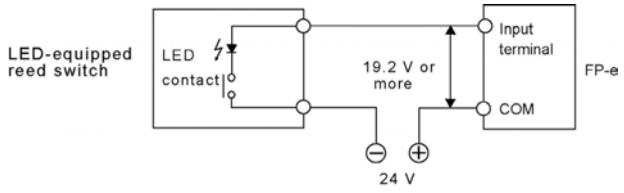
3.4 Wiring of Input and Output

3.4.1 Input wiring

- Connection of photoelectric sensor and proximity sensor

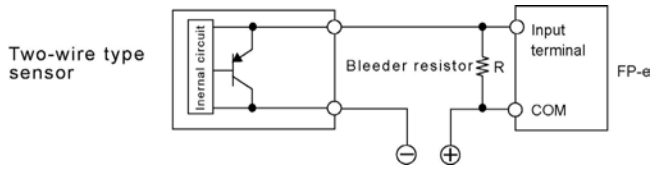


- Precaution when using LED-equipped reed switch



When a LED is connected in series to an input contact such as LED-equipped reed switch, make sure that the ON voltage applied to the FP-e input terminal is greater than 19.2V DC. In particular, take care when connecting a number of switches in series.

- Precaution when using two-wire type sensor



When the input of FP-e does not turn off because of leakage current from the two-wire type sensors (e.g. photoelectric sensor and proximity sensor), the use of a bleeder resistor is recommended, as shown in the diagram on the left.
The formula below is based on an input impedance of 5.6 kΩ The input impedance varies depending on the input terminal number.

I : Sensor's leakage current (mA)
R: Resistance of the bleeder resistor (kΩ)

The OFF voltage of the input is 2.4V. Determine the value of bleeder resistor "R" so that the voltage between the COM terminal and the input terminal will be less than 2.4V.

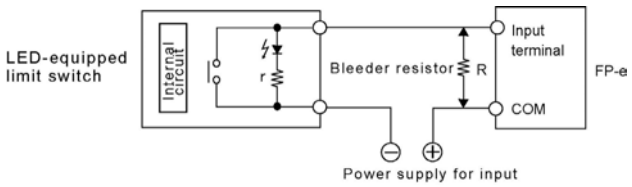
$$I \times \frac{5.6R}{5.6+R} \leqq 2.4 \qquad R \leqq \frac{13.44}{5.6I-2.4} \ (k\Omega)$$

The wattage (W) of the resistor is:

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

Normally, use a value that is 3 to 5 times determined for the value of "W."

- Precautions when using LED-equipped limit switch



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

r : Internal resistor of limit switch (kΩ)
R : Resistance of the bleeder resistor (kΩ)

The OFF voltage of input is 2.4V. When the power supply voltage is 24V, determine the value for the bleeder resistor "R" so that the current will be greater than "I" as shown below:

$$I = \frac{24-2.4}{r} \text{ or more}$$

"R" of the bleeder resistor is:

$$R \leqq \frac{13.44}{5.6I-2.4} \ (k\Omega)$$

The wattage (W) of the resistor is:

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

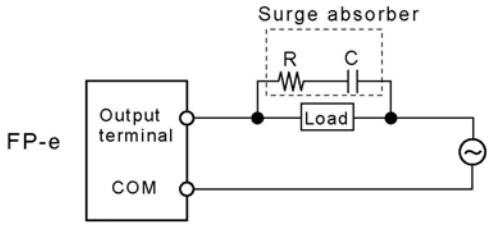
Normally, use a value that is 3 to 5 times determined for the value of "W."

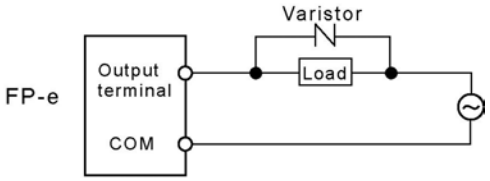
3.4.2 Output wiring

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 type, be sure to connect a diode across the ends of the load.

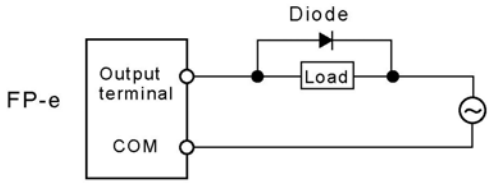
When using an AC inductive load (Relay output)





Example of surge absorber R: 50Ω
C: 0.47μF

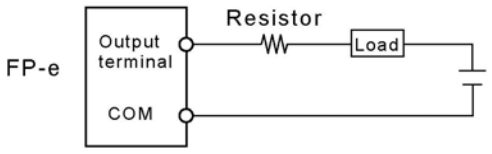
When using a DC inductive load

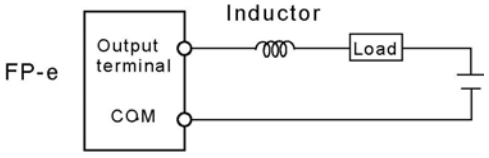


Diode
Reverse voltage: 3 times the load voltage
Average rectified forward current: Load current or more

Precautions when using capacitive load

When connecting large rush current loads, install a protection circuit (below) to minimize their effect.





Provide over-load protection with an external fuse

There is no fuse protection built into the output circuit. Therefore, in order to protect against overheating of the output circuit by possible short circuit, install an external fuse at each point. However, in cases such as short circuits, the control unit itself may not be able to be protected.

3.4.3 Common precautions for input and output wiring

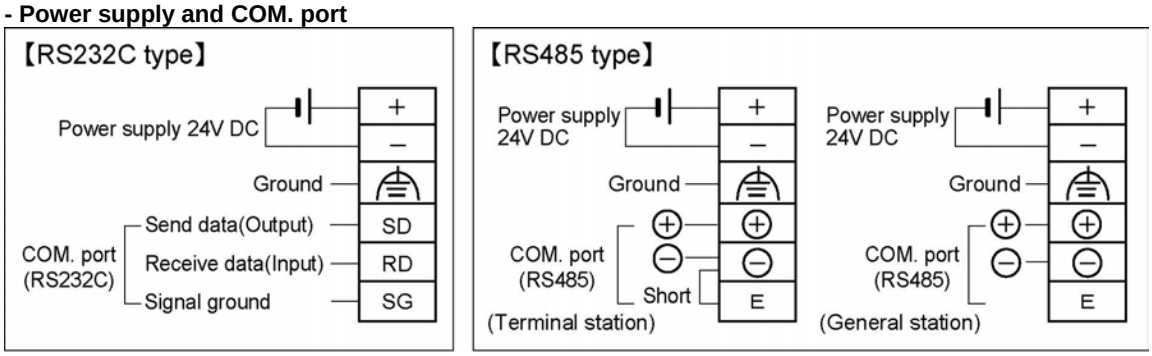
Separate the input, output, and power wiring

- 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 wiring are separated from the power wiring, as much as possible. Do not route them through the same duct or bind them together.
- Separate the input or output wire from the power's high voltage wire by at least 100 mm /3.937 in.

3.5 Wiring COM. Port

Terminal layout

- Power supply and COM. port



- COM. Port specifications

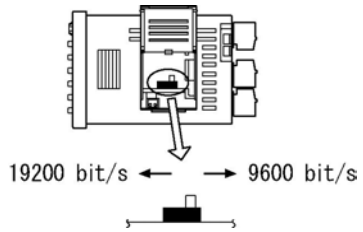
COM. port type	RX232C *Note 2	RS485
Isolation status with the internal circuit	Non-isolated	Isolated
Transmission distance	15 m	1200 m
Baud rate	300, 600, 1200, 2400, 4800, 9600, 19200 bit/s	9600, 19200 bit/s *Note 3, 4
Communication method	Half-duplex	
Synchro system	Synchronous communication method	
Transmission data format	Stop bit: 1-bit/2-bit	
	Parity: None/Even/Odd	
	Data length: 7-bit/8-bits	
	Beginning code: STX available/STX not available	
	Ending code: CR/CR+LF/None/ETX	
Data output order	Starting from 0 bit per character	
No. of connected units	–	99 *Note 5, 6
Communication mode	- General-purpose communication - Computer link - MODBUS S RTU *Note7	

Note1) When communicating between FP-e and other device, it is recommnedable to perform resend Processing as it may be affected by excessive noise depending on the environments installed.

Note2) For RS232C wiring, be sure to use shield wires for higher noise immunity.

Note3) Set the baud rate of RS485 to both FP-e system register and FP-e internal switch. Set the baud rate of RS232C to FP-e system register.

Note4) After sending a command from the FP-e in RS485 communication, send a response from the receiving device to the FP-e after the following time has been elapsed.
9600 bit/s: 2 ms or longer
19200 bit/s: 1 ms or longer
It takes at least 1 scan time (at least 2 ms) for the FP-e to send back a response after receiveing the command.



Note5) When our C-NET Adapter or other RS485 device than recommended is connected in the system, the maximum connection number is limited to 32 units.

Note6) For a RS485 converter on the computer side, SI-35 (from LINE EYE Co., Ltd.) is recommended. (When SI-35 is used in the system, up to 99 units can be connected.)

Note7) MODBUS S RTU (binary communication) is available with FP-e Ver. 1.2 or higher.

- Settings when shipped from factory

System register	Description
No.412	Computer Link
No.413	Character bit: 8 bits Parity check: odd Stop bit: 1 bit Header: STX not exist Terminator: CR
No.414	Baud rate: 9600 bit/s
No.415	Unit No.: 1
No.416	Modem: Not enable

 **Reference**: B.3 System register list

- Suitable wires (twisted wire)

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

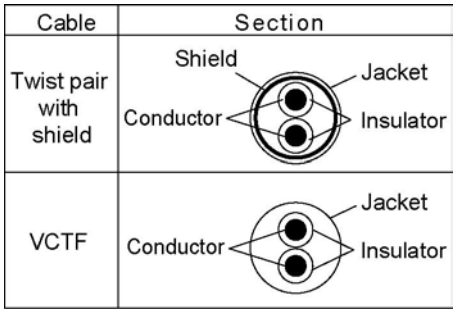
Use a shielded wire of the above wiring. It is recommend to ground the shield section.

 **Reference**: 3.2 Terminal layout and terminal block wiring

- Recommended cables for RS485 communication

Use the transmission cables shown below for the FP-e RS485 communication system.

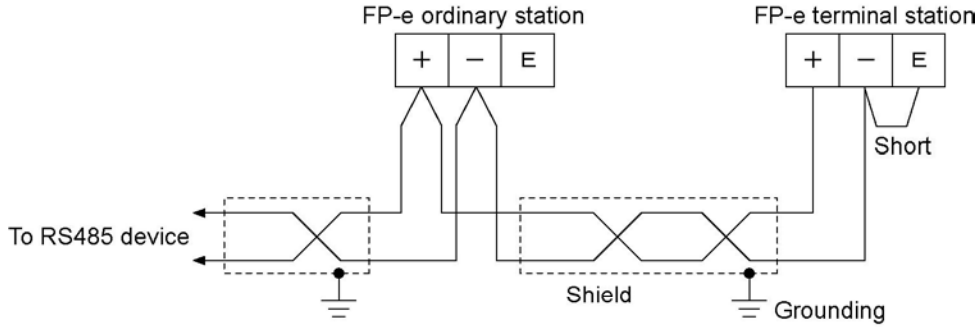
Cable	Conductor		Insulator		Cable Diameter	Applicable cables
	Size	Resistance (at 20 °C)	Material	Thickness		
Twist pair with shield	0.5 mm^2 (AWG20) or more	Max. 33.4 Ω/km	Polyethylene	Max. 0.5 mm	Approx. 7.8 mm	HITACHI KPEV-S0.5 mm^2 × 1P Belden Inc. 9207
VCTF	0.75 mm^2 (AWG18) or more	Max. 25.1 Ω/km	PVC	Max. 0.6 mm	Approx. 6.6 mm	VCTF0.75 mm^2 × 2C (JIS)

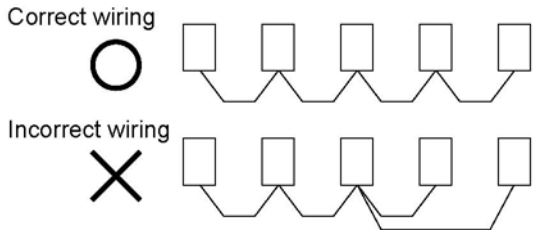


*1. Use shielded type twist cables.
*2. Use only one type of the transmission cables.
Do not mix different types of the cables.
*3. Use twist pair cables under a bad noise environment.
*4. When connecting two cables to the "+" and "–" terminals of the COM. port (RS485), use the above cables of which conductor cross section is 0.5 to 0.75 mm^2, and the cross sections of two cables should be the same.

- RS485 wiring and terminal station setting

1. For the FP-e unit at RS485 terminal station, wire the transmission line (–) terminal and E-terminal using a short circuit.
2. For RS485 transmission line, three or more pairs of cables should not be connected to one station.
3. When using shielded cables for RS485 transmission line, connect one end of the shielded cable to the ground. Provide an exclusive ground for each FP-e power supply section and RS485 transmission shield line. Do not share a ground with other lines.





3.6 Safety Measures

3.6.1 Safety measures

System design
In applications in which FP-e is used, malfunctions may occur for the following reasons:
-Power on timing difference between the FP-e system and input/output or mechanical power devices.
-Response time lag when a momentary power failure occurs.
-Abnormality in the FP-e unit, external power supply, or other devices.

In order to prevent a malfunction resulting in system shutdown, take the adequate safety measures as listed below:

- Interlock circuit
When a motor clockwise/counter-clockwise operation is controlled, provide an interlock circuit on the outside of the FP-e unit.

- Emergency stop circuit
Add an emergency stop circuit on the outside of the FP-e unit to turn off the output devices in order to prevent a system shutdown or an irreparable accident when malfunction occurs.

- Start up sequence
The FP-e should be operated after all of the input/output devices and power devices are energized.

Procedure:
-After power is supplied to the FP-e unit, switch the mode from PROG. to RUN.
-Install the timer circuit to delay the FP-e startup.


Note: When stopping the FP-e unit, the I/O devices should be turned off after the unit has stopped operating.

- Secure grounding
When grounding the FP-e unit next to an inverter, or other such device that produces high-voltage due to switching, avoid common grounding. Use an exclusive ground connection for each device.

3.6.2 Momentary power failures

Operation of momentary power failures
If the duration of the power failure is less than 10 ms, the FP-e unit continues to operate. If the power is turned off for 10 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.)

3.6.3 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 a fuse.

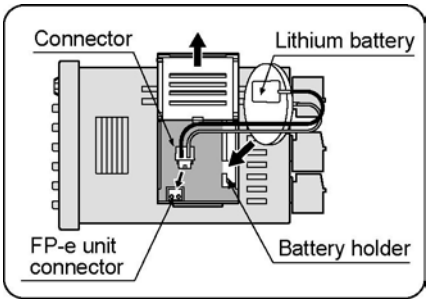
Protection of output
If current exceeding the rated control capacity is being supplied in the form of a motor lock current or a coil shorting in an electromagnetic device, a protective element such as a fuse should be attached externally.

3.7 Memory backup battery

3.7.1 Installation of memory backup battery (For FP-e unit with a calendar timer function)

Although FP-e units with a calendar timer have a built-in lithium battery, a lithium battery connector is not connected to an FP-e unit connector. Follow the procedure as shown below to connect them.

1. Open the battery cover on the top of the FP-e unit.
2. Connect the lithium battery connector to the FP-e unit connector.
3. Place a lithium battery in the battery holder in the FP-e unit.
4. Close the battery cover.



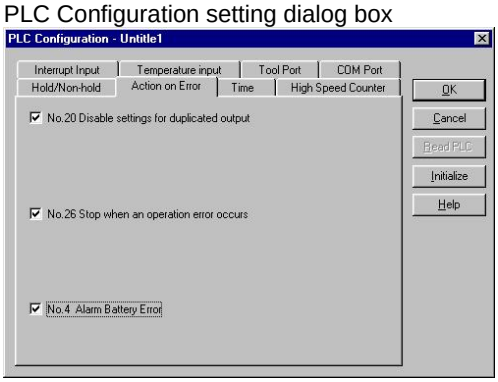
Note: A calendar timer is available only when a battery is installed.
Install a new battery within a minute after removing the old battery.

3.7.2 System register setting (For FP-e unit with a calendar timer function)

- Setting the battery error alarm

In the system register default settings, “No.4 Alarm Battery Error” is set to “OFF.” When using the battery, set system register No. 4 of the control unit so that the battery error alarm is turned on.

PLC Configuration setting dialog box



- Setting procedure using FPWIN GR
  1. Select “PLC Configuration” on the “Option (O)” menu, and click on “Action on Error” tab.
  2. Turn on “No. 4 Alarm Battery Error” check box.

- Specifying the hold area

In order to use backup functions such as data registers, settings must be entered for system registers Nos. 6 to 12.

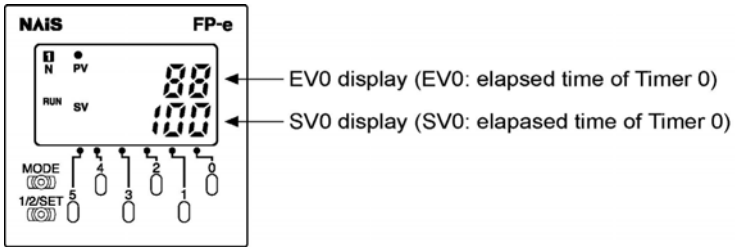
For hold area setting using FPWIN GR, select “PLC Configuration” on the “Option (O)” menu, and click on “Hold/Non-hold.”

Note: Be sure to install a lithium battery when changing the hold area with the system register or using the calendar timer function.

Chapter 4

Display and Settings in N (Normal) Mode

4.1 Display and operation in N (Normal) mode



Operation examples

- Values of EV0 and SV0 are displayed in the upper and lower sections of the controller screen respectively, using the F180 (SCR) instruction.
- Pressing the operation switches (“0” to “5”) when the value (indicated in decimal or hexadecimal system) is displayed in the lower section changes the value in each digit.
  When the ASCII code or bit is displayed in the lower section, however, it cannot be changed.
- In the data change mode after the operation switch “0” to “5” is pressed, the data in the lower section blinks.
- For writing the changed data, press the screen changeover switch “1/2/SET” for about one second. Then, the blinking stops and the data is written.
- For canceling the data change process before the data is not completely changed, press the operation switch “5” for about one second. Then, blinking the display data stops.
- Pressing the operation switch “5” adds or deletes a minus sign. (when displayed in a decimal system.)
- Pressing the “MODE” switch for about 2 seconds displays “LOCK.” In this mode, the data cannot be changed even if the operation switch is pressed.
  The “LOCK” status cannot be cancelled even if the power turns ON/OFF.
- For canceling the “LOCK” status, press the “MODE” switch for about 2 seconds again.

Notes:

1. Arbitrary characters and data (WX, WY, WR, SV, EV, DT, IX, or IY) can be displayed in the upper section of the screen.
2. Arbitrary characters and data (WY, WR, SV, EV, DT, IX, or IY) can be displayed in the lower section of the screen.
3. Numerical values are displayed only in 16-bit. (The data can be displayed in a bit, decimal, or hexadecimal system.
   - In a decimal system display: K-32768 to K32767
   - In a hexadecimal system display: H0000 to HFFFF
4. The front switches can be used as the input contact switches “X38” to “X3F.” (Available in the “LOCK” mode as well.)
5. Switching the power ON/OFF or RUN/PROG. mode cancels the data changed using the front switches.
6. Only the data displayed in the lower section can be changed with the operation switches “0” to “5”.

4.2 Instructions to control the display

4.2.1 F180 (SCR): Screen display instruction, Number of steps: 9

Screen display instructions in the N and S modes of FP-e unit

The FPWIN GR wizard facilitates the programming.

S1: Used to specify the registration screen.
S2: Used to specify the head of the screen display control data (3 words).
S3: Used to specify the data displayed in the upper section
(Numerical values are displayed only in 16-bit.)
S4: Used to specify the data displayed in the lower section.
(Numerical values are displayed only in 16-bit.)

Example:

F180 (SCR), K0, DT0, EV0, SV0

Registration of N mode 1st screen
Control data: DT0, DT1, DT2
Upside display data: EV0
Downside display data: SV0

- Available memory areas A: Can be specified N/A: Cannot be specified (Unit: Word)

		WX	WY	WR	SV	EV	DT	IX	IY	K	H	Index modifier
S1	Display mode and No. (0 to 3 can be specified.)	A	A	A	A	A	A	A	A	A	A	A
S2	Head address of the area to specify the display measure.	A	A	A	A	A	A	N/A	N/A	N/A	N/A	A
S3	Area which stores the data to be displayed in the upper section.	A	A	A	A	A	A	A	A	N/A	N/A	A
S4	Area which stores the data to be displayed in the lower section.	N/A	A	A	A	A	A	A	A	N/A	N/A	A

Note: Special register "DT9***" cannot be specified for the lower section display data "S4."
This instruction cannot be used in the interrupt program.

- Specifying the "S1" registration screen

Display type of the FP-e unit can be specified.

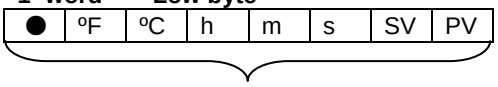
Values for "S1"	Display type
K0	N mode 1 st screen
K1	N mode 2 nd screen
K2	S mode 1 st screen
K3	S mode 2 nd screen

- Flag conditions

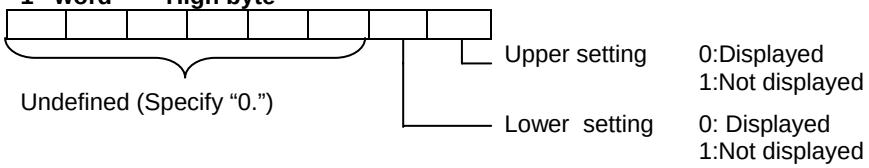
R9007 R9008 (ER)	Turns ON when the area specified using the Index modifier exceeds the limit.
	Turns ON when the "S1" or "S2" value is outside of the range specified.

- Configuration of "S2" screen display control data

1st word Low byte

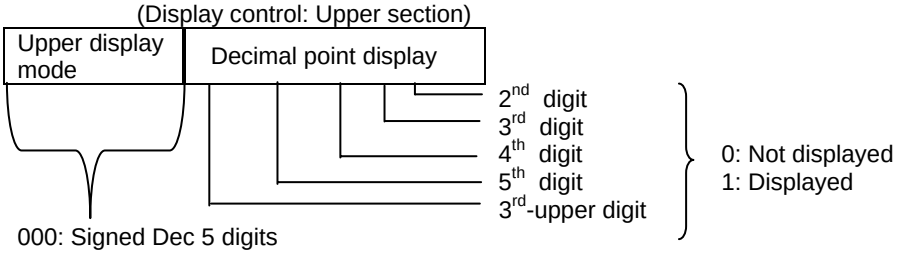


1st word High byte



2nd word Low byte

(Display control: Upper section)

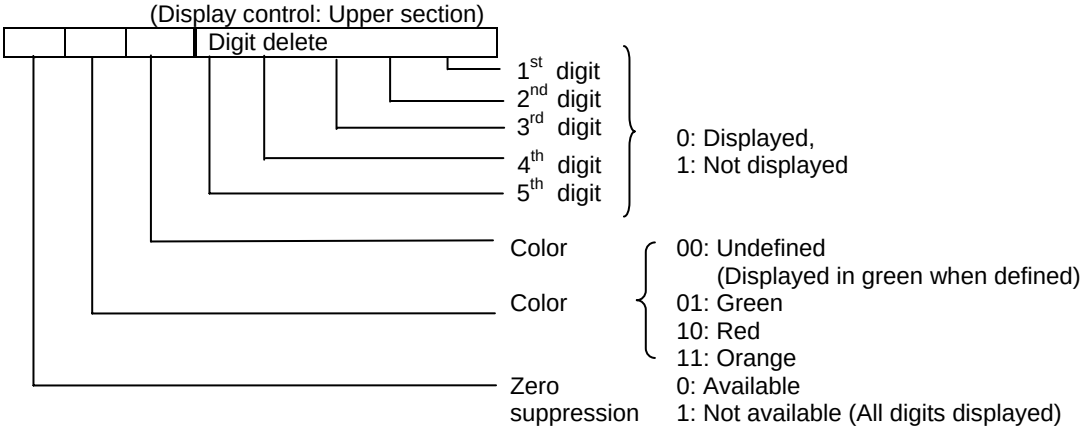


000: Signed Dec 5 digits
001: Hex 4digits or BCD 4digits
010: Bit
011: ASCII code of five characters
100: 7-segment Data
101: Undefined
110: Undefined
111: Undefined

101 and later: Undefined.
Error occurs when the undefined data is specified.

