

Instructions used with FP-X

Relative manual: FP series Programming manual ARCT1F313E-7
FP-X User's Manual ARCT1F409

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1.1 Instructions used with FP-X

This document describes the instructions to be used with Programmable Controller FP-X, which are the new instructions and the existing instructions that include the additional contents especially for FP-X.

Use this together with the Programming Manual ARCT1F313E-7.



Reference: For the details on the instructions to be used with FP-X,
<FP-X User's Manual ARCT1F409E Appendix2. Instructions>

1.1.1 New Instructions for FP-X

These are new instructions for FP-X. They are not mentioned in the current Programming Manual.

	No.	Name
High-level Instructions	F250(BTOA)	Binary data → ASCII conversion
	F251(ATOB)	ASCII → binary data conversion

1.1.2 Contents added to the Existing Instructions for FP-X

The contents that are exclusive for FP-X are added as below. For the following instructions, use this explanation.

For FP-X, do not refer to the current programming manual.

	No.	Name
Basic Instructions	ICTL	Interrupt control
	SYS1	Communication conditions setting etc..
	SYS2	System registers "No. 40 to No. 47" changing
High-level Instructions	F0(MV)	High-speed counter and Pulse output controls
	F1(DMV)	Change and read of the elapsed value of high-speed counter and Pulse output
	F145(SEND)	Data send
	F146(RECV)	Data receive
	F159(MTRN)	Serial data communication
	F166(HC1S)	Target value much on
	F167(HC1R)	Target value much off
	F171(SP0H)	Pulse output (Trapezoidal control and home return)
	F172(PLSH)	Pulse output (JOG operation)
	F173(PWMH)	PWM output
	F174(SP0H)	Pulse output (Selectable data table control operation)
F175(SPSH)	Pulse output (Linear interpolation)	

Note) The contents of the other instructions to be used with FP-X except the above instructions are the same as the current ones.

ICTL**Interrupt control**

Availability

FP0/FPΣ/FP-X/FP1/FP-M

Outline Performs the interrupt enable or disable and the interrupt clear.

Program example

Ladder Diagram	Boolean	
	Address	Instruction
	0	ST X 10
	1	DF
	2	ICTL
		H 0 0
		H 1 1
S1	16-bit equivalent constant or 16-bit area for interrupt control data setting	
S2	16-bit equivalent constant or 16-bit area for interrupt condition setting	

Operands

Operand	Relay				Timer/Counter		Register			Index register		Constant		Index modifier
	WX	WY	WR	WL	SV	EV	DT	LD	FL	IX	IY	K	H	
S1	A	A	A	A	A	A	A	A	A	A	A	A	A	A
S2	A	A	A	A	A	A	A	A	A	A	A	A	A	A

A: Available

Description

When the **ICTL** instruction is executed, the interrupt program enable/disable and interrupt clear are set according to the settings in S1 and S2.

Be sure to use **ICTL** instructions so that they are executed once at the leading edge of the execution condition (trigger) using the **DF** instruction.

Two or more **ICTL** instructions can have the same execution condition (trigger).

**Note**

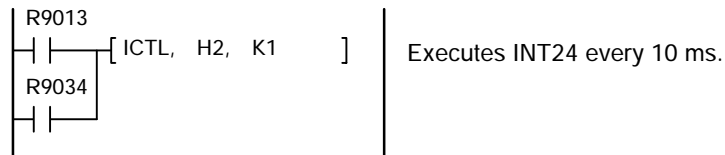
Before executing an interrupt program, be sure to execute the **ICTL instruction and enable the execution of the interrupt program.**

Precaution if rewriting during a RUN operation (for FP0/FPΣ)

If rewriting is done during a RUN operation while the interrupt function is being used, execution of the interrupt function is inhibited. The ICTL instruction has to be used once again to enable the interrupt program to be executed.



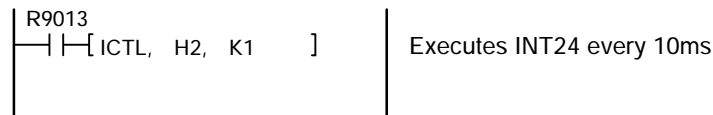
Example: A periodic interrupt is set every 10 ms when the operation is begun. (After rewriting during a RUN operation, interrupts are enabled again.)



Input examples



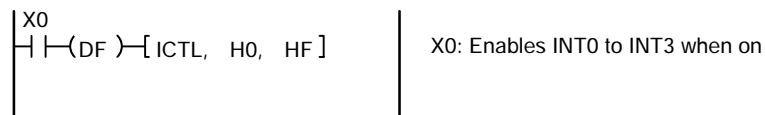
Example 1: Setting a periodical interrupt every 10ms from the start of operations



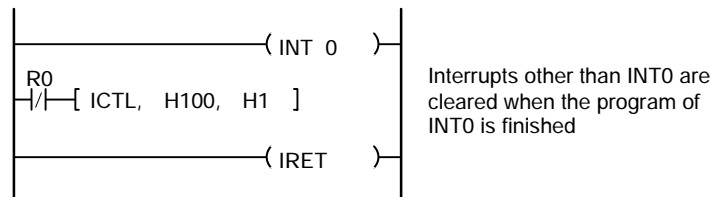
The R9013 (initial pulse relay) turns on only for the first scan after operations begin.



Example 2: Enable INT0 through INT3 when X0 rises.



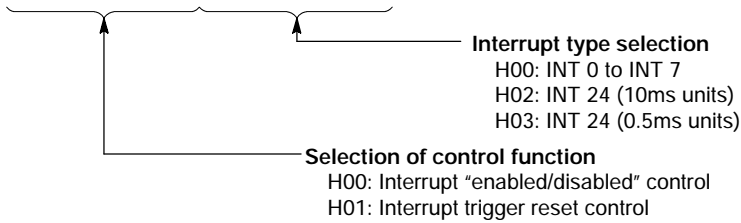
Example 3: Clear interrupts other than INT0 after the INT0 program is completed.



Specifying control data

S1: Specifying the control functions and interrupt types

Bit position	15 ··· 12	11 ··· 8	7 ··· 4	3 ··· 0
S1				



Set S1 = H0 to specify enable or disable for the execution of INT0 through INT7.

Set S1 = H100 to clear interrupts INT0 through INT7.

Set S1 = H2 (for units of 10ms) to set the time interval for INT24.

Set S1 = H3 (for units of 0.5ms) to set the time interval for INT24.

Precautions during programming

With the FP0, INT5 to 7 cannot be specified.

With the FP1 and FP-M, periodic interrupts cannot be specified in units of 0.5 ms.

With the FPΣ, INT8 to 13 cannot be specified.

With the FP-X, INT8 to 13 can be specified when the pulse I/O cassette is used.

S2: Specifying the control of interrupts

① Enabling or disabling interrupt programs (when S1 = H0 or S1 = H1).

Set the control data in the bit corresponding to the number of the interrupt program that you want to control.

Set the bit corresponding to the number of the program you want to enable to "1." (INT program disabled.)

Set the bit corresponding to the number of the program you want to disable to "0." (INT program enabled.)



Example: When specified so that the interrupt programs INT1 and INT2 are enabled, and INT0 and INT3 to 13 are inhibited

Bit position	15 ··· 12	11 ··· 8	7 ··· 4	3 ··· 0
INT program number	15 14 13 12	11 10 9 8	7 6 5 4	3 2 1 0
S2 (Enabled/disabled)	0 0 0 0	0 0 0 0	0 0 0 0	0 1 1 0

② Clearing interrupt programs (when S1 = H100 or S1 = H101)

Set the control data in the bit corresponding to the number of the interrupt program that you want to control.
 Set the bit corresponding to the number of the program you want to clear to "0." (INT program disabled.)
 Set the bit corresponding to the number of the program you want to not clear to "1." (INT program enabled.)



Example: When specified so that the interrupt programs INT0 to INT2 are cleared, and INT3 to INT13 are not cleared

Bit position	15 · · · 12	11 · · · 8	7 · · · 4	3 · · · 0
INT program number	15 14 13 12	11 10 9 8	7 6 5 4	3 2 1 0
S2 (Enabled/disabled)	0 0 0 0	0 0 0 0	1 1 1 1	1 0 0 0

③ Specifying periodical interrupt (when S1 = H2)

Specify the setting with decimal number. The time interval = value of S2 × 10 (ms).

Bit position	15 · · · 12	11 · · · 8	7 · · · 4	3 · · · 0
S2				

K0 to K3000

Time interval setting: K1 to K3000 (10ms to 30s)

INT24 disabled: K0

④ Specifying periodical interrupt programs (when S1 = H3)

The time interval = value of S2 × 0.5 (ms).


Bit position	15 · · · 12	11 · · · 8	7 · · · 4	3 · · · 0
S2				

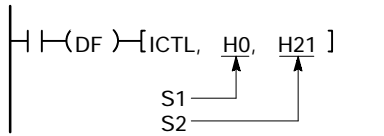
K0 to K3000

Time interval setting: K1 to K3000 (0.5ms to 1.5s)

INT24 disabled: K0

Example of enabling the execution of interrupt programs

 Example:

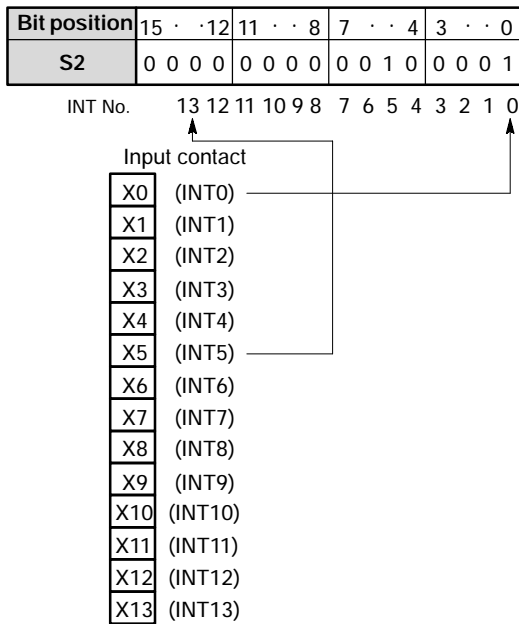


S1: H0000

Specifies enabling or disabling of interrupt programs that correspond to interrupts at specified input contact or to target value match interrupts.

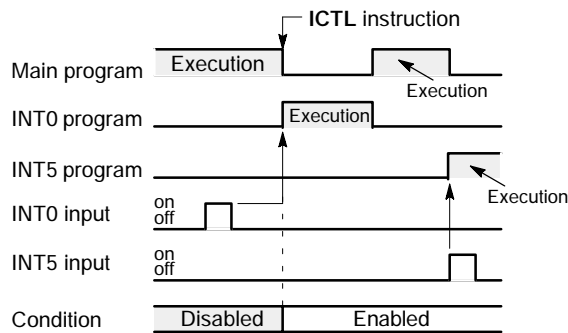
S2: H0021

Enable INT0 and INT5 (set bits 0 and 5 to "1") and disable all others.



Set the bits to "1" that correspond to the interrupts to be enabled.

When this ICTL instruction is executed, interrupt programs No. 0 and No. 5 will be executed when their corresponding interrupt inputs occur.



How to start the interrupt program when executing the high-speed counter match ON/match OFF instruction.

- ① Set the counter by the system register. (It is not necessary to set the external interrupt.)
- ② Describe the interrupt program on the program. The high-speed counter corresponds to the interrupt program as below.

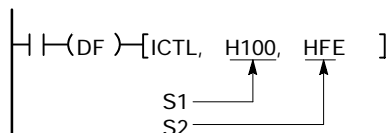
High-speed counter channel	Interrupt program
ch0	INT0
ch1	INT1
:	:
ch7	INT7
ch8	INT8
ch9	INT9
chA	INT11
chB	INT12

- ③ Enable the setting by the ICTLinstruction.
Enable ICTL, H0, H9 -INT0 and INT7.
- ④ Start the match ON/match OFF instruction.
- ⑤ The program is executed when the conditions for the match ON/match OFF instruction are met.

Example for clearing interrupt programs



Example:



S1: H100

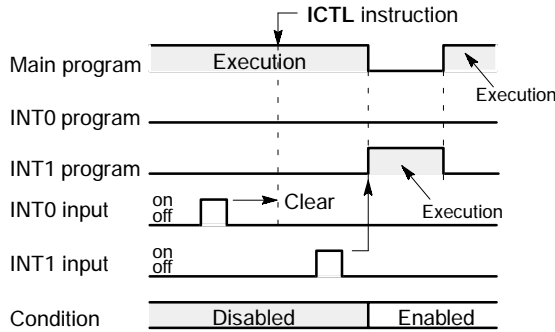
Clears interrupts from specified input contact or target value match interrupts.

S2: HFE

Clears interrupt INT0 (bit 0 is "0") and does not clear the other interrupts.

For the relationship between the set value and the interrupt input contact, refer to page 2 - 106.

Even though the INT0 interrupt input occurred, when the interrupt program is disabled, the ICTL instruction can still be used to clear the INT0 interrupt.

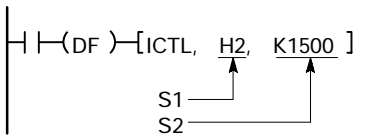


Since INT0 is cleared, the INT0 program will not be executed even after execution is enabled. Since INT1 is not cleared, the INT1 program will be executed after execution is enabled.

Example for setting periodical interrupt



Example:



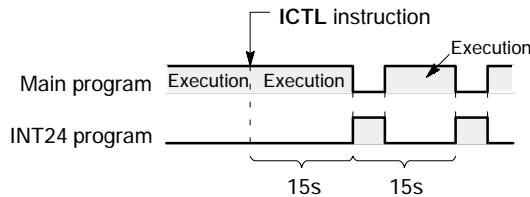
[S1]: H0002

Specifies periodical interrupt

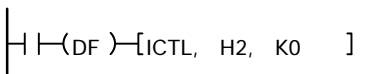
[S2]: K1500

Specifies the time interval for the periodical interrupt. With K1500, the time interval is $K1500 \times 10\text{ms} = 15000\text{ms}$ (15s)

After this ICTL instruction is executed, the periodical interrupt will occur every 15 seconds. At these times, the INT24 interrupt program will be executed.



To stop the periodical interrupt program, execute the following program.



SYS1**Communication conditions setting**

Availability

FPΣ/FP-X

Outline This changes the communication conditions for the COM port or Tool port based on the contents specified by the character constant.

Program example

Ladder Diagram		Boolean Non-ladder	
		Address	Instruction
	10	ST R	0
	11	DF	
	12	SYS1	
	25	M COM1, B8POS1	
		SYS1	
		M COM1,19200	
S		Character constant "M"	

Operands

Operand	Relay				Timer/Counter		Register			Index register	Constant			Index modifier
	WX	WY	WR	WL	SV	EV	DT	LD	FL	I	K	H	M	
S	N/A	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

A: Available
N/A: Not Available

Explanation of example

When R0 turns on, the transmission format and baud rate for the COM. 1 port are set as follows.

Character bit: 8, Parity: Odd
Stop bit: 1
Baud rate: 19,200 bps

Description

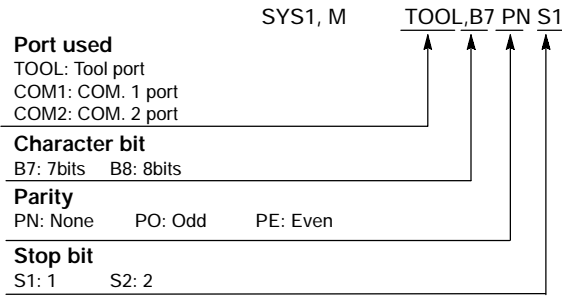
The communication conditions for the port specified by No. 1 keyword are changed to the contents specified by No. 2 keyword.

Contents that can be changed include the following:

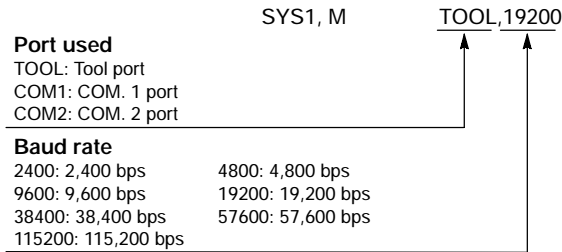
- 1) Communication format
- 2) Baud rate
- 3) Unit No.
- 4) Header and Terminator
- 5) RS (Request to Send) control

Keyword setting

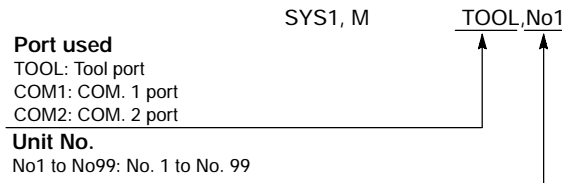
1) Communication format (Shared by the Tool, COM. 1 and COM. 2 ports)



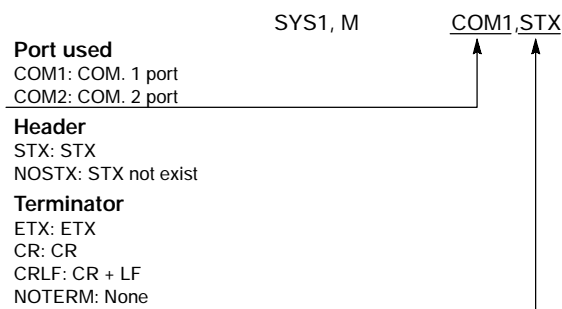
2) Baud rate (Shared by the Tool, COM. 1 and COM. 2 ports)



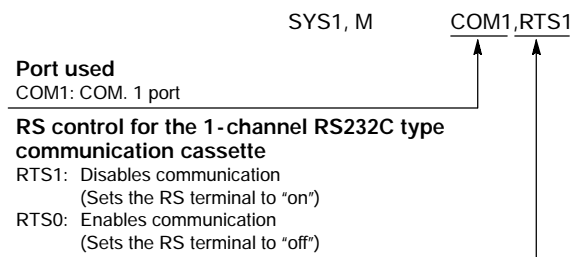
3) Unit No. (Shared by the Tool, COM. 1 and COM. 2 ports)



4) Header and Terminator (Shared by the COM. 1 and COM. 2 ports)



5) RS (Request to Send) control (COM. 1 port only)

**Precautions during programming**

- Executing this instruction does not rewrite the contents of the system ROM in the control unit. As a result, turning the power supply off and then on again rewrites the contents of the system registers specified by the tool software.
- We recommend using differential execution with this instruction.
- Because the system register settings are changed, a verification error may occur in some cases if verification is carried out with the tools.
- Separate No. 1 and No. 2 keywords with a comma "," and do not use spaces.

Flag conditions

- Error flag (R9007): Turns on and stays on when:
 - Error flag (R9008): Turns on for an instant when:
 - Any character other than a keyword is specified
 - There is no comma between No. 1 and No. 2 keywords
 - The small letter of the alphabet is used to specify the keyword (except for numbers used to specify unit No.)
 - No communication cassette has been installed when COM1 or COM2 has been set
 - The setting of the unit No. setting switch is anything other than 0 when COM1 or COM2 has been set and the unit No. is being changed
 - The unit No. set using this instruction is anything other than a value between 1 and 99
 - The baud rate or transmission format for COM1 has been changed when the PLC link mode is specified for COM1
 - The baud rate or transmission format is changed while the Tool port, COM. port 1, or COM. port 2 is being initialized using MODEM
 - The communication mode is set to anything other than the general communication mode when header and terminator have been set
 - Any communication cassette other than the 1-channel RS232C type communication cassette is installed when using RS control
 - The specified unit No. is larger than the largest unit No. specified by the system register when the COM. 1 port is in the PLC link mode

SYS1

Password setting

Availability
FPΣ/FP-X

Outline This changes the password specified by the controller, based on the contents specified by the character constant.

Program example

Ladder Diagram	Boolean Non-ladder	
	Address	Instruction
	10	ST R 0
	11	DF
	12	SYS1 M PASS,ABCD
		No. 1 keyword No. 2 keyword
	100	ST R 1
	101	DF
	102	SYS1 M PAS,abcdefgh
		No. 1 keyword No. 2 keyword
S		Character constant "M"

Operands

Operand	Relay				Timer/Counter		Register			Index register	Constant			Index modifier
	WX	WY	WR	WL	SV	EV	DT	LD	FL	I	K	H	M	
S	N/A	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

A: Available
N/A: Not Available

Explanation of example

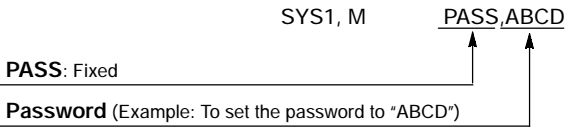
When R0 turns on, the controller password is changed to "ABCD".

