e-Front runners

MICREX-SX series

USER'S MANUAL

Standard Expansion FB, User ROM Card FB for SX-Programmer Standard (Type: NP4H-SWN) (Version: V2.0.0.0)

FEH589b

Preface

Thank you for purchasing Fuji Electric Programmable Controller MICREX-SX Series.
This User's Manual explains the specifications and operations of the standard expansion FBs for programming loader SX-Programmer Standard (type: NP4H-SWN) and user ROM card FBs (for SPH2000).
Read this manual carefully to ensure correct operation. For MICREX-SX series, be sure to read the corresponding user's manual listed below.

Title	Manual No.	Contents
User's Manual General Purpose Communication Module, MICREX-SX series SPH	FEH225	Explains the specifications and operations of MICREX-SX series general purpose communication module.
User's Manual High-speed Counter Module, MICREX-SX series SPH	FEH210	Explains the specifications and operations of MICREX-SX series high-speed counter module.
User's Manual Digital High-speed Input Module, MICREX-SX series SPH	FEH211	Explains the specifications and operations of MICREX-SX series digital high-speed input module.
User's Manual Digital High-speed Output Module, MICREX-SX series SPH	FEH212	Explains the specifications and operations of MICREX-SX series digital high-speed output module.
User's Manual Instructions (for SX-Programmer Standard), MICREX-SX series SPH	FEH588	Explains the memory, language and system definitions of the MICREX-SX series SPH in the case of using SX-Programmer Standard
User's Manual SX-Programmer Standard <Reference>, MICREX-SX series SPH	FEH590	Explains the installation procedure, functions and operating method of SX-Programmer Standard.
User's Manual Hardware, MICREX-SX series SPH	FEH201	Explains the system configuration, hardware specifications and operations of modules in the MICREX-SX series SPH.

* The above manuals can be downloaded from the following Fuji Electric FA Components & Systems Co., Ltd. site. In addition to them, various manuals are also available there.

URL http://www.fujielectric.co.jp/fcs/eng/

* The standard expansion FBs are included in SX-Programmer Standard (type: NP4H-SWN)

Notes

1. This manual may not be reproduced in whole or part in any form without prior written approval by the manufacturer.
2. The contents of this manual (including specifications) are subject to change without prior notice.
3. If you find any ambiguous or incorrect descriptions in this manual, please write them down (along with the manual No. shown on the cover) and contact FUJI.

Safety Precautions

Be sure to read the “Safety Precautions” thoroughly before using this product.

Caution : Incorrect handling of the device may result in minor injury or physical damage.

Even some items indicated by “Caution” may result in a serious accident.
These safety instructions provide important information. Be sure to strictly observe them.
The items to be cared most are shown below:

Caution

- ❑ Do not use one found damaged or deformed when unpacked, otherwise, failure or erratic operation might be caused.
- ❑ Do not shock the product by dropping or tipping it over, otherwise, it might be damaged or troubled.
- ❑ Do not play back the CD-ROM supplied with the product using an ordinary audio CD player, otherwise, you may get your auditory sense or audio device damaged due to a loud sound.
- ❑ Engage the CD-ROM or loader connector in a correct orientation, otherwise, an erratic operation might occur.
- ❑ Sufficiently make sure of safety before program change, forced output, starting, stopping or anything else during a run. The wrong operation might break or cause machine problems.
- ❑ Be sure to keep within the software operating environment described in this manual when using this product, otherwise an erratic operation or a failure might be caused.
- ❑ When operating the personal computer loader, be sure to select a stable place so that they won’t be dropped. Otherwise, a failure might be caused.

Revisions

*The manual No. is printed at the bottom right of the cover of this manual.

Printed on	*Manual No.	Revision contents
Jun. 2004	FEH589	First edition
Mar. 2006	FEH589a	◆ Counter FBs and positioning FBs were added. ◆ Specifications for FBs supporting array/structure were added.
May 2008	FEH589b	◆ Specifications for user ROM card FBs were added.

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Section 1 General

Communication program for MICREX-SX series to communicate data with external devices via the general purpose communication module is made using the function blocks dedicated to communication ("function block" will be abbreviated to "FB" below). The following FBs are prepared for communication purpose:

*** "a" is suffixed to the name of the FB supporting array/structure.**

1-1 List of Standard Expansion FBs for General Purpose Communication Module

The following standard expansion FBs are prepared for the general purpose communication module. The standard expansion FBs are included with "SX-Programmer Standard".

Type	FB name	FB Overview
Non-procedural FB	_C_free	Non-procedural FB Send: 512 words Receive: 512 words
	_Cfr252	Non-procedural FB Send: 252 words Receive: 252 words
	_Cfr128	Non-procedural FB Send: 128 words Receive: 128 words
	_Cfr64	Non-procedural FB Send: 64 words Receive: 64 words
	_Cfr32	Non-procedural FB Send: 32 words Receive: 32 words
	_Cfrpr	Non-procedure FB which built into communication protocol Send: 512 words Receive: 512 words The program capacity is reduced by performing a part of the communication processing with the module.
	_Cfrp2	Non-procedure FB which built into communication protocol Send: 512 words Receive: 512 words The program capacity is reduced by performing a part of the communication processing with the module. In addition, communication processing can be performed at high-speed by using two communication ports.
For FUJI Inverter	_CfdFRN	For FUJI Inverter FRENIC series
	_CfdFVR	For FUJI Inverter FVR-C11 series (FGI-BUS)
	_Cfvrpr	For FUJI Inverter FVR-C11 series (FGI-BUS) The program capacity is reduced by performing a part of the communication processing with the module.
For FUJI temperature controller	_CfdPYX	For FUJI temperature controller PYX series and PYH series
For FUJI bar code	_CfdPK	For FUJI bar code reader PK2 series
For MODBUS	_C_modm	MODBUS procedure FB communicates data with MODBUS slave statins, making MICREX-SX the master station.

1-2 List of High-speed Counter Standard Expansion FBs

Type	FB name	FB overview
Counter FB	_MHCNTR	High-speed counter (multifunctional version) FB
	_MHCNTH	High-speed counter (simple-function version) FB
	_MHCNTM	Multiple channel counter FB
	_MHCNTD	High-speed input module counter FB

1-3 List of Simple Positioning Standard Expansion FBs

Type	FB name	FB overview
Simple Positioning FB	_MSMOV	One-axis PTP positioning FB
	_MSMVDAT	One-axis PTP positioning data setting FB

Section 1 General

1-4 List of User ROM Card FBs

Function name	FB name	FB Overview
Write CSV file	_F_WRITE_CSV_DI	Writes data to a file in the user ROM card in CSV format.
Read CSV file	_F_READ_CSV_DI	Reads data from a CSV-format file in the user ROM card to the user data area.
Append CSV file	_F_APPEND_CSV_DI	Appends a row of data to the end of an existing CSV-format file.
Append file	_F_APPEND	Appends data to the end of a file in the user ROM card in binary format.
Delete file	_F_DELETE	Deletes an existing file in the user ROM card.
Read file with offset	_F_OFFSET_READ	Reads data in the user ROM card by specifying the offset position from the beginning of data and read size.
Read free capacity	_F_GET_DRV_SIZE	Reads the total memory capacity and free capacity of the user ROM card.
Create file name	_F_CREATE_FNAME	Concatenates character type data and creates a file name.

* For more information about user ROM card FBs, refer to “Section 6 User ROM Card FB”.

Section 2 Installation

2-1 Personal Computer Environment Required for Strandard Expansion FBs

To use standard expansion FBs and user ROM card FBs, the operating environment of SX-Programmer Standard plus the hard disk capacity necessary to install the expansion FBs that you want to use are required as personal computer operating environment.

Item		Specifications
Personal computer		IBM-AT compatible
CPU		Intel Pentium 233 MHz or higher is recommended.
Hrad disk		200MB or more
External storage		Necessary for installation
	Floppy disk drive	Min. 1 unit, 1.25M bytes/1.44M bytes (3.5 inch)
	CD-ROM drive	Min. 1 unit (Quadruple speed or higher device is recommended.)
Memory capacity		Min. 64 MB
Mouse		USB mouse, serial mouse, bus mouse, or PS2 mouse
Keyboard		106 Japanese (A01) keyboard (Ctrl + alphanumeric)
Display		Resolution: 800 x 600 dots or higher, 1024 x 768 dots or higher is recommended
OS		Windows95/98/ME English version
		WindowsNT WorkstationV4.0 English version SP6 or highrer
		Windows2000 Professional English version
		WindowsXP English version

Section 2 Installation

2-2 Installation

The standard expansion FB is included in the SX-Programmer Standard System Software Package (CD-ROM).

<Operating Procedure>

◆ Activate Windows and then insert the product CD-ROM into the CD-ROM drive. The following dialog appears.

Note: If the installation dialog does not appear, perform the following operations:
Click [Start] on the Windows screen and then [RUN]. Enter (drive where the CD-ROM is inserted) : \autorun.exe for the name, and then click the [OK] button.

◆ When you click [Standard Expansion FB Setup], the following dialog appears.
Click “Standard Expansion FB Setup” or “CSV Interface FB Setup” to start installation. Perform the installation procedure following the instructions displayed on the screen.