Reference: "ASCII code of five characters" and "7 segment Data. " (See the following page.)

2nd word High byte
(Display control: Upper section)



* When a value with a decimal point is to be displayed in the “Signed Dec 5 digits” mode, the value(s) before the decimal point should be displayed.

3rd word Low byte
(Display control: Lower section)
Same as the low byte display control data for 2nd word

3rd word High byte
(Display control: Lower section)
Same as the high byte display control data for 2nd word

- Examples of control register

1st word

"0 0 0 0 0 0 0 0 1 0 0 0 0 0 1 1" = H83

Upper/Lower section display ● SV PV

2nd word

"0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0" = H4000

Red All digits Decimal point: Not displayed

Zero suppression

3rd word

"0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0" = H6000

Orange All digits Decimal point: Not displayed

Zero suppression

- ASCII code and its display

When 5 characters from DT0 are displayed (for 5 bytes from DT0):

DT0	H32	H31	(H32:2, H31:1)
DT1	H34	H33	(H34:4, H33:3)
DT2	H36	H35	(H36:6, H35:5)

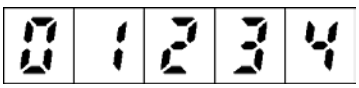
The ASCII code above are displayed as follows.

- 7-segment data and its display

When the data of 5 digits from DT0 are displayed (Lower byte in 1 word stores the data of 1 digit.):

DT0		H3F	(7-segment display data H3F: 0)	5th digit (highest-order digit)
DT1		H6	(7-segment display data H6: 1)	4th digit
DT2		H5B	(7-segment display data H5B: 2)	3rd digit
DT3		H4F	(7-segment display data H4F: 3)	2nd digit
DT4		H66	(7-segment display data H66: 4)	1st digit (lowest-order digit)

The 7-segment data above are displayed as follows:



Note) An arbitrary segment can be displayed using this function.

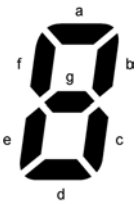
- Display description and data

Value	Conversion data (for 1 digit)				7-segment display data (for 1 digit)								7-segment display
					/	g	f	e	d	c	b	a	
0	0	0	0	0	0	0	1	1	1	1	1	1	
1	0	0	0	1	0	0	0	0	0	1	1	0	
2	0	0	1	0	0	1	0	1	1	0	1	1	
3	0	0	1	1	0	1	0	0	1	1	1	1	
4	0	1	0	0	0	1	1	0	0	1	1	0	
5	0	1	0	1	0	1	1	0	1	1	0	1	
6	0	1	1	0	0	1	1	1	1	1	0	1	
7	0	1	1	1	0	0	1	0	0	1	1	1	
8	1	0	0	0	0	1	1	1	1	1	1	1	
9	1	0	0	1	0	1	1	0	1	1	1	1	
A	1	0	1	0	0	1	1	1	0	1	1	1	
B	1	0	1	1	0	1	1	1	1	1	0	0	
C	1	1	0	0	0	0	1	1	1	0	0	1	
D	1	1	0	1	0	1	0	1	1	1	1	0	
E	1	1	1	0	0	1	1	1	1	0	0	1	
F	1	1	1	1	0	1	1	1	0	0	0	1	

LSB

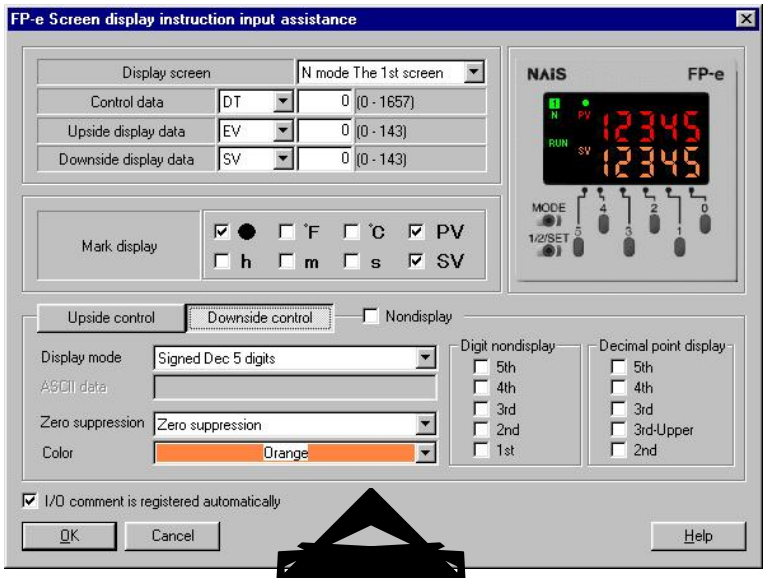
a
b
c
d
e
f
g
/

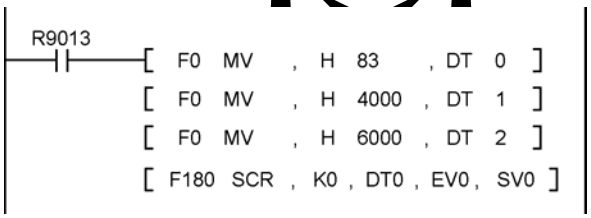
MSB



4.2.2 F180 (SCR) instruction: FPWIN GR Wizard

Using the FPWIN GR wizard facilitates the programming.

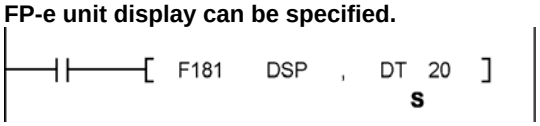




* FPWIN GR Ver. 2.2 or higher can be used with the FP-e unit.
  Customers who use the FPWIN GR Ver.2 software can upgrade it through our HP free of charge.

4.2.3 F181 (DSP) : Screen change instruction Number of steps: 3

FP-e unit display can be specified.



- Available memory areas A: Can be specified N/A: Cannot be specified (Unit: Word)

		WX	WY	WR	SV	EV	DT	IX	IY	K	H	Index modifier
S	Display mode and No. (0 to 7 can be specified.)	A	A	A	A	A	A	A	A	A	A	A

- Operation

The FP-e display mode is changed to the one specified using “S.”

- Specifying the “S1” registration display

Display type of the FP-e unit can be specified.

Values for “S”	Display type
K0	N mode 1st screen
K1	N mode 2nd screen
K2	S mode 1st screen
K3	S mode 2nd screen
K4	R mode 1st screen
K5	R mode 2nd screen
K6	I mode 1st screen
K7	I mode 2nd screen

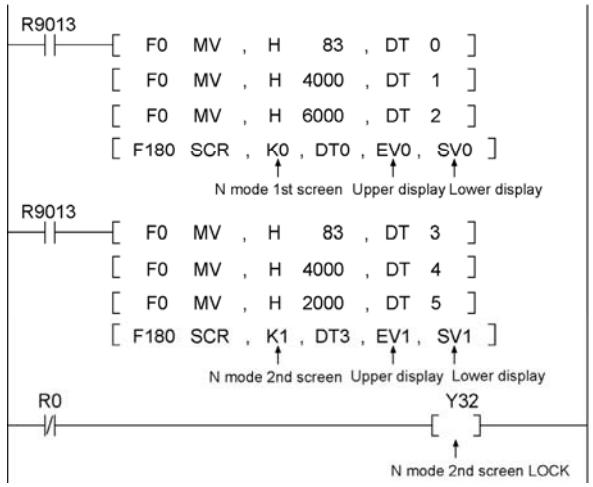
- Flag conditions

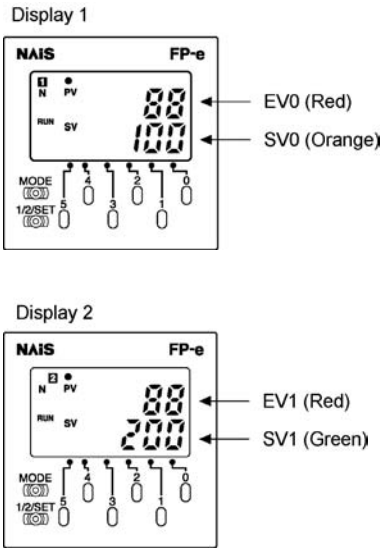
R9007 R9008 (ER)	Turns ON when the area specified using the index modifier exceeds the limit.
	Turns ON when the value “S” is not “0” to “7.”

Notes: 1. If the value other than “0” to “7” is specified for “S,” an operation error will occur.
2. The F181 (DSP) instruction cannot be used during the interrupt program.

4.3 N mode sample program

- Sample program





- Screen display

On N mode 1st screen, EV0 (red) and SV0 (orange) are displayed in the upper and lower sections respectively.
On N mode 2nd screen, EV1 (red) and SV1 (green) are displayed in the upper and lower sections respectively.

- Front switches

Pressing the operation switch “0” to “4” on N mode 1st screen changes the mode to the change mode for SV0.
Note: Data blinks in the change mode.

When the display selection switch “1/2/SET” is pressed for about one second, the data for the SV0 is changed and the blinking of the data stops.

Note: Data which is out of the specified range (16-bit) cannot be written.

When the display selection switch “1/2/SET” is pressed, the current screen changes to 2nd screen. The operation switches (“0” to “5”) are locked by the program on 2nd screen. (Y32 is ON.) Even when the operation switch is pressed, therefore, SV1 cannot be changed.

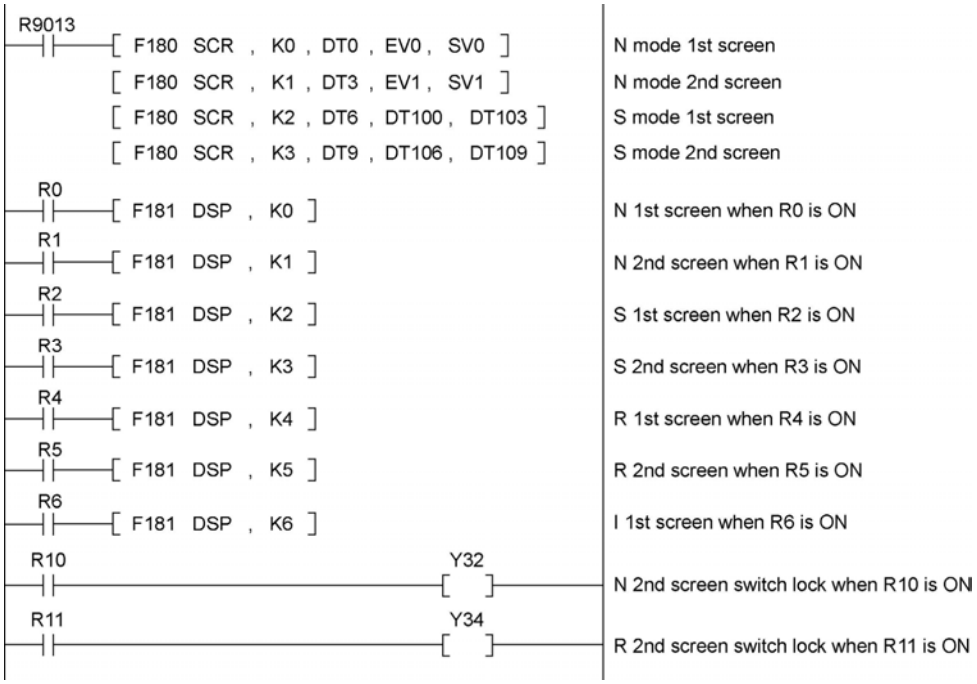
Reference: For further information, see “Locking the Switch” in A.2 I/O Allocation.”

Pressing the “MODE” switch for about 2 seconds locks both display selection switch and operation switch. In this “LOCK” status, the display and data cannot be changed. In addition, the “LOCK” status is not cancelled even when the power turns ON/OFF.

Pressing the “MODE” switch for about 2 seconds again unlocks the “LOCK” status. At this time, the “LOCK” display turns off.

4.4 Display screen and lock with the program

- **Sample program**



- Program operation

Turning ON the “R0” to “R6” switches the screen to be displayed.

Note: Even if the “MODE” switch or the “1/2/SET” switch is pressed under the condition that the “R0” is always set to ON using the sample program, the N1 screen cannot be switched to other screen. Using this function prevents operation mistake of the front switch.

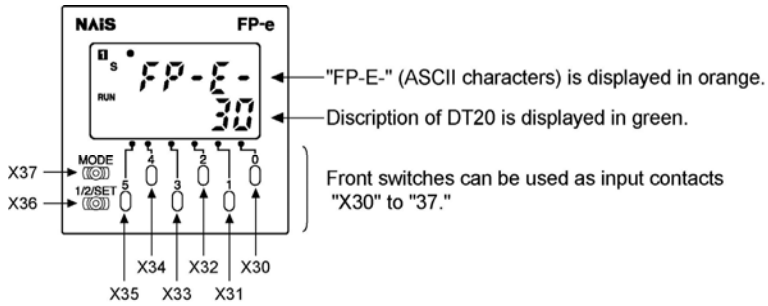
Setting the “Y30” to “Y34” to ON locks the front switch. Using this function prevents operation mistake of the front switch.

Reference: For further information, see “Locking the Switch” in A.2 I/O Allocation.

Chapter 5

Data Display and Settings in S (Switch) Mode

5.1 Display and operation in S (Switch) mode



The ASCII characters “FP-E-“ and the description of the “DT20” are displayed in the upper and lower sections of the controller screen respectively, using the F180 (SCR) instruction.

The front switches can be used as the input contacts “X30” to “X37.” The switch can also be used to change the display description, and so on depending on the program.

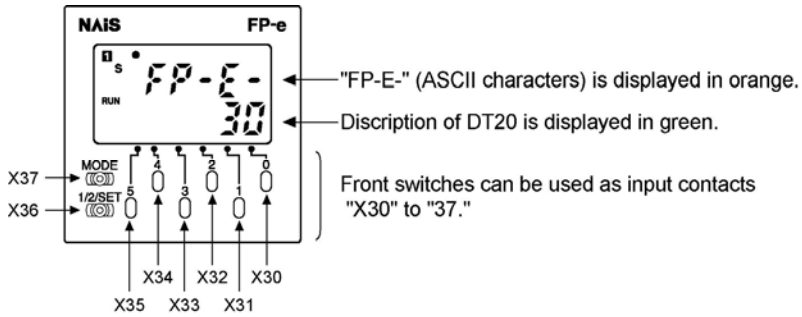
Note: 1. The front switches are allocated as the input contacts “X30” to “X37” and “X38” to “X3F.”
“X30” to “X37”: The switch can be locked using the program.
“X38” to “X3F”: The switch cannot be locked using the program.

Reference: For further information, see “Locking the Switch” in A.2 “I/O Allocation.”

2. Pressing the “MODE” switch for about 2 seconds displays the “LOCK.”
In this condition, the input contacts “X30” to “X37” cannot be used, but “X38” to “X3F” can be used.

3. The input contacts “X30” to “X3F” do not turn ON during the first scanning after the mode is switched to RUN mode.

5.2 S mode sample program



- Sample program

```
R9013
 |-|---[ F0  MV   , H  80   , DT  0  ]
       [ F0  MV   , H  6060 , DT  1  ]
       [ F0  MV   , H  2000 , DT  2  ]
       [ F0  MV   , H  5046 , DT  10 ]
       [ F0  MV   , H  452D , DT  11 ]
       [ F0  MV   , H  2D   , DT  12 ]
       [ F180 SCR , K2 , DT0 , DT10 , DT20 ]
                    |        |       |
                    S 1st screen  Upper display  Lower display
       [ F181 DSP , K2 ] <- S mode 1st screen

X30
 |-|---( DF )---[ F0  MV , K  30 , DT  20 ]
X31
 |-|---( DF )---[ F0  MV , K  31 , DT  20 ]
X32
 |-|---( DF )---[ F0  MV , K  32 , DT  20 ]
X33
 |-|---( DF )---[ F0  MV , K  33 , DT  20 ]
X34
 |-|---( DF )---[ F0  MV , K  34 , DT  20 ]
X35
 |-|---( DF )---[ F0  MV , K  35 , DT  20 ]
```

"FP-E-" (ASCII character)

K30 is transferred to DT20 when X30 (switch "0") is ON.

K31 is transferred to DT20 when X31 (switch "1") is ON.

K32 is transferred to DT20 when X32 (switch "2") is ON.

K33 is transferred to DT20 when X33 (switch "3") is ON.

K34 is transferred to DT20 when X34 (switch "4") is ON.

K35 is transferred to DT20 when X35 (switch "5") is ON.

- Screen display

On S mode 1st screen, the ASCII character “FP-E-“ is displayed in the upper section in orange.

Reference: See “ASCII character and 7-segment display” in Appendix A of this manual.

On 2nd screen, the data of “DT20” is displayed in green.

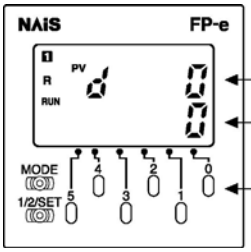
- Front switches

- When the front switch “0” is pressed, “X30” turns ON and “30” is displayed in the lower section of the screen.
- When the front switch “1” is pressed, “X31” turns ON and “31” is displayed in the lower section of the screen.
- Pressing the “MODE” switch for about 2 seconds locks all the front operation switches and “LOCK” is displayed. In this “LOCK” status, the display cannot be changed even if the front operation switch “0” to “5” is pressed.

Chapter 6

Data Display and Settings in R (Register) Mode

6.1 Display and operation in R (Register) mode



Device type (DT, WR, SV, or EV) in the memory areas displayed in green.

Specified device type data (16-bit data in the decimal system) is displayed in green.

Used to change the device type and descritpion

1. When the device type (DT, WR, SV, or EV) in the memory area is specified using the front operation switch, the specified device type data is displayed.

- When "PV" blinks, the device type in the memory area can be specified.
- The device No. can be specified using the switches "0" to "3." The device type can be switched using the switch "4" in the following order: DT→WR→SV→EV

Note: When specifying the No. which is out of the designated range, the display color in the upper section switches from green to red and the display in the lower section turns off.

2. The specified device data can be changed using the front switch.

- When the switch "5" is pressed for about 1 second, "SV" blinks. In this status, the data can be changed.
- When the switch "0" to "5" is pressed, the data in the lower section is changed and then blinks.
- When the "1/2/SET" switch is pressed for about 1 second, the blinking stops and the data change completes.
- For canceling the data change process before the data is not yet completely changed, press the operation switch "5" for about one second. Then, blinking the display data stops.
- For changing to the device specification mode after the data change has completed, press the operation switch "5" for about one second. When the mode changes to the device specification mode, "PV" blinks.
- The mode cannot be changed to the device specification mode before the data is not yet completely changed. Wait for the completion of the data change process or cancel the data change process to change the mode to the device specification mode.

Note: If you try to change the data to the one which is out of the specified range, the data is displayed in red only when the "1/2/SET" switch is pressed, and blinking does not stop.
When the power ON/OFF or RUN/PR OG. mode switching is performed, the data which is not yet completely changed using the front switch will be cancelled.
The data change can also be cancelled by turning Y38 ON.
(This is available for Ver. 1.1 or higher.)

3. Pressing the "1/2/SET" switch changes the current screen to 1st screen or 2nd screen.

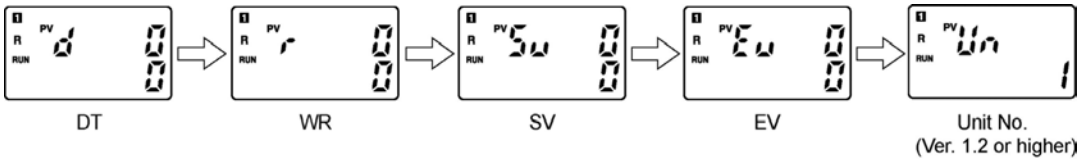
4. When "MODE" switch is pressed for about 2 seconds, "LOCK" is displayed. In this "LOCK" status, the display cannot be changed even if any switches are pressed.

6.2 Operation in R (Register) mode

6.2.1 Specifying the device type

When "PV" blinks, the device type and No. can be changed.

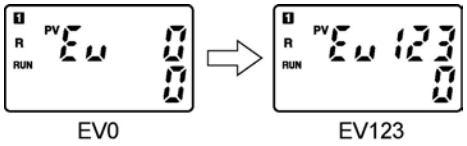
1. Specifying the device type (Example of "EV")



Press the switch "4" until "EV" is displayed as shown above.

Note: At this moment, the "EV0" data is displayed in the lower section.

2. Specifying the device No. (Example of "EV123")

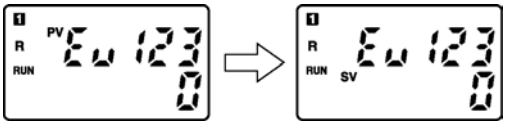


Specify the device No. "EV123" using the switches "0" to "3."

Note: When specifying the No. which is out of the designated range, the display color in the upper section changes from green to red and the data display in the lower section turns off.

6.2.2 Changing the data

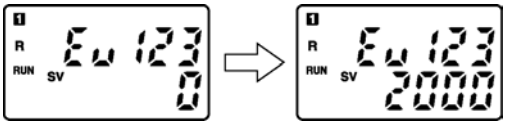
1. Switching to the data change mode



- When the switch “5” is pressed for about 1 second, the “PV” display turns off and then the “SV” blinks. While the “SV” is blinking, data can be changed.

Note: When the switch “5” is pressed for about 1 second again, the “SV” display turns off and the “PV” display blinks. While the “PV” is displayed, the device type can be specified.

2. Changing the data



- Pressing the switch “0” to “5” changes the data displayed. The changed data blinks.
- Pressing the switch “1/2/SET” for about 1 second stops blinking. At this point, data change completes.

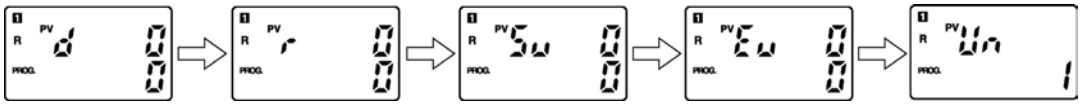
Notes:

1. Press the operation switch “5” for about one second when the data display is blinking to cancel the data under change.
   The data change can also be cancelled by turning Y38 ON.
   (This is available for Ver. 1.1 or higher.)
2. If you try to change the data to the one which is out of the specified range, the data is displayed in red only when the “1/2/SET” switch is pressed, and blinking does not stop.
3. When the power ON/OFF or RUN/PROG. mode switching is performed, the data under change will be cancelled.

6.2.3 Changing the unit No. of COM. port

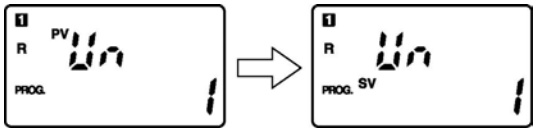
The unit No. specified in the system register can be changed by the front switch (for Ver. 1.2 or higher).

1. Displaying the unit No.



- Press the switch “4” to display the unit No.

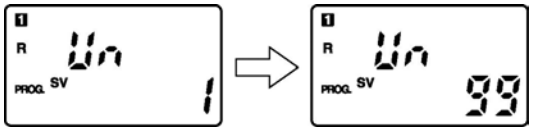
2. Switching to the unit No. change mode



- When the switch “5” is pressed for about 1 second, the “PV” display turns off and then the “SV” blinks. While the “SV” is blinking, data can be changed.

Note: When the switch “5” is pressed for about 1 second again, the “SV” display turns off and the “PV” display blinks. While the “PV” is displayed, the device type can be specified.