Description

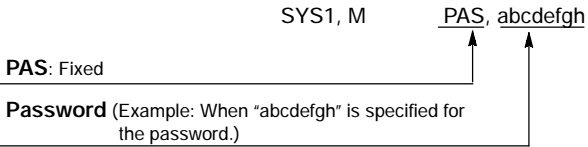
This changes the password specified by the controller to the contents specified by No. 2 keyword.

Keyword setting

For the 4-digit password



For the 8-digit password (It is available for FP-X only.)



If the specified characters are less than 8, spaces are added at the end of the characters to be 8-digit password.

Precautions during programming

- When this instruction is executed, writing to the internal F-ROM takes approximately 100 ms.
- If the specified password is the same as the password that has already been written, the password is not written to the F-ROM.
- We recommend using differential execution with this instruction.
- Separate No. 1 and No. 2 keywords with a comma "," and do not use spaces.

Flag conditions

- Error flag (R9007): Turns on and stays on when:
 - Any character other than a keyword is specified
 - There is no comma between No. 1 and No. 2 keywords
 - The small letter of the alphabet is used to specify the keyword (For the 4-digit password)
 - The data specified for the password setting is any character other than 0 to 9 or A to F, or the specified data consists of other than four digits. (For the 4-digit password)
- Error flag (R9008): Turns on for an instant when:
 - Any character other than a keyword is specified
 - There is no comma between No. 1 and No. 2 keywords
 - The small letter of the alphabet is used to specify the keyword (For the 4-digit password)
 - The data specified for the password setting is any character other than 0 to 9 or A to F, or the specified data consists of other than four digits. (For the 4-digit password)

SYS1 Interrupt setting

Availability
FPΣ/FP-X

Outline This sets the interrupt input based on the contents specified by the character constant.

Program example

Ladder Diagram	Boolean Non-ladder	
	Address	Instruction
	10	ST R 0
	11	DF
	12	SYS1 M INT1,UP
S		Character constant "M"

Operands

Operand	Relay				Timer/Counter		Register			Index register	Constant			Index modifier
	WX	WY	WR	WL	SV	EV	DT	LD	FL	I	K	H	M	
S	N/A	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

A: Available
N/A: Not Available

Explanation of example

When R0 turns on, input X1 is set to the interrupt that becomes valid at the rising edge.

Description

This sets the input specified by No. 1 keyword as the interrupt input, and changes the input conditions to the contents specified by No. 2 keyword.

Keyword setting

Interrupt input	SYS1, M	INT2,UP
INT0: X0	INT1: X1	INT8: X0
INT2: X2	INT3: X3	INT9: X1
INT4: X4	INT5: X5	INT10: X2
INT6: X6	INT7: X7	INT11: X3
INT8 - INT10 → Pulse I/O cassette 1		INT12: X4
INT11 - INT12 → Pulse I/O cassette 2		INT13: X5

Effective edges
 UP: Rising edge
 DOWN: Falling edge
 BOTH: Rising and falling edges

Precautions during programming

- Executing this instruction does not rewrite the contents of the system ROM in the control unit. As a result, turning the power supply off and then on again rewrites the contents of the system registers specified by the tool software.
- We recommend using differential execution with this instruction.
- When UP or DOWN has been specified, the contents of the system registers change in accordance with the specification, so a verification error may occur in some cases, when the program is verified. When BOTH has been specified, the contents of the system registers do not change.
- Separate No. 1 and No. 2 keywords with a comma "," and do not use spaces.

Flag conditions

- Error flag (R9007): Turns on and stays on when:
 - Error flag (R9008): Turns on for an instant when:
 - Any character other than a keyword is specified
 - There is no comma between No. 1 and No. 2 keywords
 - The small letter of the alphabet is used to specify the keyword
-

SYS1**PLC link time setting**

Availability

FPΣ/FP-X

Outline This sets the system setting time when a PLC link is used, based on the contents specified by the character constant.

Program example

Ladder Diagram		Boolean Non-ladder	
		Address	Instruction
	10	ST R 90141	
	11	DF	
	12	SYS1	
	25	M PCLK1T0,100	
		SYS1 M PCLK1T1,100	
S		Character constant "M"	

Operands

Operand	Relay				Timer/Counter		Register			Index register	Constant			Index modifier
	WX	WY	WR	WL	SV	EV	DT	LD	FL	I	K	H	M	
S	N/A	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

A: Available

N/A: Not Available

Explanation of example

When R9014 turns on when a PLC link is being used, the link entry wait time and the error detection times for transmission assurance relay are set as follows.

Link entry wait time: 100 ms

Error detection time for transmission assurance relay: 100 ms

Description

The conditions specified by No. 1 keyword are set as the time specified by No. 2 keyword.

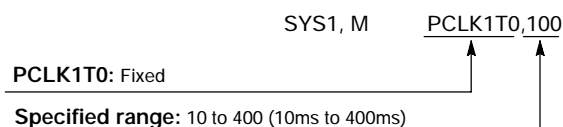
The setting for the link entry waiting time is set if the transmission cycle time is shortened when there are stations that have not joined the link (*).

* Stations that have not joined the link: Stations that have not been connected between the No. 1 station and the station with the largest number, or stations for which the power supply has not been turned on

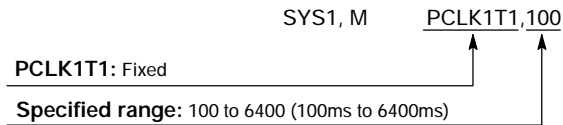
The error detection time setting for the transmission assurance relay is set if the time between the power supply being turned off at one station and the transmission assurance relay being turned off at a different station is to be shortened.

Keyword setting

1) Link entry wait time



2) Error detection time for transmission assurance relay



Precautions during programming

- The program should be placed at the beginning of all PLCs being linked, and the same values specified.
- This instruction should be specified in order to set special internal relay R9014 as the differential execution condition.
- The setting contents of the system registers are not affected by this instruction being executed.
- Separate No. 1 and No. 2 keywords with a comma "," and do not use spaces.

Precautions when setting the link entry wait time

- This should be specified such that the value is at least twice that of the largest scan time of all the PLCs that are linked.
- If a short value has been specified, there may be some PLCs that are not able to join the link even though the power supply for that PLC has been turned on.
- If there are any stations that have not joined the link, the setting should not be changed, even if the link transmission cycle time is longer as a result. (The default value is 400 ms.)

Precautions when setting the error detection time for the transmission assurance relay

- This should be specified such that the value is at least twice that of the largest transmission cycle time of all the PLCs that are linked.
- If a short value has been specified, there is a possibility that the transmission assurance relay will malfunction.
- The setting should not be changed, even if the detection time for the transmission assurance relay is longer as a result. (The default value is 6400 ms.)

Flag conditions

- Error flag (R9007): Turns on and stays on when:
 - Any character other than a keyword is specified
 - There is no comma between No. 1 and No. 2 keywords
 - The small letter of the alphabet is used to specify the keyword
 - The specified value is outside the specified range
- Error flag (R9008): Turns on for an instant when:
 - Any character other than a keyword is specified
 - There is no comma between No. 1 and No. 2 keywords
 - The small letter of the alphabet is used to specify the keyword
 - The specified value is outside the specified range

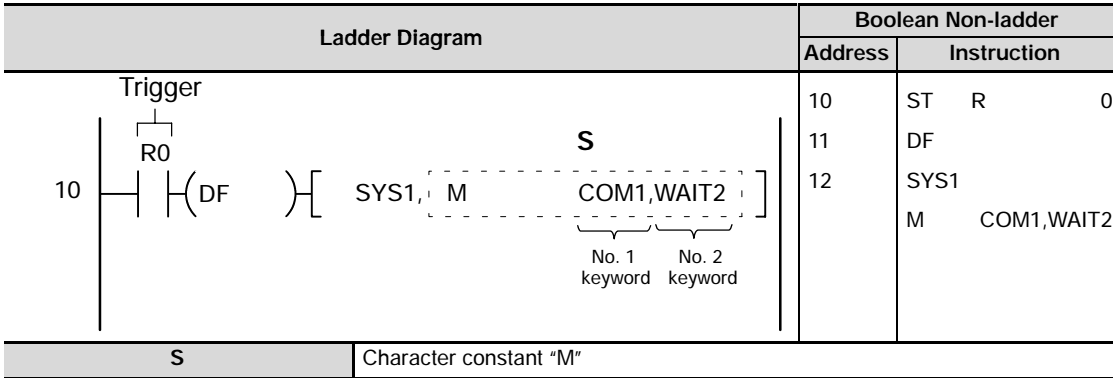
SYS1

MEWTOCOL - COM response control

Availability
FPΣ/FP-X

Outline This specifies the response waiting time based on the MEWTOCOL - COM of the COM port or Tool port, in response to the contents specified by the character constant.

Program example



Operands

Operand	Relay				Timer/Counter		Register			Index register	Constant			Index modifier
	WX	WY	WR	WL	SV	EV	DT	LD	FL	I	K	H	M	
S	N/A	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

A: Available
N/A: Not Available

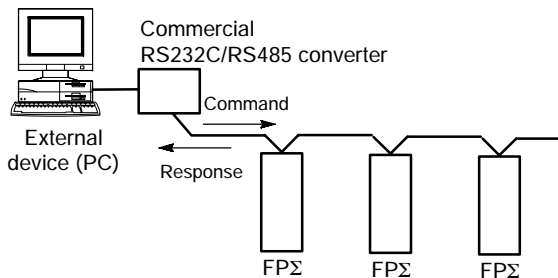
Description

The port MEWTOCOL - COM response time specified by No. 1 keyword is delayed based on the contents specified by No. 2 keyword.

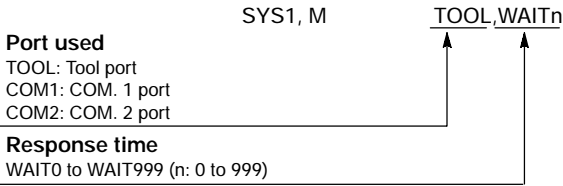
This instruction is used to delay the response time on the PLC side until the state is reached in which commands can be sent by an external device and responses can be received from the PLC.

<Usage example>

When a commercial RS232C/RS485 converter is being used to carry out communication between a personal computer and the FPΣ, this instruction is used to return the PLC response after switching of the enable signal has been completed on the converter side.



Keyword setting



If the communication mode or the MOD BUS RTV mode has been set to the computer link mode, the set time is the scan time x n (n: 0 to 999).

If the communication mode has been set to the PLC link mode, the set time is n μs (n: 0 to 999).

If n = 0, the delay time set by this instruction will be set to "None".

Precautions during programming

- The settings should not be changed as long as there is no trouble, to prevent the PLC link from getting unstable.
- This instruction is valid only if the setting on the controller side has been set to the computer link mode or the PLC link mode.
- The instruction should be executed at the beginning of the program, at the rise of R9014. The same value should be set for all linked PLCs.
- Executing this instruction does not change the settings in the system registers.
- If changing the settings, a value of at least twice should be set.
- We recommend using differential execution with this instruction.
- When the power supply to the PLC is off, the settings set by this instruction are cleared. (The set value will become 0.) If the mode is switched to the PROG. mode after the instruction has been executed, however, the settings will be retained.
- If a commercial RS232C/RS485 converter is being used in the PLC link mode, this instruction should be programmed in all of the stations (PLCs) connected to the link.
- For No. 1 and No. 2 keywords, input 12 letters after "M" aligning to the right. Separate No.1 and No.2 keywords with a comma "," and do not use spaces. An operation error will occur.

[Example] If inputting (SYS1, M COM1, WAIT2)

Input => M C O M 1 , W A I T 2

Input a space after "M" to be 12 letter aligning to the right.

Flag conditions

- Error flag (R9007): Turns on and stays on when:
 - Any character other than a keyword is specified
 - There is no comma between No. 1 and No. 2 keywords
 - The small letter of the alphabet is used to specify the keyword
 - No communication cassette has been installed when COM1 or COM2 has been set
- Error flag (R9008): Turns on for an instant when:

SYS2

Change system registers
(No. 40 to No. 47, No. 50 to No. 57)

Availability

FPΣ/FP-X

Outline This changes the settings entered for the system registers of the PLC link function, in accordance with the specified data.

Program example

Ladder Diagram	Boolean	
	Address	Instruction
	10	ST R 0
	11	SYS2 DT 0 K 40 K 47
S	Starting number of the area in which 16-bit data is stored	
D1	Starting number of the system registers being specified (K40 to K47)	
D2	Ending number of the system registers being specified (K40 to K47)	

Operands

Operand	Relay				Timer/Counter		Register			Index register	Constant		Index modifier
	WX	WY	WR	WL	SV	EV	DT	LD	FL	I	K	H	
S	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A
D1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A
D2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A

A: Available
N/A: Not Available

Description

The contents of system registers No. 40 to No. 47 are changed to the contents of the data registers starting with the number specified by [S].

Note) With the FP-X, the contents of system registers No. 50 to No. 57 are also changed.

System registers

	No.	Name	Setting value and range
PLC WO-0	40	Range of link relays used	0 to 64 words
	41	Range of link data registers used	0 to 128 words
	42	Starting number for link relay transmission	0 to 63
	43	Link relay transmission size	0 to 64 words
	44	Starting number for link data register transmission	0 to 127
	45	Link data register transmission size	0 to 127 words
	46	PC (PLC) Link switch flag	Normal/reverse
	47	Maximum unit number setting for MEWNET - W0 PLC link	1 to 16
PLC WO-1	50	Range of link relays used	0 to 64 words
	51	Range of link data registers used	0 to 128 words
	52	Starting number for link relay transmission	64 to 127
	53	Link relay transmission size	0 to 64 words
	54	Starting number for link data register transmission	128 to 255
	55	Link data register transmission size	0 to 127 words
	57	Maximum unit number setting for MEWNET - W0 PLC link	1 to 16

Program example

[F0 MV , K 64, DT0]	Set value of system register 40
[F0 MV , K 128, DT1]	Set value of system register 41
[F0 MV , K 0, DT2]	Set value of system register 42
[F0 MV , K 10, DT3]	Set value of system register 43
[F0 MV , K 0, DT4]	Set value of system register 44
[F0 MV , K 10, DT5]	Set value of system register 45
[F0 MV , K 0, DT6]	Set value of system register 46
[F0 MV , K 5, DT7]	Set value of system register 47
[SYS2 , DT0, K40, K47]	Sets the values stored in DT0 to DT7 in system registers 40 to 47

Decimals of the average value are rounded off so that the average value is an integer.

Precaution during programming

- Executing this instruction does not rewrite the contents of the system ROM in the control unit. As a result, turning the power supply off and then on again rewrites the contents of the system registers specified by the tool software.
- A value between K40 and K47 should be specified for "D1" or "D2". Also, the values should always be specified in such a way that $D1 \leq D2$.
- The values of the system registers change, so a verification error may occur when the program is verified.

Flag conditions

- Error flag (R9007): Turns on and stays on when:
 - Error flag (R9008): Turns on for an instant when:
 - $D1 > D2$
 - The specified value is outside the ranges specified for the various system registers setting values
-

F0 (MV)**High-speed counter control**

Availability

FP0/FPΣ/FP-X

Outline This instruction is used to perform control such as software reset, counter disabling, and high-speed counter instruction clearing.

Program example

Ladder Diagram	Boolean	
	Address	Instruction
	10	ST R 0
	11	DF
	12	F0 (MV) H 1 DT 9052
	17	F0 (MV) H 0 DT 9052
	<p>* The high-speed counter and pulse output controls flag area varies depending on the PLC type.</p>	
	S	Area for storing high-speed counter control code or constant data

Operands

Operand	Relay			Timer/Counter		Register	Index register		Constant		Index modifier
	WX	WY	WR	SV	EV	DT	IX (*1)	IY (*2)	K	H	
S	A	A	A	A	A	A	A	A	A	A	A

A: Available

(*1) I0 to IC on FPΣ/FP-X

(*2) ID on FPΣ/FP-X

Description

Performs high-speed counter control according to the control code specified in "S".

This instruction is used to perform the following operations when using a high-speed counter:

<Function>

- 1) Performing a software reset
- 2) Disabling the count
- 3) Temporarily disables reset input setting using external inputs X2 and X5
- 4) Clearing control executed with high-speed counter and pulse output instructions **F166** or **F167**.

Once written, a control code is retained until the next write operation.

Precautions during programming

Hardware resets can only be disabled if a reset input (X2 or X5) is used.

With the FP-X, hardware resets can only be disabled if the pulse I/O cassette is used.

Flag conditions

- Error flag (R9007): Turns on and stays on when:
- Error flag (R9008): Turns on for an instant when:
 - The area is exceeded when an index modifier is used
 - The "S" is outside specification range

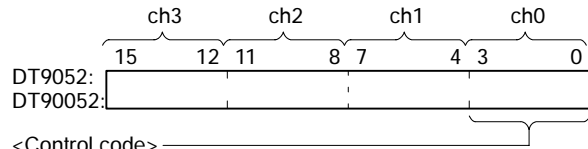
Using the FP0

High-speed counter and Pulse output controls flag area

Four bits are allocated to each high-speed counter channel for use as the control code write area DT9052 (DT90052 on the FP0 T32)

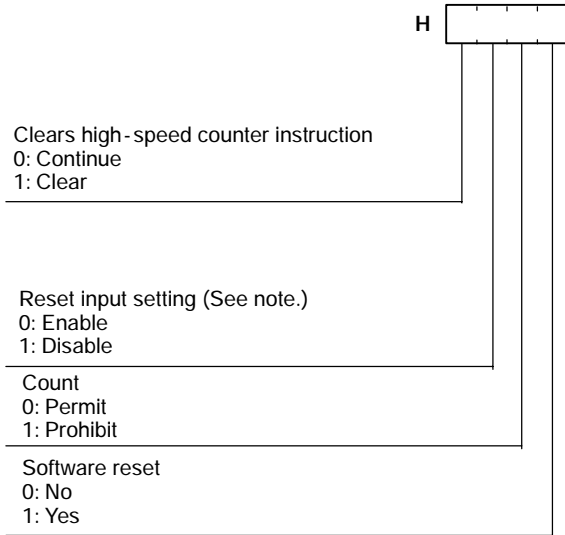
A control code written using an **F0(MV)** instruction is stored in special data register DT9052 (DT90052 on the FP0 T32).

High-speed counter and Pulse output controls flag area of FP0



<Control code>
Written using an F0(MV)
instruction (H0 to HF)

Select control codes in units of one bit and specify with H.



Note:
At the reset input setting, you set whether the reset input (X2 or X5), which was assigned by the system register high-speed counter setting, will be enabled or disabled.

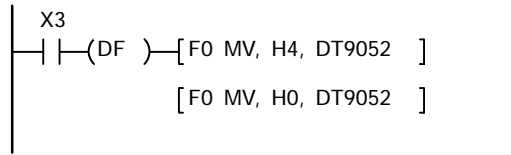
Example:

- Perform software reset H1(0001)
- Prohibit count H2(0010)
- Clear high-speed counter instruction H8(1000)
- Clear high-speed counter instruction and reset elapsed value H9(1001)

Program example



Example: Software reset of channel 0 of high-speed counter.



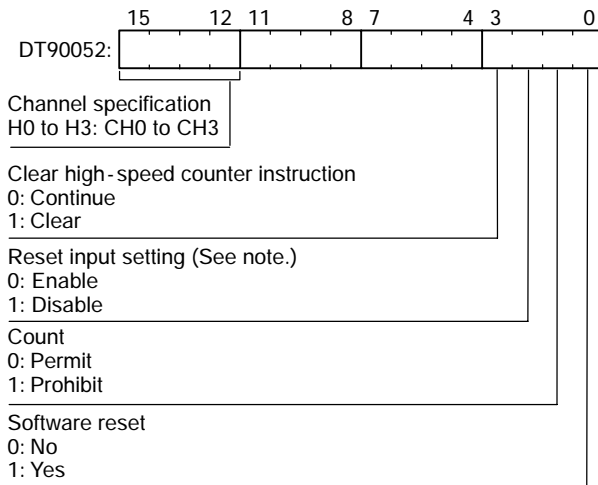
Using the FPΣ

High-speed counter and Pulse output controls flag area

The area DT90052 for writing channels and control codes is allocated as shown below.

Control codes written with an **F0(MV)** instruction are stored by channel in special registers DT90190 to DT90193.