Section 2 Installation

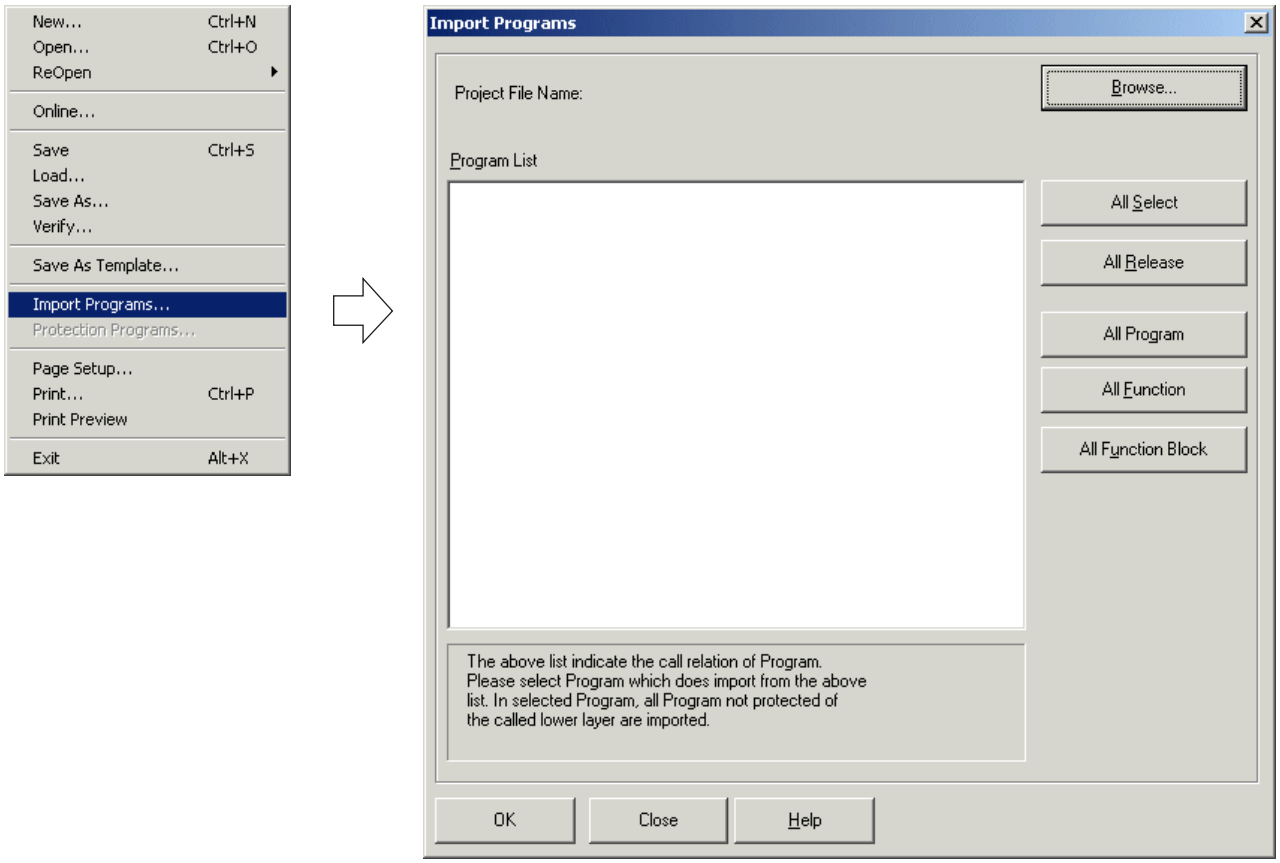
2-3 How to Use Expansion FBs

2-3-1 Importing programs

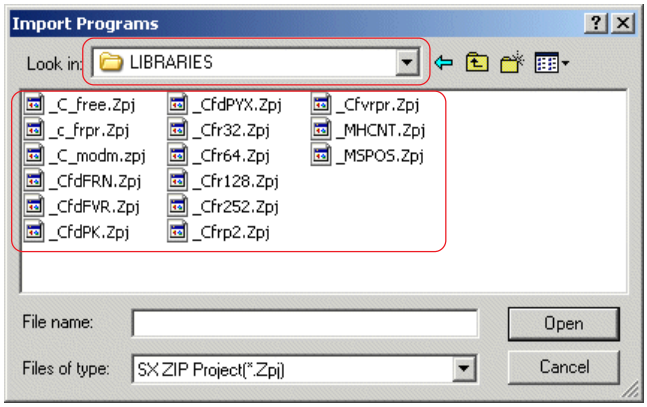
Individual communication FBs included in the standard expansion FB package can be used by importing programs into a created project.

<Operation>

◆ When you execute the [Import Programs...] command in the [File] menu, the [Import Programs] dialog appears.

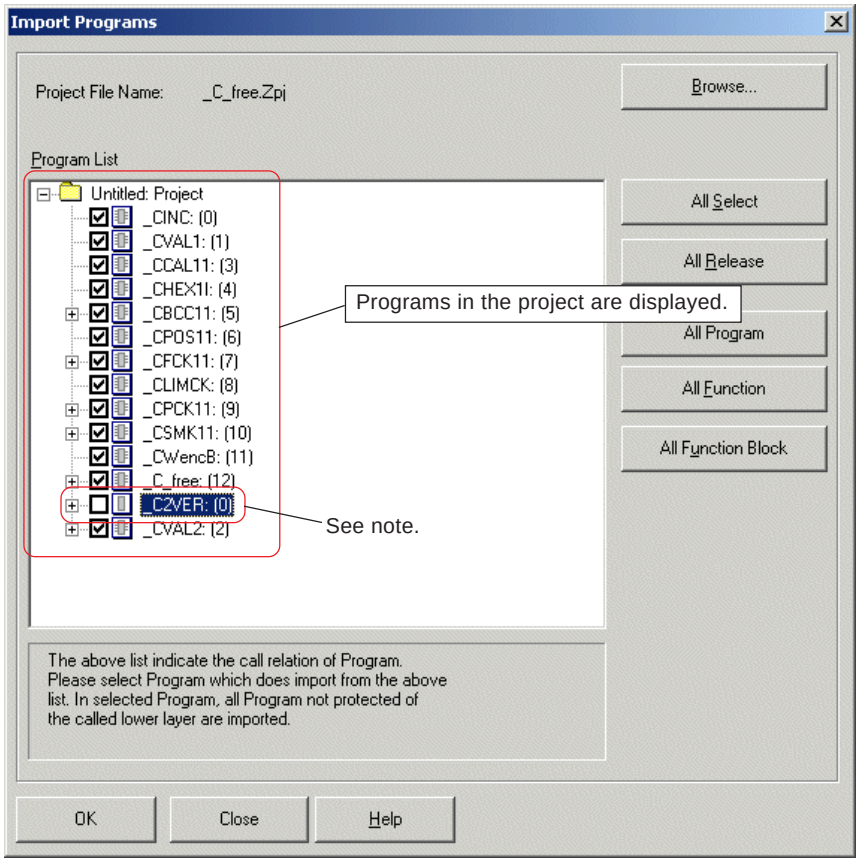


◆ Click the [Browse] button and then select a project which is a import source.
The imported project is stored in the compressed project (*.Zpj) format in the “LIBRARIES” folder under the folder where this expansion FB is installed.



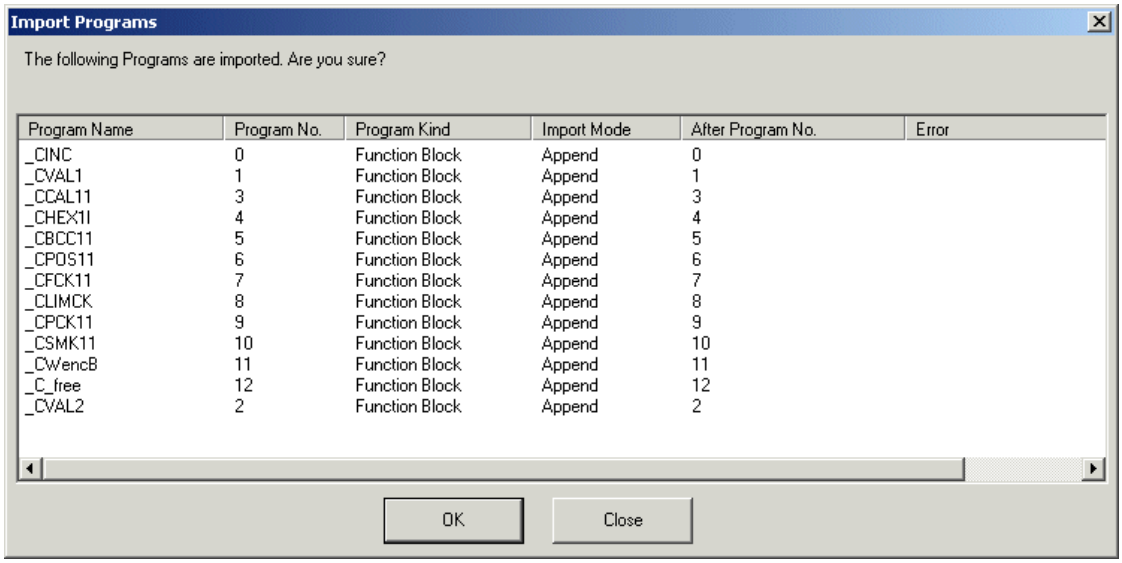
2-3 How to Use Expansion FBs

◆ Select the compressed project, and then click the [OK] button. The compressed project is extracted and the following dialog appears.



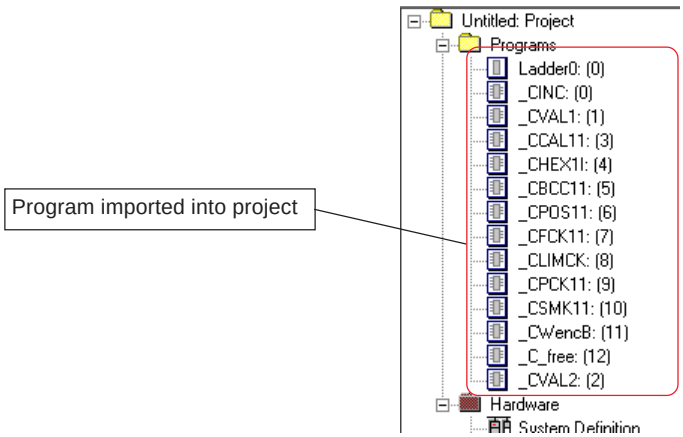
Note:
When importing programs, _C2VER is not necessary (dummy program). Therefore, uncheck its box.

◆ When you click the [All Select] button, all the programs in the project are selected. Select all of them, and click the [OK] button to display the following dialog.



2-3 How to Use Expansion FBs

◆ Click the [OK] button. The program is imported into the programs folder in the project tree.



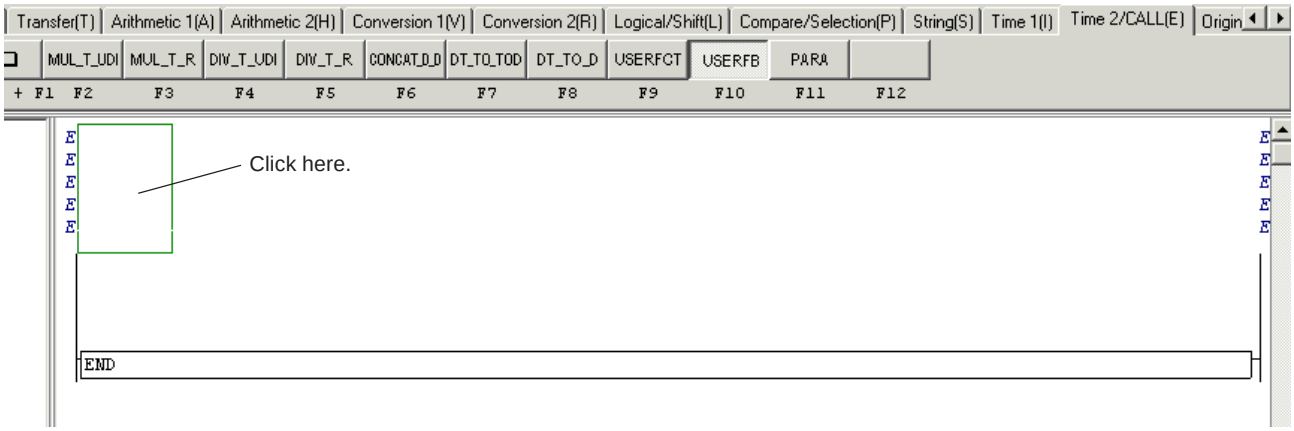
Section 2 Installation

2-3 How to Use Expansion FBs

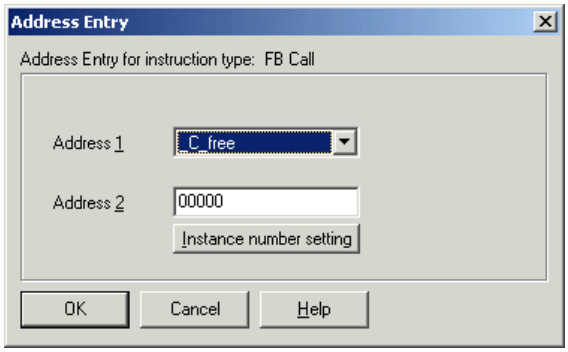
2-3-2 Reading of expansion FB

The method of reading the imported expansion FB to the program of the program type is explained below.