3. Changing the unit No.



- Pressing the switch “0” and “1” changes the unit No. displayed. The changed No. blinks.
- Pressing the switch “1/2/SET” for about 1 second stops blinking. At this point, data change completes.

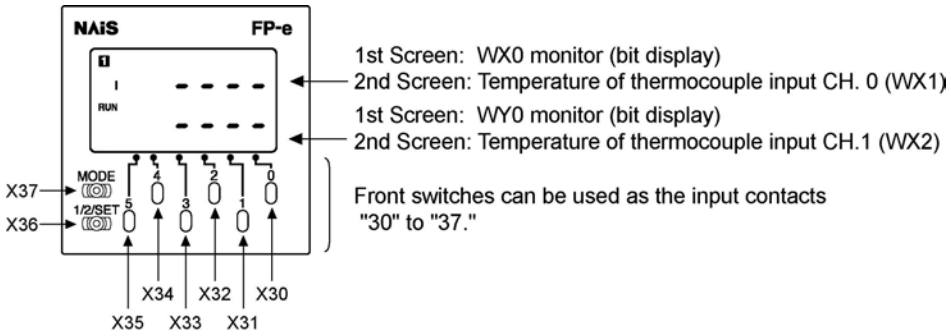
Notes:

1. Change the unit No. in PROG. mode.
   The unit No. cannot be changed in RUN mode.
2. Press the operation switch “5” for about one second when the unit No. display is blinking to cancel the unit No. under change.
3. If you try to change the data to the one which is out of the specified range (1 to 99), the changing process of the unit No. is cancelled by pressing the “1/2/SET” switch.
4. When the power ON/OFF or RUN/PROG. mode switching is performed, the data under change will be cancelled.

Chapter 7

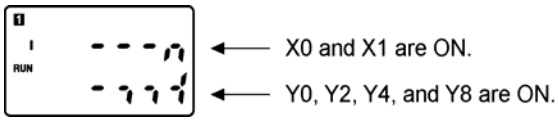
I (I/O Monitor) Mode

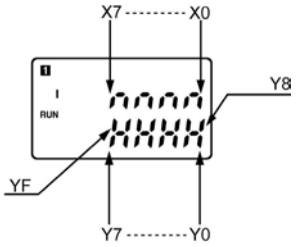
7.1 I/O monitor



1. I/O status of "WX0" and "WY0" can be monitored using 1st screen.

- Example:



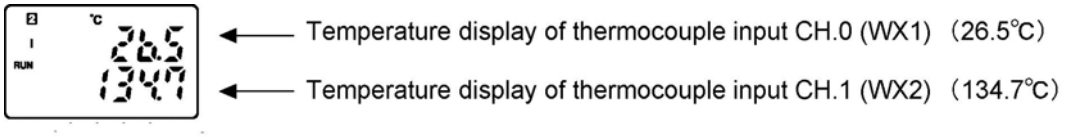


Note: 1. "Y6" or higher does not exist for the FP-e external output, but it can be used as the contact on the program.

2. In case of forced input/output, the monitoring of the forced input contact is not available.

2. Temperature display of the thermocouple input can be monitored using 2nd Screen.

- Example:



Note: Turning Y37 contact ON displays the Fahrenheit degree. (ºF)

3. The front switches can be used as the input contacts "X30" to "X37."

Note: 1. The front switches are allocated as the input contacts "X30" to "X37" and "X38" to "X3F."
"X30" to "X37": The switch can be locked using the program.
"X38" to "X3F": The switch cannot be locked using the program.

Reference: For further information, see "Locking the Switch" in Appendix A, "I/O Allocation" of this manual.

2. Pressing the "MODE" switch for about 2 seconds displays the "LOCK."
In this condition, the input contacts "X30" to "X37" cannot be used, but "X38" to "X3F" can be used.

Chapter 8

PID Control

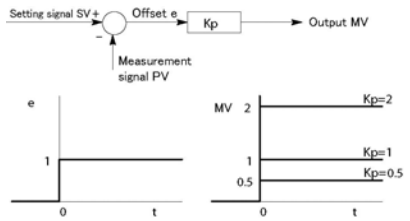
8.1 PID Control

8.1.1 Operation of PID control

PID is a control method widely used in the instrumentation field involving feedback control of process quantities such as temperature, pressure, flow, and fluid level.

- Proportional operation

Proportional operation generates an output which is proportional to the input.

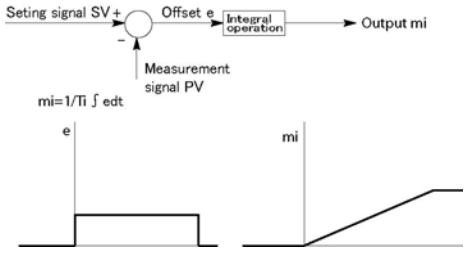


The amount of control is held constant.
An offset (steady-state deviation) remains.
Proportional control grows stronger as “Kp” is increased.

Kp: Proportional gain

- Integral operation

Integral operation generates an output which is proportional to the integral time of the input.

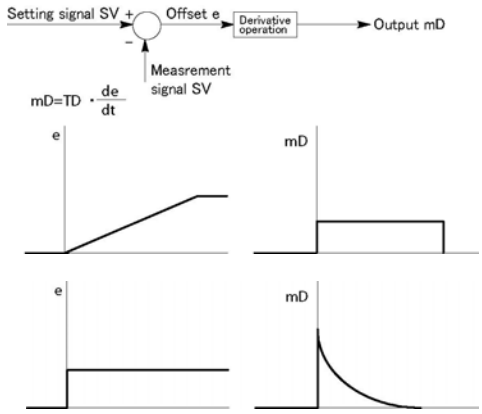


In combination with proportional operation or proportional-derivative operation, integral operation removes the offset produced by these methods.
Integral operation grows stronger as the integral time “Ti” is shortened.

Ti: Integral time

- Derivative operation

Derivative operation generates an output which is proportional to the derivative time of the input.

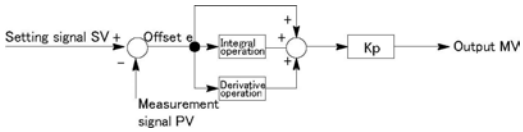


The advancing characteristic of derivative operation alleviates the adverse effect that the delaying characteristic of the process exerts on control.
Derivative control grows stronger as the derivative time “Td” is increased.
In the case of pure derivative operation, control can temporarily become ineffective if noise is input, and this can have an adverse effect on the process being controlled. For this reason, incomplete differential operation is executed.

Td: Derivative time

- PID operation

PID operation is a combination of proportional, integral, and derivative operations.



If the parameters are set to the optimum values, PID control can quickly bring the amount of control to the target value and maintain it there.

8.2 PID control instruction

8.2.1 F355 (PID)

- PID control

- Operands (Unit: Word)

		WX	WY	WR	WL	SV	EV	DT	I	Constant			Index modifier
										K	H	f	
S	Starting number of PID parameter area (31 words)	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A

(A: Available, N/A: Not Available)

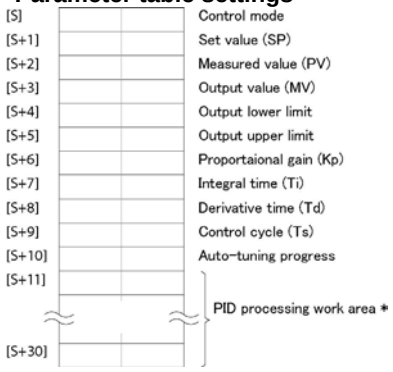
- Descriptions

· PID processing is performed to hold the measured value specified by [S+2] at the set value [S+1], and the result is output to [S+3].
· Derivative control or proportional-derivative control can be selected for the PID processing type.
· Set the PID processing coefficients (proportional gain, integral time and derivative time) and the processing mode and cycle in the parameter table. PID processing will be performed based on these settings.

- Types of PID processing

1. Reverse and forward operations
   When a process has been changed, whether the output will be increased or decreased can be selected.
   · When the measured value decreases, “Reverse operation” is specified to boost the output (heating, etc.).
   · When the measured value increases, “Forward operation” is specified to boost the output (cooling, etc.).
2. Derivative type (PI-D) and Proportional-derivative type (I-PD)
   Derivative type (PI-D): When a set value is changed, fluctuation in the output is large, however convergence is fast.
   Proportional-derivative type (I-PD): When a set value is changed, fluctuation in the output is small, however convergence is slow.

- Parameter table settings



* For FP-e, [S+11] to [S+30] (20 words) are used as the PID processing work area.

- Flag conditions

R9007	Turns ON when the value set for the parameter is out of range.
R9008 (ER)	The area specified using the index modifier exceeds the limit.

- Descriptions of parameters

1. Control mode: [S]

Select the type of PID processing and auto-tuning ON/OFF using the H constants.

Control mode		Value of [S]	
		Auto-tuning: Not executed	Auto-tuning: Executed
Derivative type (PI-D)	Reverse operation	H0	H8000
	Forward operation	H1	H8001
Proportional-derivative type (I-PD)	Reverse operation	H2	H8002
	Forward operation	H3	H8003

Auto-tuning

The optimum values for the Kp, Ti, and Td of the PID parameters can be measured by checking the process response. When auto-tuning is executed, the estimated results are reflected in the parameter area after auto-tuning has been completed. (There may be cases in which auto-tuning cannot be executed, depending on the process. If this happens, a value returns to the original parameter operation value.)

Reverse and forward operations

When a process has been changed, whether the output will be increased or decreased can be determined.

Reverse operation: When the measured process value decreases, the output will be boosted. (Example: heating, etc.)
Forward operation: When the measured process value increases, the output will be boosted. (Example: cooling, etc.)

Derivative type (PI-D) and Proportional-derivative type (I-PD)

When the set value is changed, the output changes.

Derivative type (PI-D): When a set value is changed, fluctuation in the output is large, however, convergence is fast.
Proportional-derivative type (I-PD): When a set value is changed, fluctuation in the output is small, however, convergence is slow.

2. Set value (SP): [S + 1]

Set the target value (temperature set value) within the following range which determines the amount of process control.
K0 to K10000

3. Measured value (PV): [S + 2]

Set the current process control value (temperature data WX1 and WX2) within the following range.
K0 to K10000

4. Output value (MV): [S + 3]

The result of PID processing is stored. Use the PWM output function to output it to the process.
K0 to K10000

5. Output lower limit value: [S + 4]

K0 to K9999 (< upper limit value)

6. Output upper limit value: [S + 5]

K1 to K10000 (> lower limit value)
Specify the range of the output value (MV). The values specified for the range are output.
The limits should be as follows;
0 ≤ Output lower limit value < Output upper limit value ≤ 10000

7. Proportional gain (Kp): [S + 6]

Specify the coefficient used for PID processing.
The set value × 0.1 will be the actual proportional gain.
The setting range is K1 to K9999 (0.1 to 999.9, Specify the range in increments of 0.1.)
When the auto-tuning is selected for the specified control mode, the set value is automatically adjusted and rewritten.

8. Integral time (Ti): [S + 7]

Specify the coefficient used for PID processing.
The set value × 0.1 will be the actual integral time.
The setting range is K1 to K30000 (0.1 to 3000 sec., Specify the range in increments of 0.1 sec.)
When the set value is "0," the integration is not executed.
When the auto-tuning is selected for the specified control mode, the set value is automatically adjusted and rewritten.

9. Derivative time (Td): [S + 8]

Specify the coefficient used for PID processing.
The set value × 0.1 will be the actual derivative time.
The setting range is K0 to K10000 (0 to 1000 sec., Specify the range in increments of 0.1 sec.)
When the auto-tuning is selected for the specified control mode, the set value is automatically adjusted and rewritten.

10. Control cycle (Ts): [S + 9]

Specify the cycle for executing PID processing.
The set value × 0.01 will be the actual control cycle.
The setting range is K1 to K6000 (0.01 to 60.00 sec., Specify the range in increments of 0.01 sec.)

11. Auto-tuning progress: [S + 10]

When the auto-tuning is specified in the control mode, the progress of the auto-tuning is indicated.
The values for K1 to K5 are stored based on the progress from the default value of "0."
When the auto-tuning has been completed, the value returns to the default value.

12. PID processing work area: [S + 11] to [S + 30]

This work area that is necessary for PID processing is used in the system.

Note:

- Precautions when executing auto-tuning

When “Execute auto-tuning” is specified using the parameter table (control mode [S]), attention should be paid to the following points.

· Before the auto-tuning is executed for the first time, confirm the range of the set values for [S] to [S + 30].
· After the auto-tuning has been completed, the control mode [S] area is automatically rewritten from H8000-H8003 to H0-H3. Make sure the mode is not rewritten again in the program.
· After the auto-tuning has been completed, the optimum values are stored for the proportional gain (Kp), the integral time (Ti) and derivative time (Td). Before executing the auto-tuning, however, the appropriate values (e.g. the lower limit value) within the specified setting range must be set.
· After the auto-tuning has been completed, the optimum values are stored for the proportional gain (Kp), the integral time (Ti) and derivative time (Td). Be careful that the stored values are not inadvertently rewritten.
· In the auto-tuning, the optimum values for Kp, Ti and Td are calculated for the set value (SP) by checking the fluctuations of the measured values (PV) when the output value (MV) is the upper limit and lower limit.
  During this process, the set value (SP) can exceed the measured value (PV).
· The output value (MV) in the auto-tuning fluctuates at least three times:
  Upper limit output – Lower limit output – Upper limit output
  If the value for the auto-tuning progress remains “0” after the fluctuation is performed more than twice, shorten the control synchronization period (Ts) and then execute the auto-tuning once more.

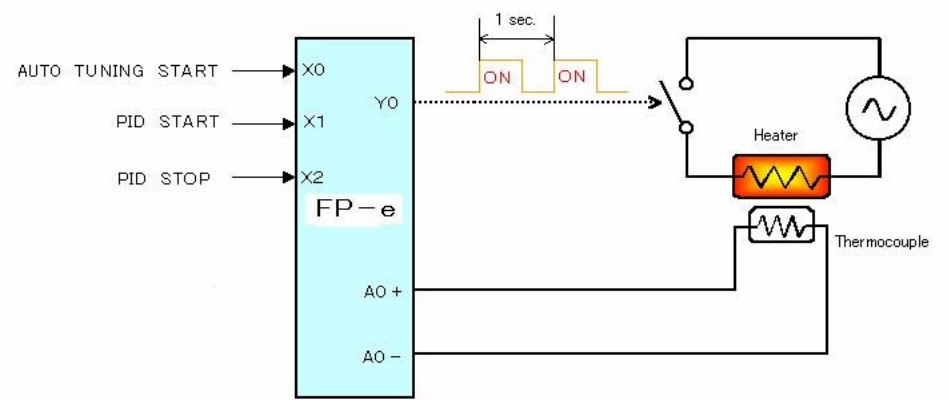
- Precautions during programming

· A 31-word area is required for the parameter table, including the work area for processing. Take care that other instructions do not overwrite the values in this area.
· An error will not be detected even if the parameter table exceeds its area. When specifying [S], select a number at least 31 words before the last number.
· Take care that the area is not exceeded due to index modification. An error will not be detected even if the area is exceeded.
· For the current measured value [S+2], input the temperature data (WX1 and WX2).
· Output the result of PID processing [S+3] to the process using the PWM output function.
· For FP-e, this instruction F355 (PID) cannot be programmed in the interrupt program.

8.3 PID control sample program

- PID control

When a K-type thermocouple is connected with the thermocouple input of FP-e, PID temperature control can be easily conducted. (In addition, parameter setting can be automatically selected using “AUTO TUNING.”)



- Thermocouple input specifications

Item	Description
Number of input point	2 points (CH0: WX1, CH1: WX2)
Temperature sensor type	K-type thermocouple
Input temperature range	- 30.0 to 300.0 ºC (- 22 to 572 °F)
Accuracy	±0.5 %FS±1.5 ºC (FS = - 30 to 300 ºC)
Resolution	0.1 ºC
Conversion time	250 ms/2CH
Insulation method	Between internal circuit and thermocouple input circuit: noninsulated Between CH0 and CH1 of thermocouple input: PhotoMos insulation
Detection function of wire disconnection	Available

Reference: Description of the specifications <2.3.1 Input specifications>

- Thermocouple

A thermocouple is the sensor that measures the temperature using the thermo-electromotive force generated by the temperature difference between two metal wires connected, whose materials are different.

- (1) Screen display setting sample program

Sample program

```
0   PV = DT202, SV = DT201
  R9013
 ─┤ ├─[F0 MV     ,  H 23    ,  DT 0    ]
    [F0 MV     ,  H 6001  ,  DT 1    ]
    [F0 MV     ,  H 2001  ,  DT 2    ]
    [F180 SCR  ,  K 0     ,  DT 0    ,  DT 202  ,  DT 201  ]
```

Screen display setting: K0 (N mode 1st screen)

Display control data: D0 to D2

Upper section display data: DT202

Lower section display data: DT201

Screen display

Screen display setting	: K0: N mode 1st screen
Display control data	: DT0: H23: ºC, PV, SV display DT1: H6001: Signed Dec 5 digits, 2nd decimal place display, Orange DT2: H2001: Signed Dec 5 digits, 2nd decimal place display, Green
Upper display data	: DT202: Measured temperature
Lower display data	: DT201: Set temperature

- (2) PID parameter setting sample program

Sample program

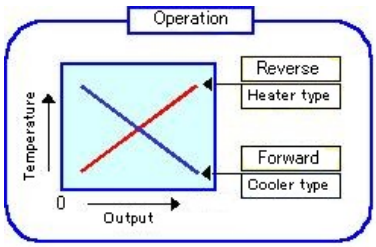
```
25  ********** PID data table settings **********
  R9013
 ─┤ ├─[F0 MV     ,  H 0     ,  DT 200  ] Control code
    [F0 MV     ,  K 550   ,  DT 201  ] Set temperature (SP)
  R9010
36─┤ ├─[F0 MV     ,  WX 1    ,  DT 202  ] Current temperature (PV)
  R9013
42─┤ ├─[F0 MV     ,  K 0     ,  DT 203  ] PID output value (MV)
    [F0 MV     ,  K 0     ,  DT 204  ] PID output lower limit
    [F0 MV     ,  K 10000 ,  DT 205  ] PID output upper limit
    [F0 MV     ,  DT 1652 ,  DT 206  ] Proportional gain (Kp)
    [F0 MV     ,  DT 1653 ,  DT 207  ] Integral time (Ti)
    [F0 MV     ,  DT 1654 ,  DT 208  ] Derivative time (Td)
    [F0 MV     ,  K 100   ,  DT 209  ] PID cycle (Ts)
    [F0 MV     ,  K 0     ,  DT 210  ] Auto-tuning progress
```

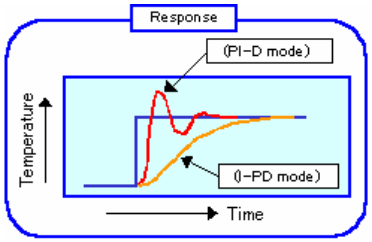
DT200: Control code (H0: Reverse operation PI-D mode)
DT201: Set temperature = 55 ℃ (550*0.1 ℃)
(Use the same unit as the one for the current temperature.)
DT202: Current temperature (Reading from WX1, unit: 0.1 ℃)
DT203: PID processing output value (automatically calculated)
DT204: PID output lower limit value (Normally, 0 %)
DT205: PID output upper limit value (Normally, 100.00 %)
DT206: Proportional gain
DT207: Integral time
DT208: Derivative time
} These are automatically selected in the auto-tuning process. Write them in the program.
DT209: Processing interval (Approx. 1 sec. in temperature control. Use the same interval as the one for heater PWM cycle.)
DT210: Auto-tuning progress

Note: DT211 to DT230 are used for the PID processing work area. Therefore, do not use them for other uses.

- Control code

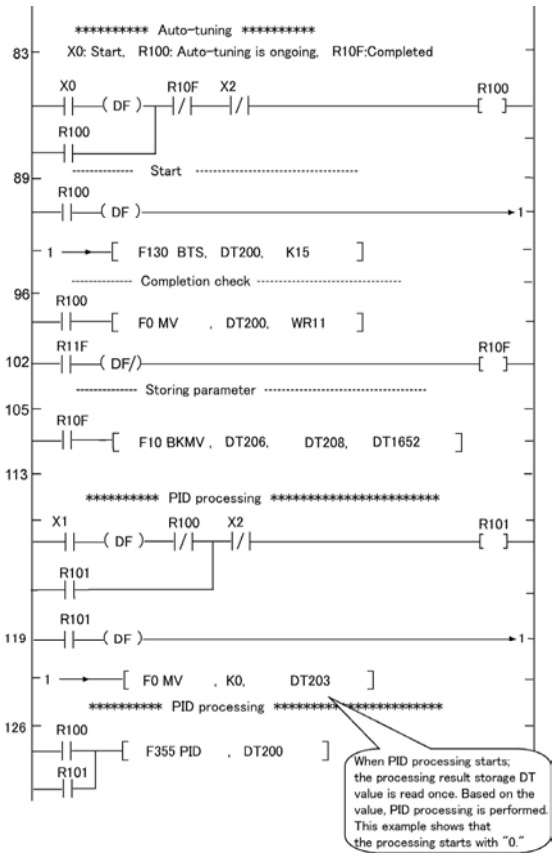
Control code	H0	H1	H2	H3
Control operation	Reverse	Forward	Reverse	Forward
Response characteristics	PI-D		I-PD	





- (3) PID processing sample program

Sample program



Program

X0 : Auto-tuning start
(Auto-tuning is executed only once.)

R100 : Auto-tuning is being executed.

R130 : 16-bit data bit set
When the most significant digit bit (K15) of the DT200 is “1”, auto-tuning starts.
When the most significant bit (R11F) of the DT200 is “0”, auto-tuning completes.

R10F : Auto-tuning completes.

F10 : Block transfer instruction
Parameters (Kp, Ti, Td), which are automatically adjusted in auto-tuning, are stored.

X1 : PID control starts.

R101 : PID control is being executed.

X2 : PID control stops.

F355 : PID processing instruction
Always turn to “ON” while PID control.

Notes:

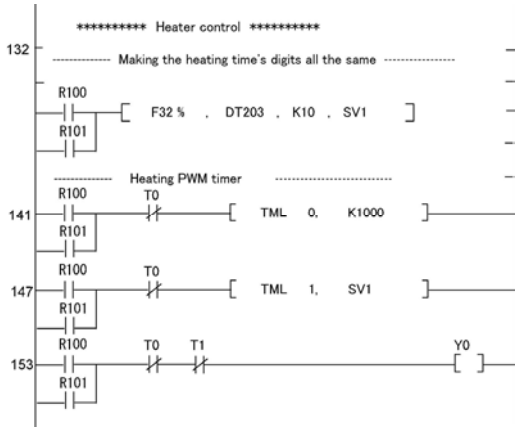
1. Before starting the auto-tuning for the first time, set the parameters (Kp, Ti, Td) specified for the PID control.
(Using the FPWIN GR data monitor facilitates the setting.)

Setting example
· DT1652: K1 Proportional gain (Kp)
· DT1653: K1 Integral time (Ti)
· DT1654: K0 Derivative time (Td)

2. To store the PID control parameters obtained in the auto-tuning, write them in the storage type data area (e.g., DT 1652 to DT1653) when the auto-tuning is completed.

- (4) Heater PWM control sample program

Sample program



Program

DT203 : PID processing output
SV1 : Heating time setting
Heater control depending on PID processing result. To turn the heater ON (100 %) when the PID processing output DT203 is 100 % (K10000), divide the PID processing output DT203 (K10000) by 10 and write 100 % (1000 ms) into SV1 of heating timer.

TML0 : PWM output cycle setting

TML1 : Heating time setting

Y0 : Heater control

Setting the input timing

Set the input timings as shown below so that the temperature conversion cycle (250 ms for FP-e), PID control cycle (DT209) and PWM output cycle (TM0) are all equal, or PID control cycle takes longer than other two cycles.