High-speed counter and Pulse output controls flag area of FPΣ

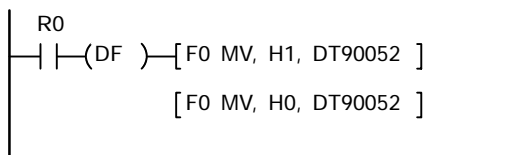


Note:

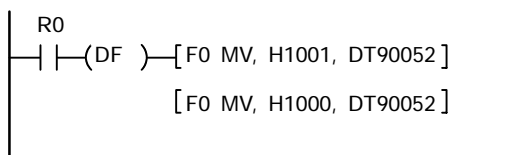
At the reset input setting, you set whether the reset input (X2 or X5), which was assigned by the system register high-speed counter setting, will be enabled or disabled.

Program example

Example 1: Software reset of channel 0 of high-speed counter



Example 2: Software reset of channel 2 of high-speed counter



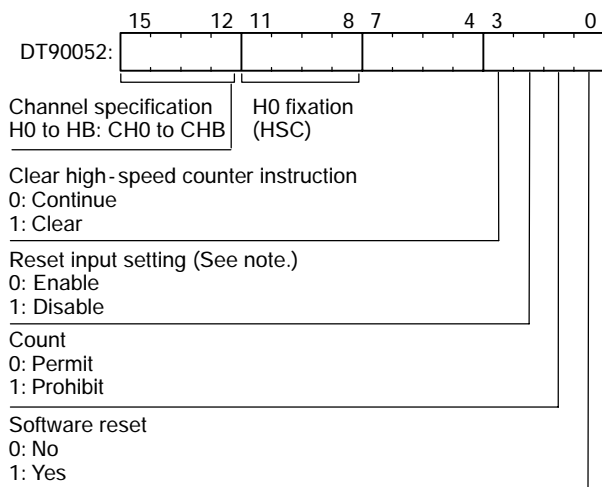
Using the FP-X

High-speed counter and Pulse output controls flag area

The area DT90052 for writing channels and control codes is allocated as shown below.

Control codes written with an **F0(MV)** instruction are stored by channel in special registers DT90190 to DT90193.

High-speed counter and Pulse output controls flag area of FP-X



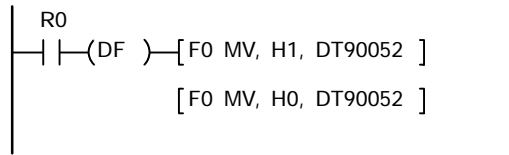
Note:

At the reset input setting, you set whether the reset input (X2 or X5) of the pulse I/O cassette, which was assigned by the system register high-speed counter setting, will be enabled or disabled.

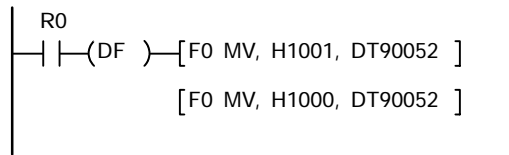
Program example



Example 1: Software reset of channel 0 of high-speed counter



Example 2: Software reset of channel 1 of high-speed counter



F0 (MV)**Pulse output control**

Availability

FP0/FPΣ/FP-X

Outline This instruction is used to perform control such as software reset, counter disabling, and stopping pulse output.

Program example

Ladder Diagram	Boolean	
	Address	Instruction
	10	ST R 0
	11	DF
	12	F0 (MV) H 1 DT 9052
	17	F0 (MV) H 0 DT 9052
	<p>* The high-speed counter and pulse output controls flag area varies depending on the PLC type.</p>	
	<p>S Area for storing pulse output control code or constant data</p>	

Operands

Operand	Relay			Timer/Counter		Register	Index register		Constant		Index modifier
	WX	WY	WR	SV	EV	DT	IX (*1)	IY (*2)	K	H	
S	A	A	A	A	A	A	A	A	A	A	A

A: Available

(*1) I0 to IC on FPΣ/FP-X

(*2) ID on FPΣ/FP-X

Description

Performs Pulse output control according to the control code specified in "S".

This instruction is used to perform the following operations when using a Pulse output:

<Function>

- 1) Performing a software reset
- 2) Disabling the count
- 3) Preemptively stopping positioning/pulse output
- 4) Clearing control executed with pulse output-related instructions **F171** or **F176**.
- 5) Setting near home input when returning to home position and changing to deceleration.

Once written, a control code is retained until the next write operation.

Precautions during programming

The near home processing is not possible when the count is prohibited during a return to home position, or when a software reset is performed.

The near home bit is retained; however, each time you wish to perform near home processing during a return to home position, "1" must be written to the respective bit.

Flag conditions

- Error flag (R9007): Turns on and stays on when:
- Error flag (R9008): Turns on for an instant when:
 - The area is exceeded when an index modifier is used
 - The "S" is outside specification range

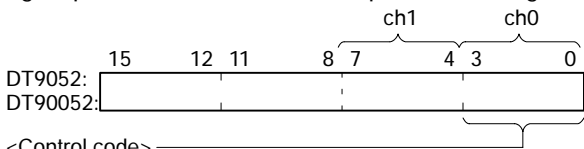
Using the FP0

High-speed counter and Pulse output controls flag area

Four bits are allocated to each Pulse output channel for use as the control code write area DT9052 (DT90052 on the FP0 T32)

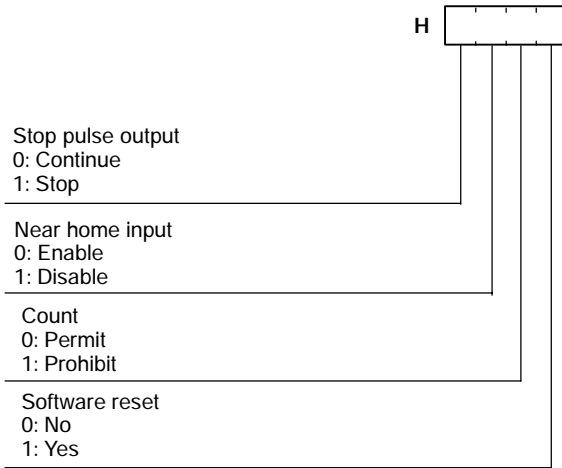
A control code written using an **F0(MV)** instruction is stored in special data register DT9052 (DT90052 on the FP0 T32).

High-speed counter and Pulse output controls flag area of FP0



<Control code>
Written using an F0(MV)
instruction (H0 to HF)


Select control codes in units of one bit and specify with H.

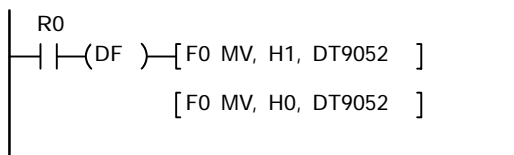


Example:

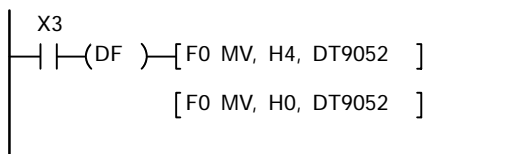
- Perform software reset H1(0001)
- Prohibit count H2(0010)
- Stop pulse output H8(1000)
- Turn off pulse output and reset elapsed value . H9(1001)

Program example

 **Example 1: Software reset of channel 0 of Pulse output.**



 **Example 2: Enable near home input during pulse output control and change to deceleration.**



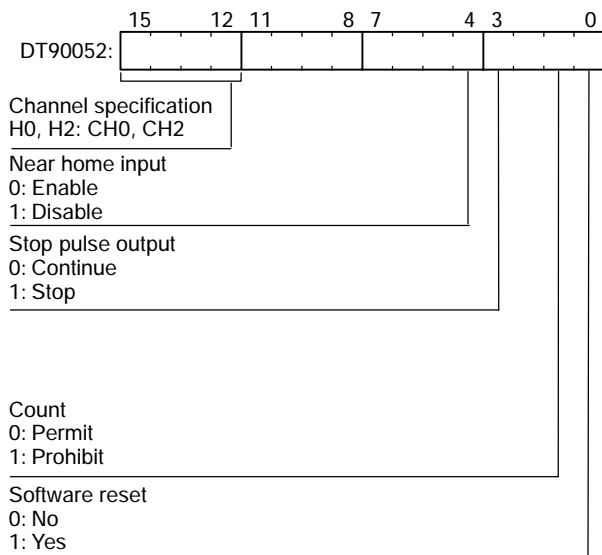
Using the FPΣ

High-speed counter and Pulse output controls flag area

The area DT90052 for writing channels and control codes is allocated as shown below.

Control codes written with an **F0(MV)** instruction are stored by channel in special registers DT90190 to DT90192.

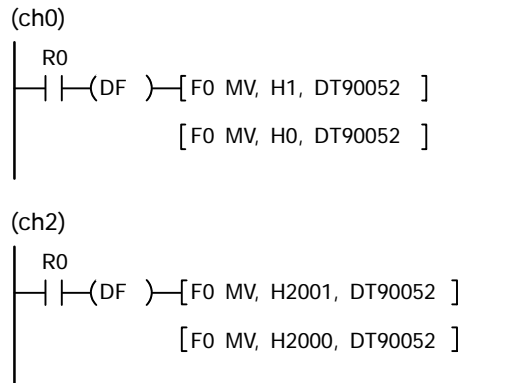
High-speed counter and Pulse output controls flag area of FPΣ



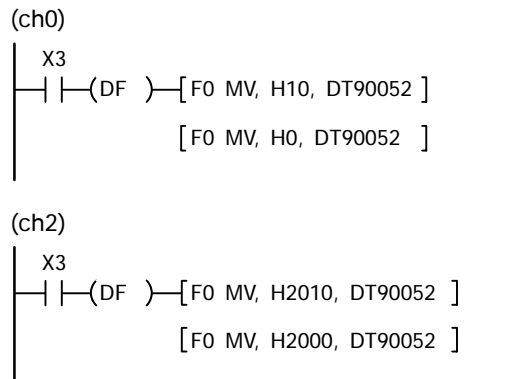
Program example



Example 1: Software reset of Pulse output

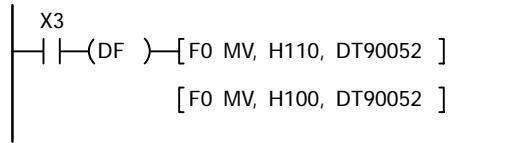


Example 2: Enable near home input during pulse output control and change to deceleration.

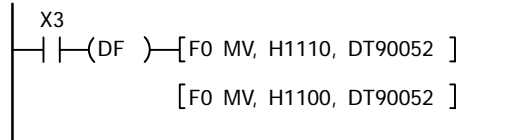


**Example 2: Enable near home input during pulse output control and change to deceleration.**

(ch0)



(ch1)



F1 (DMV)

Writing and reading the high-speed counter and pulse output elapsed value

Availability
FP0/FPΣ/FP-X

Outline This instruction is used to write and read the elapsed value of the high-speed counter/pulse output.

Program example

Ladder Diagram	Boolean	
	Address	Instruction
<p>Writing</p> <p>Elapsed value area of high-speed counter and pulse output</p> <p>Reading</p> <p>Elapsed value area of high-speed counter and pulse output</p> <p>* The high-speed counter and pulse output elapsed value area varies dependinon the PLC type.</p>	10	ST R 0
	11	DF
	12	F1 (DMV)
		K 3000
		DT 9044
	:	:
	:	:
	20	ST R 10
	21	DF
	22	F1 (DMV)
	DT 9044	
	DT 6	

S	Writing Area for storing the elapsed value (32 bits) write in the high-speed counter/pulse output, or constant data
D	Reading Area for reading the elapsed value of the high-speed counter/pulse output

Operands

Operand	Relay			Timer/Counter		Register	Index register		Constant		Index modifier
	WX	WY	WR	SV	EV	DT	IX (*1)	IY	K	H	
S	A	A	A	A	A	A	A	N/A	A	A	A
D	N/A	A	A	A	A	A	A	N/A	N/A	N/A	A

A: Available
N/A: Not Available

(*1) I0 to IC on FPΣ/FP-X

Writing the elapsed value

This instruction writes the 32-bit data specified in "S" to the elapsed value area of the high-speed counter and pulse output channel being used, and simultaneously sets the data in the elapsed value area of the high-speed counter used inside the system.

Make sure the 32-bit data value that is written to the elapsed value is within the following range.

Type	Allowed setting range
FP0	K -8,388,608 to K 8,388,607
FPΣ/FP-X	K -2,147,483,648 to K 2,147,483,647

Writing is only possible using an **F1(DMV)** instruction. Writing is not possible using other applied instructions such as the transfer instruction **F0(MV)** or arithmetic instructions.

When specifying the memory area in "S" or "D" (when reading), specify only the lower-order 16 bits of the memory area number.

Explanation of example

When the execution condition R0 is on, K3000 is written to the elapsed value area of ch0 of the high-speed counter and pulse output.

Reading the elapsed value

The contents of the special data register that stores the elapsed value of the high-speed counter and pulse output is written to the area specified in "D".

Explanation of example

When the execution condition R10 is on, the elapsed value of the high-speed counter and pulse output is transferred to data registers DT6 and DT7.

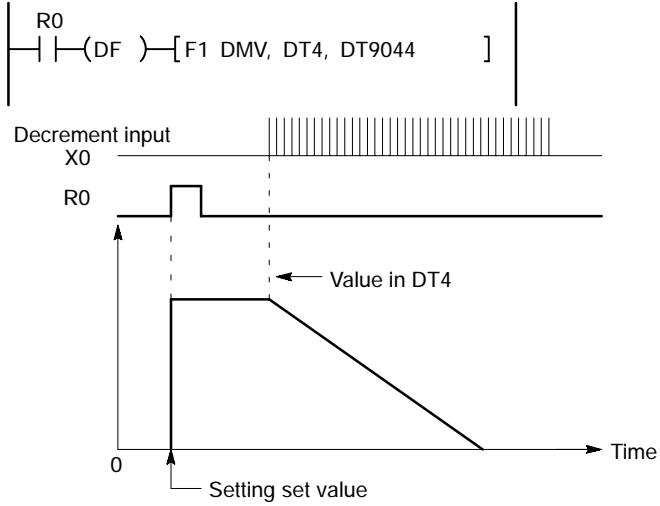
Flag conditions

- Error flag (R9007): Turns on and stays on when:
 - The area is exceeded when an index modifier is used
 - The "S" is outside specification range
- Error flag (R9008): Turns on for an instant when:
 - The area is exceeded when an index modifier is used
 - The "S" is outside specification range

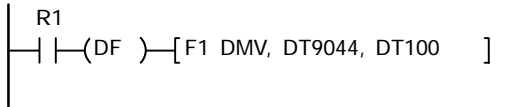
Program examples

The elapsed value area varies depending on the model and channel number.

- ✎ **Example 1: On R0 input, the value in data register DT4 is set in the ch0 elapsed value area as the set value.**



- ✎ **Example 2: On R1 input, the elapsed value of the ch0 is stored in data register DT100.**



- ✎ **Example 3: When the elapsed value of the ch0 is greater than K10000, the internal relay R0 turns on.**

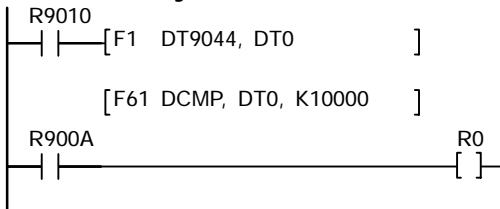


Table of channel number and elapsed value area

For FP0

High-speed counter channel no.	Pulse output channel no.	Elapsed value area
ch0	ch0	DT9044 to DT9045
ch1	ch1	DT9048 to DT9049
ch2	-	DT9104 to DT9105
ch3	-	DT9108 to DT9109

For FP0(T32)

High-speed counter channel no.	Pulse output channel no.	Elapsed value area
ch0	ch0	DT90044 to DT90045
ch1	ch1	DT90048 to DT90049
ch2	-	DT90104 to DT90105
ch3	-	DT90108 to DT90109

For FPΣ

High-speed counter channel no.	Pulse output channel no.	Elapsed value area
ch0	ch0	DT90044 to DT90045
ch1	-	DT90048 to DT90049
ch2	ch2	DT90200 to DT90201
ch3	-	DT90204 to DT90205

For FP-X

High-speed counter channel no.	Pulse output channel no.	Elapsed value area
ch0	-	DT90300 to DT90301
ch1	-	DT90304 to DT90305
ch2	-	DT90308 to DT90309
ch3	-	DT90312 to DT90313
ch4	-	DT90316 to DT90317
ch5	-	DT90320 to DT90321
ch6	-	DT90324 to DT90325
ch7	-	DT90328 to DT90329
ch8	-	DT90332 to DT90333
ch9	-	DT90336 to DT90337
chA	-	DT90340 to DT90341
chB	-	DT90344 to DT90345
-	ch0	DT90348 to DT90349
-	ch1	DT90352 to DT90353

F145 (SEND)Data send
(For MODBUS master mode)**P145 (PSEND)**

Availability

FP-X

Outline Sends specified data to another PLC or computer from the serial port of the unit.

Program example

Ladder Diagram	Boolean	
	Address	Instruction
	10	ST R 0
	11	F145 (SEND)
		DT 10
		DT 20
		DT 0
	K 100	
S1	Starting 16-bit area for storing control data	
S2	Starting 16-bit area for storing source data (data area at the local unit)	
D	16-bit area of destination to send (The device No. is fixed at 0).	
N	Starting 16-bit address of the destination to send.	

Operands

Operand	Relay				Timer/Counter		Register		Index register In (*1)	SWR	SDT	Constant		Index modifier
	WX	WY	WR	WL	SV	EV	DT	LD				K	H	
S1	A	A	A	A	A	A	A	A	N/A	A	A	N/A	N/A	A
S2	A	A	A	A	A	A	A	A	N/A	A	A	N/A	N/A	A
D	N/A	A	A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A

(*1) I0 to ID

A: Available
N/A: Not Available**Operation**

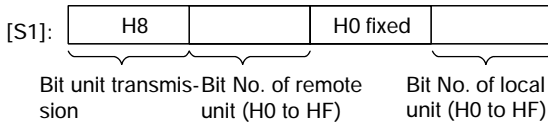
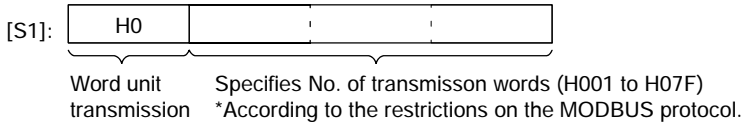
S It is used to send commands to the serial port (COM1 or COM2) of the specified unit in the MODBUS mode connecting the unit that enables to receive the MODBUS command. (MODBUS command 05, 06, 15 and 16)

S The data of the local area specified by [S2] is written in the area of the remote unit specified by [D] and [N], according to the specification for the 2-word data stored in the control data with starting area specified by [S1].

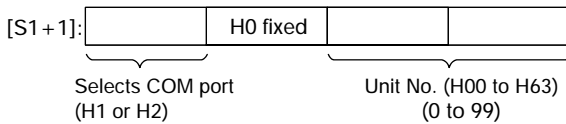
Specifications for each item

S The control data specified by [S1][S1+1] is specified as follows.

[S1]: Specifying transmission unit and transmission method



[S1+1]: Specifying the remote unit



(1) Specifying the transmission unit and transmission method [S1]

If data is to be sent in word units, specify the data volume, and if it is to be sent in bit units, specify the position of the target bit.

*In word units, the maximum of 127 (7Fh) words can be transmitted as the transmission range is up to 254 bytes.

(2) Specifying the remote unit [S1+1]

Specify the remote unit with the unit number. When H00, it is global transmission. (No response)

Specify either the COM1 or COM2 port from which data is transmitted to the remote unit.

Specify H0 (fixed) for the route No.

(3) Specify the area of the local unit by [S2] in which the data to be transmitted is stored

Specify the memory area of the local unit in which the data to be transmitted is stored.

(4) Specify the area of the remote unit for storing by [D] and [N].

Specify 0 for the device No. of [D].

Specify the memory area of the remote unit in which the data to be transmitted is stored, specifying the type D and the address N in combination.

Example) [D]:DT0, [N]:K100

↓
DT100

S The MODBUS command is created according to the operands specified by [S1],[S1+1], [S2], [D], and [N].

When being transmitted in word units: The command 06 (DT1 word write), command 15 (Y, R multi-points write) and command 16 (DT multi-words write) can be transmitted.

When being transmitted in bit units: The command 05 (Y, R single point write) can be transmitted.

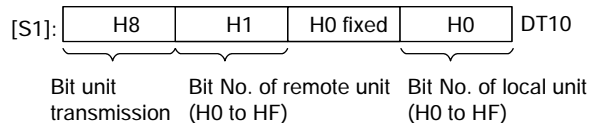
The transmission is executed adding the 2 bytes of CRC at the end after the MODBUS command has been created.