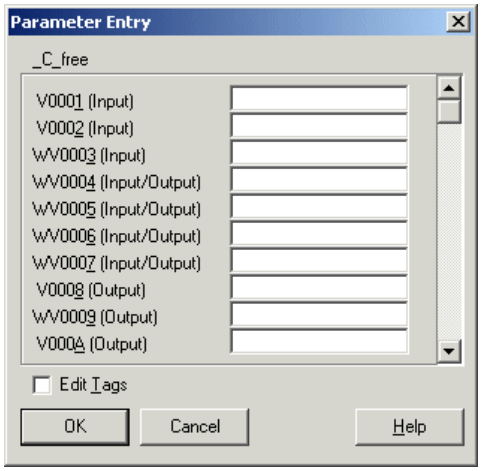
◆ When you click the position to insert the expansion FB to be used with the [USERFB] button selected, the [Address Entry] dialog appears.



◆ Set the expansion FB to be used and the FB instance number, and then click the [OK] button.



◆ The [Parameter Entry] dialog appears. Enter devices and constants to each parameter, and then click the [OK] button. The expansion FB is called to the program.



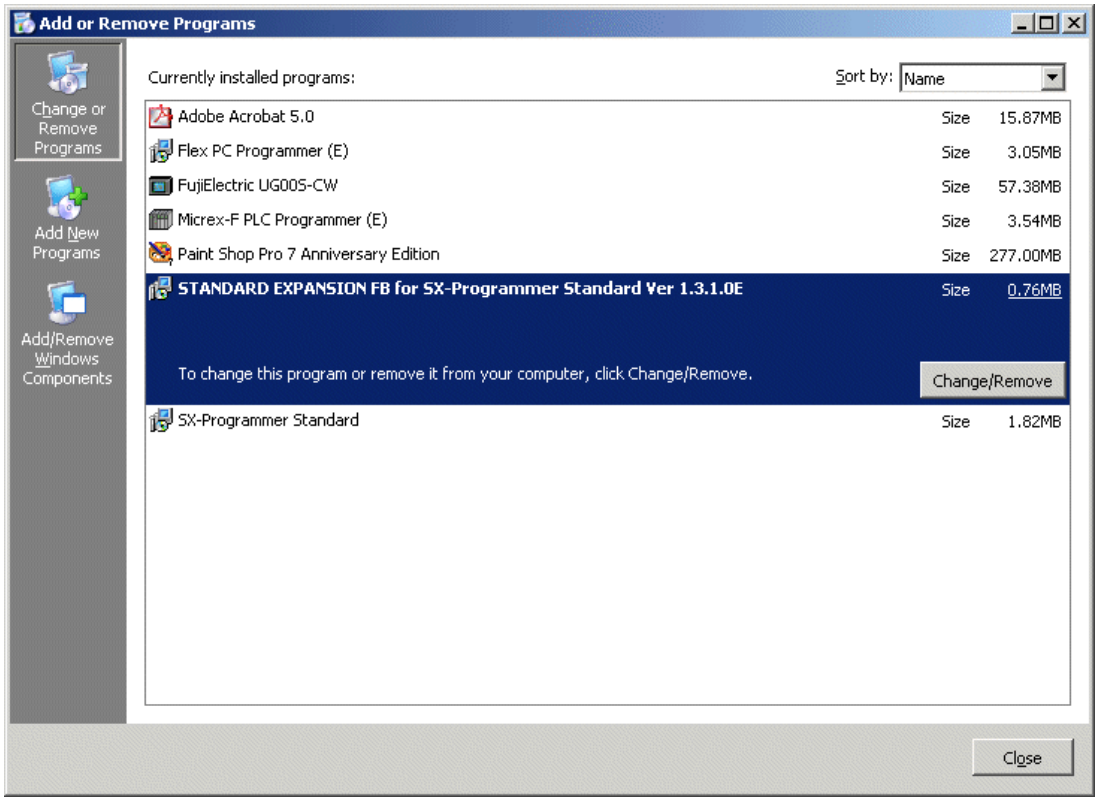
* For the specifications for individual expansion FBs (explanation of parameters, etc.) refer to “Section 3 Specifications for Communication FB.”

Section 2 Installation

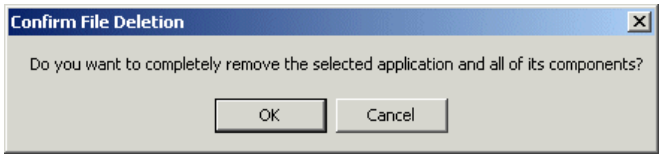
2-4 Uninstallation

<Operation>

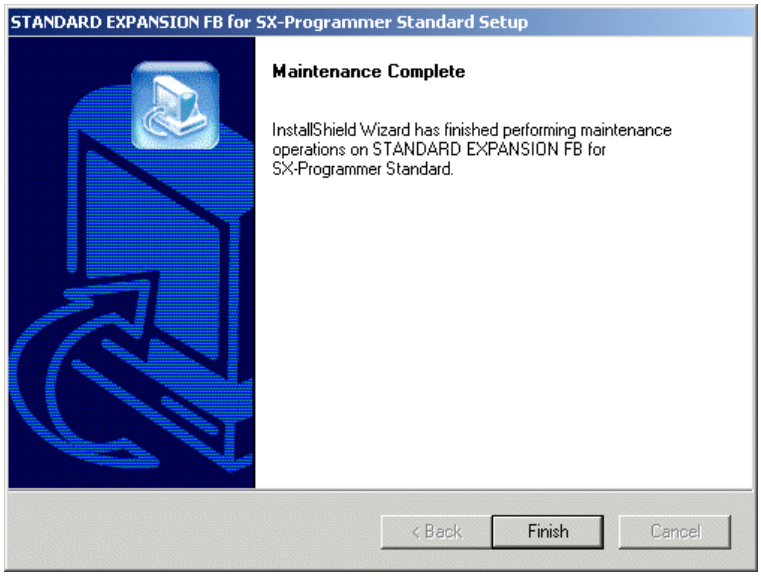
◆ Activate “Add/delete application” from the Control Panel window. The figure below shows an example of WindowsXP screen image.



◆ Select “Standard Expansion FB for SX-Programmer Standard Ver∗.∗.∗.∗” and click the [Change/Remove] button. The following confirmation screen for file deleting appears.



◆ Clicking the [OK] button on the confirmation screen starts uninstalling the “Standard Expansion FB for SX-Programmer Standard” file. When uninstalling is completed, a message to the effect is displayed.



3-1 Non-procedural FB

3-1-1 General

For communication between MICREX-SX series and external device via RS-232C or RS-485 (NP1L-RS1/2/4), the “non-procedural” FB included with the loader is used. The non-procedural FB carries out data communications between the CPU module and external devices using the start-stop synchronization type non-procedural transmission protocol. Seven types of non-procedural FB are prepared, as shown below.

FB Name	Specification Overview
_C_free/_C_freea	Non-procedural FB Send: 512 words, Receive: 512 words
_Cfr252/_Cfr252a	Non-procedural FB Send: 252 words, Receive: 252 words
_Cfr128/_Cfr128a	Non-procedural FB Send: 128 words, Receive: 128 words
_Cfr64/_Cfr64a	Non-procedural FB Send: 64 words, Receive: 64 words
_Cfr32/_Cfr32a	Non-procedural FB Send: 32 words, Receive: 32 words
_Cfrpr/Cfrpra	Non-procedural FB with a built-in communication protocol (See note 1) Send: 512 words, Receive: 512 words The program capacity is reduced by performing a part of the communication processing with the module.
_Cfrp2/_Cfrp2a	Non-procedural FB with a built-in communication protocol (See note 1) Send: 512 words, Receive: 512 words The program capacity is reduced by performing a part of the communication processing with the module. In addition, communication processing can be performed at high-speed by using two communication ports.

* “a” is suffixed to the name of the FB supporting array/structure.

Note 1: Non-procedural FB with a built-in communication protocol performs part of communication processing in the firmware in the module. Therefore, to use this FB, V2536 or later version (V2535 or later version for “_Cfrpr”) of general purpose communication module is necessary.
Note 2: When using FBs supporting array/structure, use V2.2.3.0 or later version of Standard loader.

The “non-procedural” FB performs the following operations:

1) Initialization of communication ports

Initializes RS-232C and RS-485 ports. (sets transmission speed, data bit length, parity bits, etc., so as to match the external device.)

2) Data sending/receiving function

Sends the data from an application in the CPU of MICREX-SX series via the general purpose communication module to an external device, or outputs the data received via the general purpose communication module to an application.

3) Monitoring of transmission condition

Monitors the condition of data transmission and, if abnormal, outputs error information.

<FB operating conditions>

System configuration:
One FB is necessary for each external device which is connected by RS-232C or RS485 to one general purpose communication module. However, when RS-232C/RS485 signal conversion is enabled (the mode selection switch is set to 4) for the general purpose communication, each FB is used by two channels.

3-1 Non-procedural FB

3-1-2 Memory capacity for using non-procedural FB

The non-procedural FBs use the following memories:

FB name	Program area	User FB instance	System FB instance	Standard memory or Retain memory
_C_free/_C_freea	Approx. 3.4k steps	772 worss	82 words	Approx. 3.7k words (For user send/receive area: Approx. 1.1k words)
_Cfr252/_Cfr252a	Approx. 3.5k steps	892 words	82 words	Approx. 2.2k words (For user send/receive area: Approx. 0.51k words)
_Cfr128/_Cfr128a	Approx. 3.5k steps	892 words	82 words	Approx. 1.9k words (For user send/receive area: Approx. 0.26k words)
_Cfr64/_Cfr64a	Approx. 3.5k steps	892 words	82 words	Approx. 1.8k words (For user send/receive area: Approx. 0.13k words)
_Cfr32/_Cfr32a	Approx. 3.5k steps	892 words	82 words	Approx. 1.7k words (For user send/receive area: Approx. 0.07k words)
_Cfrpr/_Cfrpra	Approx. 1.5k steps	244 words	58 words	Approx. 1.7k words (For user send/receive area: Approx. 1.1k words)
_Cfrp2/_Cfrp2a	Approx. 1.6k steps	268 words	84 words	Approx. 1.7k words (For user send/receive area: Approx. 1.1k words)

Note 1: The above list for the memory capacity includes the area for the main body of non-procedural FB and those for sub-FBs that are called from the non-procedural FB.
Note 2: The above list for standard memory and retain memory includes the memory capacity necessary for sending/receiving data.