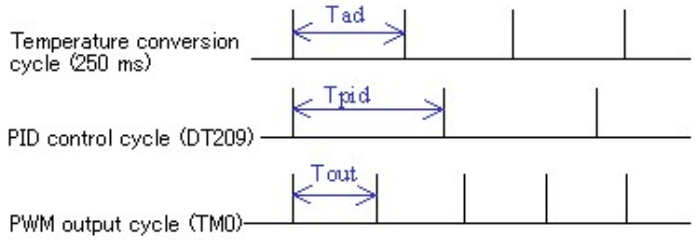
Correct:

· Tad = Tpid = Tout

· Tad < Tpid > Tout

Incorrect:

· Tad > Tpid < Tout

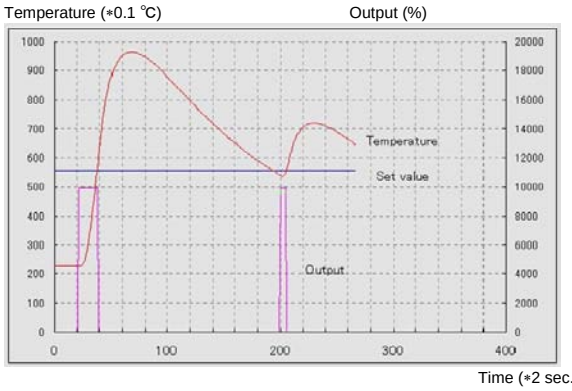


8.4 Example of temperature control

- Example of auto-tuning

Control cycle: Ts = K100 (1 s)

Selected parameter: Proportional gain (Kp) = K171 (17.1), Integral time (Ti) = K600 (60 s),
Derivative time (Td) = K150 (15 s)

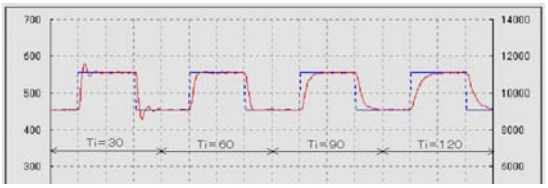


· The temperature input conversion for FP-e is performed every 250 ms. The average cycle (1 to 50 times) can be set using the system register 409. The initial setting is “0.” (Average: 20 times) When the heat capacity of the control system is small and heating/cooling is performed at high speed, set a value for the average time to a smaller one.

· Executing the auto-tuning sets the parameters suitable for any control system automatically. Optimum control can be conducted by changing the values (1/2 to 2 times).
Generally, Kp (proportional gain) affects on the response characteristics. As the value of Kp becomes larger, the response error becomes smaller. When the value is too large, however, it may cause the hunting. Ti (Integral time) greatly affects on the response characteristics. As the value of Ti becomes smaller, the response becomes faster. When the value is too small, however, it may cause the overshoot.

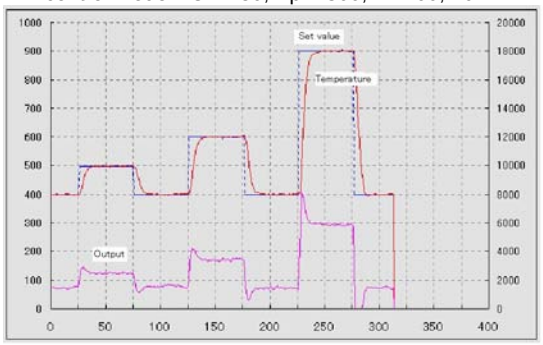
- Example of PID parameter characteristics

When Ti is changed to 30, 60, 90, and 120 under the conditions as follows:
Ts = 250, Kp = 300, Td = 1



- Example of PID processing

PID control mode: Ts = 250, Kp = 300, Ti = 60, Td =



Chapter 9

Specifications

9.1 Specifications

9.1.1 General specifications

Item	Description	
Rated voltage	24V DC	
Operating voltage range	21.6 to 26.4V DC	
Allowed momentary power off time	10 ms	
Ambient temperature	0 to +55ºC	
Storage temperature	-20 to +70ºC	
Ambient humidity	30 to 85%RH (at 25 ºC, non-condensing)	
Storage humidity	30 to 85%RH (at 25 ºC, non-condensing)	
Breakdown voltage	Between insulated circuits: 500V AC, 1 min However, between 3) Output terminal (Y5, COM) and other insulated circuits: 1500V AC, 1 min (Cut-off current: 10mA, excluding the barrister for protection)	Insulated circuit 1) Power supply terminal, function earth, Input terminal (A0,A1), COM.(RS232C)Terminal 2) Input terminal (COM, X0 to Xn) 3) Output terminal (+, –, Y0 to Y4) 4) Output terminal (Y5, COM) 5) COM. (RS485) terminal
Insulation resistance	Between insulated circuits: 100 MΩ or higher (measured with 500V DC)	
Vibration resistance	10 to 55 Hz, 1 cycle/min. Double amplitude: 0.75 mm, 10 min. on X, Y , and Z axes	
Shock resistance	98 m/s^2 , 4 times on X, Y, and Z axes	
Noise resistance	1000V (p-p) with pulse widths 50 ns 1 µs (based on in-house measurements)	
Operating condition	Free from corrosive gases and excessive dust	
Electric current	200 mA or less (24V DC), surge current: 20 A	
Protection	IP66-compliant front section (Only when a rubber packing is used.)	
Weight	Approx. 130 g (Weight of the mounting frame and unit package is not included.)	

9.1.2 Performance specifications

Item \ Model			AFPE224300 (Standard type) RS232C	AFPE224302 (Standard type) RS485	AFPE224305 (Calendar timer type) RS232C	AFPE214325 (Thermo-couple input type) RS232C	AFPE224322 (Thermo-couple input type) RS485
Programming method/ Control method			Relay symbol/Cyclic operation				
Number of controllable I/O points	**Control unit**		14 points [Input: 8, Output: 6 (Tr. NPN: 5/Ry 1)]			12 points [Input: 6, Output: 6]	
	Front switch input		8 points For mode switching 1 point For screen switching 1 point For data setting or external input 6 points				
Program memory	**Built-in memory**		Built-in EEP-ROM				
Program capacity			2,720 steps				
Number of instruction	**Basic**		83				
	High-level		168 Note1)				
Operation speed			0.9 μ s/step (Basic instruction)				
I/O update and Base time			2 ms			Typical 2 to 3 ms Max. 15 ms Note2)	
Operation memory points	**Relays**	**Internal relay (R)**	1,008 points (R0 to R62F)				
		Special internal relay (R)	64 points (R9000 to R903F)				
		Timer/Counter (T/C)	144 points (Initial setting: 100 timer points, T0 toT99/44 counter points, C100 to C143 Note 3) Timer range (1 ms, 10ms, 100ms, 1 s): selected by instruction				
	Memory areas	**Data register (DT)**	1,660 words (DT0 to DT1659)				
		Special data register (DT)	112 words (DT9000 to DT9111)				
		Index registers (IX. IY)	2 points				
Differential points			Unlimited number of points				
Master control relay points (MCR)			32 points				
Number of labels (JP and LOOP)			64 labels				
Number of step ladders			128 stages				
Number of subroutines			16 subroutines				
Number of interrupt programs			7 programs (external: 6, internal 1)				
Self-diagnostic function			Watchdog timer, program syntax check, etc.				
Clock/calendar function Note 4)			Not available		Available (year, month, day, hour, minute, second and day of week) However, this can only be used when a battery has been installed.		Not available
Battery life			No battery		220 days or more (actual usage value: approx. 870 days (25 ºC) (Periodic replacement interval: 1 year) (Value applies when no power is supplied at all.)		No battery
Pulse catch input			6 points in total (X0 and X1: 50 µs, X2 to X5: 100 µs)				
Interrupt input							
COM. port Note 5)			RS232C	RS485	RS232C	RS232C	RS485
Periodical interrupt			0.5 ms to 30 s				
Constant scan			Available				
Password			Available				

Note 1) High-level instructions are available for Ver1.2 or higher.
Note 2) The time takes longer every 250 ms.
Note 3) The proportion of timer points to counter points can be changed using a system register.
Note 4) Precision of calendar timer:
- At 0 ºC/32 ºF, less than 200 seconds error per month
- At 25 ºC/77 ºF, less than 70 seconds error per month
- At 55 ºC/131 ºF, less than 240 seconds error per month

Note 5) When using the COM. port to communication with other devices, retransmission is recommended as it may be affected by excessive noise depending on the environments installed. The driver IC for the RS232C port conforms to EIA/TIA-232E and CCITT V. 28 standards.

Item \ Model			AFPE224300 (Standard type) RS232C	AFPE224302 (Standard type) RS485	AFPE224305 (Calendar timer type) RS232C	AFPE214325 (Thermo-couple input type) RS232C	AFPE224322 (Thermo-couple input type) RS485
Special functions	**High-speed counter function** *** The combinations 1-phase x 2 ch. and 2-phase x 1 ch. are also possible for the high-speed counter.** *** For details and l imitations on the high-speed counter, see the following pages.**		Counter mode: Addition/subtraction (1-phase) Note 6) - Input points: 4 ch. (Max.) - Max. speed: 10 kHz (total of 4 ch.) :Max. 5 kHz - Input contact: X0: count input (ch. 0), X1: count input (ch. 1), X2: reset input Note 7); X3: count input (ch. 2), X4: count input (ch. 3), X5: reset input Note 7) - Min. input pulse width: X0, X1: 50µs(10 kHz) X0, X1: 100µs (5 kHz) X3 and X4: 100 µs (5kHz) Counter mode: 2-phase/individual/direction decision (2-phase) - Input points: 2 ch (Max.) - Max. speed: 2 kHz (total of 2 ch.) :Max. 1 kHz - Input contact: X0: count input (ch. 0), X1: count input (ch. 0), X2: reset input; X3: count input (ch. 2), X4: count input (ch. 2), X5: reset input - Min. input pulse width: X0, X1: 50µs(10 kHz) X0, X1: 100µs (5 kHz) X3 and X4: 100 µs (5 kHz)			
	Pulse output function *** For details and limitations on the high-speed counter, see the following pages.**	**Output points**	2 independent points (Y0 and Y1) (No interpolation function)				
		Output frequency	40 Hz to 10 kHz (Y0/Y1: 1-point) Note 8) 40 Hz to 5 kHz (Y0/Y1:2-point)			40Hz to 5kHz (1-point) 40Hz to 2.5kHz (2-point)	
	PWM output function *** For details and limitations on the high-speed counter, see the following pages.**	**Output points**	2 points (Y0 and Y1)				
		Output frequency	Frequency: 0. 15 Hz to 1 kHz, Duty: 0.1 to 99.9 %				
Memory backup Note 9)	**Timer**		Non-hold (all points)				
	Counter	**Non-hold type**	From set value to C139				
		Hold type	C140 to C143, EV140 to EV143 (elapsed values)				
			SV: Non-hold Note 10)		SV: Hold		SV: Non-hold Note 10)
	Internal relay	**Non-hold type**	976 points (R0 to R60F)		61 words (WR0 to WR60)		
		Hold type	32 points (R610 to R62F)		2 words (WR61 to WR62)		
	Data register	**Non-hold type**	1652 words (DT0 to DT1651)				
		Hold type	8 words (DT1652 to DT1659)				

Note 6) The max counting speed (10 kHz) is the counting speed with a rated input voltage of 24 V DC and an ambient temperature of 25 ºC. The counting speed (frequency) will decrease depending on the voltage and temperature.

Note 7) If the unit is equipped with both reset inputs X0 and X1, X2 serves as the reset input for X1. If X3 and X4 are used, X5 serves as the reset input for X4.

Note 8) When the positioning control instruction “F168” is performed, the maximum output frequency is 9.5 kHz.

Note 9) The program, system registers and the hold type area (internal relay, data register, and timer/ counter) are backed up by the built-in EEP-ROM. Data can be written 10000 times or less with the EEP-ROM writing instruction. When a battery is replaced with a new one in the FP-e unit with a calendar timer function, settings can be changed using the system register. If a battery is not installed, the data cannot be stored even when the settings of the system register are changed.

Note 10) Use the following methods for holding the SV data:

1. Set the transfer instruction for the special data register (DT) to hold the data. Then, perform the setting so that the data can be transferred from DT to SV after the RUN mode starts.
2. Use the FP-e model with a battery.

9.1.3 Specifications (High-Speed Counter/Pulse Output/PWM Output)

Table of high-speed counter function specifications

Input/Output counter number being used			Built-in high-speed counter channel No.	Memory area used			Performance specifications			Related instructions
On/Off output	Count mode	Input contact No (value in parenthesis is reset input) (Note 1)		Control flag	Elapsed value area	Target value area	Min. of input pulse width	Max. counting speed		
								Using only 1 channel	Using multiple channels	
Specify the desired output from Y0 to Y5	**Incremental input** **Decremental input**	**X0 (X2)**	CH0	R903A	DT9044 DT9045	DT9046 DT9047	50 µs Note 2)	Max. 10 kHz Note 3)	Total of 4 CH with Max. 10 kHz Note 3)	**F0 (MV), F1 (DMV), F166 (HC1S, F167 (HC1R)**
		X1 (X2)	CH1	R903B	DT9048 DT9049	DT9050 DT9051		Max. 10 kHz Note 3)		
		X3 (X5)	CH2	R903C	DT9104 DT9105	DT9106 DT9107	100 µs	Max. 5 kHz		
		X4 (X5)	CH3	R903D	DT9108 DT9109	DT9110 DT9111		Max. 5 kHz		
Specify the desired output from Y0 to Y5	**2-phase input** **Incremental/decremental input** **Directional distinction**	**X0 X1 (X2)**	CH0	R903A	DT9044 DT9045	DT9046 DT9047	250 µs Note 4)	Max. 2 kHz Note 5)	Total of 2 CH with Max. 2 kHz Note 5)	
		X3 X4 (X5)	CH2	R903C	DT9104 DT9105	DT9106 DT9107	500 µs	Max. 1 kHz		

Note 1) Reset input X2 can be set to either CH0 or CH1. Reset input X5 can be set to either CH2 or CH3.
Note 2) Thermocouple input type: 100 µs
Note 3) Thermocouple input type: Max. 5 kHz.
Note 4) Thermocouple input type: 500 µs
Note 5) Thermocouple input type: Max. 1 kHz

Table of pulse output function specifications

Input/Output contact number being used				Built-in high-speed counter channel No.	Memory area used			Performance specifications for maximum output frequency	Related instructions
Pulse output	Directional output	Home input	Near home input		Control flag	Elapsed value area	Target value area		
Y0	**Y2**	**X0**	**DT9052 <bit 2>**	CH.0	R903A	DT9044 DT9045	DT9046 DT9047	Max. 10 kHz for 1-point output Max. 5 kHz for 2-point output	**F0 (MV), F1 (DMV), F168 (SPD1), F169 (PLS)**
Y1	**Y3**	**X1**	**DT9052 <bit 6>**	CH1	R903B	DT9048 DT9049	DT9050 DT9051		

Notes: - The maximum 1-point output for instruction F168 (SPD1) is 9.5 kHz.
- For the thermocouple input type, the maximum output frequency is 5 kHz (1-point output) and 2.5 kHz (2-point output).

Table of PWM output specifications

Output number being used	Built-in high-speed counter channel No.	Memory area used	Performance specifications for output frequency	Related instructions
		Control flag		
Y0	CH0	R903A	Frequency: 0.15 Hz to 1kHz Duty: 0.1% to 99.9%	**F0 (MV), F1 (DMV), F170 (PWM)**
Y1	CH1	R903B		

9.1.4 Functions and Restrictions (High-Speed Counter/Pulse Output/PWM Output)

Channel
The same channel cannot be used by more than one function.

Example of prohibited application:
You cannot share CH.0 with the high-speed counter and pulse output functions.

I/O number (input/output contact point)
The number allocated to each function cannot be used for normal inputs or outputs.

Example of prohibited application
When using CH.0 for 2-phase inputting with the high-speed counter function, you cannot allot X0 and X1 to normal inputs.

When using Y0 for the pulse output function, you cannot allot origin input X0 to a normal input.

When using Y0 for the pulse output (with directional output operating) function, you cannot allot Y2 (directional output) to a normal input or output.

When using the high-speed counter with a mode that does not use the reset input, you can allot the inputs listed in parenthesis in the specifications table to a normal input.

Example of allowable application
When using the high-speed counter with no reset input and 2-phase input, you can allot X2 to a normal input.

Restrictions on the execution of related instructions (F166 to F170)
When any of the instructions related to the high-speed counter (**F166** to **F170**) are executed, the control flag (special internal relay: R903A to R903D) corresponding to the used channel turns on.

When the flag for a channel turns on, another instruction cannot be executed using the same channel.

Example of prohibited application
While executing **F166** (target value match on instruction) and flag R903A is in the on state, **F167** (target value match off instruction) cannot be executed with CH.0.

Restrictions for maximum counting speed/pulse output frequency

The counting speed when using the high-speed counter function will differ depending on the counting mode as shown in the table.

Example 1:

While in the incremental input mode and using the two channels CH.0 and CH.1, if CH.0 is being used at 8 kHz, then CH.1 can be used up to 2 kHz.

Example 2:

While in the 2-phase input mode and using the two channels CH.0 and CH.2, if CH.0 is being used at 1 kHz, then CH.2 can be used up to 1 kHz.

The maximum output frequency when using the pulse output function will differ depending on the output contact number as shown in the table.

Example 1:

When using either only Y0 or only Y1, the maximum output frequency is 10 kHz.

Example 2:

When using the two contacts Y0 and Y1, the maximum output frequency is 5 kHz.

When using the high-speed counter function and pulse output function, specifications will differ depending on the conditions of use.

Example:

When using one pulse output contact with a maximum output frequency of 5 kHz, the maximum counting speed of the high-speed counter being used simultaneously is 5 kHz with the incremental mode and 1 kHz with the 2-phase mode.

9.2 I/O Allocation

- I/O Allocation of FP-e control unit

Contact	Description	Note
X0 X1 X2 X3 X4 X5 X6 X7	External input External input External input External input External input External input External input External input	X0 to X5: Used for thermocouple input type. X6, X7: Not used. (Thermocouple input type)
X8 ⋮ XF	Not used.	
X10 ⋮ X1F	CH.0 Temperature data (WX1)	Used only for thermocouple input type.
X20 ⋮ X2F	CH.1 Temperature data (WX2)	Used only for thermocouple input type.
X30 X31 X32 X33 X34 X35 X36 X37	Front switch input "0" switch Front switch input "1" switch Front switch input "2" switch Front switch input "3" switch Front switch input "4" switch Front switch input "5" switch Front switch input "1/2/SET" switch Front switch input "MODE" switch	Available when the mode is set to S or I mode (Not available when the mode is set to "LOCK.") Note: X30 to X3F do not turn ON in the 1st scanning after the mode is set to RUN.
X38 X39 X3A X3B X3C X3D X3E X3F	Front switch input "0" switch Front switch input "1" switch Front switch input "2" switch Front switch input "3" switch Front switch input "4" switch Front switch input "5" switch Front switch input "1/2/SET" switch Front switch input "MODE" switch	Available in all modes (Available even when the mode is set to "LOCK.") Note: X30 to X3F do not turn ON in the 1st scan after the mode is set to RUN.
X40 X41 X42 X43 X44 X45 X46 X47 X48 X49 X4A X4B X4C X4D X4E X4F	Data setting error (Out of the specified 16-bit) Determination of N mode 1st screen data Determination of N mode 2nd screen data Determination of R mode 1st screen data Determination of R mode 2nd screen data Not used. Not used. Not used. Not used. N mode 1st screen data is being changed. N mode 2nd screen data is being changed. R mode 1st screen data is being changed. R mode 2nd screen data is being changed. Not used. CH. 0 Temperature conversion completion flag CH. 1 Temperature conversion completion flag	When the data change starts: 0 When the data is determined: 1 When the data is being changed: 1 Date is determined or cancelled: 0 Note 1)

Note 1) To cancel the data change, press the operation switch "5" for 1 second, or switch the mode using the RUN/PROG. switch.
The data change can also be cancelled by turning Y38 ON. (Ver.1.1 or higher)

Contact	Description	Note
Y0	External output	
Y1	External output	
Y2	External output	
Y3	External output	
Y4	External output	
Y5	External output	
Y6	Not used.	
Y7	Not used.	
Y8	Not used.	
Y9	Not used.	
YA	Not used.	
YB	Not used.	
YC	Not used.	
YD	Not used.	
YE	Not used.	
YF	Not used.	
Y30	"Mode", "1/2/SET", "0" to "5" switches: Locked.	Switch is locked: 1 Switch is available: 0
Y31	Switch lock ("0" to "5") of N mode 1st screen	
Y32	Switch lock ("0" to "5") of N mode 2nd screen	
Y33	Switch lock ("0" to "5") of R mode 1st screen	
Y34	Switch lock ("0" to "5") of R mode 2nd screen	
Y35	Not used.	
Y36	Not used.	
Y37	Temperature data unit change (Ver.1.1 or higher)	ºF: 1, ºC: 0
Y38	Data change cancellation (Ver.1.1 or higher)	Cancellation: Yes:1, No: 0
Y39	Not used.	
Y3A	Not used.	
Y3B	Not used.	
Y3C	Not used.	
Y3D	Not used.	
Y3E	Not used.	
Y3F	Not used.	

9.3 Relays,memory Areas and Constants

Item		Number of points	Memory area available for use Matsushita	IEC	Function
Relay	External input relay (See Note 3.)	208	X0 - X12F	%IX0.0 - %IX12.15	Turns on or off based on external input.
	External output relay (See Note 3.)	208	Y0 - Y12F	%QX0.0 - %QX12.15	Outputs on or off state externally.
	Internal relay (See Note 2.)	1008	R0 - R62F	%MX0.0 - %MX0.62.15	Turns on or off only within a program.
	Timer (See Notes 1 and 2.)	100	T0 -T99/ C100 - C143	%MX1.0 - %MX1.99/ %MX2.100 - %MX2.143	Turns on when the timer reaches the specified time. Corresponds to the timer number.
	Counter (See Notes 1 and 2.)	44	C100 -C143/ T0 - T99	%MX2.100 - %MX2.143/ %MX1.0 - %MX1.99	Turns on when the counter increments. Corresponds to the counter number.
	Special internal relay	64	R9000 - R903F	%MX0.900.0 - %MX0.903.15	Turns on or off based on specific conditions. Used as a flag.
Memory area (words)	External input relay (See Note 3.)	13 words	WX0 - WX12	%IW0 - %IW12	Code for specifying 16 external input points as one word (16 bits) of data.
	External output relay (See Note 3.)	13 words	WY0 - WY12	%QW0 - %QW12	Code for specifying 16 external output points as one word (16 bits) of data.
	Internal relay (See Note 2.)	63 words	WR0 - WR62	%MW0.0 - %MW0.62	Code for specifying 16 internal relay points as one word (16 bits) of data.
	Data register (See Note 2.)	1660 words	DT0 - DT1659	%MW5.0 - %MW5.1659	Data memory used in a program. Data is handled in 16-bit units (one word).
	Timer/counter set value area	144 words	SV0 - SV143	%MW3.0 - %MW3.143	Data memory for storing a target value of a time and an initial value of a counter. Stores by time/counter number.
	Timer/counter elapsed value area (See Note 2.)	144 words	EV0 - EV143	%MW4.0 - %MW4.143	Data memory for storing the elapsed value during operation of a timer/counter. Stores by time/counter number.
	Special data register	112 words	DT9000 - DT9111	%MW5.9000 - %MW5.9111	Data memory for storing specific data. Various settings and error codes are stored.
	Index register	2 words	IX - IY	%MW6.0 - %MW6.1	Used as an address of memory area and constants modifier.