Explanation of command

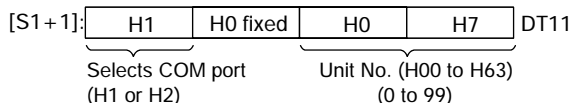
Command 05 (Y, R single write) send

Example) When the value of the bit 0 of WR3 is transmitted to the 1st bit of WY1 of the unit No. 7 in the remote unit from the COM1.

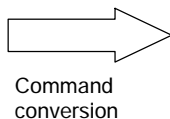
[F145 (SEND), DT10, WR3, WY0, K1]



*Bit units (H8) should be specified for the transmission method of the [S1] to send the command 05.



[S1]: DT10 (DT10=8100H, DT11=1007H)
 [S2]: WR3 (WR3=0007H)
 [D]: WY0
 [N]: K1



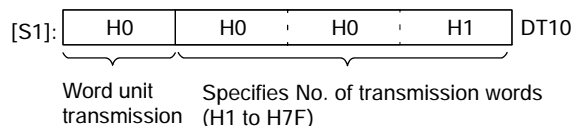
MODBUS commands	
1	Slave address 07
2	Command (05H) 05
3	Coil No. (H) 00
4	Coil No. (L) 11
5	Setting status (H) FF
6	Setting status (L) 00
7	CRC16 (H) DC
8	CRC16 (L) 59

* Reads a value of the bit 0 of WR3 and sets the condition by selecting ON or OFF.
 Specify ON=FF00, OFF=0000.

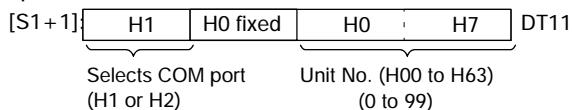
Command 06 (DT1 word write) send

Example) When the 1 - word data of WR3 is transmitted to the DT1000 of the unit No. 7 in the remote unit from the COM1.

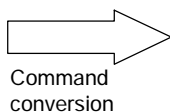
[F145 (SEND), DT10, WR3, DT0, K1000]



*Word units (H0) for the transmission method of [S1] and (H1) for No. of transmission words should be specified to send the command 06.



[S1]:DT10(DT10=0001H, DT11=1007H)
 [S2]:WR3(WR3=1234H)
 [D] :DT0
 [N] :K1000



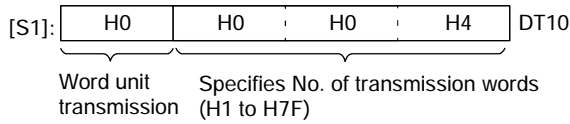
MODBUS commands	
1	Slave address 07
2	Command (06H) 06
3	Starting No. of write (H) 03
4	Starting No. of write (L) E8
5	Write data (H) 12
6	Write data (L) 34
7	CRC16 (H) 04
8	CRC16 (L) AB

* Reads the word data of WR3 and sets in the write data.

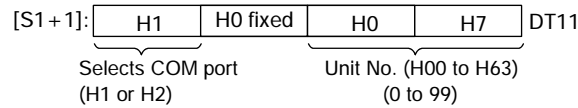
Command 15 (Y, R multi-points write) send

Example) When the 64 - bit data from the bit 0 of the WR3 to the bit F of the WR6 is transmitted to the W0 to Y3F of the unit No. 7 in the remote unit from the COM1.

[F145 (SEND), DT10, WR3, WY0, K0]



*Word unit (H0) should be specified for the transmission method of [S1] to send the command 15.

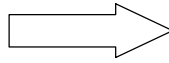


[S1]:DT10(DT10=0004H, DT11=1007H)

[S2]:WR3(WR3=3210H
WR4=7654H
WR5=BA98H
WR6=FEDCH)

[D] :WY0

[N] :K0



Command conversion

*Specify the coil No. of the destination for the starting No. of status change. (Remote unit)
The quantity of changed coils is that the No. of write bits is changed to HEX.
Max. quantity of changed coils is 2032 (07F0H).
(due to the restrictions on the MODBUS protocol)
No. of data (No. of bytes) is calculated regarded 8 coils as 1 data (1 byte). (Max. 254 (FEH) bytes)

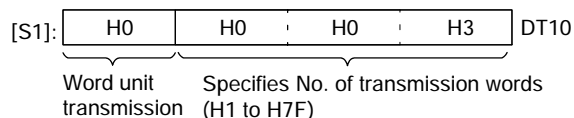
MODBUS commands

1	Slave address	07
2	Command (0FH)	0F
3	Starting No. of status change (H)	00
4	Starting No. of status change (L)	00
5	Quantity of changed coils (H)	00
6	Quantity of changed coils (L)	40
7	No. of data (No. of bytes)	08
8	Setting data 1	10
9	Setting data 2	32
10	Setting data 3	54
11	Setting data 4	76
12	Setting data 5	98
13	Setting data 6	BA
14	Setting data 7	DC
15	Setting data 8	FE
16	CRC16 (H)	6C
17	CRC16 (L)	B3

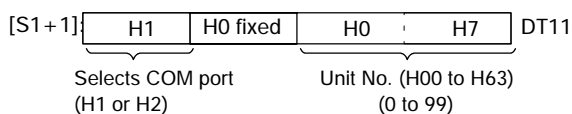
Command 16 (DT multi-words write) send

Example) When the 3- word data from WR3 to WR5 is transmitted to DT500 to DT502 of the unit No. 7 of the remote unit.

[F145 (SEND), DT10, WR3, DT0, K500]



*Word units (H0) should be specified for the transmission method of [S1] to send the command 16.



[S1]:DT10(DT10=0003H, DT11=1007H)

[S2]:WR3(WR3=0011H

WR4=2233H

WR5=4455H)

[D] :DT0

[N] :K500



Command conversion

*Max. quantity of write registers is 127 (7FH)
(due to the restrictions on the MODBUS protocol).
No. of data (No. of bytes) is calculated regarded No. of write registers as 2 bytes. (Max. 254 (FEH) bytes)

MODBUS commands

1	Slave address	07
2	Command (10H)	10
3	Starting No. of write (H)	01
4	Starting No. of write (L)	F4
5	No. of write registers (H)	00
6	No. of write registers (L)	03
7	No. of data (No. of bytes)	06
8	Write data 1 (H)	00
9	Write data 1 (L)	11
10	Write data 2 (H)	22
11	Write data 2 (L)	33
12	Write data 3 (H)	44
13	Write data 3 (L)	55
14	CRC16 (H)	5A
15	CRC16 (L)	E7

Flag conditions

S Error flag (R9007) : Turns on and stays on when:

S Error flag (R9008) : Turns on for an instant when:

- The control data of [S1] and [S1+1] is a value outside of the specified range.
- The number of words specified by S1 causes the area of S2 or D to be exceeded when word unit transmission is being used.
- [D]+[N] exceeds the area of [D].
- The MODBUS mode has not been specified for the COM port of the control data specified by [S1+1].
- The area of [D] is DT in bit unit transmission.
- The device No. of [D] is not 0.

Precautions during programming

S It is not possible to execute multiple F145 (SEND) instructions and F146 (RECV) instructions for the same communication port simultaneously.

The program should be set up so that these instructions are executed when the SEND/RECV execution enabled flag (R9044: COM1/R904A: COM2) is on.

R9044 (COM1)	0: Execution inhibited (SEND/RECV instruction being executed) 1: Execution enabled
R904A (COM2)	0: Execution inhibited (SEND/RECV instruction being executed) 1: Execution enabled

S The SEND instruction only requests that the data be sent, but the actual processing takes place when the ED instruction is executed.

The SEND/RECV execution end flag (R9045: COM1/R904B: COM2) can be used to check whether or not the transmission has been completed.

R9045 (COM1)	0: Completed normally 1: Completed with error (The error code is stored in DT90045.)
DT90124 (COM1)	If the transmission has been completed with an error (R9045 is on), the contents of the error (error code) are stored.
R904B (COM2)	0: Completed normally 1: Completed with error (The error code is stored in DT90125.)
DT90125 (COM2)	If the transmission has been completed with an error (R904B is on), the contents of the error (error code) are stored.

For information on the contents of error codes, refer to the manual. If the error code is H73, a communication time-out error has occurred.

The time-out time can be changed within a range of 10.0 ms to 81.9 seconds (in units of 10 ms), using the setting of system register 32.

The default value is set to 10 seconds.

Error code (HEX)	Description
73	Time-out: Waiting for response

S For global transmission (the transmission performed by specifying H00 for the unit No.), the program should be set up so that the transmission is executed after a time of at least the maximum scan time elapsed.

S The F145 or F146 instruction cannot be executed if the target is a special internal relay (from R9000) or a special data register (from DT9000).

F146 (RECV)

P146 (PRECV)

Data receive
(For MODBUS master mode)

Availability
FP-X

Outline Receives specified data from the serial port of another PLC or computer to the unit.

Program example

Ladder Diagram	Boolean	
	Address	Instruction
	10	ST R 0
	11	F146 (RECV)
		DT 10
		DT 0
		K 100
	DT 50	
S1	Starting 16-bit area for storing control data	
S2	16-bit area of destination to receive (The device No. is fixed at 0).	
N	Starting address of the destination to receive.	
D	Starting 16-bit area address for storing data received (destination data area at local unit).	

Operands

Operand	Relay				Timer/Counter		Register		Index register	SWR	SDT	Constant		Index modifier
	WX	WY	WR	WL	SV	EV	DT	LD	In (*1)			K	H	
S1	A	A	A	A	A	A	A	A	N/A	A	A	N/A	N/A	A
S2	A	A	A	A	N/A	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A
N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
D	N/A	A	A	A	A	A	A	A	N/A	N/A	N/A	N/A	N/A	A

(*1) I0 to ID

A: Available
N/A: Not Available

Operation

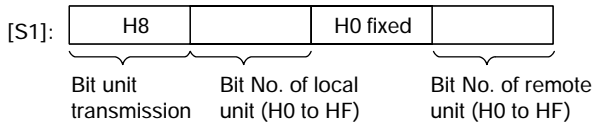
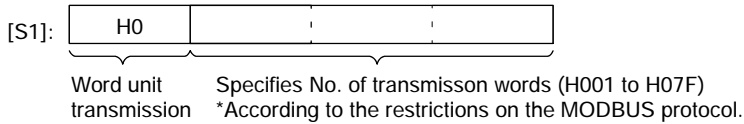
S It is used to send commands to the serial port (COM1 or COM2) of the specified unit in the MODBUS mode connecting the unit that enables to receive the MODBUS command. (MODBUS command 01, 02, 03 and 04)

S The data is sent from the area of the remote unit specified by [S2] and [N], and is stored in the area of the local unit that starts with [D], according to the specification for the 2-word data stored in the control data that starts with the area specified by [S1].

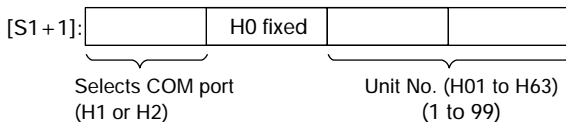
Specifications for each item

The control data specified by [S1][S1+1] is specified as follows.

[S1]: Specifying transmission unit and transmission method



[S1+1]: Specifying the remote unit



(1) Specifying the transmission unit and transmission method [S1]

If data is to be sent in word units, specify the data volume, and if it is to be sent in bit units, specify the position of the target bit.

* For word units, the maximum of 127 (7Fh) words can be transmitted as the transmission range is up to 254 bytes.

(2) Specifying the remote unit [S1+1]

Specify the remote unit with the unit number.

Specify either the COM1 or COM2 port from which data is transmitted to the remote unit.

Specify H0 (fixed) for the route No.

(3) Specifying the area of the remote unit which is received by [S2] and [N].

Specify 0 for the device No. of [S2].

Specify the memory area of the remote unit in which the data to be transmitted is stored, specifying the type S2 and the address N in combination.

Example) [S2]:DT0, [N]:K100

↓
DT100

(4) Specifying the area of the local unit by [D] in which the data to be received is stored

Specify the memory area of the local unit in which the data to be received is stored.

S The MODBUS command is created according to the operands specified by [S1],[S1+1], [S2], [D], and [N].

When being transmitted in word units: The command 01 (Y, R coil read), command 02 (WL, LD read), command 03 (DT read) and command 04 (WL, LD read) can be transmitted.

When being transmitted in bit units: The command 01 (Y, R coil read) and command 02 (X contact read) can be transmitted.

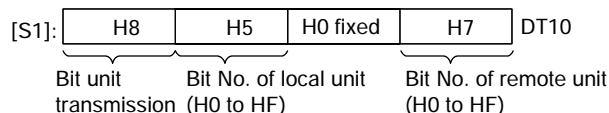
S The transmission is executed adding the 2 bytes of CRC at the end after the MODBUS command has been created.

Explanation of command

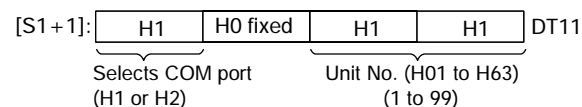
Command 01 (Y, R coil read) send

Example) When the 1 bit of Y17 is readed from the unit No. 17 of the remote unit, and a command to transmit the readed bit data to the 5th bit of the DT100 in the local unit is sent from the COM1.

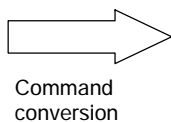
[F146 (RECV), DT10, WY0, K1, DT100]



*Bit units (H8) should be specified for the transmission method of [S1] to read only 1bit of data by the command 01.



[S1]: DT10(DT10=8507H, DT11=1011H)
 [S2]: WY0
 [N] : K1
 [D] : DT100

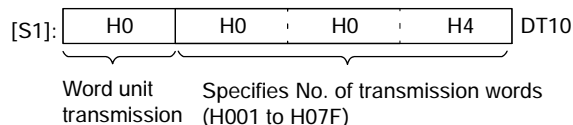


MODBUS commands		
1	Slave address	11
2	Command (01H)	01
3	Starting No. of read (H)	00
4	Starting No. of read (L)	17
5	Quantity to read (H)	00
6	Quantity to read (L)	01
7	CRC16 (H)	DC
8	CRC16 (L)	59

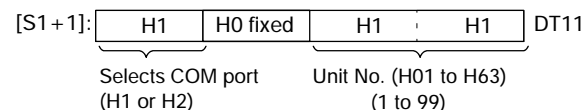
*Specify the coil No. of the destination for the starting No. of read. (Remote unit: Y17)
 The quantity to read should be 1.

Example) When the 64 bits (4 words) of data from Y10 to Y4F is readed from the unit No. 17 of the remote unit, and a command data to the area starting with DT100 in the local unit is sent from the COM1.

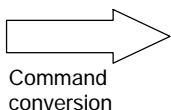
[F146 (RECV), DT10, WY0, K1, DT100]



*Bit units (H0) should be specified for the transmission method of [S1] to read in word units by the command 01.



[S1]: DT10 (DT10=0004H, DT11=1011H)
 [S2]: WY0
 [N]: K1
 [D]: DT100



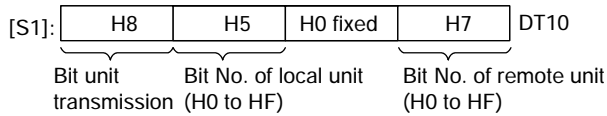
MODBUS commands		
1	Slave address	11
2	Command (01H)	01
3	Starting No. of read (H)	00
4	Starting No. of read (L)	10
5	Quantity to read (H)	00
6	Quantity to read (L)	40
7	CRC16 (H)	3E
8	CRC16 (L)	AF

* Specify the coil No. of the destination for the starting No. of read. (Remote unit: Y10)
 The quantity to read should be the value of "No. of specified words X 16". (64-bit read)

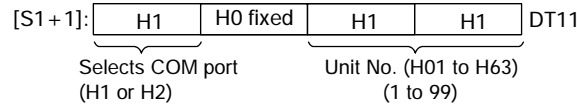
Command 02 (X contact read) send

Example) When the 1 bit of X17 is readed from the unit No. 17 of the remote unit, and a command to transmit the readed bit data to the 5th bit of DT100 in the local unit is sent.

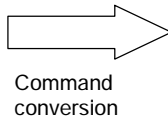
[F146 (RECV), DT10, WX0, K1, DT100]



*Bit units (H8) should be specified for the transmission method of the [S1] to read only 1bit of data by the command 02.



[S1]: DT10(DT10=8507H, DT11=1011H)
[S2]: WX0
[N] : K1
[D] : DT100

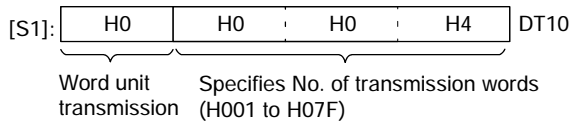


MODBUS commands		
1	Slave address	11
2	Command (02H)	02
3	Starting No. of read (H)	00
4	Starting No. of read (L)	17
5	Quantity to read (H)	00
6	Quantity to read (L)	01
7	CRC16 (H)	0B
8	CRC16 (L)	5E

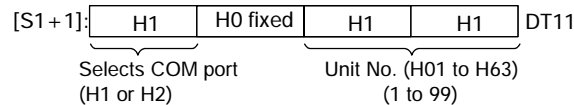
*Specify the coil No. of the destination for the starting No. of read. (Remote unit: X17)
The quantity to read should be 1.

Example) When the 64 bits (4 words) of data from X10 to X4F is readed from the unit No. 17 of the remote unit, and a command data to the area starting with DT100 in the local unit is sent from the COM1.

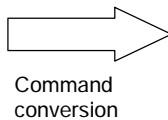
[F146 (RECV), DT10, WX0, K1, DT100]



*Bit units (H0) should be specified for the transmission method of [S1] to read in word units by the command 02.



[S1]: DT10 (DT10=0004H, DT11=1011H)
[S2]: WX0
[N]: K1
[D]: DT100



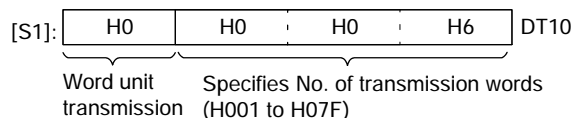
MODBUS commands		
1	Slave address	11
2	Command (02H)	02
3	Starting No. of read (H)	00
4	Starting No. of read (L)	10
5	Quantity to read (H)	00
6	Quantity to read (L)	40
7	CRC16 (H)	7A
8	CRC16 (L)	A0

*Specify the coil No. of the destination for the starting No. of read. (Remote unit: X10)
The quantity to read should be the value of "No. of specified words X 16". (64-bit read)

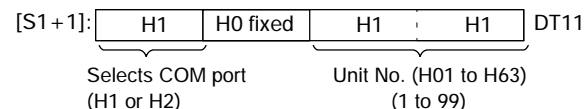
Command 03 (DT read) send

Example) When the 6 words of data from DT500 to DT505 is read from the unit No. 17 of the remote unit, and a command data to the area starting with DT100 in the local unit is sent from the COM1.

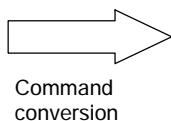
[F146 (RECV), DT10, DT0, K500, DT100]



*Word units (H0) should be specified for the transmission method of [S1] to read in word units by the command 03.



[S1]: DT10 (DT10=0006H, DT11=1011H)
 [S2]: DT0
 [N]: K500
 [D]: DT100



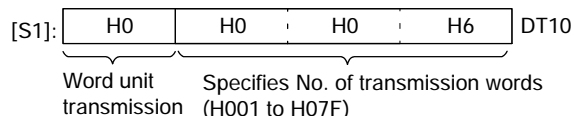
MODBUS commands		
1	Slave address	11
2	Command (03H)	03
3	Starting No. of read (H)	01
4	Starting No. of read (L)	F4
5	Quantity to read (H)	00
6	Quantity to read (L)	06
7	CRC16 (H)	87
8	CRC16 (L)	56

* Specify the data No. of the destination for the starting No. of read. (Remote unit: DT500)
 The quantity to read should be the No. of specified words. (6-word read)

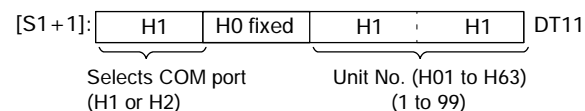
Command 04 (WL, LD read) send

Example) When the 6 words of data from WL20 to WL25 is read from the unit No. 17 of the remote unit, and a command data to the area starting with DT100 in the local unit is sent from the COM1.

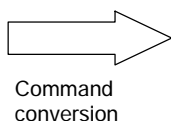
[F146 (RECV), DT10, WL0, K20, DT100]



*Word units (H0) should be specified for the transmission method of [S1] to read in word units by the command 04.