3-1 Non-procedural FB

3-1-3 Communication specifications for non-procedural FB

(1) Communication specifications

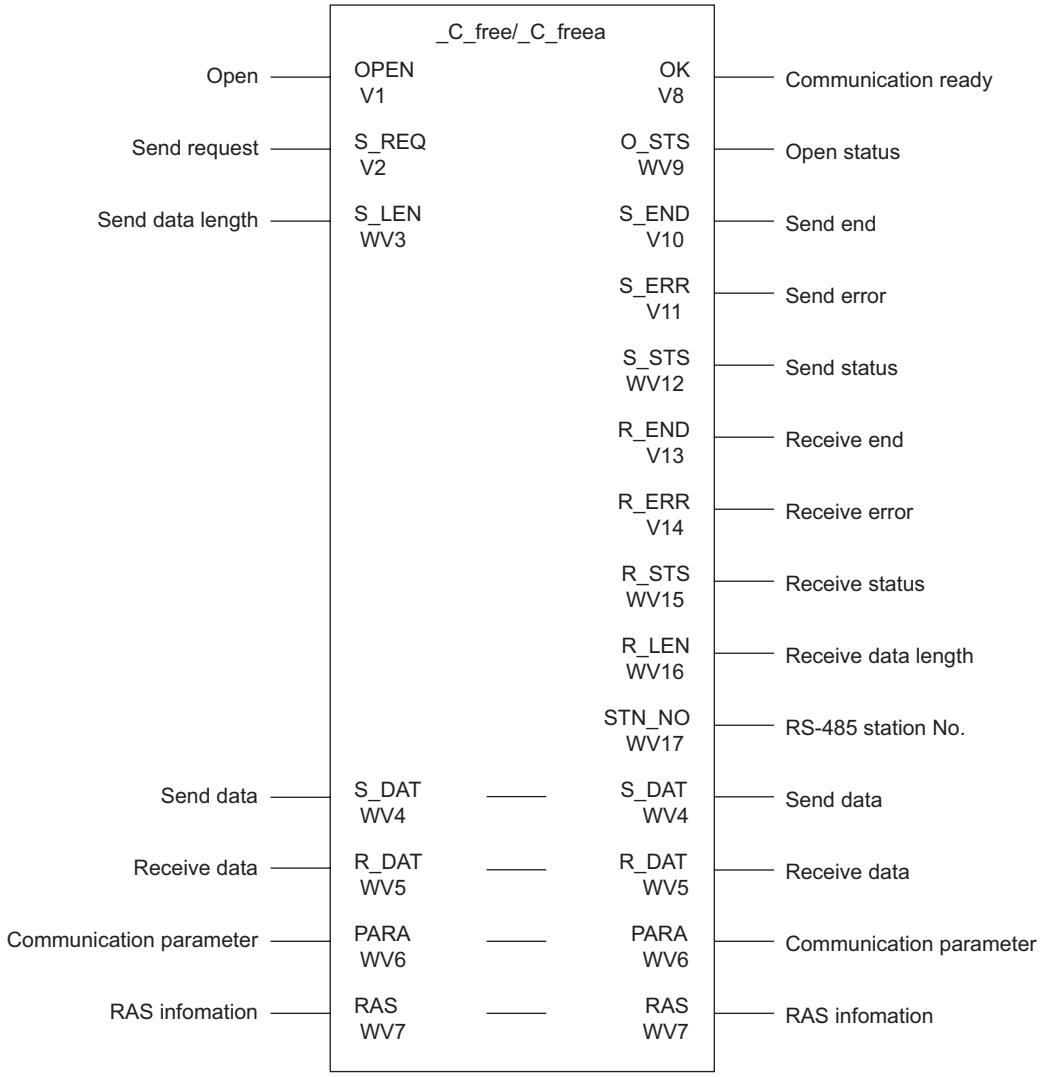
Item		Specification
Transmission speed		300/600/1200/2400/4800/9600/19200/38400/57600/76800/115200 bps (Note)
Data bits		Selected from 7/8 bits
Parity bit		Selected from none/odd/even
Stop bits		Selected from 1/2 bits
DCE		Selected from DTE/DCE/modem DTE mode Modem DTE mode: Turn CD ON when receiving
Signal control	DTE mode	ER: always ON
	DCE mode	DR: always ON
Signal flow control	DTE mode	Off RS: always ON; Sending: unconditional On RS: ON during sending; Sending: when CS is ON
	DCE mode	Off CS: always ON; Sending: unconditional On CS: ON when RS is ON; Sending: when ER is ON
XON/XOFF control		Selected from ON/OFF *To use flow control with XON and XOFF, XON and XOFF must not occur in data.
RS-485 mode		Selected from 4-wire/2-wire
Code conversion		Selected from none/ASCII conversion/ EBCDIC conversion
Frame detection	None	Disable frame detection function.
	Fixed length	Designate the number of receive data bytes
	Variable length	Designate start and end codes.
Horizontal parity (BCC)	None	None
	Upper order/Lower order	Calculation range designation. Designate position. Formula: Selected from add/add and invert/EOR/CRC BCC code: Selected from character code/binary/code
	Lower order/Upper order	
Transmission timer value		(Set value) * 10ms

Note: The non-procedural FBs that can select the transmission speed of 300, 600, 76800 and 115200 bps are “_Cfrpr” and “_Cfrp2”.
V2535 or later version of general purpose communication module can use the “_Cfrpr” FB; V2536 or later version of general purpose communication module can use the “_Cfrp2” FB.

3-1 Non-procedural FB

(2) FB format

The format of the non-procedural FB is as follows. The figure below is an example of "_C_free", however, other non-procedural FBs have the same formats (the same parameter names and number of parameters).



3-1 Non-procedural FB

(3) Explanation of FB parameters

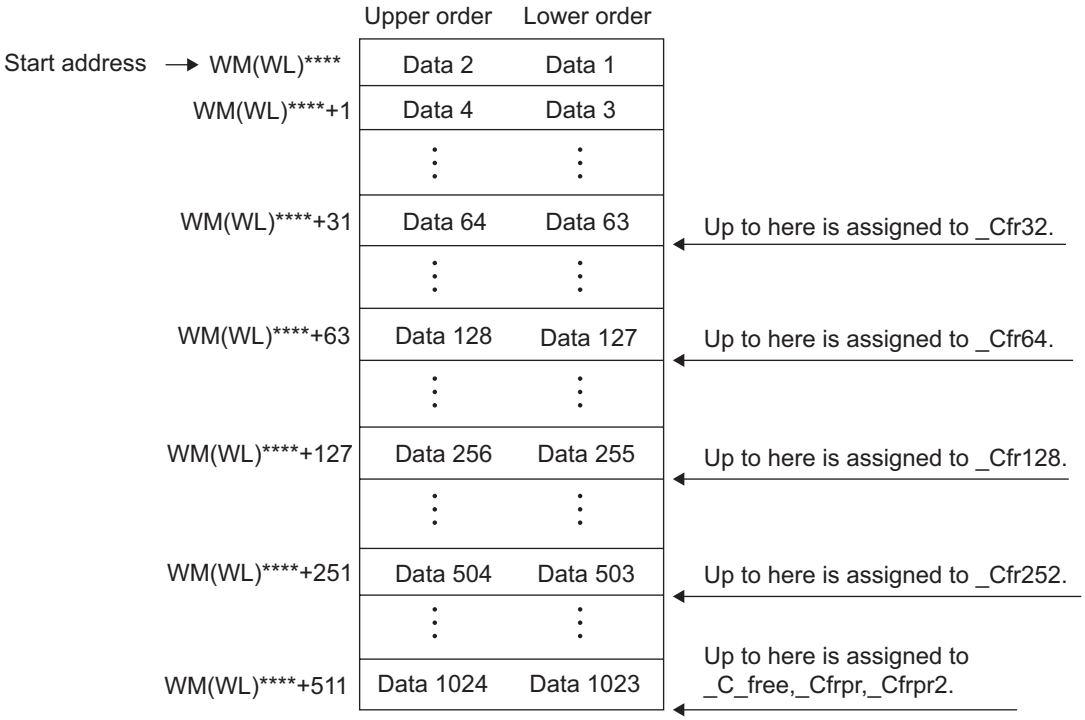
Parameter name		Data type	I/O	Description
Open (OPEN)	V0001	BOOL	IN	ON: Sends the "communication parameters" to the general purpose communication module to initialize communication. When communication becomes possible, "communication ready" turns ON. OFF: Performs the processing for ending communication. "Communication ready" turns OFF.
Send request (S_REQ)	V0002	BOOL	IN	Starts to send data. When sending has ended, this needs to be turned OFF by the application program.
Send data length (S_LEN)	WV0003	INT	IN	Designates the length of send data by the number of bytes.
Send data (S_DAT)	WV0004	WORD	IN_OUT	Stores send data.
Receive data (R_DAT)	WV0005	WORD	IN_OUT	Stores received data.
Communication parameter (PARA)	WV0006	WORD	IN_OUT	Stores the initialization parameters.
RAS information (RAS)	WV0007	WORD	IN_OUT	Operating information of this FB.
Communication ready (OK)	V0008	BOOL	OUT	Turns ON when initialization has ended normally to indicate that the system is ready for sending/receiving data.
Open status (O_STS)	WV0009	INT	OUT	2-digit hexadecimal code to indicate the result of initialization.
Send end (S_END)	V0010	BOOL	OUT	Turns ON when sending has completed.
Send error (S_ERR)	V0011	BOOL	OUT	Turn ON if a send error has occurred.
Send status (S_STS)	WV0012	INT	OUT	Code to indicate the result of sending
Receive end (R_END)	V0013	BOOL	OUT	Turns ON when receiving has completed.
Receive error (R_ERR)	V0014	BOOL	OUT	Turns ON if a receive error has occurred.
Receive status (R_STS)	WV0015	INT	OUT	Code to indicate the result of receiving
Receive data length (R_LEN)	WV0016	INT	OUT	Outputs the received data length.
RS-485 station No. (STN_NO)	WV0017	INT	OUT	The condition of the RS-485 station number setup switch of the general purpose communication module is output to this pin.

* For more information about data type, refer to “Appendix 1.”

3-1 Non-procedural FB

<Send data parameter; format of the memory assigned to "WV0004">

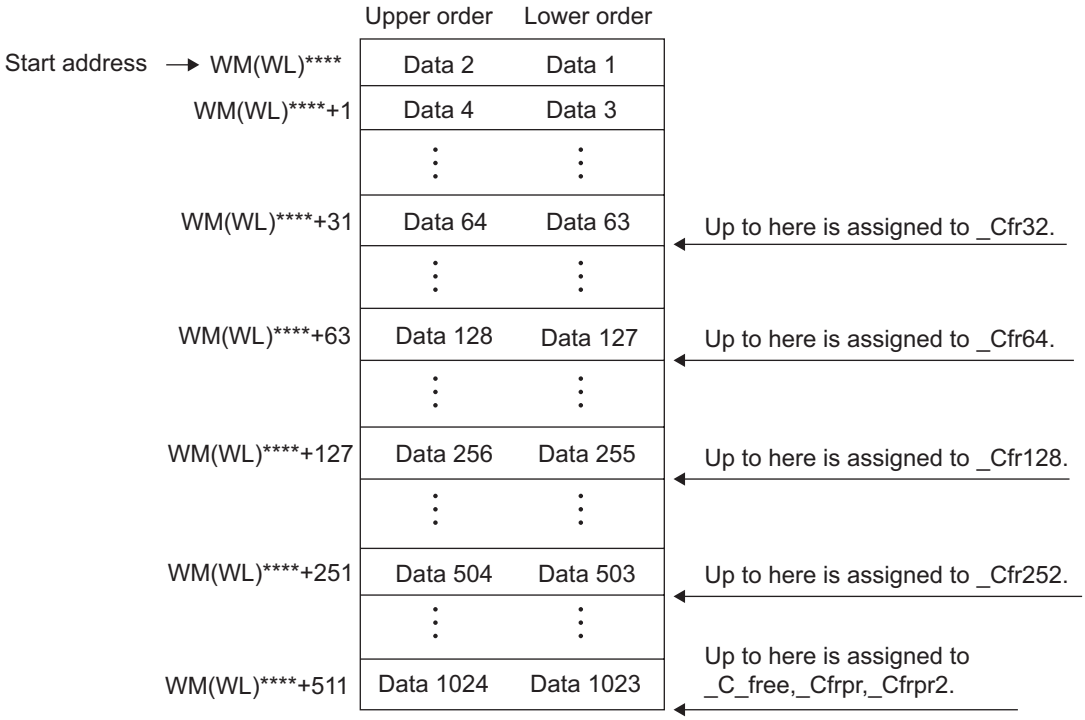
The memory that is assigned to WV0004 must be set (secured) as follows.
Specify the start address of the memory for WV0004.