Item		Number of points	Memory area available for use Matsushita	IEC	Function
Memory area (double word) (See Note 4.)	External input relay (See Note 3.)	6 double words	DWX0 - DWX11	%ID0 -%ID11	Code for specifying 32 external input points as a double word (32 bits) of data.
	External output relay (See Note 3.)	6 double words	DWY0 - DWY11	%QD0 - %QD11	Code for specifying 32 external output points as double word (32 bits) of data.
	Internal relay (See Note 2.)	31 double words	DWR0 - DWR61	%MD0.0 - %MD0.61	Code for specifying 32 internal relay points as double word (32 bits) of data.
	Data register (See Note 2.)	830 double words	DDT0 - DDT1658	%MD5.0 - %MD5.1658	Data memory used in a program. Data is handled in 32-bit units (double words).
	Timer/counter set value area	72 double words	DSV0 - DSV142	%MD3.0 - %MD3.142	Data memory for storing a target value of a timer and an initial value of a counter. Stores by timer/counter number.
	Timer/counter elapsed value area (See Note 2.)	72 double words	DEV0 - DEV142	%MD4.0 - %MD4.142	Data memory for storing the elapsed value during operation of a timer/counter. Stores by timer/counter number.
	Special data register	56 double words	DDT9000 - DDT9110	%MD5.9000 - %MD5.9110	Data memory for storing specific data. Various settings and error codes are stored.
	Index register	1 double words	DI0	%MD6.0	Used as an address of memory area and constants modifier.

Item		Number of points
Control instruction point	Master control relay points(MCR)	32 points
	Number of labels (JP and LOOP)	64 labels
	Number of step ladders	128 stages
	Number of subroutiones	16 subroutiones
	Number of interrupt programs	7 programs (external:6,internal:1)

Item		Range available for use Matsushita	IEC
Constant	Decimal constants (Integral type)	K – 32768 to K32767 (for 16-bit operation)	– 32768 to 32767 (for 16-bit operation)
		K – 2147483648 to K2147483647 (for 32-bit operation)	– 2147483648 to 2147483647 (for 32-bit operation)
	Hexadecimal constants	H0 to HFFFF (for 16-bit operation)	16#0 to 16#FFFF (for 16-bit operation)
		H0 to HFFFFFFFF (for 32-bit operation)	16#0 to 16#FFFFFFFF (for 32-bit operation)
	Decimal constants (monorefined real number)	F – 1.175494 $\times$ 10^{-38} to F – 3.402823 $\times$ 10^{38}	– 1.17549410E-38 to – 3.402823E38
		F1.175494 $\times$ 10^{-38} to F3.402823 $\times$ 10^{38}	1.17549410E-38 to 3.402823E38

Notes:

1. The points for the timer and counter can be changed by the setting of System register No.5. The number given in the table above are the numbers when System register No. 5 is at its default setting.
2. There are two unit types;
   the hold type that saves the conditions that exist just before turning the power off or changing from the RUN mode to PROG. mode, and the non-hold type that resets them.
   These areas can be specified as hold type or non-hold type by setting system register.
   For the FP-e, that area is fixed and allotted the numbers as shown in the table below. For the FP-e with clock/calendar function type, the selection of hold type and non-hold type can be changed by the setting of system register.
3. The number of points noted above is the number reserved in the system. For the actual number of points available for use, refer to “I/O Allocation” in Appendix A.
4. Double words cannot be specified with FPWIN GR.

Hold type and non-hold type areas Note 1)

Model		AFPE224300 (Standard type)	AFPE224305 (Calendar timer type)	AFPE214325 (Thermocouple input type)
Timer		Non-hold type: all points		
Counter	Non-hold type	From the set value to C139		
	Hold type	C140 to C143, EV140 to EV143 (elapsed value)		
		SV: non-hold Note 2)	SV: hold	
Internal relay	Non-hold type	976 points (R0 to R60F) 61 words (WR0 to WR60)		
	Hold type	32 points (R610 to R62F) 2 words (WR61 to WR62)		
Data register	Non-hold type	1652 words (DT0 to DT1651)		
	Hold type	8 words (DT1652 to DT1659)		

Notes:

1. When a battery is installed in a calendar timer type FP-e, the areas above can be changed using the system register.
   If a battery is not installed, the data cannot be stored even when the settings are changed using the system register.
2. Use the following methods for holding the SV data:
   1. Set the transfer instruction for the special data register (DT) to hold the data. Then, perform the setting so that the data can be transferred from DT to SV after the RUN mode starts.
   2. Use the FP-e model with a battery.

9.4 ASCII characters displayed in the FP-e unit

9.4.1 Available ASCII characters

Available output characters using ASCII Code

	0xh	1xh	2xh	3xh	4xh	5xh	6xh	7xh
x0h	NUL	DEL	SPACE	0	@	P	`	p
x1h	SOH	DC1	!	1	A	Q	a	q
x2h	STX	DC2	”	2	B	R	b	r
x3h	ETX	DC3	#	3	C	S	c	s
x4h	EOT	DC4	$	4	D	T	d	t
x5h	ENQ	NAK	%	5	E	U	e	u
x6h	ACK	SYN	&	6	F	V	f	v
x7h	BEL	ETB	’	7	G	W	g	w
x8h	BS	CAN	(	8	H	X	h	x
x9h	HT	EM	)	9	I	Y	i	y
xAh	LF	SUB	*	:	J	Z	J	z
xBh	VT	ESC	+	;	K	[	k	{
xCh	FF	FS	,	<	L	¥	l	|
xDh	CR	GS	-	=	M	]	m	}
xEh	SO	RS	.	>	N	^	n	~
xFh	SI	US	/	?	O	_	o	DEL

Note 1) If specifying a characters which cannot be output, a blank is output.
Note 2) There is no discrimination between uppercase (41 h to 5Ah) and lowercase (61h to 7Ah) characters.
Therefore, “A” and a” is output in the same way.

9.4.2 ASCII code and display

Ascii code	Ascii character	Output image
20h	(SPACE)	
21h	!	
22h	"	
23h	#	
24h	$	
25h	%	
26h	&	
27h	'	
28h	(	
29h	)	
2Ah	*	
2Bh	+	
2Ch	,	
2Dh	−	
2Eh	.	
2Fh	/	

Ascii code	Ascii character	Output image
30h	0	
31h	1	
32h	2	
33h	3	
34h	4	
35h	5	
36h	6	
37h	7	
38h	8	
39h	9	
3Ah	:	
3Bh	;	
3Ch	<	
3Dh	=	
3Eh	>	
3Fh	?	

Ascii code	Ascii character	Output image
40h	@	
41h	A	
42h	B	
43h	C	
44h	D	
45h	E	
46h	F	
47h	G	
48h	H	
49h	I	
4Ah	J	
4Bh	K	
4Ch	L	
4Dh	M	
4Eh	N	
4Fh	O	

Ascii code	Ascii character	Output image
50h	P	
51h	Q	
52h	R	
53h	S	
54h	T	
55h	U	
56h	V	
57h	W	
58h	X	
59h	Y	
5Ah	Z	
5Bh	[	
5Ch	¥	
5Dh	]	
5Eh	^	
5Fh	_	

Ascii code	Ascii character	Output image
60h	`	
61h	a	
62h	b	
63h	c	
64h	d	
65h	e	
66h	f	
67h	g	
68h	h	
69h	i	
6Ah	j	
6Bh	k	
6Ch	l	
6Dh	m	
6Eh	n	
6Fh	o	

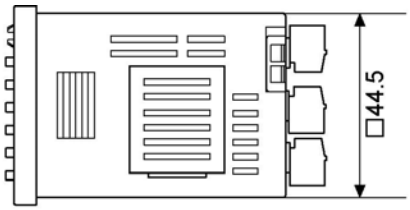
Ascii code	Ascii character	Output image
70h	p	
71h	q	
72h	r	
73h	s	
74h	t	
75h	u	
76h	v	
77h	w	
78h	x	
79h	y	
7Ah	z	
7Bh	{	
7Ch	|	
7Dh	}	
7Eh	~	
7Fh	(DEL)	

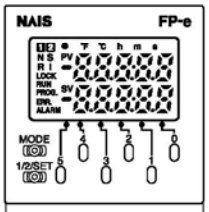
Note) When specifying the control code (00h to 1Fh, or 7Fh), a blank appears. (No display is turned on.)

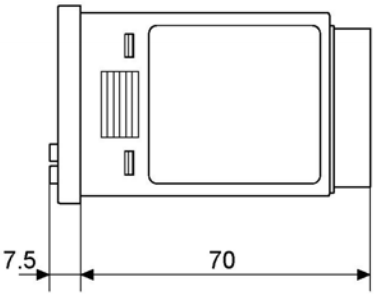
Chapter 10

Dimensions

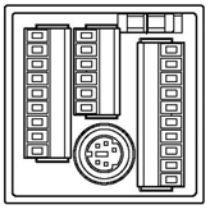
10.1 Dimensions





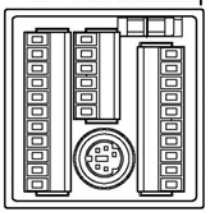


Analog input
without thermocouple



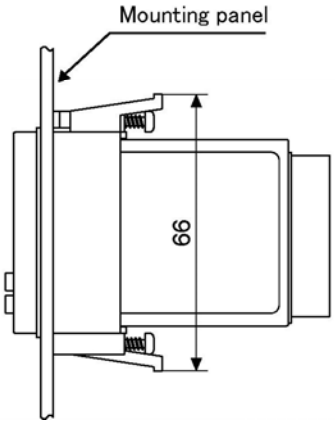
AFPE224300
AFPE224305
AFPE224302

Analog input
with thermocouple



AFPE214325
AFPE214322

– When FP-e is on a mounting panel



Chapter 11

Appendix

11.1 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

(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 couner 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

Using FP programmer II
Produce:
1. Set the mode selector of the CPU to PROG.
2. Press the keys on the FP programmer II, as shown below.

3. Specify the register number (e.g. No. 26) for the parameter to be set and read the parameter. The value set in the selected register (e.g. No. 26) will be displayed.

4. To change the set value, press the <CLR (clear)> key and write the new value as indicated in the system register table using decimal (K) or hexadecimal (H) constant.

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.

11.1.1 Table of System Registers for FP-e

	No.	Name	Default value	Descriptions	
Hold/ Non-hold	**5**	Starting number setting for counter	100	0 to 144	
	6	Hold type area starting number setting for timer and counter	140	0 to 144	(See note.)
	7	Hold type area starting number setting for internal relays	61	0 to 63	
	8	Hold type area starting number setting for data registers	1652	0 to 1660	
	14	Hold or non-hold setting for step ladder process	Non-hold	Hold/Non-hold	
Action on error	**20**	Disable or enable setting for duplicated output	Yes FPWIN GR: Disabled	Fixed FPWIN GR: Disabled/Enabled	
	26	Operation setting when an operation error occurs	Stop	Stop/Continuation of operation	
	4	Alarm battery error (Operating setting when battery error occurs)	Disabled	Dis-abled: When a battery error occurs, a self-diagnostic error is not issued and the ERROR LED does not light. Ena-bled: When a battery error occurs, a self-diagnostic error is issued and the ERROR LED lights.	
Time set-ting	**31**	Wait time setting for multi-frame communication	6500.0 ms	10 to 81900 ms	
	34	Constant value settings for scan time	0.0 ms	0: Normal scan 0 to 160 ms: Scans once each specified time interval	

Note) Use models without a clock/calendar function with the default value left as is. If you change the setting the hold/non-hold operation will be unstalbe.
Settings are valid for models with a clock/calendar time function.

	No.	Name	Default value	Descriptions	
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) incremental/decremental input (X0, X1) incremental/decremental 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)
	401	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 (X3) Decremental input (X3), Reset input (X5) Incremental/decremental input (X3, X4) Incremental/decremental input (X3, X4), Reset input (X5) Incremental/decremental control input (X3, X4) Incremental/decremental control input (X3, X4), Reset input (X5)
			HC3: Do not set input X4 as high-speed counter	CH3	Do 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)

FP-e

	No.	Name	Default value	Descriptions
Inter-rupt-input	**402**	**Pulse catch input settings**	Not set	X0 X1 X2 X3 X4 X5 Specify the input contacts used as pulse catch input.
	403	**Interrupt input settings**	Not set	X0 X1 X2 X3 X4 X5 Specify the input contacts used as intrrupt input. X0 X1 X2 X3 X4 X5 Specify the effective interrupt edge. (When set: ON→OFF is valid)

Note1) If the operation mode is set to two-phase, incremental/decremental, or incremental/decremental control, the setting for CH1 is invalid in part 2 of system register 400 and the setting for CH3 is invalid in part 2 of 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) The settings for pulse catch and interrupt input can only be specified in system registers 402 and 403.

Note4) If system register 400 to 403 have been set simultaneously for the same input relay, the following precedence order is effective:

1. High-speed counter
2. Pulse catch
3. Interrupt input.

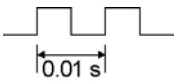
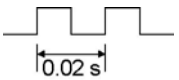
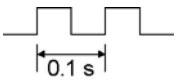
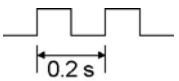
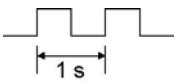
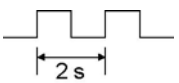
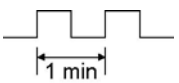
This means, the counter keeps counting even after an interrupt.

	No.	Name	Default value	Descriptions
Tem-pera-ture inout	**409**	**Number of temperature input average processing times (Available PLC: model with thermocouple input)**	0	0 to 50 For default valeu “0”, the number of average processing times is 20.
Tool port set-ting	**410**	**Unit No. setting**	1	1 to 99
	411	**Communication format setting**	Disabled	Modem connection: enabled/Disabled
			Data length: 8 bits	Data length: 7 bits/8 bits When connecting a modem, the format will be as follows depending on the data length setting. 8 bits data length: no parity, 1 stop bit 7 bits data length: odd parity, 1 stop bit
	414	**Communication speed (Baud rate) setting**	9600 bps	9600 bps 19200 bps
COM. port set-ting	**412**	**Communication mode setting**	Computer link	Computer link General-purpose serial communication MODBUS RTU (Ver.1.2 and higher)
	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: 7 bits/8 bits - Parity check: none/with odd/with even - Stop bit: 1 bit/2 bits - The following setting is valid only when the communication mode specified by system register 412 has been set to “General-purpose serial communication”. - Terminator CR/CR+LF/None - Header: STX not exist/STX exist
	414	**Communication speed (Baud rate) setting**	9600 bps	300 bps / 600 bps / 1200 bps / 2400 bps / 4800 bps / 9600 bps / 19200 bps
	415	**Unit no. setting**	1	1 to 99 (In Ver.1.2 and higher, settings can be changed in R mode even with the front operation switch.)
	416	**Selection of modem connection**	Disabled	Enabled/Disabled
	417	**Starting address for received buffer of general (serial data) communication mode**	0	0 to 1659
	418	**Buffer capacity setting for data received of general (serial data) communication mode**	1660	0 to 1660

11.1.2 Table of Special Internal Relays for FP-e

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.

Relay No.: Matsushita IEC	Name	Description
R9000 %MX0.900.0	**Self-diagnostic error flag**	Turns on when a self-diagnostic error occurs. ⇒ The content of self-diagnostic error is stored in DT90000.
R9001 %MX0.900.1	**Not used**	-
R9002 %MX0.900.2	**Not used**	-
R9003 %MX0.900.3	**Not used**	-
R9004 %MX0.900.4	**Not used**	-
R9005 %MX0.900.5	**Backup battery error flag (non-hold)**	Turns on for an instant when a backup battery error occurs.
R9006 %MX0.900.6	**Backup battery error flag (hold)**	Turns on and keeps the on state when a backup battery error occurs. Once a battery error has been detected, this is held even after recovery has been made. It goes off if the power supply is turned off, or if the system is initialized.
R9007 %MX0.900.7	**Operation error flag (hold)**	Turns on and keeps the on state shen an operation error occurs. ⇒The address where the error occurred is stored in DT9017. (Indicates the first operation error which occurred).
R9008 %MX0.900.8	**Operation error flag (non-hold)**	Turns on for an instant when an operation error occurs. ⇒The address where the operation error occurred is stored in DT9018. The contents change each time a new error occurs.
R9009 %MX0.900.9	**Carry flag**	This is set if an overflow or underflow occurs in the calculation results, and as a result of a shift system instruction being executed.
R900A %MX0.900.10	**> Flag**	Turns on for an instant when the compared results become larger in the comparison instructions.
R900B %MX0.900.11	**= Flag**	Turns on for an instant, - when the compared results are equal in the comparison instructions. - when the calculated results become 0 in the arithmetic instructions.
R900C %MX0.900.12	**< Flag**	Turns on for an instant when the compared results become smaller in the comparison instructions.
R900D %MX0.900.13	**Auxiliary timer instruction flag**	Turns on when the set time elapses (set value reaches 0) in the timing operation of the F137(STMR)/F183(DSTM) auxiliary timer instruction. The flag turns off when the trigger for auxiliary timer instruction turns off.
R900E %MX0.900.14	**Tool port communication error**	Turns on when a communication error at Tool port has occurred.
R900F %MX0.900.15	**Constant scan error flag**	Turns on when the 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.

Relay No.: Matsushita IEC	Name	Description
R9010 %MX0.901.0	**Always on relay**	Always on.
R9011 %MX0.901.1	**Always off relay**	Always off.
R9012 %MX0.901.2	**Scan pulse relay**	Turns on and off alternately at each scan.
R9013 %MX0.901.3	**Initial (on type) pulse relay**	Goes on for only the first scan after operation (RUN) has been started, and goes off for the second and subsequent scans.
R9014 %MX0.901.4	**Initial (off type) pulse relay**	Goes off for only the first scan after operation (RUN) has been started, and goes on for the second and subsequent scans.
R9015 %MX0.901.5	**Step ladder initial pulse relay (on type)**	Turns on for only the first scan of a process after the boot at the step ladder control.
R9016 %MX0.901.6	**Not used**	-
R9017 %MX0.901.7	**Not used**	-
R9018 %MX0.901.8	**0.01 s clock pulse relay**	Repeats on/off operations in 0.01 s cycles. 
R9019 %MX0.901.9	**0.02 s clock pulse relay**	Repeats on/off operations in 0.02 s cycles. 
R901A %MX0.901.10	**0.1 s clock pulse relay**	Repeats on/off operations in 0.1 s cycles. 
R901B %MX0.901.11	**0.2 s clock pulse relay**	Repeats on/off operations in 0.2 s cycles. 
R901C %MX0.901.12	**1 s clock pulse relay**	Repeats on/off operations in 1 s cycles. 
R901D %MX0.901.13	**2 s clock pulse relay**	Repeats on/off operations in 2 s cycles. 
R901E %MX0.901.14	**1 min clock pulse relay**	Repeats on/off operations in 1 min cycles. 
R901F %MX0.901.15	**Not used**	-

FP-e

Relay No.: Matsushita IEC	Name	Description
R9020 %MX0.902.0	**RUN mode flag**	Turns off while the mode selector is set to PROG. Turns on while the mode selector is set to RUN.
R9021 %MX0.902.1	**Not used**	-
R9022 %MX0.902.2	**Not used**	-
R9023 %MX0.902.3	**Not used**	-
R9024 %MX0.902.4	**Not used**	-
R9025 %MX0.902.5	**Not used**	-
R9026 %MX0.902.6	**Message flag**	Turns on while the F149 (MSG) instruction is executed.
R9027 %MX0.902.7	**Not used**	-
R9028 %MX0.902.8	**Not used**	-
R9029 %MX0.902.9	**Forcing flag**	Turns on during forced on/off operation for input/output relay timer/counter contacts.
R902A %MX0.902.10	**Interrupt enable flag**	Turns on while the external interrupt trigger is enabled by the ICTL instruction.
R902B %MX0.902.11	**Interrupt error flag**	Turns on when an interrupt error occurs.
R902C %MX0.902.12	**Not used**	-
R902D %MX0.902.13	**Not used**	-
R902E %MX0.902.14	**Not used**	-
R902F %MX0.902.15	**Not used**	-

Relay No.: Matsushita IEC	Name		Description
R9030 %MX0.903.0	**Not used**		-
R9031 %MX0.903.1	**Not used**		-
R9032 %MX0.903.2	**Not used**		-
R9033 %MX0.903.3	**Print instruction execution flag**		Off: Printing is not executed. On: Execution is in progress.
R9034 %MX0.903.4	**RUN overwrite complete flag**		Goes on for ony the first scan following completion of a rewrite during RUN operation.
R9035 %MX0.903.5	**Not used**		-
R9036 %MX0.903.6	**Not used**		-
R9037 %MX0.903.7	**COM port communication error flag**		- Goes on is a transmission error occurs during data communication.
R9038 %MX0.903.8	**COM port reception done flag during general-purpose serial communication**		- Turns on when the terminator is received during general - purpose serial communication.
R9039 %MX0.903.9	**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 %MX0.903.10	**High-speed counter control flag**	**ch0**	Turns on while the high-speed counter instructions F166(HC15), F167(HC1R) and the pulse output instructions F168(SPD1) to F170(PWM) are executed.
R903B %MX0.903.11	**High-speed counter control flag**	**ch1**	Turns on while the high-speed counter instructions F166(HC15), F167(HC1R) and the pulse output instructions F168(SPD1) to F170(PWM) are executed.
R903C %MX0.903.12	**High-speed counter control flag**	**ch2**	Turns on while the high-speed counter instructions F166(HC15), F167(HC1R) and the pulse output instructions F168(SPD1) to F170(PWM) are executed.
R903D %MX0.903.13	**High-speed counter control flag**	**ch3**	Turns on while the high-speed counter instructions F166(HC15), F167(HC1R) and the pulse output instructions F168(SPD1) to F170(PWM) are executed.
R903E %MX0.903.14			-
R903F %MX0.903.15			-

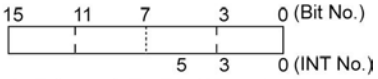
11.1.3 Table of Special Data Registers for FP-e

The special data registers are one word (16-bit) memory areas which store specific information.

(A: Available, N/A: Not available)

Register No. Matsushita IEC	Name	Descriptions	Read -ing	Writ- ing
DT9000 %MW5.9000	**Self-diagnostic error code**	The self-diagnostic error code is stored here when a self-diagnostic error occurs.	A	N/A
DT9001 %MW5.9001	**FP-e screen display switching**	Switches the FP-escreen to the screen of the mode specified. K0: N mode first screen K1: N mode second screen K2: S mode first screen K3: S mode second screen K4: R mode first screen K5: R mode second screen K6: I mode first screen K7: I mode second screen	A	N/A
DT9002 DT9003	**Analog input data**	Ch.0 analog input data (2-word real data)	A	N/A
DT9004 DT9005	**Analog input data**	Ch.1 analog input data (2-word real data)	A	N/A
DT9014 %MW5.9014	**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 the F0 (MV) instruction.	A	A
DT9015 %MW5.9015	**Operation auxiliary register for division instruction**	The divided remainder (16-bit) is stored in DT9015 when the division instruction F32(%) or F52(B%) instruction is executed. The divided remainder (32-bit) is stored in DT9015 and DT9016 when the division instruction F33(D%) or F53(DB%) is executed. The value can be read and written by executing the F0(MV) instruction.		
DT9016 %MW5.9016				
DT9017 %MW5.9017	**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
DT9018 %MW5.9018	**Operation error address (non-hold type)**	The address where an operation error occurred is stored. Each time an error occurs, the new address overwrites the previous address. At the beginning of a scan, the address is 0. Monitor the address using decimal display.		
DT9019 %MW5.9019	**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.		