[S1]: DT10 (DT10=0006H, DT11=1011H)
 [S2]: WL0
 [N]: K20
 [D]: DT100

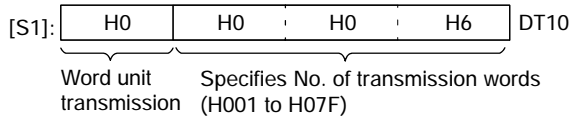


MODBUS commands		
1	Slave address	11
2	Command (04H)	04
3	Starting No. of read (H)	00
4	Starting No. of read (L)	14
5	Quantity to read (H)	00
6	Quantity to read (L)	06
7	CRC16 (H)	32
8	CRC16 (L)	9C

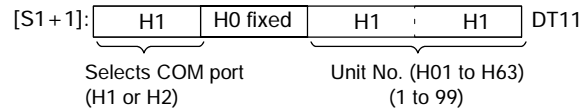
* Specify the data No. of the destination for the starting No. of read. (Remote unit: WL20)
 The quantity to read should be the No. of specified words. (6-word read)

Example) When the 6 words of data from LD100 to LD105 is readed from the unit No. 17 of the remote unit, and a command data to the area starting with DT100 in the local unit is sent from the COM1.

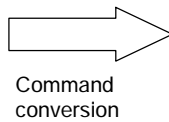
[F146 (RECV), DT10, LD0, K100, DT100]



*Word units (H0) should be specified for the transmission method of [S1] to read in word units by the command 04.



[S1]: DT10 (DT10=0006H, DT11=1011H)
 [S2]: LD0
 [N]: K100
 [D]: DT100



MODBUS commands		
1	Slave address	11
2	Command (04H)	04
3	Starting No. of read (H)	08
4	Starting No. of read (L)	34
5	Quantity to read (H)	00
6	Quantity to read (L)	06
7	CRC16 (H)	31
8	CRC16 (L)	36

* Specify the data No. of the destination for the starting No. of read. (Remote unit: LD100)
 The quantity to read should be the No. of specified words. (6 - word read)

*For specifying LD, it should be from 07D0H (LD0).

Flag conditions

- S Error flag (R9007) : Turns on and stays on when
- S Error flag (R9008) : Turns on for an instant when
 - The control data of [S1] and [S1+1] is a value outside of the specified range.
 - The number of words specified by S1 causes the area of S2 or D to be exceeded when word unit transmission is being used.
 - [S2]+[N] exceeds the area of [S2].
 - The MODBUS mode has not been specified for the COM port of the control data specified by [S1+1].
 - The area of [S2] is DT, WL and LD in the bit unit transmission.
 - The device No. of [S2] is not 0.

Precautions during programming

S It is not possible to execute multiple F145 (SEND) instructions and F146 (RECV) instructions for the same communication port simultaneously.

The program should be set up so that these instructions are executed when the SEND/RECV execution enabled flag (R9044: COM1/R904A: COM2) is on.

R9044 (COM1)	0: Execution inhibited (SEND/RECV instruction being executed) 1: Execution enabled
R904A (COM2)	0: Execution inhibited (SEND/RECV instruction being executed) 1: Execution enabled

S The SEND instruction only requests that the data be sent, but the actual processing takes place when the ED instruction is executed.

The SEND/RECV execution end flag (R9045: COM1/R904B: COM2) can be used to check whether or not the transmission has been completed.

R9045 (COM1)	0: Completed normally 1: Completed with error (The error code is stored in DT90045.)
DT90124 (COM1)	If the transmission has been completed with an error (R9045 is on), the contents of the error (error code) are stored.
R904B (COM2)	0: Completed normally 1: Completed with error (The error code is stored in DT90125.)
DT90125 (COM2)	If the transmission has been completed with an error (R904B is on), the contents of the error (error code) are stored.

For information on the contents of error codes, refer to the manual. If the error code is H73, a communication time-out error has occurred.

The time-out time can be changed within a range of 10.0 ms to 81.9 seconds (in units of 10 ms), using the setting of system register 32.

The default value is set to 10 seconds.

Error code (HEX)	Description
73	Time-out: Waiting for response

S The F145 or F146 instruction cannot be executed if the target is a special internal relay (from R9000) or a special data register (from DT9000).

F159 (MTRN) Serial data communication

Availability
FPΣ/FP-X

Outline This is used to send data to or receive data from an external device through the specified RS232C port.

Program example

Ladder Diagram	Boolean	
	Address	Instruction
	10	ST R 0
	11	DF
	12	F159 (MTRN)
		DT 100
		K 8
	K 1	

S	Starting area of data table (data register)
n	Area for storing the number of bytes of data to be transmitted, or constant data. When the value is positive, an end code is added. When the value is negative, an end code is not added. When the value is H8000, the transmission mode of the RS232C port is changed.
D	Port for transmitting data (K0, K1, K2) K0: FP-X only

Operands

Operand	Relay				Timer/Counter		Register		Index register		Constant		Index modifier
	WX	WY	WR	WL	SV	EV	DT	LD	IX (*1)	IY	K	H	
S	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	N/A	A
n	A	A	A	A	A	A	A	A	A	A	A	A	A
D	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	N/A	A

(*1) I0 to ID.

A: Available
N/A: Not Available

Description

This instruction is used to send and receive instructions and data when an external device (computer, measuring instrument, bar code reader, etc.) has been connected to the specified RS232C port.

1) Transmission

Transmits "n" bytes of the data stored in the data table that begins from the starting area specified in "S" through the communication port specified in "D" to an external device. A start code and end code can be automatically added to the transmission. The maximum number of bytes that can be transmitted is 2048.

2) Reception

Reception is controlled by the reception done flag (R9038/R9048) turning on and off. When the reception done flag is off, reception can take place at any time and data coming into the RS232C port is stored in the data register specified in system registers 416 to 419.

The F159(MTRN) instruction is used to turn off (enable reception) the reception done flag (R9038/R9048). The maximum number of bytes that can be received is 4094.

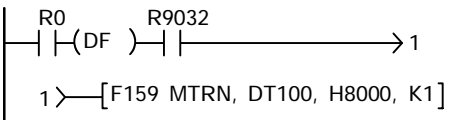
Flag conditions

- Error flag (R9007): Turns on and stays on when:
- Error flag (R9008): Turns on for an instant when:
 - The area is exceeded when there is an index modifier.
 - The data table exceeds the area because of the number of bytes specified in "n".

3) Changing the transmission mode of the RS232C port

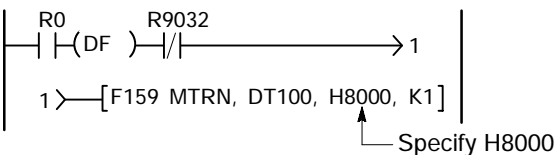
An F159(MTRN) instruction can be executed to change between "general transmission mode" and "computer link mode". To do so, specify "H8000" in "n" (the number of transmission bytes) and execute the instruction.

Changing from "general port" to "computer link"



RS232C port selection flag in R9032 or R9042.
Turns on when "general port" is selected.

Changing from "computer link" to "general port"



Note

When the power is turned on, the mode of use selected in system register 412 takes effect.

The FP-X tool port is always set to the computer link mode in the PROG. mode.

Programming and operation during transmission

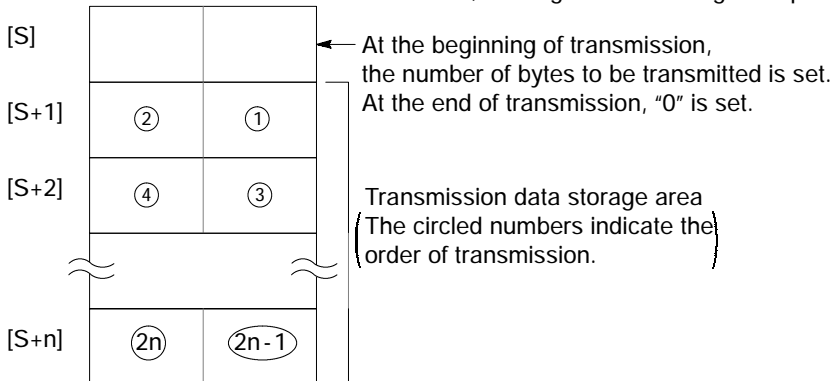
To execute transmission, write the data to be transmitted to the data table and specify with an **F158(MTRN)** instruction.

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

- Do not include an end code in the transmission data. An end code is added automatically.
- When "yes" is specified for the start code in system register 413 or 414, do not add a start code to the transmission data. A start code is added automatically.
- The maximum number of transmission bytes "n" is 2048.

Data table for transmission

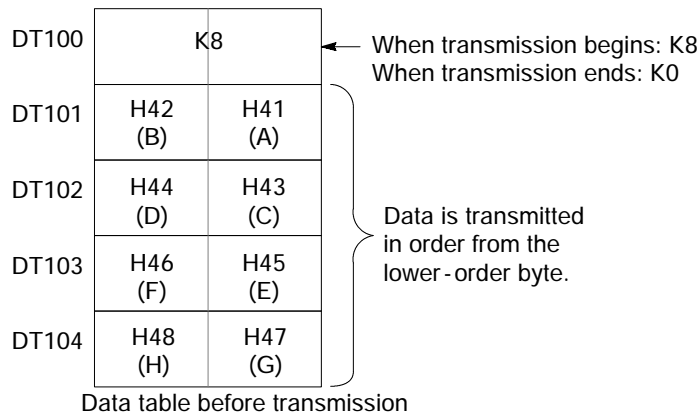
This is used as a data table for transmission, starting at the data register specified in "S".



Example:

Transmitting the eight characters A, B, C, D, E, F, G, H (8 bytes of data)

This example uses DT100 to DT104 as the data table.

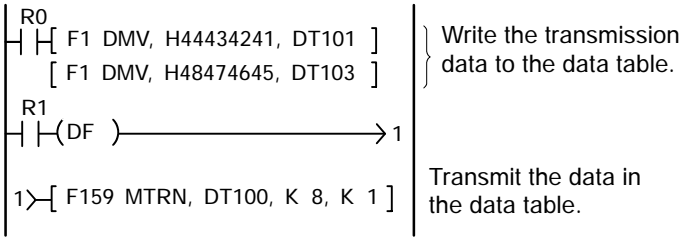


Notes

- When using a RS232C × 1 ch type communication cassette, transmission does not take place until CS (Clear to Send) turns on. If you are not going to connect to the other device, connect to RS (Request to Send).
- The reception done flag (R9038/R9048) also changes during scanning.

Program

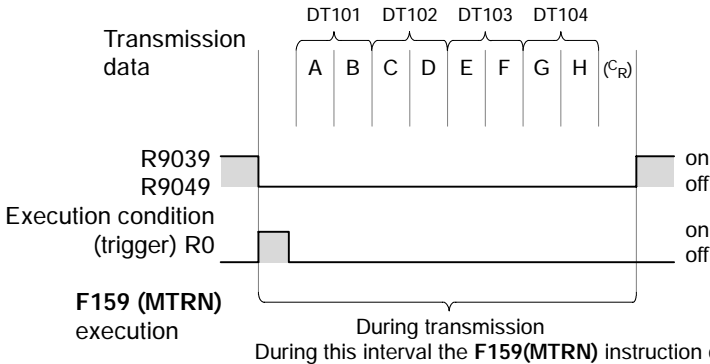
Specify the starting address of the transmission data table in "S", and the number of data bytes to be transmitted in "n".



Operation

When the execution condition of the **F159(MTRN)** instruction turns on, operation is as follows when the transmission done flag (R9039/R9049) is on:

- 1) "n" is preset in "S". The reception done flag (R9038/R9048) is turned off, and the reception data number is cleared to "0".
- 2) The set data is transmitted in order from the lower-order byte in "S+1" of the table.
 - During transmission, the transmission done flag (R9039/R9049) turns off.
 - If system register 413 or 414 is set to start code with STX, a start code is automatically added to the beginning of the data.
 - The end code specified in system register 413 or 414 is automatically added to the end of the data.



- 3) When all of the specified quantity of data has been transmitted, the "S" value is cleared to "0" and the transmission done flag (R9039/R9049) turns on.

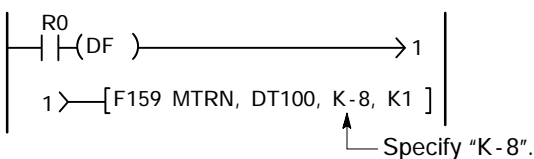
When you do not wish to add an end code to transmissions, use one of the following methods:

Specify the number of bytes to be transmitted using a negative number.

If you also do not wish to add an end code to receptions, set system register 413 or 414 to "no end code".

Example:

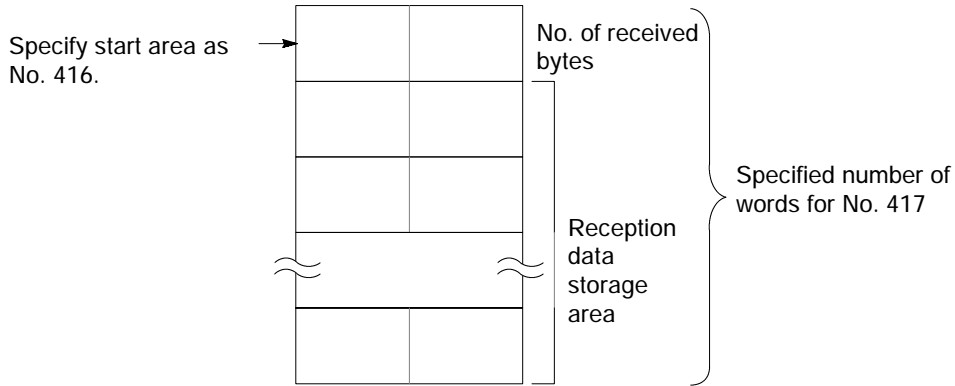
Program for transmitting 8 bytes of data without adding an end code



Preparation for reception

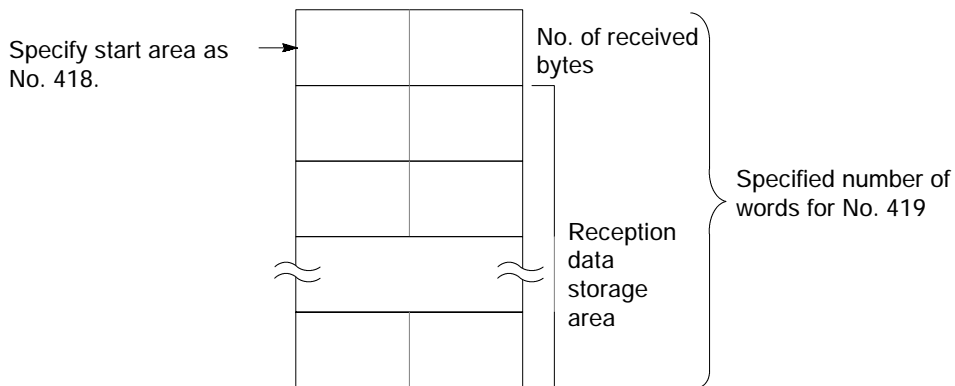
Setting of COM 1 port reception buffer **No. 416 and No. 417**

The area of data registers DT0 up to DT2047 is the default reception buffer.
 The maximum number of bytes that can be received is 4094 bytes.



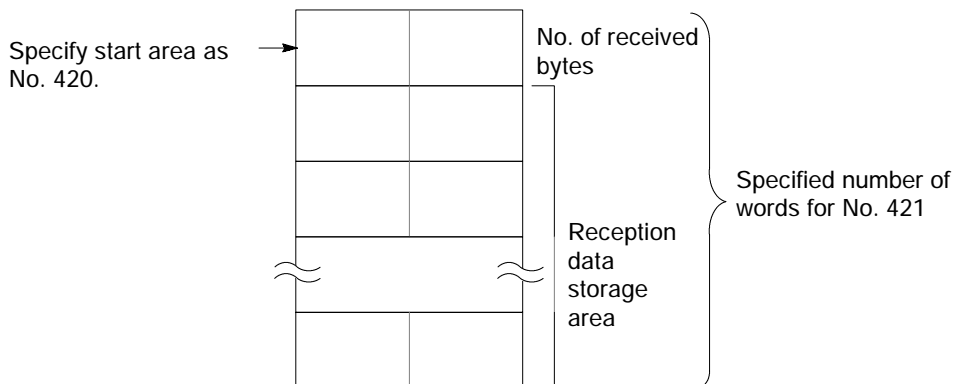
Setting of COM 2 port reception buffer **No. 418 and No. 419**

The area of data registers DT2048 up to DT4095 is the default reception buffer.
 The maximum number of bytes that can be received is 4094 bytes.



Setting of Tool port reception buffer **No. 420 and No. 421**

The area of data registers DT4096 up to DT6143 is the default reception buffer.
 The maximum number of bytes that can be received is 4094 bytes.



Programming and operation during reception

Data sent from an external device connected to the RS232C port is stored in the data registers that have been set as the reception buffer.

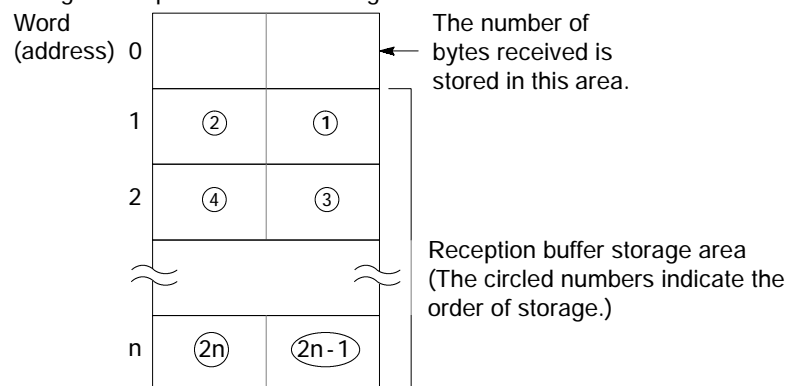
Data registers are used for the reception buffer. Specify the data registers in system registers 416 to 419.

The number of bytes of data received is stored in the starting address of the reception buffer. The initial value is "0".

Received data is stored in the received data storage area in order from the lower-order byte.

Reception buffer

Using a "reception buffer" data register



Example:

Receiving eight bytes of data, A, B, C, D, E, F, G, H, from an external device through the COM1 port

DT200 to DT204 are used as the reception buffer.

System register settings are as follows:

- System register 416: K200
- System register 417: K5

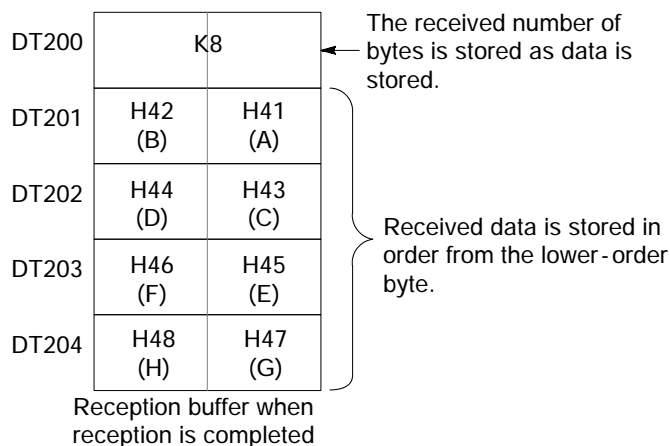


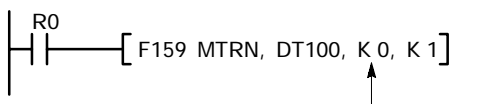
Table of related flags and system registers

Item	For COM1	For COM2	For Tool
Transmission mode flag	R9032	R9042	R9040
Reception done flag	R9038	R9048	R903E
Transmission done flag	R9039	R9049	R903F
Beginning of reception buffer	Specified in 416	Specified in 418	Specified in 420
Reception buffer capacity	Specified in 417	Specified in 419	Specified in 421

Program

The reception done flag (R9038/9048) turns on when data reception from the external device is completed. Reception of any further data is prohibited.

To receive subsequent data, you must execute an **F159(MTRN)** instruction to turn off the reception done flag (R9038/R9048) and clear the byte number to "0".



To repeatedly perform only reception, specify K0.
R9038/R9048 also turn off when transmission is performed with a byte number specification.

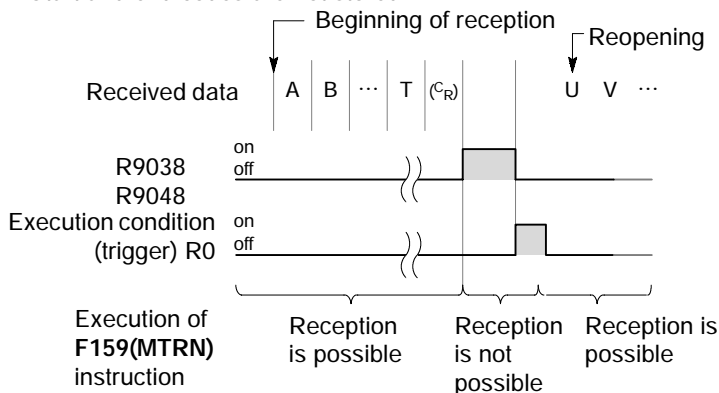
Operation

When the reception done flag (R9038/R9048) is off, operation takes place as follows when data is sent from an external device.