* The size of send data is maximum 1024 bytes including start code, end code and BCC when code conversion is not to be performed.

<Receive data parameter; format of the memory assigned to "WV0005">

The memory that is assigned to WV0005 must be set (secured) as follows.
Specify the start address of the memory for WV0005.



* The size of receive data is maximum 1024bytes including start code, end code and BCC when code conversion is not to be performed.

3-1 Non-procedural FB

<Communication parameter; format of the memory assigned to "WV0006">

The memory that is assigned to WV0006 must be set (secured) as follows. This format is common to all non-procedural FBs. Specify the start address of the memory for WV0006.

Start address

WM(WL)***	General purpose communication module station No.
WM(WL)***+1	Port No.
WM(WL)***+2	Message port No.
WM(WL)***+3	Message port No.2
WM(WL)***+4	Transmission speed
WM(WL)***+5	Data bit
WM(WL)***+6	Parity bit
WM(WL)***+7	Stop bit
WM(WL)***+8	DCE designation
WM(WL)***+9	ER/DR signal control
WM(WL)***+10	Signal flow control
WM(WL)***+11	XON/XOFF control
WM(WL)***+12	RS-485 mode
WM(WL)***+13 to 15	Reserved
WM(WL)***+16	Code conversion
WM(WL)***+17	Frame detection
WM(WL)***+18	Number of receive data bytes
WM(WL)***+19	Number of start codes bytes
WM(WL)***+20	Start code1
WM(WL)***+21	Start code2
WM(WL)***+22	Start code3
WM(WL)***+23	Start code4
WM(WL)***+24	Start code5
WM(WL)***+25	Number of end codes bytes
WM(WL)***+26	End code1
WM(WL)***+27	End code2
WM(WL)***+28	End code3
WM(WL)***+29	End code4
WM(WL)***+30	End code5
WM(WL)***+31	BCC designation
WM(WL)***+32	Calculation range, position
WM(WL)***+33	Calcuration formula
WM(WL)***+34	Code type
WM(WL)***+35	Send timer value
WM(WL)***+36 to 39	Reserved

<RAS information; format of the memory assigned to "WV0007">

The memory that is assigned to WV0007 must be set (secured) as follows. This format is common to all non-procedural FBs. Specify the start address of the memory for WV0007.

Start address — _Cfrpr,_Cfrpr2

WM(WL)****	Work area for sending (256 words)
WM(WL)****+255	
WM(WL)****+256 ⋮ WM(WL)****+511	Work area for receiving (256 words)
WM(WL)****+512 ⋮ WM(WL)****+531	RAS area (20 words)

Start address — _C_free

WM(WL)**** ⋮ WM(WL)****+255	Work area for sending (256 words)
WM(WL)****+256 ⋮ WM(WL)****+511	Work area for receiving (256 words)
WM(WL)****+512 ⋮ WM(WL)****+1535	Receove buffer area (1024 words)
WM(WL)****+1536 ⋮ WM(WL)****+2559	Send buffer area (1024 words)
WM(WL)****+2560 ⋮ WM(WL)****+2579	RAS area (20 words)

Start address — _C_fr252, _Cfr128 _Cfr64, _Cfr32

WM(WL)**** ⋮ WM(WL)****+255	Work area for sending (256 words)
WM(WL)****+256 ⋮ WM(WL)****+511	Work area for receiving (256 words)
WM(WL)****+512 ⋮ WM(WL)****+1023	Receove buffer area (512 words)
WM(WL)****+1024 ⋮ WM(WL)****+1535	Send buffer area (512 words)
WM(WL)****+1536 ⋮ WM(WL)****+1555	RAS area (20 words)

3-1 Non-procedural FB

3-1-4 Initialization

(1) Initialization parameters

In order to initialize each individual port of the general purpose communication module, it is necessary to set values which match the communication specifications of the object external device to the individual communication parameters. The table below shows the setting contents of these parameters.

No.	Item		Description
0	General purpose communication module station No.		Sets the station number of the general purpose communication module on the SX bus.
1	Port No.		Designates an interface port on general purpose communication module. 0: RS-232C port 1: RS-485 port
2	Message port No. 1		Designates a port No. for sending/receiving messages to/from a general purpose communication module (1 to 127). Note: Avoid designating a port No. which is already used for sending/receiving messages to/from other module.
3	Message port No. 2 * For _Cfrpr2 only		Designates a port No. for sending/receiving messages to/from a general purpose communication module (1 to 127). Note: Avoid designating message port No. 1 or a port No. which is already used for sending/receiving messages to/from other module.
4	Transmission speed		Designates the transmission speed. 0: 1200, 1: 2400, 2: 4800, 3: 9600, 4: 19200, 5: 38400, 6: 57600, 7: 76800, 8: 115200, 90: 300, 91:600 bps Note: 7, 8, 90 and 91 can be set for _Cfrpr or _Cfrpr2 only.
5	Data bit		Designates the data bit length. When "7" is selected, 7 bits make up one data; when "8," 8 bits make up one data. 0: 7 bits, 1: 8 bits
6	Parity bit		This is a bit which is added to data for the purpose of error detection. Designate the proper one to match the setting of the device at the other end. 0: None, 1: Odd, 2: Even
7	Stop bit		This bit indicates the end of data. Designate the proper one to match the setting of the device at the other end. 0: 1 bit, 2: 2 bits
8	DCE designation		When signal line control is not performed, there is no difference in functions between DCE and DTE modes. The RS-232C of the general purpose communication module is of DTE specification, however, it can be used as a DCE specification interface when signal lines are converted as follows: No. 7 pin (RS) to CS No. 6 pin (DR) to ER No. 8 pin (CS) to RS No. 4 pin (ER) to DR 0: DTE, 1: DCE, 2: Modem DTE
9	ER/DR signal control		0: Off, 1: On
10	Signal flow control	DTE mode	0: Off RS: always ON; Sending: unconditional 1: On RS: ON while sending; Sending: when CS is ON
		DCE mode	0: Off CS: always ON; Sending: unconditional 1: On CS: ON when RS is ON; Sending: when ER is ON
11	XON/XOFF control		Because communication between sender and receiver is performed asynchronously, flow control may be necessary. The receiver sends an XOFF signal to indicate that it cannot receive data for a while and then sends an XON signal to cancel the XOFF condition. To use XON/OFF control, the device at the other end must also have this function. 0: NO, 1: YES
12	RS-485 mode		Selects 4-wire or 2-wire for RS-485. 0: 4-wire, 1: 2-wire

3-1 Non-procedural FB

13	Reserved	Not used
14	Reserved	
15	Reserved	
16	Code conversion	Converts binary data into a character string variable. 0: None, 1: ASCII conversion, 2: EBCDIC conversion
17	Frame detection	Designates data receiving method. 0: None Receiving completes when data is received. 1: Variable length Receiving completes when the data in a range between start and end codes is received. 2: Fixed length Receiving completes when receive data reaches the specified number of receive data bytes.
18	Number of receive data bytes	Designates the number of receive data bytes when "Fixed length" is selected for frame detection. When "Variable length" is selected, set this item to "0."
19	Number of start code bytes	Designates the number of start code bytes when "Variable length" is selected.
20	Start code 1	Designates start code when "Variable length" is selected.
21	Start code 2	
22	Start code 3	
23	Start code 4	
24	Start code 5	
25	Number of end code bytes	Designates the number of end code bytes when "Variable length" is selected.
26	End code 1	Designates end code when "Variable length" is selected.
27	End code 2	
28	End code 3	
29	End code 4	
30	End code 5	
31	BCC designation	Sets whether or not to add horizontal parity for checking text data transmission error. 0: None 1: Set in the order of upper- and lower-order byte [Upper byte of BCC][Lower byte of BCC] 2: Set in the order of lower- and upper-order byte [Lower byte of BCC][Upper byte of BCC]
32	Calculation range, position	Sets the calculation range and BCC position. ←→ : Calculation range 0: Calculates the text part and enters it ahead of the end code. [Start code] [TEXT] [BCC] [End code] (Note) 1: Calculates text part and end code and inserts them behind the end code. [Start code] [TEXT] [End code] [BCC] 2: Calculates start code and text part and inserts them ahead of the end code. [Start code] [TEXT] [BCC] [End code] (Note) 3: Calculates start code, text part and end code and inserts them behind the end code. [Start code] [TEXT] [End code] [BCC] Note: In this case, the BCC code type cannot be designated as “binary.” Specify other than CR-16 for the BCC expression.

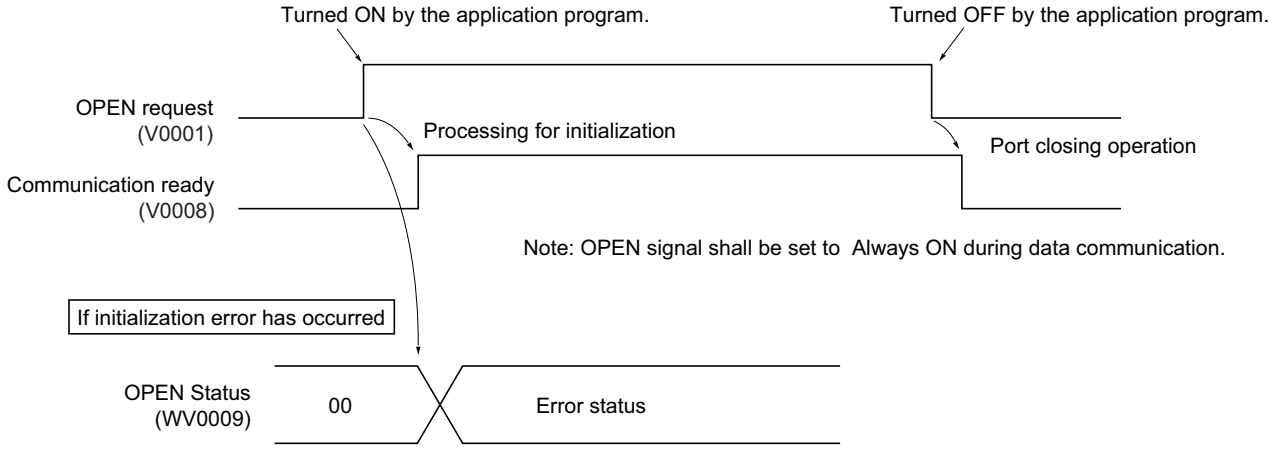
3-1 Non-procedural FB

33	BCC calculation formula	Calculation method to check for transmission error. D1 D2 · · · Dn 0: Add D1 + D2 + · · · + Dn 1: Add and invert Inversion of (D1 + D2 + · · · + Dn) 2: EOR D1 EOR D2 EOR · · · EOR Dn 3: CRC Note: When CRC is selected, specify “BCC Code Format” to “0: Binary.” CRC-16: $X^{16}+X^{15}+X^{2}+1$
34	BCC code type	Designates the code type of BCC data. 0: Binary 1: ASCII 2: EBCDIC
35	Send timer value	The timer for monitoring during the period from when the CPU module (FB) sends a send request to an external device until communication ends. This value can be set in 0.01-second steps. Example: For 1 second, set this value to "100". Up to 327.67 seconds can be set.
36 : 39	Reserved	Not used

Note 1: Parameter Nos.16 to 35 are valid even if changed after opening.
After opening, if parameter Nos.16 to 35 are changed and a setup error occurs, or if other parameters are changed, an open error results and communication “OK” is turned OFF.
Note 2: No. in the above table is the number of the words from the start for communication parameter.