FP-e (A: Available, N/A: Not available)

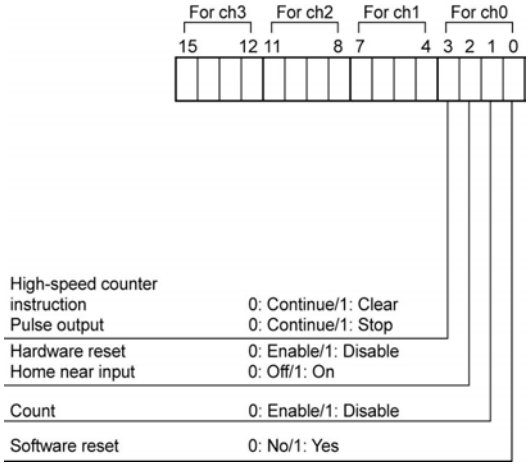
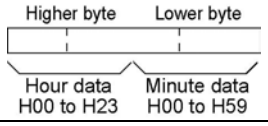
Register No. Matsushita IEC	Name	Descriptions	Read-ing	Writ-ing
DT9020 %MW5.9020	**Not used**	-	N/A	N/A
DT9021 %MW5.9021	**Not used**	-		
DT9022 %MW5.9022	**Scan time (current value)** Note)	The current scan time is stored here. Scan time is calculated using the formula: Scan time (ms) = stored data (decimal) x 0.1 ms Example: K50 indicates 5 ms.	A	N/A
DT9023 %MW5.9023	**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.		
DT9024 %MW5.9024	**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.		
DT9025 %MW5.9025	**Mask condition monitoring register for interrupts**	The mask conditions of interrupts using the instruction can be stored here. Monitor using binary display.  0: Interrupt disabled (masked) 1: Interrupt enabled (unmasked)		
DT9026 %MW5.9026	**Not used**	-	N/A	N/A
DT9027 %MW5.9027	**Periodical interrupt interval (INT24)**	The value set by the 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
DT9028 %MW5.9028	**Not used**	-	N/A	N/A
DT9029 %MW5.9029	**Not used**	-		
DT9030 %MW5.9030	**Message 0**	The contents of the specified message (Data lenght) are stored in these special data registers when F149 (MSG) instruction is executed.	A	N/A
DT9031 %MW5.9031	**Message 1**			
DT9032 %MW5.9032	**Message 2**			
DT9033 %MW5.9033	**Message 3**			
DT9034 %MW5.9034	**Message 4**			
DT9035 %MW5.9035	**Message 5**			

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.

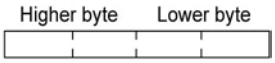
FP-e (A: Available, N/A: Not available)

Register No. Matsushita IEC	Name		Descriptions	Read-ing	Writ-ing
DT9036 %MW5.9036	**Not used**		-	N/A	N/A
DT9037 %MW5.9037	**Operation auxiliary register for search instruction F96(SRC)**		The number of data that match the searched data is stored here when F96 (SRC) insturction is executed.	A	A
DT9038 %MW5.9038	**Operation auxiliary register for search instruction F96(SRC)**		The position of the first matching data is stored here when an F96 (SRC) instruction is executed.		
DT9039 %MW5.9039	**Not used**		-	N/A	N/A
DT9040 %MW5.9040	**Temperature input ch.0**		The value of the temperature input before average processing is stored.	A	N/A
DT9041 %MW5.9041	**Temperature input ch.1**				
DT9042 %MW5.9042	**Not used**		-	N/A	N/A
DT9043 %MW5.9043	**Used by the system**		Used by the system (Battery).	A	N/A
DT9044 %MW5.9044	**High-speed counter elapsed value**	**For CH0**	The elapsed value (24-bit data) of the high-speed counter is stored here. The value can be read and written by executing F1 (DMV) instruction.	A	A
DT9045 %MW5.9045					
DT9046 %MW5.9046	**High-speed counter target value**	**For CH0**	The targe value (24-bit data) of the high-speed counter specified by the high-speed counter instruction is stored here. Target values have been preset for the various instructions to be used when the high-speed counter related instruction is executed. The value can be read by executing F1 (DMV) instruction.	A	N/A
DT9047 %MW5.9047					
DT9048 %MW5.9048	**High-speed counter elapsed value area**	**For CH1**	The elapsed value (24-bit data) of the high-speed counter is stored here. The value can be read and written by executing F1 (DMV) instruction.	A	A
DT9049 %MW5.9049					

FP-e (A: Available, N/A: Not available)

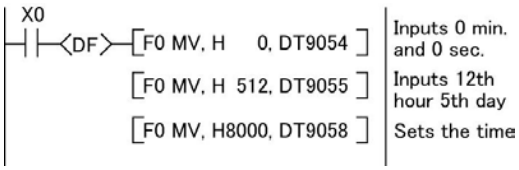
Register No. Matsushita IEC	Name		Descriptions	Read-ing	Writ-ing
DT9050 %MW5.9050 **DT9051** %MW5.9051	**High-speed counter target value area**	**For CH1**	The target value (24-bit data) of the high-speed counter specified by the high-speed counter instruction is stored here. Target values have been preset for the various instructions to be used when the high-speed counter related instruction is executed. The value can be read by executing F1 (DMV) instruction.	A	N/A
DT9052 %MW5.9052	**High-speed counter and 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  	N/A	A
DT9053 %MW5.9053	**Clock/calendar monitor (hour/minute)**		Hour and minute data of the clock/calendar are stored here. This data is read-only data. It cannot be overwritten.  	A	N/A

FP-e (A: Available, N/A: Not available)

<table>
<tr><th>Register No.
Matsushita
IEC</th><th>Name</th><th>Descriptions</th><th>Read-ing</th><th>Writ-ing</th></tr>
<tr><td>DT9054
%MW5.9054</td><td>Clock/calendar setting (minute/second)</td><td rowspan="4">The year, month, day, hour, minute, second and day-of-the-week data for the calender timer is stored. The built-in calendar timer will operate correctly through the year 2099 and supports leap years. The calendar timer can be set by writing a value using a programming tool software or a program that uses the F0 (MV) instruction.(see example for DT90058)
 

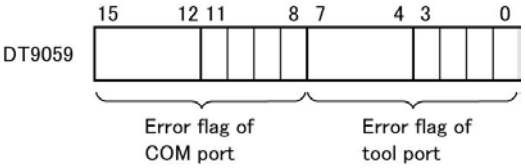
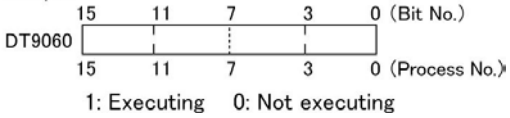
<table><tr><td>DT9054</td><td>Minute data (H00 to H59)</td><td>Second data (H00 to H59)</td></tr><tr><td>DT9055</td><td>Day data (H01 to H31)</td><td>Hour data (H00 to H23)</td></tr><tr><td>DT9056</td><td>Year data (H00 to H99)</td><td>Month data (H01 to H12)</td></tr><tr><td>DT9057</td><td>—</td><td>Day-of-the-week (H00 to H06)</td></tr></table></td><td rowspan="4">A</td><td rowspan="4">A</td></tr>
<tr><td>DT9055
%MW5.9055</td><td>Clock/calendar setting (day/hour)</td></tr>
<tr><td>DT9056
%MW5.9056</td><td>Clock/calendar setting (year/month)</td></tr>
<tr><td>DT9057
%MW5.9057</td><td>Clock/calendar setting (day-of-the-week)</td></tr>
<tr><td>DT9058
%MW5.9058</td><td>Clock/calendar time setting</td><td>By setting the highest bit of DT9058 to 1, the time becomes that written to DT9054 to DT9057 by the F0 (MV) instruction. After the time is set, DT9058 is cleared to 0. (Cannot be performed with any instruction other than the F0 (MV) instruction.)

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

FPWIN GR:
 

If you changed the values of DT9054 to DT9057 with the programming tool software, the time will be set when the new values are written. Therefore, it is unnecessary to write to DT9058.</td><td>A</td><td>A</td></tr>
</table>

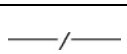
FP-e (A: Available, N/A: Not available)

Register No. Matsushita IEC	Name	Descriptions	Read -ing	Writ -ing
DT9059 %MW5.9059	**Serial communication error code**	Error code is sotred here when a communication error occurs.  ・Tool port bit 0 = 1: Over run error bit 1 = 1: Framing error bit 2 = 1: Parity error ・COM port bit 8 = 1: Over run error bit 9 = 1: Framing error bit 10 = 1: Parity error	A	N/A
DT9060 %MW5.9060	**Step ladder process (0 to 15)**	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. Example:  1: Executing 0: Not executing A programming tool software can be used to write data.	A	A
DT9061 %MW5.9061	**Step ladder process (16 to 31)**			
DT9062 %MW5.9062	**Step ladder process (32 to 47)**			
DT9063 %MW5.9058	**Step ladder process (48 to 63)**			
DT9064 %MW5.9064	**Step ladder process (64 to 79)**			
DT9065 %MW5.9065	**Step ladder process (80 to 95)**			
DT9066 %MW5.9066	**Step ladder process (96 to 111)**			
DT9067 %MW5.9067	**Step ladder process (112 to 127)**			

FP-e (A: Available, N/A: Not available)

Register No. Matsushita IEC	Name		Descriptions	Read -ing	Writ -ing
DT9104 %MW5.9104 **DT9105** %MW5.9105	**High-speed counter elapsed value**	**For ch2**	The elapsed value (24-bit data) for the high-speed conter is stored here. The value can be read and written by executing the F1 (DMV) instruciton.	A	A
DT9106 %MW5.9106 **DT9107** %MW5.9107	**High-speed counter target value**	**For ch2**	The target valeu (24-bit data) of the high-speed counter specified by the high-speed counter instruction is stored here. Target values have been preset for the various instructions, to be used when the high-speed counter related instruction is executed. The value can be read by executing the F1 (DMV) instruction.	A	N/A
DT9108 %MW5.9108 **DT9109** %MW5.9109	**High-speed counter elapsed value**	**For ch3**	The elapsed value (24-bit data) for the high-speed counter is stored here. The value can be read and written by executing the F1 (DMV) instruction.	A	A
DT9110 %MW5.9110 **DT9111** %MW5.9111	**High-speed counter target value**	**For ch3**	The target value (24-bit data) of the high-speed counter specified by the high-speed counter instruction is stored here. Target values have been preset for the various instructions, to be used when the high-speed counter related instruction is executed. The value can be read by executing the F1 (DMV) instruction.	A	N/A

11.2 Table of Basic Instructions

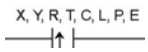
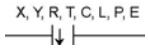
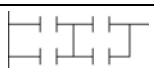
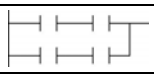
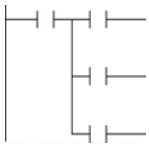
Name	Boolean	Symbol	Description	Steps (*1)
Sequence basic instructions				
Start	**ST**		Begins a logic operation with a Form A (normally open) contact.	1 (2)
Start Not	**ST/**		Begins a logic operation with a Form B (normally closed) contact.	1 (2)
Out	**OT**		Outputs the operated result to the specified output.	1 (2)
Not	**/**		Inverts the operated result up to this instruction.	1
AND	**AN**		Connects a Form A (normally open) contact serially.	1 (2)
AND Not	**AN/**		Connects a Form B (normally closed) contact serially.	1 (2)
OR	**OR**		Connects a Form A (normally open) contact in parallel.	1 (2)
OR Not	**OR/**		Connects a Form B (normally closed) contact in parallel.	1 (2)
Leading edge start	**ST↑**		Begins a logic operation only for one scan when the leading edge of the trigger is detected.	2
Trailing edge start	**ST↓**		Begins a logic operation only for one scan when the trailing edge of the trigger is detected.	2

Name	Availability												
					FP1			FP-M					
	FP0	FPΣ	FP-X	FP-e	C14 C16	C24 C40	C56 C72	C16	C20 C32	FP3	FP2	FP2SH	FP10SH
Sequence basic instructions													
Start	A	A	A	A	A	A	A	A	A	A	A	A	A
Start Not	A	A	A	A	A	A	A	A	A	A	A	A	A
Out	A	A	A	A	A	A	A	A	A	A	A	A	A
Not	A	A	A	A	A	A	A	A	A	A	A	A	A
AND	A	A	A	A	A	A	A	A	A	A	A	A	A
AND Not	A	A	A	A	A	A	A	A	A	A	A	A	A
OR	A	A	A	A	A	A	A	A	A	A	A	A	A
OR Not	A	A	A	A	A	A	A	A	A	A	A	A	A
Leading edge start	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Trailing edge start	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

Note:

- A: Available, N/A: Not available

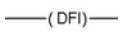
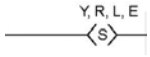
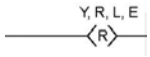
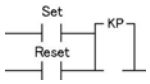
1) In the FP2/FP2SH/FP10SH, when using X1280, Y1280, R1120 (special internal relay included), L1280, T256, C256 or anything beyond for the ST, ST/, OT, AN, AN/, OR and OR/ instructions, the number of steps is shown in parentheses. Also, in the FP2/FP2SH/FP10SH, when a relay number has an index modifier, the number of steps is shown in parentheses.

Name	Boolean	Symbol	Description	Steps (*1)
Leading edge AND	**AN↑**		Connects a Form A (normally open) contact serially only for one scan when the leading edge of the trigger is detected.	2
Trailing edge AND	**AN↓**		Connects a Form A (normally open) contact serially only for one scan when the trailing edge of the trigger is detected.	2
Leading edge OR	**OR↑**		Connects a Form A (normally open) contact in parallel only for one scan when the leading edge of the trigger is detected.	2
Trailing edge OR	**OR↓**		Connects a Form A (normally open) contact in parallel only for one scan when the trailing edge of the trigger is detected.	2
Leading edge out	**OT↑**		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↓**		Outputs the operated result to the specified output only for one scan when trailing edge of the trigger is detected. (for pulse relay)	2
Alternative out	**ALT**		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
Push stack	**PSHS**		Stores the operated result up to this instruction.	1
Read stack	**RDS**		Reads the operated result stored by the PSHS instruction.	1
Pop stack	**POPS**		Reads and clears the operated result stored by the PSHS instruction	1
Leading edge differential	**DF**		Turns on the contact for only one scan when the leading edge of the trigger is detected.	1
Trailing edge differential	**DF/**		Turns on the contact for only one scan when the trailing edge of the trigger is detected.	1

Name	Availability												
					FP1			FP-M					
	FP0	FPΣ	FP-X	FP-e	C14 C16	C24 C40	C56 C72	C16	C20 C32	FP3	FP2	FP2SH	FP10SH
Leading edge AND	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Trailing edge AND	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Leading edge OR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Trailing edge OR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Leading edge out	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Trailing edge out	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Alternative out	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
AND stack	A	A	A	A	A	A	A	A	A	A	A	A	A
OR stack	A	A	A	A	A	A	A	A	A	A	A	A	A
Push stack	A	A	A	A	A	A	A	A	A	A	A	A	A
Read stack	A	A	A	A	A	A	A	A	A	A	A	A	A
Pop stack	A	A	A	A	A	A	A	A	A	A	A	A	A
Leading edge differential	A	A	A	A	A	A	A	A	A	A	A	A	A
Trailing edge differential	A	A	A	A	A	A	A	A	A	A	A	A	A

Note:

- A: Available, N/A: Not available

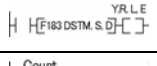
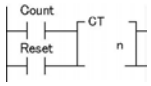
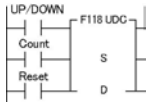
Name	Boolean	Symbol	Description	Steps (*1)
Leading edge differential (initial execution type)	**DFI**		Turns on the contact for only one scan when the leading edge of the trigger is detected. The leading edge detection is possible on the first scan.	1
Set	**SET**		Output is set to and held at on.	3
Reset	**RST**		Output is set to and held at off.	3
Keep	**KP**		Outputs at set trigger and holds until reset trigger turns on.	1 (2)
No operation	**NOP**		No operation.	1

Name	Availability												
					FP1			FP-M					
	FP0	FPΣ	FP-X	FP-e	C14 C16	C24 C40	C56 C72	C16	C20 C32	FP3	FP2	FP2SH	FP10SH
Leading edge differential (initial execution type)	N/A	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Set	A	A	A	A	A	A	A	A	A	A	A	A	A
Reset	A	A	A	A	A	A	A	A	A	A	A	A	A
Keep	A	A	A	A	A	A	A	A	A	A	A	A	A
No operation	A	A	A	A	A	A	A	A	A	A	A	A	A

Note:

- A: Available, N/A: Not available

1) 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.

Name	Boolean	Symbol	Description	Steps (*1)
Basic function instructions				
On-delay timer	**TML**		After set value “n” x 0.001 seconds, timer contact “a” is set to on.	3 (4)
	TMR		After set value “n” x 0.01 seconds, timer contact “a” is set to on.	3 (4)
	TMX		After set value “n” x 0.1 seconds, timer contact “a” is set to on.	3 (4)
	TMY		After set value “n” x 1 second, timer contact “a” is set to on.	4 (5)
Auxiliary timer (16-bit)	**F137 (STMR)**		After set value “S” x 0.01 seconds, the specified output and R900D are set to on.	5
Auxiliary timer (32-bit)	**F183 (DSTM)**		After set value “S” x 0.01 seconds, the specified output and R900D are set to on.	7
Counter	**CT**		Decrements from the preset value “n”	3 (4)
UP/DOWN counter	**F118 (UDC)**		Increments or decrements from the preset value “S” based on up/donw input.	5

Note:

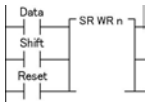
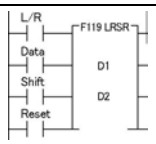
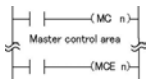
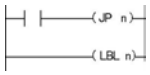
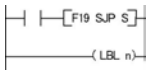
1) In the FP2/FP2SH/FP10SH, when timer 256 or higher, or counter 255 or lower, is used, the number of steps is the number in parentheses. Also, in the FP2/FP2SH/FP10SH, when a timer number or counter number has an index modifier, the number of steps is the number in parentheses.

Name	Availability												
					FP1			FP-M					
	FP0	FPΣ	FP-X	FP-e	C14 C16	C24 C40	C56 C72	C16	C20 C32	FP3	FP2	FP2SH	FP10SH
Basic function instructions													
On-delay timer TML	A (*1)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
On-delay timer TMR	A	A	A	A	A	A	A	A	A	A	A	A	A
On-delay timer TMX	A	A	A	A	A	A	A	A	A	A	A	A	A
On-delay timer TMY	A	A	A	A	A	A	A	A	A	A	A	A	A
Auxiliary timer (16-bit)	A	A	A	A	N/A	N/A	A	N/A	A	A	A	A	A
Auxiliary timer (32-bit)	A	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Counter	A	A	A	A	A	A	A	A	A	A	A	A	A
UP/DOWN counter	A	A	A	A	A	A	A	A	A	A	A	A	A

Note:

- A: Available, N/A: Not available

1) This instruction is available for FP0 C10, C14, C16, C32 CPU Ver. 2.0 or later/FP0 T32C.

Name	Boolean	Symbol	Description	Steps
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

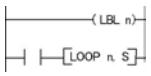
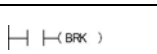
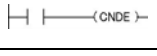
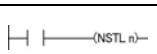
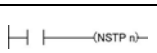
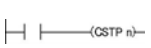
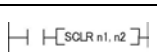
Name	Availability												
					FP1			FP-M					
	FP0	FPΣ	FP-X	FP-e	C14 C16	C24 C40	C56 C72	C16	C20 C32	FP3	FP2	FP2SH	FP10SH
Shift register	A	A	A	A	A	A	A	A	A	A	A	A	A
Left/right shift register	A	A	A	A	A	A	A	A	A	A	A	A	A
Control instructions													
Master control relay	A	A	A	A	A	A	A	A	A	A	A	A	A
Master control relay end	A	A	A	A	A	A	A	A	A	A	A	A	A
Jump **Label**	A	A	A	A	A	A	A	A	A	A	A	A	A
Auxiliary jump **Label**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A

Note:

- A: Available, N/A: Not available

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 modifier, 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 is the number in parentheses.

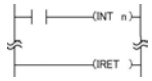
Name	Boolean	Symbol	Description	Steps
Loop **Label**	**LOOP** **LBL**		The program jumps to the label instruction and continues from there (the number of jumps is set in “S”).	4 (5) (*1) 1
Break	**BRK**		Stops program execution when the predetermined trigger turns on in the TEST/RUN mode only.	1
End	**ED**		The operation of program is ended. Indicates the end of a main program.	1
Conditional end	**CNDE**		The operation of program is ended when the trigger turns on.	1
Eject	**EJECT**		Adds page break fo ruse when printing.	1
Step ladder instructions				
Start step	**SSTP**		The start of program “n” for process control	3
Next step	**NSTL**		Start the specified process “n” and clear the process currently started. (Scan execution type)	3
	NSTP		Start the specified process “n” and clear the process currently started. (Pulse execution type)	3
Clear step	**CSTP**		Resets the specified process “n”.	3
Clear multi-ple steps	**SCLR**		Resets multiple processes specified by “n1” and “n2”.	5
Step end	**STPE**		End of step ladder area	1

Name	Availability												
					FP1			FP-M					
	FP0	FPΣ	FP-X	FP-e	C14 C16	C24 C40	C56 C72	C16	C20 C32	FP3	FP2	FP2SH	FP10SH
Loop **Label**	A	A	A	A	A	A	A	A	A	A	A	A	A
Break	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
End	A	A	A	A	A	A	A	A	A	A	A	A	A
Conditional end	A	A	A	A	A	A	A	A	A	A	A	A	A
Eject	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Step ladder instructions													
Start step	A	A	A	A	A	A	A	A	A	A	A	A	A
Next step NSTL	A	A	A	A	A	A	A	A	A	A	A	A	A
Next step NSTP	A	A	A	A	A	A	A	A	A	A	A	A	A
Clear step	A	A	A	A	A	A	A	A	A	A	A	A	A
Clear multi-ple steps	N/A	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Step end	A	A	A	A	A	A	A	A	A	A	A	A	A

Note:

- A: Available, N/A: Not available

1) 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.

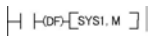
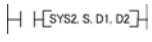
Name	Boolean	Symbol	Description	Steps
Subroutine instructions				
Subroutine call	**CALL**		Executes the specified subroutine. When returning to the main program, outputs in the subroutine program are maintained.	2 (3) (*1)
Output off type subroutine call	**FCAL**		Executes the specified subroutine. When returning to the main program, all outputs in the subroutine program are set to off.	4 (5) (*1)
Subroutine entry	**SUB**		Indicates the start of the subroutine program “n”.	1
Subroutine return	**RET**		Ends the subroutine program.	1
Interrupt instructions				
Interrupt	**INT**		Indicates the start of the interrupt program “n”.	1
Interrupt return	**IRET**		Ends the interrupt program.	1
Interrupt control	**ICTL**		Select interrupt enable/disable or clear in “S1” and “S2” and execute.	5

Name	Availability												
					FP1			FP-M					
	FP0	FPΣ	FP-X	FP-e	C14 C16	C24 C40	C56 C72	C16	C20 C32	FP3	FP2	FP2SH	FP10SH
Subroutine instructions													
Subroutine call	A	A	A	A	A	A	A	A	A	A	A	A	A
Output off type subroutine call	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
Subroutine entry	A	A	A	A	A	A	A	A	A	A	A	A	A
Subroutine return	A	A	A	A	A	A	A	A	A	A	A	A	A
Interrupt instructions													
Interrupt	A	A	A	A	N/A	A	A	A	A	A	A	A	A
Interrupt return	A	A	A	A	N/A	A	A	A	A	A	A	A	A
Interrupt control	A	A	A	A	N/A	A	A	N/A (*2)	A	A	A	A	A

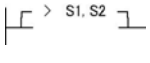
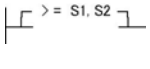
Note:

- A: Available, N/A: Not available

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 paretheses.
2) The ICTL instruction cannot be used with the FP-M C16T.
   (Interrupt masking and clearing are not possible.)
   The interrupt operation is possible using the interrupt setting of the system register 403.