(R9038/R9048 are off during the first scan after RUN. "0" is set in the starting area of the reception buffer specified in the system registers.)

- 1) Incoming data is stored in order from the lower-order byte of the 2nd-word area of the reception buffer.

Start and end codes are not stored.



- 2) When the end code is received, the reception done flag (R9038/9048) turns on. Reception of any further data is prohibited.
- 3) When an **F159(MTRN)** instruction is executed, the reception done flag (R9038/9048) turns off, the number of received bytes is cleared, and subsequent data is stored in order from the lower-order byte.

 **Notes**

- To perform repeated reception of data, refer to the following steps.
 - 1) Receive data
 - 2) Reception done (R9038/R9048: on, reception prohibited)
 - 3) Process received data
 - 4) Execute F159(MTRN) instruction (R9038/R9048: off, reception possible)
 - 5) Receive subsequent data
 - The reception done flag (R9038/R9048) also changes during scanning.
-

F166(HC1S) Target value match on (with channel specification)

Availability
FP0/FPΣ/FP-X

Outline When the elapsed value of the specified channel of the high-speed counter matches the target value, the specified output is turned on.

Program example

Ladder Diagram	Boolean	
	Address	Instruction
	10	ST R 0
	11	DF
	12	F166 (HC1S)
		K 0 K 10000 Y 0

n	The channel number of the high-speed counter that corresponds to the match output (FP0/FPΣ: H0 to H3, FP-X: H0 to HB).
S	The high-speed counter target value data or the starting address of the area that contains the data.
D	The output coil that is turned on when the values match (Yn).

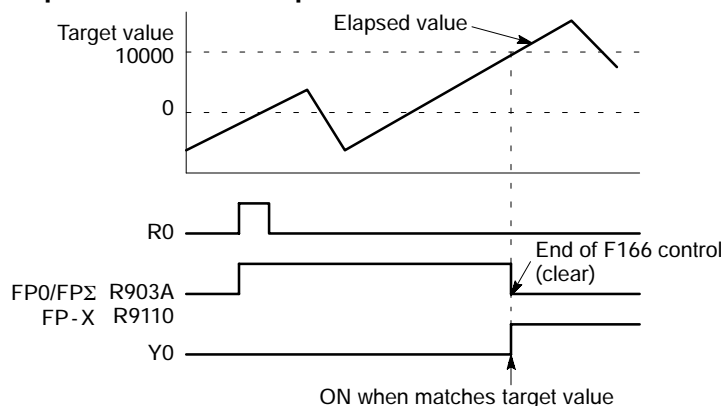
Operands

Operand	Relay			Timer/Counter		Register	Index register		Constant		Index modifier
	WX	WY	WR	SV	EV	DT	IX (*1)	IY	K	H	
n	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	N/A
S	A	A	A	A	A	A	A	N/A	A	A	A
D	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

A: Available
N/A: Not Available

(*1) I0 to IC on FPΣ/FP-X

Explanation of example



FP0/FPΣ: The number of the high-speed counter control flag (R903A to R903D) varies depending on the channel used.

FP-X: The number of the high-speed counter control flag (R9110 to R911B) varies depending on the channel used.

Description

The number specified in "S" is set as the target value of the high-speed counter, and when the elapsed value matches the target value, the specified output "Yn" turns on (by interrupt processing).

The target value setting and target value match output control are cleared when the elapsed value matches the target value.

Specify a 32-bit data value for the target value "S" within the following range:

FP0 K-8,388,608 to K8,388,607

FPΣ K-2,147,483,648 to K2,147,483,647

The "S" value is stored in the target value area when the instruction is executed.

Possible specification range for "Yn": FP0/FPΣ: Y0 to Y7, FP-X: Y0 to Y29F

However, when the output that is not implemented is specified, only the WY memory is set/reset.

Precautions during programming

The high-speed counter control flag turns on when the execution condition of the **F166(HC1S)** instruction turns on and remains on until the target value match output turns on. During this time, an instruction to the high-speed counter of the same channel (**F166** through **F176**) cannot be executed.

Before the elapsed value matches the target value, the target value and target value match output setting are not cleared even if a hardware reset is performed (the elapsed value is cleared to "0").

A check for double output with **OT** instructions, **KP** instructions, and other applied instructions is not performed on the output Y that is specified for target value match output.

To turn off the target value match output that was turned on with this instruction, reset using an **RST** instruction or **F0(MV)** instruction, or use as a pair with an **F167(HC1R)** instruction.

If both the normal program and the interrupt program contain code for the same channel, make sure both are not executed simultaneously.

The high-speed counter control flag also changes during scanning.

The interrupt program is able to be executed, when the high-speed counter elapsed value equals the set target value.

Flag conditions

- Error flag (R9007): Turns on and stays on when:
 - The area is exceeded when an index modifier is used.
 - The "n" is outside specification range.
 - The "S" is outside specification range.
 - The "D" is outside specification range.
- Error flag (R9008): Turns on for an instant when:
 - The area is exceeded when an index modifier is used.
 - The "n" is outside specification range.
 - The "S" is outside specification range.
 - The "D" is outside specification range.

F167(HC1R) Target value match off (with channel specification)

Availability
FP0/FPΣ/FP-X

Outline When the elapsed value of the specified channel of the high-speed counter matches the target value, the specified output is turned off.

Program example

Ladder Diagram	Boolean	
	Address	Instruction
	10	ST R 0
	11	DF
	12	F167 (HC1R)
		K 0 K - 200 Y 0
n	The channel number of the high-speed counter that corresponds to the match output (FP0/FPΣ: H0 to H3, FP-X: H0 to HB).	
S	The high-speed counter target value data or the starting address of the area that contains the data.	
D	The output coil that is turned off when the values match (Yn n: 0 to 7)	

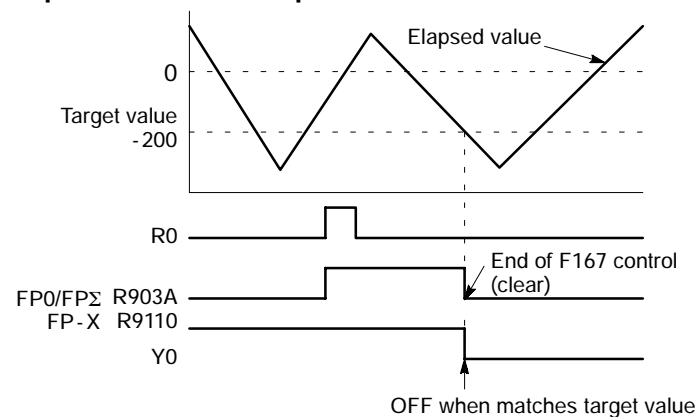
Operands

Operand	Relay			Timer/Counter		Register	Index register		Constant		Index modifier
	WX	WY	WR	SV	EV	DT	IX (*1)	IY	K	H	
n	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	N/A
S	A	A	A	A	A	A	A	N/A	A	A	A
D	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

A: Available
N/A: Not Available

(*1) I0 to IC on FPΣ/FP-X

Explanation of example



FP0/FPΣ: The number of the high-speed counter control flag (R903A to R903D) varies depending on the channel used.

FP-X: The number of the high-speed counter control flag (R9110 to R911B) varies depending on the channel used.

Description

The number specified in "S" is set as the target value of the high-speed counter, and when the elapsed value matches the target value, the specified output "Yn" turns off (by interrupt processing).

The target value setting and target value match output control are cleared when the elapsed value matches the target value.

Specify a 32-bit data value for the target value "S" within the following range:

FP0 K-8,388,608 to K8,388,607

FPΣ K-2,147,483,648 to K2,147,483,647

The "S" value is stored in the target value area when the instruction is executed.

Possible specification range for "Yn": FP0/FPΣ: Y0 to Y7, FP-X: Y0 to Y29F

However, when the output that is not implemented is specified, only the WY memory is set/reset.

Precautions during programming

The high-speed counter control flag turns on when the execution condition of the **F167(HC1S)** instruction turns on and remains on until the target value match output turns off. During this time, an instruction to the high-speed counter of the same channel (F166 through F173) cannot be executed.

Before the elapsed value matches the target value, the target value and target value match output setting are not cleared even if a hardware reset is performed (the elapsed value is cleared to "0").

A check for double output with **OT** instructions, **KP** instructions, and other applied instructions is not performed on the output Y that is specified for target value match output.

To turn on the target value match output that was turned off with this instruction, reset using an **SET** instruction or **F0(MV)** instruction, or use as a pair with an **F166(HC1S)** instruction.

If both the normal program and the interrupt program contain code for the same channel, make sure both are not executed simultaneously.

The high-speed counter control flag also changes during scanning.

The interrupt program is able to be executed, when the high-speed counter elapsed value equals the set target value.

Flag conditions

- Error flag (R9007): Turns on and stays on when:
 - The area is exceeded when an index modifier is used.
 - The "n" is outside specification range.
 - The "S" is outside specification range.
 - The "D" is outside specification range.
- Error flag (R9008): Turns on for an instant when:
 - The area is exceeded when an index modifier is used.
 - The "n" is outside specification range.
 - The "S" is outside specification range.
 - The "D" is outside specification range.

F171(SPDH)**Pulse output
(with channel specification)
(trapezoidal control)**

Availability

FPΣ/FP-X

Outline This instruction outputs pulses from the specified channel for the pulse output according to the specified parameters.

Program example

Ladder Diagram	Boolean	
	Address	Instruction
	10	ST R 10
	11	DF
	12	F171 (SPDH) DT 100 K 0
S	Starting address of area containing the data table.	
n	Channel for pulse output.	

Operands

Operand	Relay			Timer/Counter		Register	Index register	Constant		Index modifier
	WX	WY	WR	SV	EV	DT	I	K	H	
S	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	A
n	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	N/A

A: Available
N/A: Not Available

Description

Pulses are output from the specified channel when the corresponding control flag turns off and the execution condition is in on state.

Channel no.	Output	Output method	
ch0	Y0	CW	PLS
	Y1	CCW	SIGN
FPΣ: ch2 FP-X: ch1	Y3	CW	PLS
	Y4	CCW	SIGN

The control code, initial speed, maximum speed, acceleration/deceleration time, and target value are specified by creating the data table "S" to "S+11" on the following page using the user program.

The frequency is changed using the specified acceleration/deceleration time from the initial speed to the maximum speed. During deceleration, the frequency is changed based on the same slope as during acceleration.

If the frequency is set to 50 kHz or more, specify a duty of 1/4 (25%).

Table of areas used

For FPΣ

Channel no.	Control flag	Elapsed value area	Target value area
ch0	R903A	DT90044, DT90045	DT90046, DT90047
ch2	R903C	DT90200, DT90201	DT90202, DT90203

For FP-X

Channel no.	Control flag	Elapsed value area	Target value area
ch0	R911C	DT90348, DT90349	DT90350, DT90351
ch1	R911D	DT90352, DT90353	DT90354, DT90355

Operation modes

Incremental <relative value control>

Outputs the pulses set with the target value.

Selected mode Target value	CW/CCW	PLS + SIGN Forward off Reverse on	PLS + SIGN Forward on Reverse off	Elapsed value
Positive	Pulse output from CW	Pulse output on direction output off	Pulse output on direction output on	Addition
Negative	Pulse output from CCW	Pulse output on direction output on	Pulse output on direction output off	Subtraction

Absolute <absolute value control>

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

Selected mode Target value	CW/CCW	PLS + SIGN Forward off Reverse on	PLS + SIGN Forward on Reverse off	Elapsed value
Target value greater than current value	Pulse output from CW	Pulse output on direction output off	Pulse output on direction output on	Addition
Target value less than current value	Pulse output from CCW	Pulse output on direction output on	Pulse output on direction output off	Subtraction

Precautions during programming

If both the regular program and the interrupt program contain code for the same channel, make sure both are not executed simultaneously.

During the time that the circular interpolation control flag R904E is on, the pulse output instructions F166 to F176 cannot be executed.

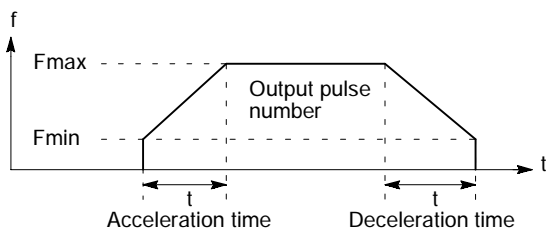
When using this instruction for FPΣ, set the channels corresponding to system registers 400 and 401 to "Not set as high-speed counter".

If you perform a rewrite during RUN when pulse output is taking place, more pulses than the setting may be output.

The pulse I/O cassette is necessary for FP-X.

Set the channels corresponding to system registers 400 and 401 to "Use pulse output".

Setting the data table



S		
S+1	Control code	(*1)
S+2	Initial speed	
S+3	Fmin (Hz)	(*2)
S+4	Maximum speed	
S+5	Fmax (Hz)	(*2)
S+6	Acceleration/deceleration time t (ms)	(*3)
S+7		
S+8	Target value (pulse number)	(*4)
S+9		
S+10		
S+11	K0	

(*1): Specification of control code (specify with H constant)

0: Fixed	H
Number of acceleration/deceleration steps	
0: 30 steps	
1: 60 steps (Can be specified for only C32T2, C28P2 and FP-X.)	
Duty (on width)	
0: Duty 1/2 (50%)	
1: Duty 1/4 (25%)	
Frequency range	
0: 1.5 Hz to 9.8 kHz	
1: 48 Hz to 100 kHz	
2: 191 Hz to 100 kHz	
Operation mode and output method	
00: Incremental CW/CCW	
02: Incremental PLS + SIGN (forward off / reverse on)	
03: Incremental PLS + SIGN (forward on / reverse off)	
10: Absolute CW/CCW	
12: Absolute PLS + SIGN (forward off / reverse on)	
13: Absolute PLS + SIGN (forward on / reverse off)	

(*2): Frequency (Hz) "K constant"

- Frequency range
- 0: 1.5 Hz to 9.8 kHz [K1 to K9800 (units: Hz)] (Max. error near 9.8 kHz: approx. -0.9 kHz)
 - * Set "1" to specify 1.5 Hz.
 - 1: 48 Hz to 100 kHz [K48 to K100000 (units: Hz)] (Max. error near 100 kHz: approx. -3 kHz)
 - 2: 191 Hz to 100 kHz [K191 to K100000 (units: Hz)] (Max. error near 100 kHz: approx. -0.8 kHz)
- Initial speed: Set to 30 kHz or lower.

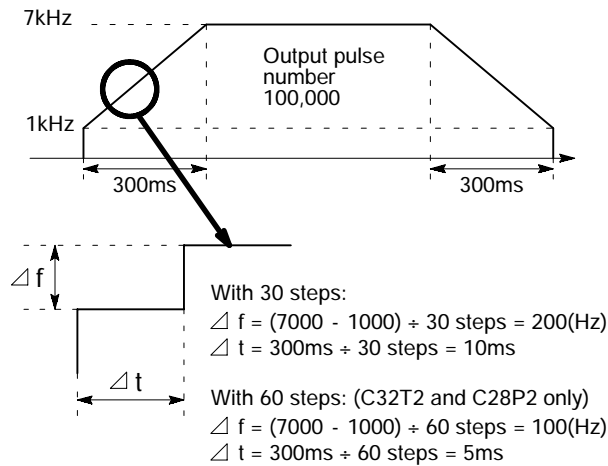
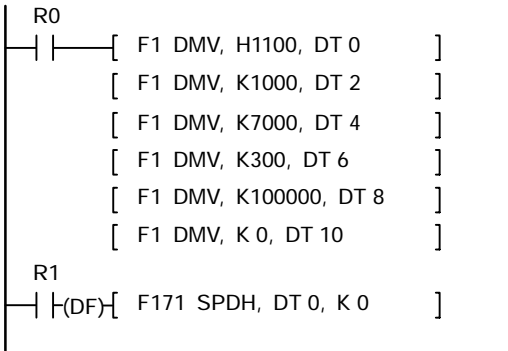
(*3): Acceleration/deceleration time (ms) "K constant"

- With 30 steps: K30 to K32760 (Set in units of 30 ms.)
- With 60 steps: K60 to K32760 (C32T2 and C28P2 only) (Set in units of 60 ms.)

(*4): Target value

K-2147483648 to K2147483647

Application example



Acceleration/deceleration time setting

When setting the acceleration/deceleration time, number of steps and initial speed, please use values that satisfy the following formula. When the acceleration/deceleration time has 30 steps please use 30 ms units. When it has 60 steps, please use 60 ms units. ^{*5}

Acceleration/deceleration time: $t [\text{ms}] \geq (\text{no. of steps} \times 1000) / \text{initial speed } f_0 [\text{Hz}]$

(*5): If they are set without using 30 ms units or 60 ms units, the values will be automatically corrected to the multiple values of 30 ms or 60 ms (larger value).

Flag conditions

- Error flag (R9007): Turns on and stays on when:
- Error flag (R9008): Turns on for an instant when:
 - The area is exceeded when an index modifier is used.
 - The "n" is outside specification range.
 - The data of "S, S+1" to "S+4, S+5" are outside specification range.
 - The "S+2, S+3" > "S+4, S+5".
 - The "S+8, S+9" is outside specification range.

F171(SPDH)**Pulse output
(with channel specification)
(home position return)**

Availability

FPΣ/FP-X

Outline This instruction outputs pulses from the specified channel for the pulse output according to the specified parameters.

Program example

Ladder Diagram	Boolean	
	Address	Instruction
	10	ST R 10
	11	DF
	12	F171 (SPDH) DT 100 K 2
S	Starting address of area containing the data table.	
n	Channel for pulse output.	

Operands

Operand	Relay			Timer/Counter		Register	Index register	Constant		Index modifier
	WX	WY	WR	SV	EV	DT	I	K	H	
S	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	A
n	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	N/A

A: Available
N/A: Not Available

Description

Pulses are output from the specified channel when the corresponding control flag turns off and the execution condition is in on state.

Channel no.	Output	Output method	
ch0	Y0	CW	PLS
	Y1	CCW	SIGN
	Y2	Deviation counter clear	
FPΣ: ch2 FP-X: ch1	Y3	CW	PLS
	Y4	CCW	SIGN
	Y5	Deviation counter clear	

The control code, initial speed, maximum speed, acceleration/deceleration time, and deviation counter clear signal are specified by creating a data table as described on the following page using the user program.

The frequency is changed using the specified acceleration/deceleration time from the initial speed to the maximum speed. During deceleration, the frequency is changed based on the same slope as during acceleration.

If the frequency is set to 50 kHz or more, specify a duty of 1/4 (25%).

Table of areas used

For FPΣ

Channel no.	Control flag	Elapsed value area	Target value area	Near home	Home input
ch0	R903A	DT90044, DT90045	DT90046, DT90047	DT90052 bit2	X2
ch2	R903C	DT90200, DT90201	DT90202, DT90203	DT90052 bit4	X5

For FP-X

Channel no.	Control flag	Elapsed value area	Target value area	Near home	Home input
ch0	R911C	DT90348, DT90349	DT90350, DT90351	DT90052 bit4	X2
ch1	R911D	DT90352, DT90353	DT90354, DT90355	DT90052 bit4	X5

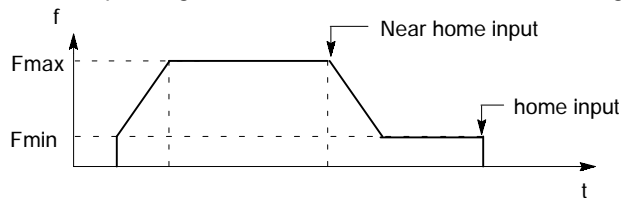
Operation modes

Return to home position

Pulses are output continually until home input (X2 or X5) occurs. To decelerate at near home, set the corresponding bit of special data register DT90052 off → on → off when near home input occurs. The value in the elapsed value area during a home position return differs from the current value. When the return is completed, the elapsed value changes to 0.

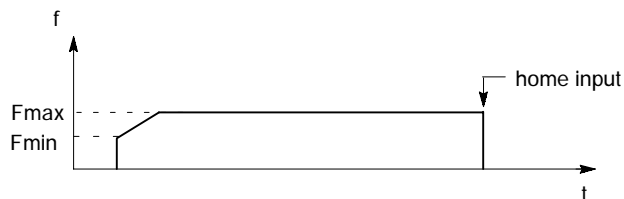
Home position return by means of near home input and home input

Deceleration occurs when near home input occurs, and pulse output stops after home input. Operation varies depending on the control code (lower order) settings described on the following page.