(2) Initialization procedure

When the OPEN (V0001) parameter of FB is turned ON, communication parameters are transferred to the general purpose communication module, which executes processing for initialization. If initialization is impossible due to a communication parameter setting error or hardware error, FB outputs the corresponding error code to the OPEN Status (WV0009).



3-1 Non-procedural FB

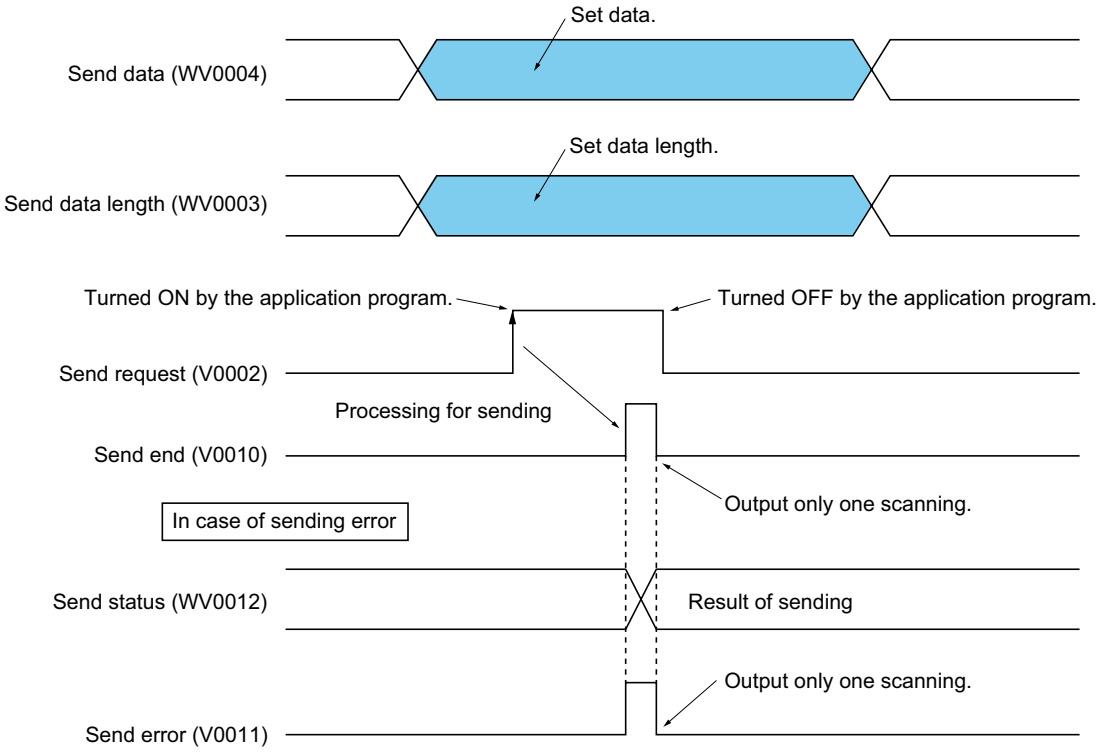
(3) OPEN status list

No.	Result of initialization	Remarks
'00'	Ended normally	
'01'	Transmission speed error	General purpose communication module detected an error.
'02'	Data bit length error	General purpose communication module detected an error.
'03'	Parity bit error	General purpose communication module detected an error.
'04'	Stop bit error	General purpose communication module detected an error.
'05'	DCE designation error	General purpose communication module detected an error.
'06'	Signal flow control setting error	General purpose communication module detected an error.
'07'	XON/XOFF control setting error	General purpose communication module detected an error.
'08'	RS-485 mode setting error	General purpose communication module detected an error.
'3F'	Parameter modification error	Parameter modification error after OPEN
'40'	Code conversion setting error	
'41'	Frame detecting method setting error	
'42'	Start code setting error	
'43'	End code setting error	
'44'	BCC code setting error	
'45'	BCC calculation range setting error	
'46'	BCC calculation formula setting error	
'47'	BCC code type setting error	
'48'	Transmission timer specify setting error	Do not specify a minus value for the send timer
'80'	General purpose communication module station No. setting error	
'81'	Channel No. setting error	
'82'	Message port No. setting error	
'93'	Open error	M_OPEN error
'94'	Open error	Initialization failed due to abnormality on general purpose communication module
'A3'	Processing impossible because in code conversion mode.	General purpose communication module detected an error.
'A5'	Processing impossible because in loader mode	General purpose communication module detected an error.
'A6'	Processing impossible because self-diagnosis is being executed	General purpose communication module detected an error.

3-1 Non-procedural FB

3-1-5 Data sending

(1) Data sending procedure



After setting send data and its data length, turn send request (V0002) ON by the application program. Then FB detects the rising edge to execute the processing for sending.
When sending has ended, send end flag (V0010) is turned ON (for only one scanning). If a send error has occurred, send end (V0010) and send error (V0011) are turned ON (for only one scanning), and corresponding error code is output to send status (WV0012) (“00” when ended normally).

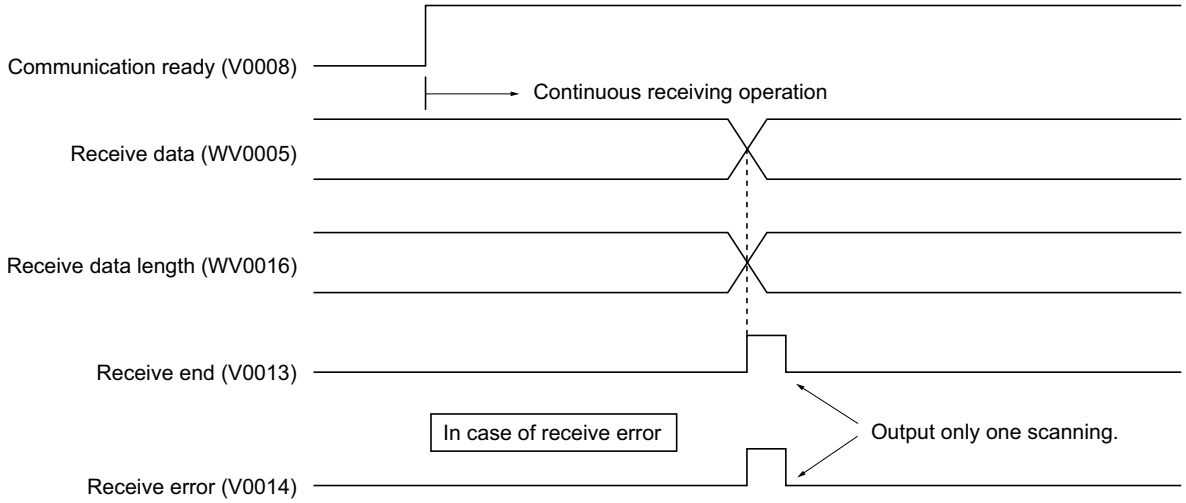
(2) Send status list

No.	Result of sending	Remarks
'00'	Normally ended	
'01'	Send buffer has overflowed.	
'40'	Data send time-out	
'90'	General purpose communication module disconnected.	Not detected
'91'	SX bus send error	
'92'	SX bus receive error	Not detected
'A0'	Object port error	Specified port No. is neither 0 nor 1.
'A3'	Processing impossible because in code conversion mode	
'A5'	Processing impossible because in loader mode.	
'A6'	Processing impossible because self-diagnosis is being executed.	Error detection on general purpose communication module
'C2'	Send buffer has overflowed.	Error detection on general purpose communication module
'C3'	Send data size over	Error detection on general purpose communication module

3-1 Non-procedural FB

3-1-6 Data receiving

(1) Data receiving procedure



While the communication ready flag is turned ON, FB checks whether the data to be received exists or not continuously, and when it exists, executes the operation for receiving. When a delimiter between data frames is detected, the received data and the number of receive data bytes are stored in receive data (WV0005) and receive data length (WV0016), respectively, and the receive end (V0013) flag is turned ON. The result of receiving is stored in receive status (WV0015). If a receive error has occurred, receive end and receive error (V0014) are turned ON.

(2) Receiving status list

No.	Result of receiving	Remarks
'00'	Ended normally	
'02'	Receive buffer has overflowed.	
'42'	BCC error	
'90'	General purpose communication module disconnected.	
'91'	SX bus send error	
'92'	SX bus receive error	
'A0'	Object port error	General purpose communication module detected an error.
'A3'	Processing impossible because in code conversion mode	General purpose communication module detected an error.
'A5'	Processing impossible because in loader mode	General purpose communication module detected an error.
'A6'	Processing impossible because self-diagnosis is being executed	General purpose communication module detected an error.
'C0'	Hardware error detected during receiving (Parity error, Franming error, etc.)	General purpose communication module detected an error.
'C1'	Receive buffer has overflowed.	General purpose communication module detected an error.

Note: Receiving conditions

The processing for receiving differs with the setting of parameter “Frame detection.”

None: Receiving completes when data is received.

Fixed length: Receiving completes when receive data reaches the specified number of receive data bytes.

Variable length: Receiving completes when the data in a range between start and end codes is received.