Name	Boolean	Symbol	Description	Steps
Special setting instructions				
Communication conditions setting	**SYS1**		Change the communication conditions for the COM port or tool port based on the contents specified by the character constant.	13
Password setting			Change the password specified by the PLC based on the contents specified by the character constant.	
Interrupt setting			Set the interrupt input based on the contents specified by the character constant.	
PLC link time setting			Set the system setting time when a PLC link is used, based on the contents specified by the character constant.	
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.	
System registers "No. 40 to No. 47" changing	**SYS2**		Change the setting value of the system register for the PLC link function.	7

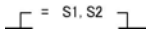
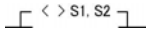
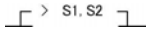
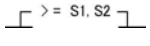
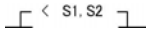
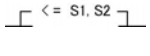
Name	Availability												
					FP1			FP-M					
	FP0	FPΣ	FP-X	FP-e	C14 C16	C24 C40	C56 C72	C16	C20 C32	FP3	FP2	FP2SH	FP10SH
Special setting instructions													
Communication conditions setting	N/A	A	A Note2)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Password setting	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Interrupt setting	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PLC link time setting	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MEWTOCOL-COM response control	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
High-speed counter operation mode changing	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
System registers "No. 40 to No. 47" changing	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Name	Boolean	Symbol	Description	Steps
Data compare instructions				
16-bit data compare (Start)	**ST=**		Begins a logic operation by comparing two 16-bit data in the comparative condition “S1=S2”.	5
	ST<>		Begins a logic operation by comparing two 16-bit data in the comparative condition “S1<S2” or “S1>S2”.	5
	ST>		Begins a logic operation by comparing two 16-bit data in the comparative condition “S1>S2”.	5
	ST>=		Begins a logic operation by comparing two 16-bit data in the comparative condition “S1>S2” or “S1=S2”.	5
	ST<		Begins a logic operation by comparing two 16-bit data in the comparative condition “S1<S2”.	5
	ST<=		Begins a logic operation by comparing two 16-bit data in the comparative condition “S1<S2” or “S1=S2”.	5

Name	Availability												
					FP1			FP-M					
	FP0	FPΣ	FP-X	FP-e	C14 C16	C24 C40	C56 C72	C16	C20 C32	FP3	FP2	FP2SH	FP10SH
Data compare instructions													
16-bit data compare (Start) ST=	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (Start) ST<>	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (Start) ST>	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (Start) ST>=	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (Start) ST<	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (Start) ST<=	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A

Note:

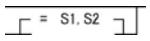
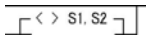
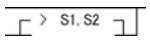
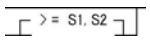
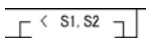
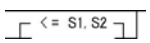
- A: Available, N/A: Not available

Name	Boolean	Symbol	Description	Steps
16-bit data compare (AND)	**AN=**		Connects a Form A (normally open) contact serially by comparing two 16-bit data in the comparative condition “S1=S2”.	5
	AN<>		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>		Connects a Form A (normally open) contact serially by comparing two 16-bit data in the comparative condition “S1>S2”.	5
	AN>=		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<		Connects a Form A (normally open) contact serially by comparing two 16-bit data in the comparative condition “S1<S2”.	5
	AN<=		Connects a Form A (normally open) contact serially by comparing two 16-bit data in the comparative condition “S1<S2” or “S1=S2”.	5

Name	Availability												
					FP1			FP-M					
	FP0	FPΣ	FP-X	FP-e	C14 C16	C24 C40	C56 C72	C16	C20 C32	FP3	FP2	FP2SH	FP10SH
16-bit data compare (AND) AN=	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (AND) AN<>	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (AND) AN>	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (AND) AN>=	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (AND) AN<	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (AND) AN<=	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A

Note:

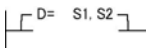
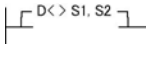
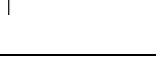
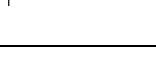
- A: Available, N/A: Not available

Name	Boolean	Symbol	Description	Steps
16-bit data compare (OR)	**OR=**		Connects a Form A (normally open) contact in parallel by comparing two 16-bit data in the comparative condition “S1=S2”.	5
	OR<>		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>		Connects a Form A (normally open) contact in parallel by comparing two 16-bit data in the comparative condition “S1>S2”.	5
	OR>=		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<		Connects a Form A (normally open) contact in parallel by comparing two 16-bit data in the comparative condition “S1<S2”.	5
	OR<=		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

Name	Availability												
					FP1			FP-M					
	FP0	FPΣ	FP-X	FP-e	C14 C16	C24 C40	C56 C72	C16	C20 C32	FP3	FP2	FP2SH	FP10SH
16-bit data compare (OR) OR=	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (OR) OR<>	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (OR) OR>	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (OR) OR>=	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (OR) OR<	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
16-bit data compare (OR) OR<=	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A

Note:

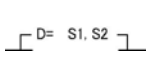
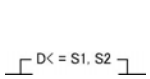
- A: Available, N/A: Not available

Name	Boolean	Symbol	Description	Steps
32-bit data compare (Start)	**STD=**		Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)=(S2+1, S2)”.	9
	STD<>		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>		Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)>(S2+1, S2)”.	9
	STD>=		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<		Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)”.	9
	STD<=		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

Name	Availability												
					FP1			FP-M					
	FP0	FPΣ	FP-X	FP-e	C14 C16	C24 C40	C56 C72	C16	C20 C32	FP3	FP2	FP2SH	FP10SH
32-bit data compare (Start) STD=	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (Start) STD<>	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (Start) STD>	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (Start) STD>=	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (Start) STD<	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (Start) STD<=	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A

Note:

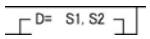
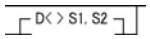
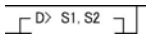
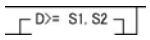
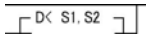
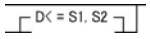
- A: Available, N/A: Not available

Name	Boolean	Symbol	Description	Steps
32-bit data compare (AND)	**AND=**		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<>		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>		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>=		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<		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<=		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

Name	Availability												
					FP1			FP-M					
	FP0	FPΣ	FP-X	FP-e	C14 C16	C24 C40	C56 C72	C16	C20 C32	FP3	FP2	FP2SH	FP10SH
32-bit data compare (AND) AND=	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (AND) AND<>	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (AND) AND>	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (AND) AND>=	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (AND) AND<	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (AND) AND<=	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A

Note:

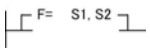
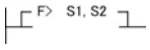
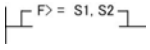
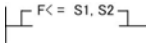
- A: Available, N/A: Not available

Name	Boolean	Symbol	Description	Steps
32-bit data compare (OR)	**ORD=**		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<>		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>		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>=		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<		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<=		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

Name	Availability												
					FP1			FP-M					
	FP0	FPΣ	FP-X	FP-e	C14 C16	C24 C40	C56 C72	C16	C20 C32	FP3	FP2	FP2SH	FP10SH
32-bit data compare (OR) ORD=	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (OR) ORD<>	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (OR) ORD>	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (OR) ORD>=	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (OR) ORD<	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
32-bit data compare (OR) ORD<=	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A

Note:

- A: Available, N/A: Not available

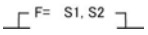
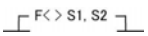
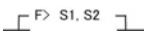
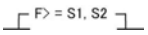
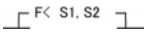
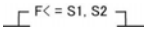
Name	Boolean	Symbol	Description	Steps
Floating point type real number data compare (Start)	**STF=**		Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)=(S2+1, S2)”.	9
	STF<>		Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)” or “(S1+1, S1)>(S2+1, S2)”.	9
	STF>		Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)>(S2+1, S2)”.	9
	STF>=		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
	STF<		Begins a logic operation by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)”.	9
	STF<=		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

Name	Availability												
					FP1			FP-M					
	FP0	FPΣ	FP-X	FP-e	C14 C16	C24 C40	C56 C72	C16	C20 C32	FP3	FP2	FP2SH	FP10SH
Floating point type real number data compare (Start) STF=	N/A	A Note)	A Note)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A Note)	A Note)	A Note)
Floating point type real number data compare (Start) STF<>	N/A	A Note)	A Note)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A Note)	A Note)	A Note)
Floating point type real number data compare (Start) STF>	N/A	A Note)	A Note)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A Note)	A Note)	A Note)
Floating point type real number data compare (Start) STF>=	N/A	A Note)	A Note)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A Note)	A Note)	A Note)
Floating point type real number data compare (Start) STF<	N/A	A Note)	A Note)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A Note)	A Note)	A Note)
Floating point type real number data compare (Start) STF<=	N/A	A Note)	A Note)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A Note)	A Note)	A Note)

Note) These instructions can be used with FP-X V1.10 or later, FPΣ 32k and FP2/FP2SH V2.0 or later.

Note:

- A: Available, N/A: Not available

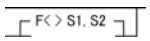
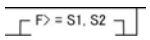
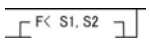
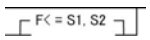
Name	Boolean	Symbol	Description	Steps
Floating point type real number data compare (AND)	**ANF=**		Connects a Form A (normally open) contact serially by comparing two 32-bit data in the comparative condition “(S1+1, S1)=(S2+1, S2)”.	9
	ANF<>		Connects a Form A (normally open) contact serially by comparing two 32-bit data in the comparative condition “(S1+1, S1)<(S2+1, S2)” or “(S1+1, S1)>(S2+1, S2)”.	9
	ANF>		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
	ANF>=		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
	ANF<		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
	ANF<=		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

Name	Availability												
					FP1			FP-M					
	FP0	FPΣ	FP-X	FP-e	C14 C16	C24 C40	C56 C72	C16	C20 C32	FP3	FP2	FP2SH	FP10SH
Floating point type real number data compare (AND) ANF=	N/A	A Note)	A Note)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A Note)	A Note)	A Note)
Floating point type real number data compare (AND) ANF<>	N/A	A Note)	A Note)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A Note)	A Note)	A Note)
Floating point type real number data compare (AND) ANF>	N/A	A Note)	A Note)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A Note)	A Note)	A Note)
Floating point type real number data compare (AND) ANF>=	N/A	A Note)	A Note)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A Note)	A Note)	A Note)
Floating point type real number data compare (AND) ANF<	N/A	A Note)	A Note)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A Note)	A Note)	A Note)
Floating point type real number data compare (AND) ANF<=	N/A	A Note)	A Note)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A Note)	A Note)	A Note)

Note) These instructions can be used with FP-X V1.10 or later, FPΣ 32k and FP2/FP2SH V2.0 or later.

Note:

- A: Available, N/A: Not available

Name	Boolean	Symbol	Description	Steps
Floating point type real number data compare (OR)	**ORF=**		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
	ORF<>		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
	ORF>		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
	ORF>=		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
	ORF<		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
	ORF<=		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

Name	Availability												
					FP1			FP-M					
	FP0	FPΣ	FP-X	FP-e	C14 C16	C24 C40	C56 C72	C16	C20 C32	FP3	FP2	FP2SH	FP10SH
Floating point type real number data compare (OR) ORF=	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
Floating point type real number data compare (OR) ORF<>	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
Floating point type real number data compare (OR) ORF>	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
Floating point type real number data compare (OR) ORF>=	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
Floating point type real number data compare (OR) ORF<	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
Floating point type real number data compare (OR) ORF<=	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A

Note) These instructions can be used with FP-X V1.10 or later, FPΣ 32k and FP2/FP2SH V2.0 or later.

Note:

- A: Available, N/A: Not available
-

11.3 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.

Num-ber	Name	Boolean	Operand	Description	Steps
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
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

Name	Availability												
					FP1 (*1)			FP-M (*1)					
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	C14 C16	C24 C40	C56 C72	C16	C20 C32	FP3	FP2	FP2SH	FP10SH
Data transfer instructions													
F0 P0	A	A	A	A	A	A	A	A	A	A	A	A	A
F1 P1	A	A	A	A	A	A	A	A	A	A	A	A	A
F2 P2	A	A	A	A	A	A	A	A	A	A	A	A	A
F3 P3	A	A	A	A	A	A	A	A	A	A	A	A	A
F4 P4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A (*2)	A (*2)	N/A
F5 P5	A	A	A	A	A	A	A	A	A	A	A	A	A
F6 P6	A	A	A	A	A	A	A	A	A	A	A	A	A
F7 P7	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F8 P8	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F10 P10	A	A	A	A	A	A	A	A	A	A	A	A	A

Note:

- A: Available, N/A: Not available

1) For the FP0/FPΣ/FP-X/FP-e/FP1/FP-M, the P type high-level instructions are not available.

2) The instruction is available for FP2/FP2SH CPU Ver. 1.5 or later.

Num-ber	Name	Boolean	Operand	Description	Steps
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 **P12** **F12**	**Data read from IC card/ROM**	**ICRD** **PICRD** **ICRD**	S1, S2, D	The data stored in the expansion memory of the IC card or ROM specified by “S1” and “S2” are transferred to the area startign at “D”.	11
F13 **P13** **P13**	**Data write to IC card/ROM**	**ICWT** **PICWT** **PICWT**	S1, S2, D	The data specified by “S1” and “S2” are transferred to the IC card expansion memory area or ROM 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
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

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
F11 P11	A	A	A	A	A	A	A	A	A	A	A	A	A
F12 P12	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
F12	A (*2)	A	A	A									
F13 P13	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
P13	A (*2)	A	A	A									
F14 P14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
F15 P15	A	A	A	A	A	A	A	A	A	A	A	A	A
F16 P16	A	A	A	A	A	A	A	A	A	A	A	A	A
F17 P17	A	A	A	A	A	A	A	A	A	A	A	A	A
F18 P18	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Control instruction													
F19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
Binary arithmetic instructions													
F20 P20	A	A	A	A	A	A	A	A	A	A	A	A	A
F21 P21	A	A	A	A	A	A	A	A	A	A	A	A	A
F22 P22	A	A	A	A	A	A	A	A	A	A	A	A	A

Note:

- A: Available, N/A: Not available

1) For the FP0/FPΣ/FP-X/FP-e/FP1/FP-M, the P type high-level instructions except for P13 (PICWT) instruction are not available.

2) This instruction is available for FP0 T32C and FP0 C10/C14/C16/C32 CPU Ver. 2.0 or later.

Num-ber	Name	Boolean	Operand	Description	Steps
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 for FP0/FP-e/FP1/FP-M/FP3 or DT90015 for FP0 T32/FPΣ/FP2/FP2SH/FP10SH)	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 for FP0/FP-e/FP1/ FP-M/FP3 or DT90016, DT90015 for FP0 T32/ FPΣ/FP2/FP2SH/FP10SH)	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

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
F23 P23	A	A	A	A	A	A	A	A	A	A	A	A	A
F25 P25	A	A	A	A	A	A	A	A	A	A	A	A	A
F26 P26	A	A	A	A	A	A	A	A	A	A	A	A	A
F27 P27	A	A	A	A	A	A	A	A	A	A	A	A	A
F28 P28	A	A	A	A	A	A	A	A	A	A	A	A	A
F30 P30	A	A	A	A	A	A	A	A	A	A	A	A	A
F31 P31	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F32 P32	A	A	A	A	A	A	A	A	A	A	A	A	A
F33 P33	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F34 P34	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F35 P35	A	A	A	A	A	A	A	A	A	A	A	A	A
F36 P36	A	A	A	A	A	A	A	A	A	A	A	A	A

Note:

- A: Available, N/A: Not available

1) For the FP0/FPΣ/FP-X/FP-e/FP1/FP-M, the P type high-level instructions are not available.

Num-ber	Name	Boolean	Operand	Description	Steps
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
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

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
F37 P37	A	A	A	A	A	A	A	A	A	A	A	A	A
F38 P38	A	A	A	A	A	A	A	A	A	A	A	A	A
F39 P39	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
BCD arithmetic instructions													
F40 P40	A	A	A	A	A	A	A	N/A	A	A	A	A	A
F41 P41	A	A	A	A	A	A	A	N/A	A	A	A	A	A
F42 P42	A	A	A	A	A	A	A	N/A	A	A	A	A	A
F43 P43	A	A	A	A	A	A	A	N/A	A	A	A	A	A
F45 P45	A	A	A	A	A	A	A	N/A	A	A	A	A	A
F46 P46	A	A	A	A	A	A	A	N/A	A	A	A	A	A
F47 P47	A	A	A	A	A	A	A	N/A	A	A	A	A	A

Note:

- A: Available, N/A: Not available

1) For the FP0/FPΣ/FP-X/FP-e/FP1/FP-M, the P type high-level instructions are not available.

Num-ber	Name	Boolean	Operand	Description	Steps
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 for FP0/FP-e/FP1/FP-M/FP3 or DT90015 for FP0 T32/FPΣ/FP2/FP2SH/FP10SH)	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 for FP0/FP-e/FP1/ FP-M/FP3 or DT90016, DT90015 for FP0 T32/ FPΣ/FP2/FP2SH/FP10SH)	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

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
F48 P48	A	A	A	A	A	A	A	N/A	A	A	A	A	A
F50 P50	A	A	A	A	A	A	A	N/A	A	A	A	A	A
F51 P51	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F52 P52	A	A	A	A	A	A	A	N/A	A	A	A	A	A
F53 P53	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F55 P55	A	A	A	A	A	A	A	N/A	A	A	A	A	A
F56 P56	A	A	A	A	A	A	A	N/A	A	A	A	A	A
F57 P57	A	A	A	A	A	A	A	N/A	A	A	A	A	A
F58 P58	A	A	A	A	A	A	A	N/A	A	A	A	A	A

Note:

- A: Available, N/A: Not available

1) For the FP0/FPΣ/FP-X/FP-e/FP1/FP-M, the P type high-level instructions are not available.

Num-ber	Name	Boolean	Operand	Description	Steps
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
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)}→(D)	7
F68 **P68**	**16-bit data exclusive NOR**	**XNR** **PXNR**	S1, S2, D	{(S1) AND (S2)} OR {$\overline{(S1)}$ AND $\overline{(S2)}$}→(D)	7
F69 **P69**	**16-bit data unite**	**WUNI** **PWUNI**	S1, S2, S3, D	([S1] AND [S3]) OR ([S2] AND [S3])→(D) When (S3) is H0, (S2)→(D) When (S3) is HFFFF, (S1) →(D)	9

Name	Availability												
					FP1 (*1)			FP-M (*1)					
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	C14 C16	C24 C40	C56 C72	C16	C20 C32	FP3	FP2	FP2SH	FP10SH
Data compare instructions													
F60 P60	A	A	A	A	A	A	A	A	A	A	A	A	A
F61 P61	A	A	A	A	A	A	A	A	A	A	A	A	A
F62 P62	A	A	A	A	A	A	A	A	A	A	A	A	A
F63 P63	A	A	A	A	A	A	A	A	A	A	A	A	A
F64 P64	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
Logic operation instructions													
F65 P65	A	A	A	A	A	A	A	A	A	A	A	A	A
F66 P66	A	A	A	A	A	A	A	A	A	A	A	A	A
F67 P67	A	A	A	A	A	A	A	A	A	A	A	A	A
F68 P68	A	A	A	A	A	A	A	A	A	A	A	A	A
F69 P69	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

Note:

- A: Available, N/A: Not available

1) For the FP0/FPΣ/FP-X/FP-e/FP1/FP-M, the P type high-level instructions are not available.

Num-ber	Name	Boolean	Operand	Description	Steps
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 → Hexadeci-mal 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
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 30 30 31 2D 20 20 → K-100 (0 0 1 -)	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

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
Data conversion instructions													
F70 P70	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F71 P71	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F72 P72	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F73 P73	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F74 P74	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F75 P75	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F76 P76	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F77 P77	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A

Note:

- A: Available, N/A: Not available

1) For the FP0/FPΣ/FP-X/FP-e/FP1/FP-M, the P type high-level instructions are not available.

Num-ber	Name	Boolean	Operand	Description	Steps
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

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
F78 P78	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F80 P80	A	A	A	A	A	A	A	A	A	A	A	A	A
F81 P81	A	A	A	A	A	A	A	A	A	A	A	A	A
F82 P82	A	A	A	A	A	A	A	A	A	A	A	A	A
F83 P83	A	A	A	A	A	A	A	A	A	A	A	A	A
F84 P84	A	A	A	A	A	A	A	A	A	A	A	A	A
F85 P85	A	A	A	A	A	A	A	A	A	A	A	A	A
F86 P86	A	A	A	A	A	A	A	A	A	A	A	A	A
F87 P87	A	A	A	A	A	A	A	A	A	A	A	A	A

Note:

- A: Available, N/A: Not available

1) For the FP0/FPΣ/FP-X/FP-e/FP1/FP-M, the P type high-level instructions are not available.

Num-ber	Name	Boolean	Operand	Description	Steps
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
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 for FP0/FP-e/FP1/FP-M/FP3 and DT90037 and DT90038 for FP0 T32/FPΣ/ FP2/FP2SH/FP10SH.	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

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
F88 P88	A	A	A	A	A	A	A	A	A	A	A	A	A
F89 P89	A	A	A	A	A	A	A	A	A	A	A	A	A
F90 P90	A	A	A	A	A	A	A	A	A	A	A	A	A
F91 P91	A	A	A	A	A	A	A	A	A	A	A	A	A
F92 P92	A	A	A	A	A	A	A	A	A	A	A	A	A
F93 P93	A	A	A	A	A	A	A	A	A	A	A	A	A
F94 P94	A	A	A	A	A	A	A	A	A	A	A	A	A
F95 P95	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F96 P96	A	A	A	A	A	A	A	A	A	A	A	A	A
F97 P97	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Data shift instructions													
F98 P98	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A

Note:

- A: Available, N/A: Not available

1) For the FP0/FPΣ/FP-X/FP-e/FP1/FP-M, the P type high-level instructions are not available.

Num-ber	Name	Boolean	Operand	Description	Steps
F99 P99	**Data table shift-in and compress**	**CMPW PCMPW**	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 hexade-cimal 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

Name	Availability												
					FP1 (*1)			FP-M (*1)					
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	C14 C16	C24 C40	C56 C72	C16	C20 C32	FP3	FP2	FP2SH	FP10SH
F99 P99	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
F100 P100	A	A	A	A	A	A	A	A	A	A	A	A	A
F101 P101	A	A	A	A	A	A	A	A	A	A	A	A	A
F102 P102	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F103 P103	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F105 P105	A	A	A	A	A	A	A	A	A	A	A	A	A
F106 P106	A	A	A	A	A	A	A	A	A	A	A	A	A
F108 P108	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F109 P109	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F110 P110	A	A	A	A	A	A	A	A	A	A	A	A	A
F111 P111	A	A	A	A	A	A	A	A	A	A	A	A	A
F112 P112	A	A	A	A	A	A	A	A	A	A	A	A	A

Note:

- A: Available, N/A: Not available

1) For the FP0/FPΣ/FP-X/FP-e/FP1/FP-M, the P type high-level instructions are not available.

Num-ber	Name	Boolean	Operand	Description	Steps
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
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

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
F113 P113	A	A	A	A	A	A	A	A	A	A	A	A	A
FIFO instructions													
F115 P115	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
F116 P116	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
F117 P117	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
Basic function instructions													
F118	A	A	A	A	A	A	A	A	A	A	A	A	A
F119	A	A	A	A	A	A	A	A	A	A	A	A	A
Data rotate instructions													
F120 P120	A	A	A	A	A	A	A	A	A	A	A	A	A
F121 P121	A	A	A	A	A	A	A	A	A	A	A	A	A
F122 P122	A	A	A	A	A	A	A	A	A	A	A	A	A
F123 P123	A	A	A	A	A	A	A	A	A	A	A	A	A

Note:

- A: Available, N/A: Not available

1) For the FP0/FPΣ/FP-X/FP-e/FP1/FP-M, the P type high-level instructions are not available.

Num-ber	Name	Boolean	Operand	Description	Steps
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 bit 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
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

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
F125 P125	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F126 P126	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F127 P127	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F128 P128	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Bit manipulation instructions													
F130 P130	A	A	A	A	A	A	A	A	A	A	A	A	A
F131 P131	A	A	A	A	A	A	A	A	A	A	A	A	A
F132 P132	A	A	A	A	A	A	A	A	A	A	A	A	A
F133 P133	A	A	A	A	A	A	A	A	A	A	A	A	A
F135 P135	A	A	A	A	A	A	A	A	A	A	A	A	A
F136 P136	A	A	A	A	A	A	A	A	A	A	A	A	A

Note:

- A: Available, N/A: Not available

1) For the FP0/FPΣ/FP-X/FP-e/FP1/FP-M, the P type high-level instructions are not available.

Number	Name	Boolean	Operand	Description	Steps
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, minutes and seconds data 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
F139 P139	**Seconds data 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
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

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
Basic function instruction													
F137	A	A	A	A	N/A	N/A	A	N/A	A	A	A	A	A
Special instructions													
F138 P138	A (*2)	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F139 P139	A (*2)	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F140 P140	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F141 P141	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A

Note:

- A: Available, N/A: Not available

1) For the FP0/FPΣ/FP-X/FP-e/FP1/FP-M, the P type high-level instructions are not available.