Home position return using only home input

Pulse output stops when home input occurs. Use a control code (lower order) setting on the following page from H20 to H27.



Setting the data table

S		
S+1	Control code	(*1)
S+2	Initial speed	(*2)
S+3	Fmin (Hz)	
S+4	Maximum speed	(*2)
S+5	Fmax (Hz)	
S+6	Acceleration/deceleration	(*3)
S+7	time t (ms)	
S+8	Deviation counter clear	(*4)
S+9	signal output time tr(ms)	

(*1): Control code specification (specify with an H constant)

H	
0: Fixed	<input type="checkbox"/>
Number of acceleration/deceleration steps	<input type="checkbox"/>
0: 30 steps	<input type="checkbox"/>
1: 60 steps (Can be specified for only C32T2, C28P2 and FP-X.)	<input type="checkbox"/>
Duty (on width)	<input type="checkbox"/>
0: Duty 1/2 (50%)	<input type="checkbox"/>
1: Duty 1/4 (25%)	<input type="checkbox"/>
Frequency range	<input type="checkbox"/>
0: 1.5 Hz to 9.8 kHz	<input type="checkbox"/>
1: 48 Hz to 100 kHz	<input type="checkbox"/>
2: 191 Hz to 100 kHz	<input type="checkbox"/>
Operation mode and output method	<input type="checkbox"/>
20: Home position return mode I	CW
21: Home position return mode I	CCW
22: Home position return mode I	Direction output off
23: Home position return mode I	Direction output on
24: Home position return mode I	CW + deviation counter clear
25: Home position return mode I	CCW + deviation counter clear
26: Home position return mode I	Direction output off + deviation counter clear
27: Home position return mode I	Direction output on + deviation counter clear
30: Home position return mode II	CW
31: Home position return mode II	CCW
32: Home position return mode II	Direction output off
33: Home position return mode II	Direction output on
34: Home position return mode II	CW + deviation counter clear
35: Home position return mode II	CCW + deviation counter clear
36: Home position return mode II	Direction output off + deviation counter clear
37: Home position return mode II	Direction output on + deviation counter clear

(*2): Frequency (Hz) "K constant"

Frequency range

0: 1.5 Hz to 9.8 kHz [K1 to K9800 (units: Hz)] (Max. error near 9.8 kHz: approx. -0.9 kHz)

* Set "1" to specify 1.5 Hz.

1: 48 Hz to 100 kHz [K48 to K100000 (units: Hz)] (Max. error near 100 kHz: approx. -3 kHz)

For this range we recommend a duty of 1/4.

2: 191 Hz to 100 kHz [K191 to K100000 (units: Hz)] (Max. error near 100 kHz: approx. -0.8 kHz)

For this range we recommend a duty of 1/4.

Initial speed: Set to 30 kHz or lower.

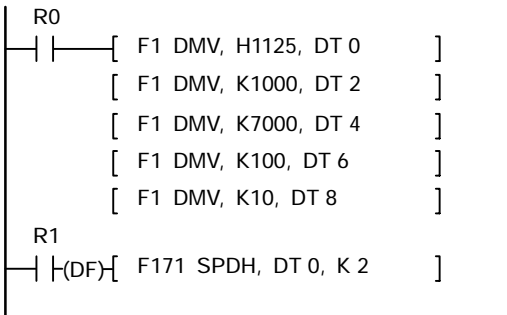
(*3): Acceleration/deceleration time (ms) "K constant"

With 30 steps: K30 to K32760

With 60 steps: K60 to K32760 (C32T2, C28P2 and FP-X only)

- (*4): Deviation counter clear signal output time
 Set the deviation counter clear signal output time.
 0.5 ms to 100 ms [K0 to K100] Set value and margin of error (0.5 ms or less)
 Specify K0 when not using this signal or when specifying 0.5 ms

Application example



Acceleration/deceleration time setting

When setting the acceleration/deceleration time, number of steps and initial speed, please use values that satisfy the following formula. When the acceleration/deceleration time has 30 steps please use 30 ms units. When it has 60 steps, please use 60 ms units. *5

Acceleration/deceleration time: t [ms] \geq (no. of steps x 1000) / initial speed f_0 [Hz]

- (*5): If they are set without using 30 ms units or 60 ms units, the values will be automatically corrected to the multiple values of 30 ms or 60 ms (larger value).

Precautions during programming

When the control code (lower order) is H20 to H27 (Home return mode type I), the home input is enabled after near home input regardless of whether deceleration has ended or is still in progress.

When the control code (lower order) is H30 to H37 (Home return mode type II), the home input is only enabled following near home input after deceleration to the initial speed has been completed.

Even when home input has occurred, executing this instruction causes pulse output to begin.

If the near home input is enabled while acceleration is in progress, deceleration begins.

If both the normal program and the interrupt program contain code for the same channel, make sure both are not executed simultaneously.

When using this instruction, set the channels corresponding to system registers 400 and 401 to "Not set as high-speed counter".

If you perform a rewrite during RUN when pulse output is taking place, more pulses than the setting may be output.

During the time that the circular interpolation control flag R904E is on, the pulse output instructions F166 to F176 cannot be executed.

Please refer to "F0 (MV) instruction pulse output control" when doing a soft reset, count disable, pulse output stop, or near home process.

Flag conditions

- Error flag (R9007): Turns on and stays on when:
 - Error flag (R9008): Turns on for an instant when:
 - The area is exceeded when an index modifier is used.
 - The "n" is outside specification range.
 - The data of "S, S+1" to "S+4, S+5" are outside specification range.
 - The "S+2, S+3" > "S+4, S+5".
-

F172 (PLSH)

**Pulse output
(with channel specification)
(JOG operation)**

Availability
FPΣ/FP-X

Outline Outputs the pulses of the specified parameter from the specified channel for the pulse output.

Program example

Ladder Diagram	Boolean	
	Address	Instruction
	10	ST R 10
	11	F172 (PLSH)
		DT 10
		K 0
S	Starting number for the area that contains the data table	
n	Channel that corresponds to the pulse output	

Operands

Operand	Relay			Timer/Counter		Register	Index register	Constant		Index modifier
	WX	WY	WR	SV	EV	DT	I	K	H	
S	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	A
n	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	N/A

A: Available
N/A: Not Available

Description

When the corresponding control flag is off and the execution condition is in the on state, pulses are output from the specified channel. The pulses are output while the execution condition is on.

Channel no.	Output	Output method	
ch0	Y0	CW	PLS
	Y1	CCW	SIGN
FPΣ: ch2	Y3	CW	PLS
FP-X: ch1	Y4	CCW	SIGN

By specifying either addition counting or subtraction counting in the control code, this instruction can be used as an instruction for JOG operations.

Frequency can be changed in each scan, and the target value can be changed asynchronously. However, the control code cannot be changed during instruction execution.

If a frequency of 50 kHz or higher is specified, a duty of 1/4 (25%) should be specified.

Table of areas used

For FPΣ

Channel no.	Control flag	Elapsed value
ch0	R903A	DT90044, DT90045
ch2	R903C	DT90200, DT90201

For FP-X

Channel no.	Control flag	Elapsed value
ch0	R911C	DT90348, DT90349
ch1	R911D	DT90352, DT90353

Precautions during programming

During the time that the circular interpolation control flag R904E is on, the pulse output instructions F166 to F176 cannot be executed.

When this instruction is used, the setting for the channels corresponding to system registers no. 400 and no. 401 should be set to "High-speed counter not used".

If a rewrite is executed during RUN while the system is operating, pulse output stops while the program is being rewritten.

If the same notation is being used for both the ordinary program and the interrupt program, make sure they are not both executed at the same time.

Target value setting can be used in C32T2, C28P2 and FP-X only.

If a value outside of the specified range is written for the frequency area while the instruction is being executed, the frequency output will be adjusted to either to the minimum or the maximum. And when starting execution of the instruction, an operation error occurs.

Flag conditions

- Error flag (R9007): Turns on when:
- Error flag (R9008): Turns on when:
 - The "S, S + 1" is outside the specified range.
 - The specified area is exceeded when an index is modified.
 - The "n" is outside specification range.

Data table settings

Mode with no target value			Target value match stop mode		
S	Control code	(*1)	S	Control code	(*1)
S+1			S+1		
S+2	Frequency	(*2)	S+2	Frequency	(*2)
S+3			S+3		
			S+4	Target value	(*3)
			S+5		

(*1): Control code specification (specify with an H constant)

	H
0: Fixed	000
Target value setting	
0: Mode with no target value	00
1: Target value match stop mode (Can be specified for only C32T2, C28P2 and FP-X.)	01
Duty (on width)	
0: Duty 1/2 (50%)	00
1: Duty 1/4 (25%)	01
Frequency range	
0: 1.5 Hz to 9.8 kHz	00
1: 48 Hz to 100 kHz	01
2: 191 Hz to 100 kHz	10
Output method	
00: No counting CW	00
01: No counting CCW	01
10: Addition counting CW	10
12: Addition counting Directional output off	11
13: Addition counting Directional output on	12
21: Subtraction counting CCW	20
22: Subtraction counting Directional output off	21
23: Subtraction counting Directional output on	22

(*2): Frequency (Hz) "K constant"

Frequency range
 0: 1.5 Hz to 9.8 kHz [K1 to K9800 (units: Hz)] (Max. error near 9.8 kHz: approx. -0.9 kHz)
 * Set "1" to specify 1.5 Hz.
 1: 48 Hz to 100 kHz [K48 to K100000 (units: Hz)] (Max. error near 100 kHz: approx. -3 kHz)
 2: 191 Hz to 100 kHz [K191 to K100000 (units: Hz)] (Max. error near 100 kHz: approx. -0.8 kHz)
 For counting method, set the initial instruction execution frequency to 30 kHz or lower.

(*3): Target value (Absolute value) (C32T2, C28P2 and FP-X only)

This is used when setting the target value match stop mode.(Absolute only)

Designate the target value setting in the range indicated below. If an out of range value is designated, the number of pulses output will be different than the designated value. The target value setting is ignored in the no count mode.

Output method	Range of target values which can be designated
Addition counting	Designate a value larger than the current value
Subtraction counting	Designate a value smaller than the current value

F173(PWMH) PWM output (with channel specification)

Availability

FPΣ/FP-X

Outline Outputs the PWM of the specified parameter from the specified channel for the PWM output.

Program example

Ladder Diagram	Boolean	
	Address	Instruction
	10	ST R 10
	11	F173 (PWMH) DT 20 K 0
S	Starting number for the area that contains the data table	
n	Channel targeted by the PWM output	

Operands

Operand	Relay			Timer/Counter		Register	Index register	Constant		Index modifier
	WX	WY	WR	SV	EV	DT	I	K	H	
S	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	A
n	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	N/A

A: Available
N/A: Not Available

Description

When the corresponding control flag is off and the execution condition is in the on state, a PWM is output from the specified channel for the PWM output. The PWM is output while the execution condition is on.

The data table shown at below, indicating the frequency and duty, is created and the values are specified by the user program.

The duty, particularly when it is close to the minimum or maximum value, may be off from the specified ratio, depending on the load voltage and load current.

The duty can be changed for each separate scan. Control codes, however, cannot be changed while an instruction is being executed.

Table of areas used

For FPΣ

Channel no.	Output	Output method
ch0	Y0	R903A
ch2	Y3	R903C

For FP-X

Channel no.	Output	Output method
ch0	Y0	R911C
ch1	Y3	R911D

Precautions during programming

During the time that the circular interpolation control flag R904E is on, the pulse output instructions F166 to F176 cannot be executed.

When this instruction is used, the setting for the channels corresponding to system registers no. 400 and no. 401 should be set to "High-speed counter not used".

If a rewrite is executed during RUN while the system is operating, pulse output stops while the program is being rewritten.

If the same notation is being used for both the ordinary program and the interrupt program, make sure they are not both executed at the same time.

If a value over the specified range is written for the duty area while the instruction is being executed, the duty output will be adjusted to the maximum. And when starting execution of the instruction, an operation error occurs.

Flag conditions

- Error flag (R9007): Turns on and stays on when:
 - The specified area is exceeded when an index is modified.
 - The n is any value other than 0 or 2.
 - The value set for the frequency specified by "S" is outside the specified range.
 - The a value higher than 100% (K100) is specified by "S + 1". (During instruction startup)
- Error flag (R9008): Turns on for an instant when:
 - The specified area is exceeded when an index is modified.
 - The n is any value other than 0 or 2.
 - The value set for the frequency specified by "S" is outside the specified range.
 - The a value higher than 100% (K100) is specified by "S + 1". (During instruction startup)

Data table settings

S	Control code	(*1)
S+1	Duty	(*2)

(*1): Control code specification (specify using K constant)

Resolution of 1000

Resolution of 100

K	Frequency (Hz)	Timing (ms)	K	Frequency (Hz)	Timing (ms)
K0	1.5	666.67	K20	15.6 k	0.06
K1	2.0	502.51	K21	20.8 k	0.05
K2	4.1	245.70	K22	25.0 k	0.04
K3	6.1	163.93	K23	31.3 k	0.03
K4	8.1	122.85	K24	41.7 k	0.02
K5	9.8	102.35			
K6	19.5	51.20			
K7	48.8	20.48			
K8	97.7	10.24			
K9	201.6	4.96			
K10	403.2	2.48			
K11	500.0	2.00			
K12	694.4	1.44			
K13	1.0 k	0.96			
K14	1.3 k	0.80			
K15	1.6 k	0.64			
K16	2.1 k	0.48			
K17	3.1 k	0.32			
K18	6.3 k	0.16			
K19	12.5 k	0.08			

(*2): Specification of duty (specify using K constant)

If the control code is K0 to K19, the duty is K0 to K999 (0.0% to 99.9%).

If the control code is K20 to K24, the duty is K0 to K990 (0% to 99%).

Set values are specified in units of 1% (K10) (digits below the decimal point are rounded off).

F174(SP0H)	Pulse output (with channel specification) (Selectable data table control operation)	Availability
		FPΣ/FP-X

Outline Outputs the pulses from the specified channel for the pulse output according to the specified data table.

Program example

Ladder Diagram		Boolean	
		Address	Instruction
	10 11 12	ST R 10 DF F174 (SP0H) DT 100 K 0	
S	Starting address of area containing the data table.		
n	Channel for pulse output.		

Operands

Operand	Relay			Timer/Counter		Register	Index register	Constant		Index modifier
	WX	WY	WR	SV	EV	DT	I	K	H	
S	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	A
n	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	N/A

A: Available
N/A: Not Available

Description

When the corresponding control flag is off and the execution condition is in the on state, pulses are output from the specified channel (ch0 or ch2) based on the contents set for the data table in which the first address is that specified by "S".

Channel no.	Output	Output method	
ch0	Y0	CW	PLS
	Y1	CCW	SIGN
FPΣ: ch2 FP-X: ch1	Y3	CW	PLS
	Y4	CCW	SIGN

When the elapsed value of the high-speed counter reaches the target value specified in the data table, the pulse frequency is switched (interrupt processing is carried out).

When the elapsed value agrees with the last target value, the pulse output operation finishes.

Use the **F0 (MV)** instruction to control the high-speed counter to force the pulse output control to stop.

If the frequency is set to 50 kHz or more, specify a duty of 1/4 (25%).

Table of areas used

For FPΣ

Channel no.	Control flag	Elapsed value area	Target value area
ch0	R903A	DT90044, DT90045	DT90046, DT90047
ch2	R903C	DT90200, DT90201	DT90202, DT90203

For FP-X

Channel no.	Control flag	Elapsed value area	Target value area
ch0	R911C	DT90348, DT90349	DT90350, DT90351
ch1	R911D	DT90352, DT90353	DT90354, DT90355

Precautions during programming

The high-speed counter control flag R903A (R903C) is on from the time that the execution condition for the F174 (SP0H) instruction has gone on until the pulse output stops.

During the time that the high-speed counter control flag R903A (R903C) is on, the high-speed counter and pulse output instructions F166 to F176, which use the same control flag, cannot be executed.

During the time that the circular interpolation control flag R904E is on, the pulse output instructions F166 to F176 cannot be executed.

An operation error occurs if a value that is not within the allowable range is specified for the control code or for frequency 1. (If the data for frequency 1 is 0, the operation is terminated without anything being executed.)

Pulse output is stopped if the frequency of the second or a subsequent stage is specified as 0 or as a value outside the allowable range.

If the table pointer exceeds the data register DT area during pulse output, pulse output control stops and the high-speed counter control flag R903A (R903C) goes off.

Always make sure that the target values are specified within the ranges indicated on the following page. If a value outside the allowable range is specified, the number of pulses output will be different from the specified value.

If a periodic interrupt or high-speed counter value interrupt program is run, or the PLC link function is used at the same time, a frequency of 80 kHz or less should be used.

Note: With FP-X, R903A (R903C) is R911C (R911D).

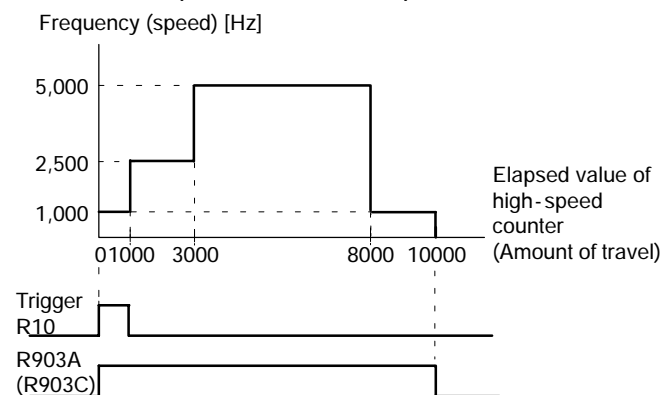
Flag conditions

- Error flag (R9007): Turns on and stays on when:
- Error flag (R9008): Turns on for an instant when:
 - The area is exceeded when an index modifier is used.
 - The "n" is other than 0 or 2.
 - The control code or frequency 1 is outside setting range.

Program example

[Operation content]

1. Pulse output from the specified channel ch0 begins at 1,000 Hz when the **F174 (SP0H)** instruction execution condition (trigger) R10 goes on.
2. At the point when 1,000 pulses have been counted at a frequency of 1,000 Hz, the frequency switches to 2,500 Hz.
3. At the point when 3,000 pulses have been counted at a frequency of 2,500 Hz, the frequency switches to 5,000 Hz.
4. At the point when 8,000 pulses have been counted at a frequency of 5,000 Hz, the frequency switches to 1,000 Hz.
5. At the point when 10,000 pulses have been counted, pulse output stops.



When the execution condition (trigger) R10 of the **F174 (SP0H)** instruction goes on, the high-speed counter control flag R903A (R903C) goes on. When the elapsed value reaches 10,000 and pulse output stops, R903A (R903C) goes off.

Note: With FP-X, R903A (R903C) is R911C (R911D).

[Settings and program]

The frequency range is from 191 Hz to 100 kHz, the duty 1/4 (25%), the operation mode is Incremental, and the output method is CW.

R0	[F1 DMV , H 1200, DT100]	Control code: "H1200"
	[F1 DMV , K 1000, DT102]	Frequency 1: 1,000Hz
	[F1 DMV , K 1000, DT104]	Target value 1: 1,000 pulses
	[F1 DMV , K 2500, DT106]	Frequency 2: 2,500Hz
	[F1 DMV , K 2000, DT108]	Target value 2: 2,000 pulses
	[F1 DMV , K 5000, DT110]	Frequency 3: 5,000Hz
	[F1 DMV , K 5000, DT112]	Target value 3: 5,000 pulses
	[F1 DMV , K 1000, DT114]	Frequency 4: 1,000Hz
	[F1 DMV , K 2000, DT116]	Target value 4: 2,000 pulses
R10	[F1 DMV , K 0, DT118]	Output pulse stops
	[(DF) F174 SP0H,DT100,K0]	Pulse output control

F175(SPSH) Pulse output (Linear interpolation)

Availability
FPΣ Ver.2/FP-X

Outline Pulses are output from channel for 2 pulse output, in accordance with the parameters in the designated data table, so that the path to the target position forms a straight line.

Program example

Ladder Diagram	Boolean	
	Address	Instruction
	10	ST R 10
	11	DF
	12	F175 (SPSH) DT 100 K 0
S	Starting address of area containing the data table.	
n	0: Fixed	

Operands

Operand	Relay			Timer/Counter		Register	Index register	Constant		Index modifier
	WX	WY	WR	SV	EV	DT	I	K	H	
S	N/A	N/A	N/A	N/A	N/A	A	N/A	N/A	N/A	A
n	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	N/A

A: Available
N/A: Not Available

Description

Pulses are output from channel ch0 (X-axis) and ch2 (Y-axis) (FP-X: ch1) when the corresponding control flag is off and the execution conditions are on.