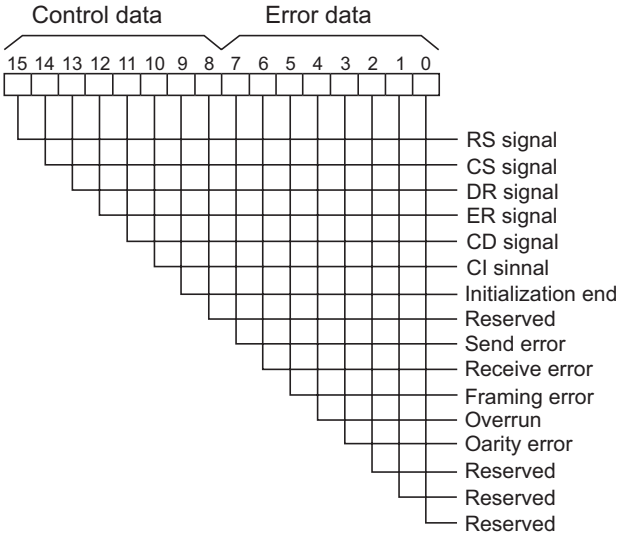
3-1 Non-procedural FB

3-1-7 RAS

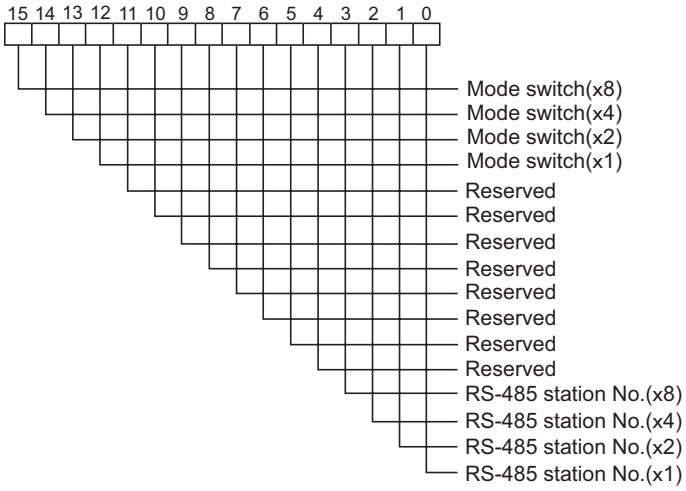
RAS information in general purpose communication is assigned as shown in the following figure. RAS data is stored in the position shown in the figure below from the start address of the device which is assigned to “RAS information parameter (WV0007)” .

_Cfrpr, _Cfrpr2	_C_free	_Cfr252, _Cfr128, _Cfr64, _Cfr32	
WM(WL)***+512	WM(WL)***+2560	WM(WL)***+1536	Port status
WM(WL)***+513	WM(WL)***+2561	WM(WL)***+1537	Status of general purpose communication module
WM(WL)***+514	WM(WL)***+2562	WM(WL)***+1538	Send request count
WM(WL)***+515	WM(WL)***+2563	WM(WL)***+1539	Send end count
WM(WL)***+516	WM(WL)***+2564	WM(WL)***+1540	Receive count
WM(WL)***+517	WM(WL)***+2565	WM(WL)***+1541	Frame detection count
WM(WL)***+518	WM(WL)***+2566	WM(WL)***+1542	M_OPEN status
WM(WL)***+519	WM(WL)***+2567	WM(WL)***+1543	M_SEND status
WM(WL)***+520	WM(WL)***+2568	WM(WL)***+1544	M_RECEIVE status
WM(WL)***+521	WM(WL)***+2569	WM(WL)***+1545	M_SEND error count
WM(WL)***+522	WM(WL)***+2570	WM(WL)***+1546	M_RECEIVE error count
WM(WL)***+523	WM(WL)***+2571	WM(WL)***+1547	Reserved
WM(WL)***+524	WM(WL)***+2572	WM(WL)***+1548	Reserved
WM(WL)***+525	WM(WL)***+2573	WM(WL)***+1549	Reserved
WM(WL)***+526	WM(WL)***+2574	WM(WL)***+1550	Reserved
WM(WL)***+527	WM(WL)***+2575	WM(WL)***+1551	Reserved
WM(WL)***+528	WM(WL)***+2576	WM(WL)***+1552	Reserved
WM(WL)***+529	WM(WL)***+2577	WM(WL)***+1553	Reserved
WM(WL)***+530	WM(WL)***+2578	WM(WL)***+1554	Reserved
WM(WL)***+531	WM(WL)***+2579	WM(WL)***+1555	Reserved

• Port status



• General purpose communication module status



3-2 FUJI General Purpose Inverter Procedure FB "_CfdFRN"

3-2-1 General

The "_CfdFRN" FB communicates data between the CPU module and FUJI FRENIC Series general purpose inverter using the start-stop synchronization type transmission protocol. For more information about the detailed transmission parameters that are necessary to control the FRENIC 5000 Series general purpose inverter, refer to the manual supplied with the inverter.

*** "a" is suffixed to the name of the FB supporting array/structure.**

Note: When using FBs supporting array/structure, use V2.2.3.0 or later version of Standard loader.

<FB functions>

1) Initialization of communication port function
Initializes the RS-485 port (the setting of transmission speed, data bit length, parity bit, etc.)

2) Data sending/receiving function
Sends data from an application program in the MICREX-SX series CPU module to general purpose inverter FRENIC 5000XXX via the general purpose communication module, or outputs the data received via the general purpose communication module to an application program.

3) Transmission condition monitoring function
Monitors data transmission condition and outputs error information if abnormal.

<Connecting method of "_CfdFRN">
The connecting method between the general purpose communication module and FUJI FRENIC 5000 series general purpose inverter must be "1:N connection" by RS-485 (2-wire system).

<FB operating conditions>

System configuration:
- One FB is necessary for each communication port (RS-485) to be used. Communication with the inverters that are connected to one RS-485 system is performed by one FB.
- FUJI general purpose inverter may not be connected to the RS-232C port.
- This FB cannot be used in the mode where RS-232C/RS-485 signal conversion is enabled for the general purpose communication module.

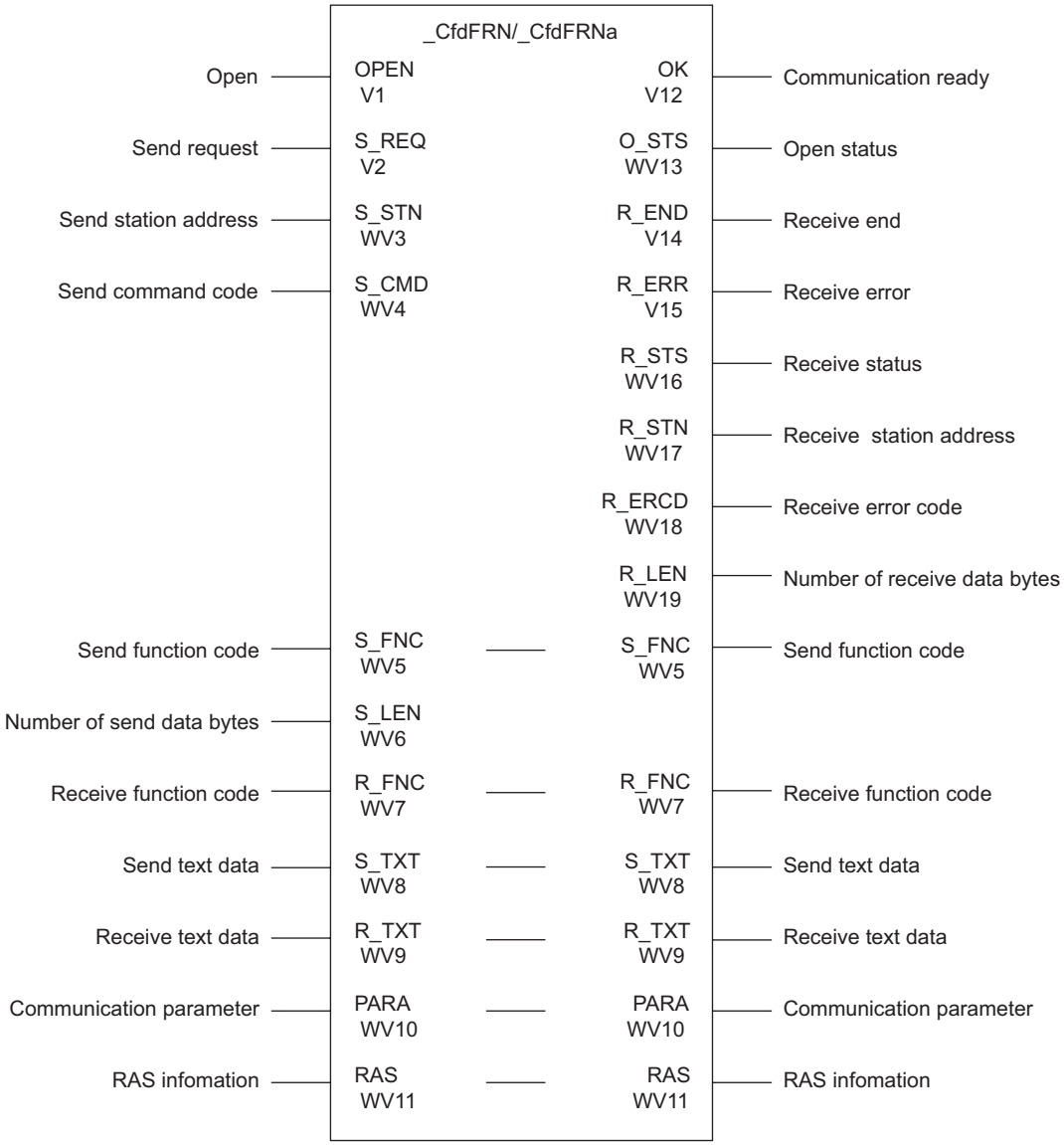
Memory capacity:
Program area = Approx. 2.6k steps
Data memory capacity = User FB memory : 376 words
Standard memory : 854 words
System FB memory : 90 words

Note 1: The above list for the memory capacity includes the area for the main body of inverter FB and those for sub-FBs that are called from the inverter FB.
Note 2: The above list for standard memory and retain memory includes the memory capacity necessary for sending/receiving data.

3-2 FUJI General Purpose Inverter Procedure FB "_CfdFRN"

3-2-2 Specifications for _CfdFRN

(1) FB format



3-2 FUJI General Purpose Inverter Procedure FB "_CfdFRN"

(2) Explanation of FB parameters

Parameter name		Data type	I/O	Description
Open (OPEN)	V0001	BOOL	IN	ON: Sends the "communication parameters" to the general purpose communication module to initialize communication. When communication becomes possible, "communication ready" turns ON. OFF: Performs the processing for ending communication. "Communication ready" turns OFF.
Send request (S_REQ)	V0002	BOOL	IN	Starts to send data. When sending has ended, this needs to be turned OFF by the application program.
Send station address (S_STN)	WV0003	WORD	IN	Stores the address of the send station.
Send command code (S_CMD)	WV0004	WORD	IN	Stores the send command code.
Send function code (S_FNC)	WV0005	WORD	IN_OUT	Stores the send function code. * Occupies two words.
Number of send data bytes (S_LEN)	WV0006	INT	IN	Stores the number of send data bytes.
Receive function code (R_FNC)	WV0007	WORD	IN_OUT	Stores the receive function code. * Occupies two words.
Send text data (S_TXT)	WV0008	WORD	IN_OUT	Stores the send text data.
Receive text data (R_TXT)	WV0009	WORD	IN_OUT	Stores the receive text data.
Communication parameter (PARA)	WV0010	INT	IN_OUT	Stores the initialization parameters.
RAS information (RAS)	WV0011	* Note 1.	IN_OUT	Operating information of this FB.
Communication ready (OK)	V0012	BOOL	OUT	Turns ON when initialization has ended normally to indicate that the system is ready for sending/receiving data.
Open status (O_STS)	WV0013	WORD	OUT	2-digit hexadecimal code to indicate the result of initialization.
Receive end (R_END)	V0014	BOOL	OUT	Turns ON when receive ends.
Receive error (R_ERR)	V0015	BOOL	OUT	Turn ON if a receive error has occurred.
Receive status (R_STS)	WV0016	WORD	OUT	Code to indicate the result of receiving
Receive station address (R_STN)	WV0017	WORD	OUT	Stores the address of the receive station.
Receive error code (R_ERCD)	WV0018	WORD	OUT	Stores the receive error code.
Number of receive data bytes (R_LEN)	WV0019	INT	OUT	Stores the number of receive data bytes.