2) On the FP0 it is only possible to use F138 and F139 with the T32 type.

Num-ber	Name	Boolean	Operand	Description	Steps
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
F145 P145	**Data send**	**SEND PSEND**	S1, S2, D, N	Sends the data to another station in the network (MEWNET).	9
F146 P146	**Data receive**	**RECV PRECV**	S1, S2, N, D	Receives the data to another station in the network (MEWNET).	9
F145 P145	**Data send**	**SEND**	S1, S2, D, N	Sends the data to the slave station as the MOD bus master.	9
F146 P146	**Data receive**	**RECV**	S1, S2, N, D	Receives the data from the slave station as the MOD bus master.	9
F145 P145	**Data send**	**SEND**	S1, S2, D, N	Sends the data to the slave station as the MEWTOCOL master.	9
F146 P146	**Data receive**	**RECV**	S1, S2, N, D	Receives the data from the slave station as the MEWTOCOL master.	9
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 for FP0/FP-e/FP1/FP-M/FP3 or DT90000 for FP0 T32/FPΣ/FP2/FP2SH/FP10SH), turns R9000 on, and turns on the ERROR LED.	3

Name	Availability												
					FP1 (*1)			FP-M (*1)					
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	C14 C16	C24 C40	C56 C72	C16	C20 C32	FP3	FP2	FP2SH	FP10SH
F142 P142	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
F143 P143	A	A	A	A	N/A	A	A	A	A	A	A	A	A
F144	A	N/A	A	A	N/A	A (*2)	A (*2)	N/A	A (*2)	N/A	A	A	A
F145 P145	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
F146 P146	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
F145 P145	N/A	A (*3)	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F146 P146	N/A	A (*3)	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F145 P145	N/A	A (*3)	A (*3)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F146 P146	N/A	A (*3)	A (*3)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F147	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F148 P148	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A

Note:

- A: Available, N/A: Not available

1) For the FP0/FPΣ/FP-X/FP-e/FP1/FP-M, the P type high-level instructions are not available.

2) Available for: - FP1 C24C, C40C, C56C, and C72C
- FP-M C20RC, C20TC, C32TC

3) These instructions can be used with FP-X V1.20 or later and FPΣ 32k.

Num-ber	Name	Boolean	Operand	Description	Steps
F149 P149	**Message display**	**MSG PMSG**	S	Displays the character constant of “S” in the connected programming tool.	13
F150 P150	**Data read from intelli-gent unit**	**READ PREAD**	S1, S2, n, D	Reads the data from the intelligent unit.	9
F151 P151	**Data write into intelli-gent unit**	**WRT PWRT**	S1, S2, n, D	Writes the data into the intelligent unit.	9
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
F154 P154	**Machine language program call**	**MCAL PMCAL**	n	The machine language program is called.	3
F155 P155	**Sampling**	**SMPL PSMPL**	-	Starts sampling data.	1
F156 P156	**Sampling trigger**	**STRG PSTRG**	-	When the trigger of this instruction turns on, the sampling trace stops.	1
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
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
F159 P159	**Serial data communica-tion**	**MTRN PMTRN**	S, n, D	This is used to send data to or receive data from an external device through the specified CPU COM port or MCU COM port.	7
F161 P161	**Serial data reception (for MCU COM port)**	**MRCV PMRCV**	S, D1, D2	Data is received from external equipment via the COM port of the specified MCU.	7

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
F149 P149	A	A	A	A	N/A	A	A	N/A	A	A	A	A	A
F150 P150	N/A	A (*2)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
F151 P151	N/A	A (*2)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
F152 P152	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
F153 P153	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
F154 P154	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	N/A	N/A
F155 P155	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
F156 P156	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
F157 P157	A (*3)	A	A	A	N/A	A	A	A	A	A	A	A	A
F158 P158	A (*3)	A	A	A	N/A	A	A	A	A	A	A	A	A
F159 P159	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A (*4)	A (*4)	N/A
F161 P161	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A (*4)	A (*4)	N/A

Note:

- A: Available, N/A: Not available

1) For the FP0/FPΣ/FP-X/FP-e/FP1/FP-M, the P type high-level instructions are not available.
2) This instruction is available for FPΣ CPU Ver. 2.0 or later.
3) On the FP0 it is only possible to use F157 and F158 with the T32 type.
4) This instruction is available for FP2/FP2SH CPU Ver. 1.5 or later.

Num-ber	Name	Boolean	Operand	Description	Steps
BIN arithmetic instruction					
F160 P160	**Double word (32-bit) data square root**	**DSQR PDSQR**	S, D	$\sqrt{(S)}\rightarrow(D)$	7
Special instructions (High-speed counter instructions)					
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
F1	**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 (DT9045, DT9044).	7
			DT9044, D	Transfers value in high-speed counter and Pulse output elapsed value area (DT9045, DT9044) to (D+1, D).	7
F162	**High-speed counter output set**	**HC0S**	S, Yn	The specified external output relay (Yn) turns on when the elapsed value of the high-speed counter agrees with the specified target value (S+1, S).	7
F163	**High-speed counter output reset**	**HC0R**	S, Yn	The specified external output relay (Yn) turns off when the elapsed value of the high-speed counter agrees with the specified target value (S+1, S).	7
F164	**Speed control (Pulse output and pattern output con-trols) (See below.)**	**SPD0**	S	Controls conditions of outputs according to the elapsed value of the high-speed counter. Two types of output control available: - Pulse output control - Pattern output control	3
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

Pulse output specifications for FP-M/FP1

Item	FP1 C14/C16, FP-M C16T	FP1 C24/C40	FP1 C56/C72 FP-M C20T/C20R/C32T
Pulse output terminal	Y7	Y7	Y6 and Y7 (selectable)
Pulse frequency	1440 Hz to 5 kHz/720 Hz to 5 kHz/360 Hz to 5kHz/180 Hz to 5 kHz/90 Hz to 5 kHz/45 Hz to 5 kHz (Switches between 6 ranges)		
Internal connection between pulse output and counter input	Not possible	Not possible	Possible

Switching of the pulse frequency range is supported by CPU Ver. 2.7 or later.

In versions prior to CPU Ver. 2.7, the range is fixed at 360 Hz to 5 kHz.

In Ver. 2.7 or later but prior to CPU Ver. 2.9, switching is possible among 4 ranges (360 Hz to 5 kHz/180 Hz to 5 kHz/90 Hz to 5 kHz/45 Hz to 5 kHz).

In CPU Ver. 2.9 and later versions, switching is possible among 6 ranges.

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
BIN arithmetic instruction													
F160 P160	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
Special instructions (High-speed counter instructions)													
F0	A	N/A	N/A	A	A	A	A	A	A	N/A	N/A	N/A	N/A
F1	A (*1)	N/A	N/A	A	A	A	A	A	A	N/A	N/A	N/A	N/A
F162	N/A	N/A	N/A	N/A	A	A	A	A	A	N/A	N/A	N/A	N/A
F163	N/A	N/A	N/A	N/A	A	A	A	A	A	N/A	N/A	N/A	N/A
F164	N/A	N/A	N/A	N/A	A	A	A	A	A	N/A	N/A	N/A	N/A
F165	N/A	N/A	N/A	N/A	A	A	A	N/A	A	N/A	N/A	N/A	N/A

 **Note:**

- A: Available, N/A: Not available

1) The elapsed value area varies depending on the channel being used.

Num-ber	Name	Boolean	Operand	Description	Steps
High speed counter/Pulse output instruction for FP0, FP-e					
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
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

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
High speed counter/Pulse output instruction for FP0, FP-e													
F166	A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F167	A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F168	A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F169	A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F170	A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note:

- A: Available, N/A: Not available

The elapsed value area varies depending on the channel being used.

Num-ber	Name	Boolean	Operand	Description	Steps
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
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

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
High speed counter/Pulse output instruction for FPΣ/FP-X													
F0	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F1	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F166	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F167	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F171	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F172	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F173	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F174	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F175	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F176	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note1) The elapsed value area differs depending on used channels.

Num-ber	Name	Boolean	Operand	Description	Steps
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					
F183	**Auxiliary timer (32-bit)**	**DSTM**	S, D	Turn on the specified output and R900D after 0.01 s. × set value.	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)	12
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 $\overline{(S2+1, S2)}$} OR {$\overline{(S1+1, S1)}$ 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 {$\overline{(S1+1, S1)}$ AND $\overline{(S2+1, S2)}$}→(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 $\overline{(S3+1, S3)}$}→(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 into the number of seconds.	6
F231 **P231**	**Second → time data conversion**	**SECTM** **PSECTM**	S, D	The specified number of seconds is changed into time data (a date and time).	6

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
Screen display instructions													
F180	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F181	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Basic function instruction													
F183	A	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Data transfer instructions													
F190 P190	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F191 P191	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Logic operation instructions													
F215 P215	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F216 P216	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F217 P217	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F218 P218	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F219 P219	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Data conversion instructions													
F230 P230	N/A	A (*3)	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A (*2)	A (*2)	N/A
F231 P231	N/A	A (*3)	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A (*2)	A (*2)	N/A

Note:

- A: Available, N/A: Not available

1) For the FP0, FPΣ, FP-X and FP-e, the P type high-level instructions are not available.

2) The instruction is available for FP2/FP2SH CPU Ver. 1.5 or later.

3) The instruction is available for FP Σ 32k.

Num-ber	Name	Boolean	Operand	Description	Steps
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	The “ij” set of 16-bit or 32-bit data is converted from (S) to “m” characters of ASCII data, and stored from the first character of D.	12
F251	**ASCII → binary data conversion**	**ATOB**	S1, S2, n, D	The “ij” set of ASCII data in “m” characters unit is converted from the first character of (S), and stored in D.	12
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

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
F235 P235	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F236 P236	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F237 P237	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F238 P238	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F240 P240	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F241 P241	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F250	N/A	A (*2)	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F251	N/A	A (*2)	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Character strings instructions													
F257 P257	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F258 P258	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F259 P259	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F260 P260	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F261 P261	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

Note:

- A: Available, N/A: Not available

1) For the FPΣ, FP-X, the P type high-level instructions are not available.

2) The instruction is available for FP Σ 32k.

Num-ber	Name	Boolean	Operand	Description	Steps
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
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
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
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
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
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
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

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
F262 P262	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F263 P263	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F264 P264	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F265 P265	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Integer type data processing instructions													
F270 P270	N/A	A	A	A (*2)	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F271 P271	N/A	A	A	A (*2)	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F272 P272	N/A	A	A	A (*2)	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F273 P273	N/A	A	A	A (*2)	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F275 P275	N/A	A	A	A (*2)	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F276 P276	N/A	A	A	A (*2)	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

Note:

- A: Available, N/A: Not available

1) For the FPΣ/FP-X, the P type high-level instructions are not available.

2) Available from Ver. 1.2 or higher.

Num-ber	Name	Boolean	Operand	Description	Steps
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
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
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
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
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
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
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
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
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
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

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
F277 P277	N/A	A	A	A (*2)	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F278 P278	N/A	A	A	A (*2)	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F282 P282	N/A	A	A	A (*2)	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F283 P283	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Integer type non-linear function instructions													
F285 P285	N/A	A	A	A (*2)	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F286 P286	N/A	A	A	A (*2)	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F287 P287	N/A	A	A	A (*2)	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F288 P288	N/A	A	A	A (*2)	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F289 P289	N/A	A	A	A (*2)	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F290 P290	N/A	A	A	A (*2)	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

Note:

- A: Available, N/A: Not available

1) For the FPΣ/FP-X, the P type high-level instructions are not available.

2) Available from Ver. 1.2 or higher.

Num-ber	Name	Boolean	Operand	Description	Steps
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

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
BCD type real number operation instructions													
F300 P300	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F301 P301	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F302 P302	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F303 P303	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F304 P304	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F305 P305	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

Note:

- A: Available, N/A: Not available

Num-ber	Name	Boolean	Operand	Description	Steps
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
F310 P310	**Floating-point type data addition**	**F+ PF+**	S1, S2, D	(S1+1, S1)+(S2+1, S2)→(D+1, D)	14
F311 P311	**Floating-point type data subtraction**	**F- PF-**	S1, S2, D	(S1+1, S1)–(S2+1, S2)→(D+1, D)	14
F312 P312	**Floating-point type data multiplication**	**F* PF***	S1, S2, D	(S1+1, S1)×(S2+1, S2)→(D+1, D)	14
F313 P313	**Floating-point type data division**	**F% PF%**	S1, S2, D	(S1+1, S1)÷(S2+1, S2)→(D+1, D)	14
F314 P314	**Floating-point type data sine operation**	**SIN PSIN**	S, D	SIN(S+1, S)→(D+1, D)	10
F315 P315	**Floating-point type data cosine operation**	**COS PCOS**	S, D	COS(S+1, S)→(D+1, D)	10
F316 P316	**Floating-point type data tangent operation**	**TAN PTAN**	S, D	TAN(S+1, S)→(D+1, D)	10
F317 P317	**Floating-point type data arcsine operation**	**ASIN PASIN**	S, D	SIN^{-1}(S+1, S)→(D+1, D)	10
F318 P318	**Floating-point type data arccosine operation**	**ACOS PACOS**	S, D	COS^{-1}(S+1, S)→(D+1, D)	10

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
Floating-point type real number operation instructions													
F309 P309	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F310 P310	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F311 P311	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F312 P312	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F313 P313	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F314 P314	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F315 P315	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F316 P316	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F317 P317	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F318 P318	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

Note:

- A: Available, N/A: Not available

1) For the FP0, FPΣ, FP-X and FP-e, the P type high-level instructions are not available.

2) The instruction is available for FP0 T32C and FP0 C10/C14/C16/C32 CPU Ver. 2.0 or later.

Num-ber	Name	Boolean	Operand	Description	Steps
F319 P319	**Floating-point type data arctangent operation**	**ATAN PATAN**	S, D	$TAN^{-1}(S+1, S) \rightarrow (D+1, D)$	10
F320 P320	**Floating-point type data natural logarithm**	**LN PLN**	S, D	$LN(S+1, S) \rightarrow (D+1, D)$	10
F321 P321	**Floating-point type data exponent**	**EXP PEXP**	S, D	$EXP(S+1, S) \rightarrow (D+1, D)$	10
F322 P322	**Floating-point type data logarithm**	**LOG PLOG**	S, D	$LOG(S+1, S) \rightarrow (D+1, D)$	10
F323 P323	**Floating-point type data power**	**PWR PPWR**	S1, S2, D	$(S1+1, S1) \wedge (S2+1, S2) \rightarrow (D+1, D)$	14
F324 P324	**Floating-point type data square root**	**FSQR PFSQR**	S, D	$\sqrt{(S+1, S)} \rightarrow (D+1, D)$	10
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
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

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
F319 P319	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F320 P320	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F321 P321	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F322 P322	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F323 P323	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F324 P324	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F325 P325	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F326 P326	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

Note:

- A: Available, N/A: Not available

1) For the FP0, FPΣ, FP-X and FP-e, the P type high-level instructions are not available.

2) The instruction is available for FP0 T32C and FP0 C10/C14/C16/C32 CPU Ver. 2.0 or later.

Num-ber	Name	Boolean	Operand	Description	Steps
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
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
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
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

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
F327 P327	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F328 P328	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F329 P329	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F330 P330	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

Note:

- A: Available, N/A: Not available

1) For the FP0, FPΣ, FP-X and FP-e, the P type high-level instructions are not available.

2) The instruction is available for FP0 T32C and FP0 C10/C14/C16/C32 CPU Ver. 2.0 or later.

Num-ber	Name	Boolean	Operand	Description	Steps
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
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
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
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
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
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
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

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
F331 P331	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F332 P332	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F333 P333	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F334 P334	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F335 P335	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F336 P336	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F337 P337	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

Note:

- A: Available, N/A: Not available

1) For the FP0, FPΣ, FP-X and FP-e, the P type high-level instructions are not available.

2) The instruction is available for FP0 T32C and FP0 C10/C14/C16/C32 CPU Ver. 2.0 or later.

Num-ber	Name	Boolean	Operand	Description	Steps
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
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
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

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
F338 P338	A (*2)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
Floating-point type real number data processing instructions													
F345 P345	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F346 P346	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F347 P347	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F348 P348	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F349 P349	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F350 P350	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

Note:

- A: Available, N/A: Not available

1) For the FP0, FPΣ, FP-X and FP-e, the P type high-level instructions are not available.

2) The instruction is available for FP0 T32C and FP0 C10/C14/C16/C32 CPU Ver. 2.0 or later.

Num-ber	Name	Boolean	Operand	Description	Steps
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
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
F356	**Eaay PID**	**EZPID**	S1, S2, S3, S4	Temperature control (PID) can be easily performed using the image of a temperautre controller.	10
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

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
F351 P351	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F352 P352	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F353 P353	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F354 P354	N/A	A (*5)	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A (*3)	A (*3)	N/A
Time series processing instruction													
F355	A (*1)	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F356	N/A	A (*4)	A (*4)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Compare instructions													
F373 P373	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
F374 P374	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

Note:

- A: Available, N/A: Not available

1) For the FP0, FPΣ, FP-X and FP-e, the P type high-level instructions are not available.
2) For the FP0, the instruction is available for the T32C and C10, C14, C16, C32 CPU Ver. 2.0 or later.
3) The instruction is available for FP2/FP2SH CPU Ver. 1.5 or later.
4) The instruction is available for FP-X V1.20 or later and FPΣ 32k.
5) The instruction is available for FPΣ 32k.

Number	Name	Boolean	Operand	Description	Steps
Index register bank processing instructions					
F410 P410	**Setting the index register bank number**	**SETB PSETB**	n	Index register (I0 to ID) bank number change over.	4
F411 P411	**Changing the index register 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 register 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
F415 P415	**Changing the file register bank number**	**CBFL PCBFL**	n	File register bank number change over with remembering preceding bank number.	4
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

Name	Availability												
	FP0 (*1)	FPΣ (*1)	FP-X(*1)	FP-e(*1)	FP1 (*1)			FP-M (*1)		FP3	FP2	FP2SH	FP10SH
					C14 C16	C24 C40	C56 C72	C16	C20 C32				
Index register bank processing instructions													
F410 P410	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
F411 P411	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
F412 P412	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A
File register bank processing instructions													
F414 P414	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A
F415 P415	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A
F416 P416	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A

Note:

- A: Available, N/A: Not available

11.4 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, 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	Operation status	Description and steps to take	FP0	FP-e	FP Σ	FP-X	FP1/FP-M	FP2	FP2SH	FP10SH	FP3
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	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	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	A
E4	**Para-meter 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	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

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	FP0	FP-e	FP Σ	FP-X	FP1/FP-M	FP2	FP2SH	FP10SH	FP3
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 combination 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	A
E9	**No program error**	Stops	Program may be damaged. ⇒Try to send the program again.							A	A	
E10	**Rewrite during RUN syntax error**	Continues	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

A:Available

Table of Self-Diagnostic Error

Error code	Name	Operation status	Description and steps to take	FP0	FP-e	FP Σ	FP-X	FP1/FP-M	FP2	FP2SH	FP10SH	FP3
E20	**CPU error**	Stops	Probably a hardware abnormality ⇒Please contact your dealer.						A	A	A	A
E21	**RAM error1**	Stops	Probably an abnormality in the internal RAM. ⇒Please contact your dealer.						A	A	A	A
E22	**RAM error2**											
E23	**RAM error3**											
E24	**RAM error4**											
E25	**RAM error5**											
E26	**User's ROM error**	Stops	FP-e,FP0,FP Σ ,and FP1 C14,C16:Probably a hardware abnormality. ⇒ Please contact your dealer.	A	A	A	A	A	A	A	A	A
			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									
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			A

A:Available

Error code	Name	Opera-tion status	Description and steps to take	FP0	FP-e	FP Σ	FP-X	FP1/FP-M	FP2	FP2SH	FP10SH	FP3
E29	**Configu-ration 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.									A
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	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	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. -FP Σ, 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	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	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	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

A:Available

Error code	Name	Opera-tion status	Description and steps to take	FP0	FP-e	FP Σ	FP-X	FP1/FP-M	FP2	FP2SH	FP10SH	FP3
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	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

A:Available

Error code	Name	Opera-tion status	Description and steps to take	FP0	FP-e	FP Σ	FP-X	FP1/FP-M	FP2	FP2SH	FP10SH	FP3
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	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	Operation status	Description and steps to take	FP0	FP-e	FP Σ	FP-X	FP1/FP-M	FP2	FP2SH	FP10SH	FP3
E43	**System watching dog timer error**	Selectable	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**	Selectable	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	A
E45	**Operation error**	Selectable	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 In the FP2,FP2SH,and FP10SH,Check the contents of special data registers DT90017,DT90018 to find the instruction address where the operation error occurred. Then correct the program. In the FP3,Check the contents of special data registers DT9017,and DT9018 to find the instruction address where the operation error occurred.Then correct the program. 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

A:Available

Error code	Name	Operation status	Description and steps to take	FP0	FP-e	FP Σ	FP-X	FP1/FP-M	FP2	FP2SH	FP10SH	FP3
E46	**Remote I/O communication error**	Selectable	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								
		Selectable	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	A	A
E47	**MEW-NET-F attribute error**	Selectable	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	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					

A:Available

Error code	Name	Operation status	Description and steps to take	FP0	FP-e	FP Σ	FP-X	FP1/FP-M	FP2	FP2SH	FP10SH	FP3
E50	**Backup battery errror**	Continues	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 (Note)	A	A	A	A
E51	**MEWNET-F terminal station error**	Continues	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	A
E52	**MEWNET-F I/O update synchronous error**	Continues	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	A
E53	**Multi-CPU I/O registration error (CPU2 only)**	Continues	Abnormality was detected when the multi-CPU system ws used. Please contact your dealer.								A	A
E54	**IC memory card back-up battery error**	Continues	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**	Continues	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	**Incompatible IC memory card error**	Continues	The IC memory card installed is not compatible. Replace the IC memory card compatible with FP2SH/FP10SH.							A	A	
E57	**No unit for the configuration**	Continues	MEWNET-W2 The MEWNET-W2 link unit is not installed in the slot specified using the configuration data. Either install a unit in the specified slot or change the parameter.						A	A		

A:Available

Error code	Name	Opera-tion status	Description and steps to take	FP0	FP-e	FP Σ	FP-X	FP1/FP-M	FP2	FP2SH	FP10SH	FP3
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

Note) Available PLC:FP1 C24,C40,C56,C76,and FP-M

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.

11.5 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.

11.6 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

11.7 ASCII Codes

b7	b6	b5	b4	b3	b2	b1	b0	R \ C	0	1	2	3	4	5	6	7
								b7								
								b6	0	0	0	0	1	1	1	1
								b5	0	0	1	1	0	0	1	1
								b4	0	1	0	1	0	1	0	1
				0	0	0	0	0	NUL	DEL	SPACE	0	@	P	`	p
				0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
				0	0	1	0	2	STX	DC2	"	2	B	R	b	r
				0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
				0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
				0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
				0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
				0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
				1	0	0	0	8	BS	CAN	(	8	H	X	h	x
				1	0	0	1	9	HT	EM	)	9	I	Y	i	y
				1	0	1	0	A	LF	SUB	*	:	J	Z	j	z
				1	0	1	1	B	VT	ESC	+	;	K	[	k	{
				1	1	0	0	C	FF	FS	,	<	L	¥	l	|
				1	1	0	1	D	CR	GS	-	=	M	]	m	}
				1	1	1	0	E	SO	RS	.	>	N	^	n	~
				1	1	1	1	F	SI	US	/	?	O	_	o	DEL

Record of changes

Manual No.	Date	Desceiption of changes
ARCT1F369E	DEC., 2002	First edition
ARCT1F369E-1	JUL., 2003	2nd edition PDF Only Addition of Chapter 8 “PID Control”
AFCT1F369E-2	APR., 2003	3rd edition PDF Only Addition of functions available for Ver. 1.2 or higher Addition of new models (RS485 type) - AFPE224302 - AFPE214322
ARCT1F369E-3	FEB.2006	4nd edition