Channel no.	Output	Output method	
ch0 (for X-axis)	Y0	CW	PLS
	Y1	CCW	SIGN
FPΣ: ch2 FP-X: ch1 (for Y-axis)	Y3	CW	PLS
	Y4	CCW	SIGN

The control code, initial speed, maximum speed, acceleration/deceleration time, and target value are specified by creating the data table "S" to "S+11" on the following page using the user program.

If the frequency is set to 40 kHz or more, specify a duty of 1/4 (25%).

Table of areas used

For FPΣ

Channel no.	Control flag	Elapsed value area	Target value area
ch0	R903A	DT90044, DT90045	DT90046, DT90047
ch2	R903C	DT90200, DT90201	DT90202, DT90203

For FP-X

Channel no.	Control flag	Elapsed value area	Target value area
ch0	R911C	DT90348, DT90349	DT90350, DT90351
ch1	R911D	DT90352, DT90353	DT90354, DT90355

Precautions during programming

Designate settings for the target value and movement distance so they are within the following range.

-8,388,608 to +8,388,607

When using in combination with other positioning instructions like **F171**, designate so the target value is within the above range, even in those instructions.

When using in application requiring precision, check with the actual machine.

If both the regular program and the interrupt program contain code for the same channel, make sure both are not executed simultaneously.

During the time that the circular interpolation control flag R904E is on, the pulse output instructions F166 to F176 cannot be executed.

When using this instruction, set the channels corresponding to system registers 400 and 401 to "Not set as high-speed counter".

If you perform a rewrite during RUN when pulse output is taking place, more pulses than the setting may be output.

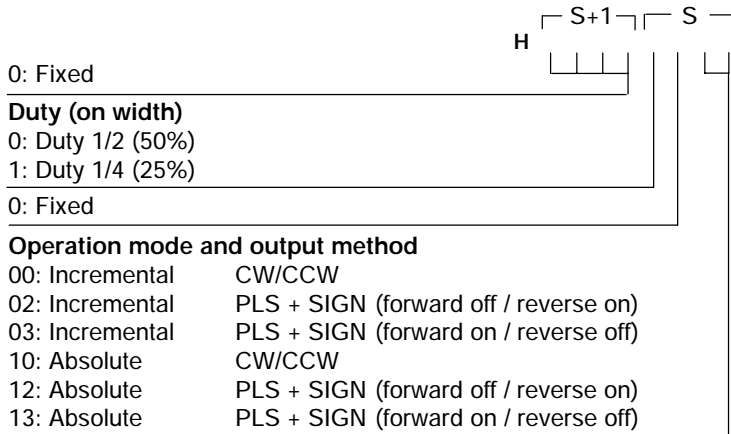
Flag conditions

- Error flag (R9007): Turns on and stays on when:
 - The area is exceeded when an index modifier is used.
 - The "n" is other than 0.
 - The data "S, S+1 to S+10, S+11" of data table are outside specification range.
 - The composite speed designation satisfies: Initial speed "S+2, S+3" > Maximum speed "S+4, S+5"
 - The composite speed designation satisfies: Maximum speed "S+4, S+5" > 100kHz
 - Incremental mode is designated and the value of "current value + movement distance" is outside the range -8388608 to +8388607.
 - Absolute mode is designated and the target value is outside the range -8388608 to +8388607.
- Error flag (R9008): Turns on for an instant when:

Setting the data table

[S]	Control code	(*1)	↑ Setting area ↓
[S+2]	Composite speed Initial speed Fmin(Hz)	(*2)	
[S+4]	Composite speed Maximum speed Fmax(Hz)	(*2)	
[S+6]	Acceleration/Deceleration time T (ms)	(*3)	
[S+8]	X-axis (CH0) Target value (Movement distance)	(*4)	↓
[S+10]	Y-axis (FPΣ: CH2, FP-X: CH1) Target value (Movement distance)	(*4)	
[S+12]	X-axis (CH0) component speed Initial speed Fxmin	↑ Operation result storage area ↓	Parameters for each axis component, calculated due to instruction execution, are stored here.
[S+14]	X-axis (CH0) component speed Maximum speed Fxmax		
[S+16]	Y-axis (FPΣ: CH2, FP-X: CH1) component speed Initial speed Fymin		
[S+18]	Y-axis (FPΣ: CH2, FP-X: CH1) component speed Maximum speed Fymax		
[S+20]	X-axis (CH0) frequency range	(*6)	↓
[S+21]	Y-axis (FPΣ: CH2, FP-X: CH1) frequency range		
[S+22]	X-axis (CH0) number of acceleration/deceleration steps	(*7)	↓
[S+23]	Y-axis (FPΣ: CH2, FP-X: CH1) number of acceleration/deceleration steps	(*7)	

(*1): Specification of control code (specify with H constant)



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

1.5Hz to 100kHz [K1 to K100000]

However, 1.5Hz is for an angle of 0deg or 90deg only.

Also, specify K1 when specifying 1.5 Hz.

If the component speed drops lower than the minimum speed for each frequency range, then the speed will become the corrected component speed, so be careful. (See *6)

When simultaneously using a high-speed counter, periodical interrupt or PLC link, do not set to 60kHz or higher.

If initial speed is set equal to maximum speed, pulses will be output with no acceleration/deceleration.

Set the composite speed so that component speed of each axis is 1.5 Hz or greater.

Composite speed (initial speed): 30 kHz or lower

Note:

Cautions regarding specification of composite speed (initial speed)

The trajectory might not be linear if the initial composite speeds for CH0 and CH2 are not 1.5 Hz or higher in the formula below (when the formula below can't be worked out).

$$f \geq \frac{1.5 \sqrt{(\Delta x)^2 + (\Delta y)^2}}{\Delta x}$$

Δx : Short CH of distance between target and current value

Δy : Long CH of distance between target and current value

(*3): Acceleration/deceleration time (ms) "K constant"

K0 to K32767

If this is 0, pulses will be output for the initial speed (composite speed) as is, with no acceleration/deceleration.

(*4): Target value

K-8388608 to K8388607

When operating only one axis,

a) In incremental mode, set the target value for the axis which will not be operated to 0.

b) In absolute mode, set the target value for the axis which will not be operated the same as the current value.

Note: Infinite feed is not possible during linear interpolation.

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

This is stored as 2 words in real numbers type.

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

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

Example:

Even if the initial speed is corrected (See *6), the calculation value will be stored as is in the operation result storage area.

(*6): Frequency range

The system automatically selects the frequency range for each component of each axis.

Range 0: 1.5Hz to 9.8kHz

Range 1: 48Hz to 100kHz

Range 2: 191Hz to 100kHz

a) If maximum speed \leq 9800Hz

If initial speed < 1.5Hz, initial speed is corrected to 1.5Hz, and range 0 is selected.

If initial speed \geq 1.5Hz, range 0 is selected.

b) If 9800Hz < maximum speed \leq 100000Hz,

If initial speed < 48Hz, initial speed is corrected to 48Hz, and range 0 is selected.

If 48Hz \leq initial speed < 191Hz, range 1 is selected.

If initial speed \geq 191Hz, range 2 is selected.

(*7): Number of acceleration/deceleration steps

The system automatically calculates the number of acceleration/deceleration steps in the range 0 to 60 steps.

If the operation result is 0, pulses are output for the initial speed (composite speed) as is, with no acceleration/deceleration.

The number of acceleration/deceleration steps is found using the formula:

acceleration/deceleration time (ms) x component initial speed (Hz).

Example:

With incremental, initial speed 300Hz, maximum speed 5kHz, acceleration/deceleration time 0.5s,
CH0 target value 1000, CH2 target value 50

$$\text{CH0 component initial speed} = \frac{300 \times 1000}{\sqrt{(1000^2 + 50^2)}} = 299.626\text{Hz}$$

$$\text{CH2 component initial speed} = \frac{300 \times 50}{\sqrt{(1000^2 + 50^2)}} = 14.981\text{Hz}$$

CH0 number of acceleration/deceleration steps = $500 \times 10^{-3} \times 299.626 \approx 147.8 \Rightarrow 60$ steps

CH2 number of acceleration/deceleration steps = $500 \times 10^{-3} \times 14.981 \approx 7.4 \Rightarrow 7$ steps

Note: With FP - X, CH2 is CH1.

F250(BTOA) Binary → ASCII conversion

Availability
FP-X

Outline Converts 16-bit/32-bit binary data to ASCII code.

Program example

Ladder Diagram	Boolean	
	Address	Instruction
	10	ST R 0
	11	F250(BTOA) M 16-D DT 10 DT 20 DT 100
S1	Control string	
S2	Starting 16-bit area for storing binary data	
N	Conversion method	
D	Starting 16-bit area for storing ASCII codes of converted result	

Operands

Operand	Relay				Timer/Counter		Register		Index register		Constant		M	Index modifier
	WX	WY	WR	WL	SV	EV	DT	LD	IX	IY	K	H		
S1	A	A	A	A	A	A	A	A	A	A	N/A	N/A	A	A
S2	A	A	A	A	A	A	A	A	A	A	N/A	N/A	N/A	A
N	A	A	A	A	A	A	A	A	A	A	A	A	N/A	A
D	N/A	A	A	A	A	A	A	A	A	A	N/A	N/A	N/A	A

A: Available
N/A: Not Available

Operation

Converts the binary data stored in the area specified by S2 to ASCII codes using the conversion method of N according to 4 control characters specified by S1. The converted result is stored in the area specified by D.

Specifying the various items

S Specifying control strings [S1]

- Conversion data scale
 "16": Converts in 16-bit (1-word) units.
 "32": Converts in 32-bit (2-word) units.
- Direction of converted data
 "+": Normal direction
 "-": Reverse direction
- Conversion format
 "D": Decimal Converts to decimal ASCII data.
 "H": Hexadecimal . . . Converts to hexadecimal ASCII data.

S Specified ranges and meanings of control strings [S1]

- M_16-D** Converts 16-bit data to decimal ASCII codes.
(Output = Smaller addresses becomes upper data.)
- M_32-D** Converts 32-bit data to decimal ASCII codes.
(Output = Smaller addresses becomes upper data.)
- M_16-H** Converts 16-bit data to hexadecimal ASCII codes.
(Output = Smaller addresses becomes upper data.)
- M_32-H** Converts 32-bit data to hexadecimal ASCII codes.
(Output = Smaller addresses becomes upper data.)
- M_16+H** Converts 16-bit data to hexadecimal ASCII codes.
(Output = Smaller addresses becomes lower data.)
- M_32+H** Converts 32-bit data to hexadecimal ASCII codes.
(Output = Smaller addresses becomes lower data.)

S Specifying the conversion method [N]

N=H
 ① ② ③

- ① No. of converted data
H0 to HFF (0 to 255)
- ② Starting position for storing
(It is specified by the byte location from D.)
H0 to HF0 (0 to 15)
- ③ Size of the area for storing ASCII codes
(It is specified by the No. of bytes.)
H1 to H4: When 16-bit hexadecimal is specified by S1
H1 to H8: When 32-bit hexadecimal is specified by S1
H1 to HF: When decimal is specified by S1

Note) When converting to hexadecimal ASCII codes;

For 16-bit data:

Specify any one between 1 and 4 characters for ③.

When ③ is smaller than 4, the ③ digits of data is converted from the lower bytes and stored.

For 32-bit data:

Specify any one between 1 and 8 characters for ③.

When ③ is smaller than 8, the ③ digits of data is converted from the lower bytes and stored.

The converted data (16-bit/32-bit) is treated as binary data with sign when it is converted to decimal ASCII codes. If the data is a negative number, the minus sign (H2D) is output before the highest digit. When the size of the area for storing ASCII codes is larger than the character string of the converted result, the space (H20) is stored in the extra smaller addresses.

Flag conditions

S Error flag (R9007): Turns on and stays on when

S Error flag (R9008): Turns on for an instant when

- There is an error in the control string specified by S1.
- The direction of converted data is changed to the normal direction when the conversion format specified by S1 is in decimal.
- The size of the area for storing ASCII codes specified by N exceeds the rated value when the conversion format specified by S1 is in hexadecimal.
(Rated value for 16-bit data: 4) (Rated value for 32-bit data: 8)
- The No. of the converted data specified by N is 0.
- The converted result exceeds the area for storing ASCII codes specified by N.
- The converted result exceeds the area.
- The area specified using the index modifier exceeds the limit.

Conversion Example

S Converts the 4 data of hexadecimal 16-bit data in the normal direction.

S1: DT0="16+H"

S2: DT10= H1234, H5678, HA9BC,
HDE0F

N: DT20=H0424

D: DT100

↓ Converted result

DT100=Hxxxx

DT101=H3433

DT102=H3231

DT103=H3837

DT104=H3635

DT105=H4342

DT106=H3941

DT107=H4630

DT108=H4544

S Converts the 4 data of decimal 16-bit data in the reverse direction.

S1: DT0="16-D"

S2: DT10=K1234, K-5678, K-32768, K3

N: DT20=H0416

D: DT100

↓ Converted result

DT100=H20xx

DT101=H3120

DT102=H3332

DT103=H2034

DT104=H352D

DT105=H3736

DT106=H2D38

DT107=H3233

DT108=H3637

DT109=H2038

DT110=H2020

DT111=H2020

DT112=Hxx33

S Converts 3 data of hexadecimal 32-bit data in the reverse direction.

S1: DT0="32-H"

S2: DT10= H1234, H5678, HA9BC, HDE0F,
H00F1, H0000

N: DT20=H0308

D: DT100

↓ Converted result

DT100=H3635

DT101=H3837

DT102=H3231

DT103=H3433

DT104=H4544

DT105=H4630

DT106=H3941

DT107=H4342

DT108=H3030

DT109=H3030

DT110=H3030

DT111=H3146

S Converts the 2 data of decimal 32-bit data in the reverse direction.

S1: DT0="32-D"

S2: DT10=H0000, H8000, H0001, H0000

N: DT20=H023C

D: DT100

↓ Converted result

DT100=Hxxxx

DT101=H20xx

DT102=H322D

DT103=H3431

DT104=H3437

DT105=H3338

DT106=H3436

DT107=H2038

DT108=H2020

DT109=H2020

DT110=H2020

DT111=H2020

DT112=H2020

DT113=Hxx31

F251 (ATOB) ASCII → Binary conversion

Availability
FP-X

Outline Converts ASCII code to 16-bit/32-bit binary data.

Program example

Ladder Diagram	Boolean	
	Address	Instruction
	10	ST R 0
	11	F251(ATOB)
		M D-16
		DT 10
		DT 20
		DT 100

S1	Control string
S2	Starting 16-bit area for storing ASCII codes
N	Conversion method
D	Starting 16-bit area for storing binary data of converted result

Operands

Operand	Relay				Timer/Counter		Register		Index register		Constant		M	Index modifier
	WX	WY	WR	WL	SV	EV	DT	LD	IX	IY	K	H		
S1	A	A	A	A	A	A	A	A	A	A	N/A	N/A	A	A
S2	A	A	A	A	A	A	A	A	A	A	N/A	N/A	N/A	A
N	A	A	A	A	A	A	A	A	A	A	A	A	N/A	A
D	N/A	A	A	A	A	A	A	A	A	A	N/A	N/A	N/A	A

A: Available
N/A: Not Available

Operation

Converts the ASCII codes stored in the area specified by S2 to binary data using the conversion method of N according to 4 control characters specified by S1. The converted result is stored in the area specified by D.

Specifying the various items

S Specifying control strings [S1]

- Conversion format
 "D": Decimal Source data is decimal ASCII code.
 "H": Hexadecimal Source data is hexadecimal ASCII code.
- Direction of converted data
 "+": Normal direction
 "-": Reverse direction
- Conversion data scale
 "16": Converts to 16-bit (1-word) data.
 "2": Converts to 32-bit (2-word) data.

S Specified ranges and meanings of control strings [S1]

- M_D-16** Converts decimal to 16-bit data.
(Output = Smaller addresses becomes upper data.)
- M_D-32** Converts decimal to 32-bit data.
(Output = Smaller addresses becomes upper data.)
- M_H-16** Converts hexadecimal to 16-bit data.
(Output = Smaller addresses becomes upper data.)
- M_H-32** Converts hexadecimal to 32-bit data.
(Output = Smaller addresses becomes upper data.)
- M_H+16** Converts hexadecimal to 16-bit data.
(Output = Smaller addresses becomes lower data.)
- M_H+32** Converts hexadecimal to 32-bit data.
(Output = Smaller addresses becomes lower data.)

S Specifying the conversion method [N]

N=H
 ① ② ③

- ① No. of converted blocks
H0 to HFF (0 to 255)
- ② Starting position for reading
(It is specified by the byte location from D.)
H0 to HF0 (0 to 15)
- ③ Size of the area for storing ASCII codes
(It is specified by the No. of bytes.)
H1 to H4: When 16-bit hexadecimal ASCII is specified by S1
H1 to H8: When 32-bit ASCII is specified by S1
H1 to HF: When decimal is specified by S1

Note) When converting to hexadecimal ASCII codes;

For 16-bit data:

Specify any one between 1 and 4 characters for ③.

For 32-bit data:

Specify any one between 1 and 8 characters for ③.

If a comma "," exists in a specified character string, it is treated as a breakpoint of data regardless of the specified size of the area for storing ASCII codes.

If a dot "." exists, it is skipped (however, for decimal data only).

Flag conditions

- S Error flag (R9007): Turns on and stays on when
- S Error flag (R9008): Turns on for an instant when
- There is an error in the control string specified by S1.
 - The direction of converted data is changed to the normal direction when the conversion format specified by S1 is in decimal.
 - The size of the area for storing ASCII codes specified by N exceeds the rated value when the conversion format specified by S1 is in hexadecimal.
(Rated value for 16-bit data: 4) (Rated value for 32-bit data: 8)
 - Any code other than 0 to F, symbols, space, dot, comma exists in ASCII code specified by S2.
 - The No. of the converted blocks specified by N is 0.
 - The size of the area for storing ASCII codes specified by N is 0.
 - The ASCII code to be converted exceeds the area.
 - The converted result exceeds the area.
 - The converted result exceeds the converted data scale specified by N.
 - The area specified using the index modifier exceeds the limit.

Conversion Example

S Converts the 7 blocks of ASCII codes to hexadecimal 16-bit binary data from the normal direction.

S1: DT0= "H+16"

S2: DT10= Hxxxx, H4342, H3941, H4630,
H4544, H2C37, H4532, H462C,
Hxx31

N: DT20=H0722

D: DT100

↓ Converted result

DT100=H00BC

DT101=H00A9

DT102=H000F

DT103=H00DE

DT104=H0007

DT105=H002E

DT106=H00F1

S Converts the 4 blocks of ASCII codes to hexadecimal 16-bit binary data from the reverse direction.

S1: DT0= "H-16"

S2: DT10= Hxxxx, H42xx, H4143, H3039,
H4446, Hxx45

N: DT20=H0432

D: DT100

↓ Converted result

DT100=H00BC

DT101=H00A9

DT102=H000F

DT103=H00DE

S Converts the 2 blocks of ASCII codes to hexadecimal 32-bit binary data from the normal direction.

S1: DT0= "H+32"

S2: DT10=H4342, H3941, H4630, H4544

N: DT20=H0204

D: DT100

↓ Converted result

DT100=HA9BC

DT101=H0000

DT102=HDE0F

DT103=H0000

S Converts the 2 blocks of ASCII codes to hexadecimal 32-bit binary data from the reverse direction.

S1: DT0= "H-32"

S2: DT10= H4342, H3941, H4630, H4544,
H4532, H3146, H3443, H4433

N: DT20=H0208

D: DT100

↓ Converted result

DT100=H0FDE

DT101=HBCA9

DT102=HC43D

DT103=H2EF1

S Converts the 5 blocks of ASCII codes to decimal 16-bit binary data from the reverse direction.

S1: DT0= "D-16"

S2: DT10= H2020, H3231, H3433, H2D20,
H3635, H3837, H2D2C, H3233,
H3637, H2038, H2E31, H2C36,
H332B, H3732, H3736

N: DT20=H0506

D: DT100

↓ Converted result

DT100=K1234

DT101=K-5678

DT102=H-32768

DT103=K16

DT104=K32767

S Converts the 2 blocks of ASCII codes to decimal 32-bit binary data from the reverse direction.

S1: DT0= "D-32"

S2: DT10= H2D20, H3132, H3734, H3834,
H3633, H3834, H2020, H2020,
H2020, H2020, H2020, H3120

N: DT20=H020C

D: DT100

↓ Converted result

DT100=H0000

DT101=H8000

DT102=H0001

DT103=H0000