*Note 1:

Element name	Data type
Work area for sending	WORD
Work area for receiving	WORD
Receive buffer area	WORD
Send buffer area	WORD
RAS area	INT

* For more information about data type, refer to "Appendix 1."

3-2 FUJI General Purpose Inverter Procedure FB "_CfdFRN"

<Send text data; format of the memory assigned to "WV0008">

The memory that is assigned to WV0008 must be set (secured) as follows.
Specify the start address of the memory for WV0008.

		Upper order	Lower order
Start address →	WM(WL)****	Data 2	Data 1
	WM(WL)****+1	Data 4	Data 3
		⋮	⋮
	WM(WL)****+31	Data 64	Data 63

<Receive text data; format of the memory assigned to "WV0009">

The memory that is assigned to WV0009 must be set (secured) as follows.
Specify the start address of the memory for WV0009.

		Upper order	Lower order
Start address →	WM(WL)****	Data 2	Data 1
	WM(WL)****+1	Data 4	Data 3
		⋮	⋮
	WM(WL)****+31	Data 64	Data 63

3-2 FUJI General Purpose Inverter Procedure FB "_CfdFRN"

<Communication parameter; format of the memory assigned to "WV0010">

The memory that is assigned to WV0010 must be set (secured) as follows.
Specify the start address of the memory for WV0010.

Start address ↓

WM(WL)***	General purpose communication module station No.
WM(WL)***+1	Port No.
WM(WL)***+2	Message port No.
WM(WL)***+3	Reserved
WM(WL)***+4	Transmission speed
WM(WL)***+5	Data bit
WM(WL)***+6	Parity bit
WM(WL)***+7	Stop bit
WM(WL)***+8 to 15	Reserved
WM(WL)***+16	Response monitoring timer
WM(WL)***+17	Retry count
WM(WL)***+18 to 39	Reserved

<RAS information; format of the memory assigned to "WV0011">

The memory that is assigned to WV0011 must be set (secured) as follows.
Specify the start address of the memory for WV0011.

Start address ↓

WM(WL)**** ⋮ WM(WL)****+255	Work area for sending (256 words)
WM(WL)****+256 ⋮ WM(WL)****+511	Work area for receiving (256 words)
WM(WL)****+512 ⋮ WM(WL)****+591	Receive buffer area (80 words)
WM(WL)****+592 ⋮ WM(WL)****+671	Send buffer area (80 words)
WM(WL)****+672 ⋮ WM(WL)****+691	RAS area (20 words)

3-2 FUJI General Purpose Inverter Procedure FB "_CfdFRN"

3-2-3 Initialization

(1) Initialization parameters

In order to initialize (RS-485) communication ports which are to be used, it is necessary to set proper values for each "communication parameter" item so as to match the communication specifications of the general purpose inverter. The table below shows the setting contents of these parameters.

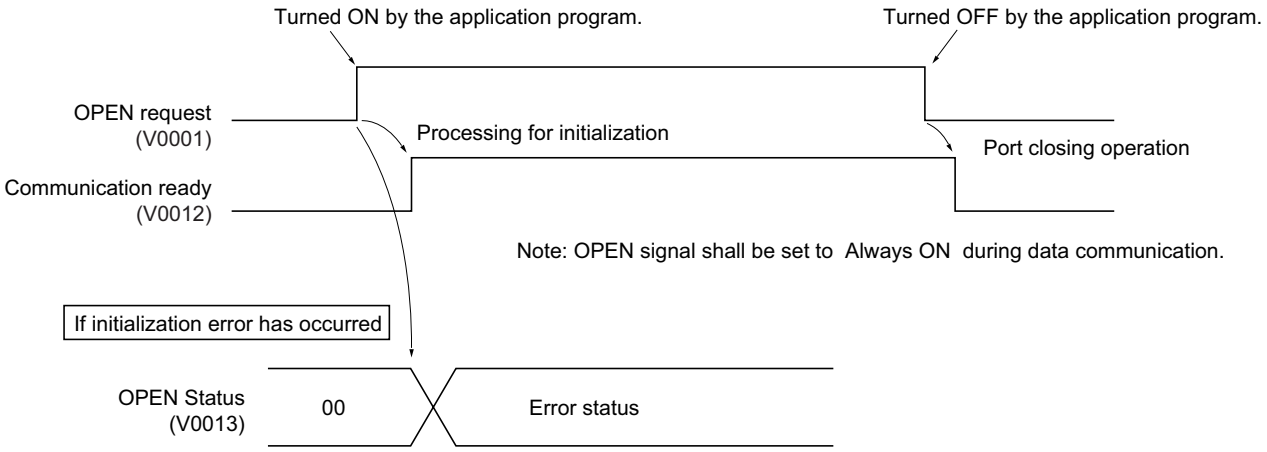
No.	Item	Description
0	General purpose communication module station No.	Sets the station number of the general purpose communication module on the SX bus.
1	Port No.	Designates an interface port on the general purpose communication module. 1: RS-485 port
2	Message port No.	Designates a port No. for sending/receiving message to/from a general purpose communication module.
3	Reserved	Not used
4	Transmission speed	Designates the transmission speed. 0: 1200, 1: 2400, 2: 4800, 3: 9600, 4: 19200 bps
5	Data bit	Designates the data bit length. When "7" is selected, 7 bits make up one data; when "8", 8 bits make up one data. 0: 7 bits (when ASCII code is used) 1: 8 bits (when EBCDIC code is used)
6	Parity bit	This is a bit which is added to data for the purpose of error detection. Designate the proper one to match the setting of the device at the other end. 0: None, 1: Odd, 2: Even
7	Stop bit	This bit indicates the end of data. Designate the proper one to match the setting of the device at the other end. 0: 1 bit, 2: 2 bits
8 : 15	Reserved	Not used
16	Response monitoring timer	The timer for monitoring during the period from when the CPU module (FB) sends a send request to an external device until communication ends. This value can be set in 0.01-second steps. Example: For 1 second, set this value to "100".
17	Retry count	In case of communication error, this designates how many times to retry communication.
18 : 39	Reserved	Not used

Note: No. in the above table is the number of the words from the start for communication parameter.

3-2 FUJI General Purpose Inverter Procedure FB "_CfdFRN"

(2) Initialization procedure

When the OPEN (V0001) parameter of FB is turned ON, communication parameters are transferred to the general purpose communication module, which executes processing for initialization. If initialization is impossible due to a communication parameter setting error or hardware error, FB outputs the corresponding error code to the OPEN Status (WV0013).



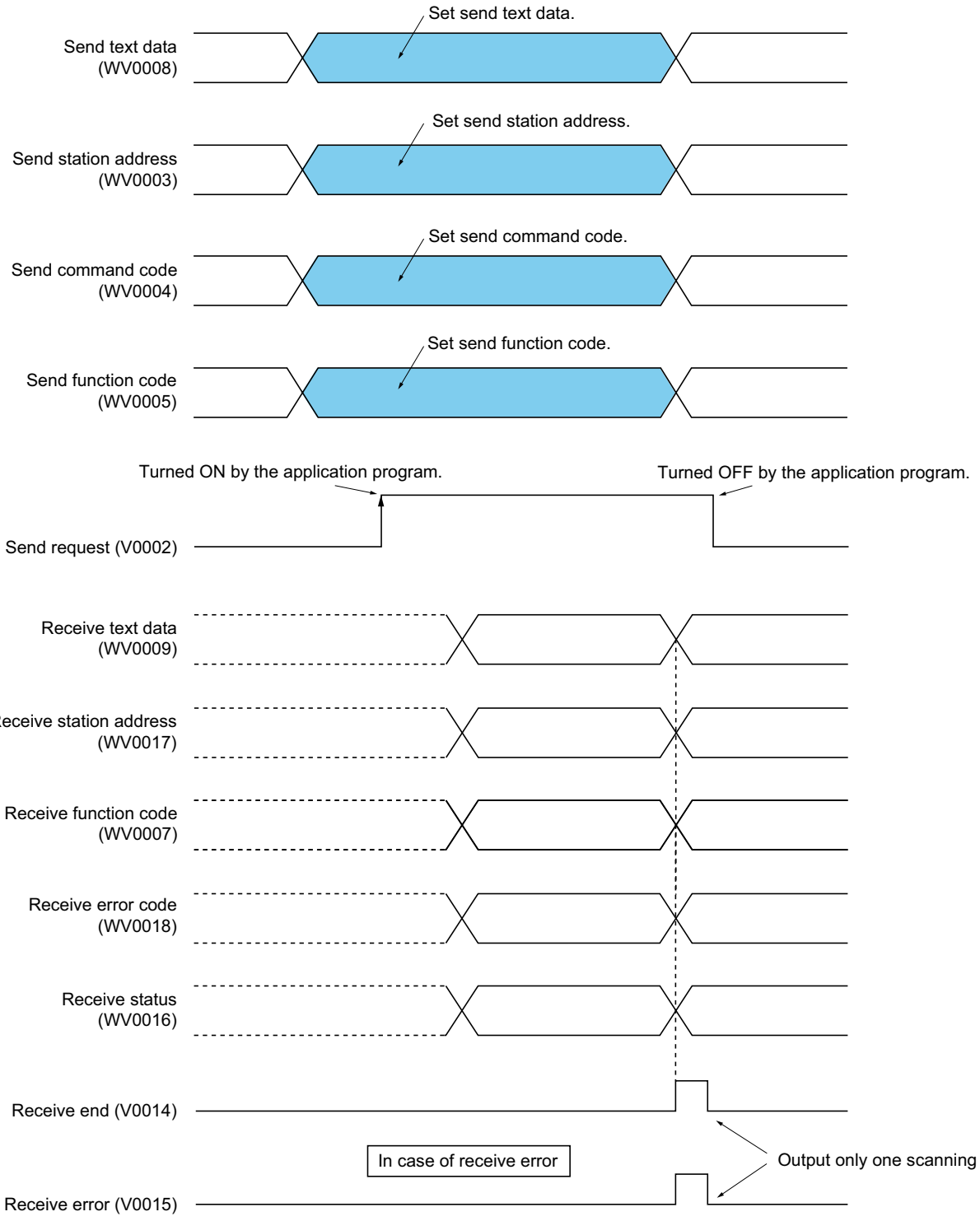
(3) OPEN status list

No.	Result of initialization	Remarks
'00'	Ended normally	
'01'	Transmission speed error	General purpose communication module detected an error.
'02'	Data bit length error	General purpose communication module detected an error.
'03'	Parity bit error	General purpose communication module detected an error.
'04'	Stop bit error	General purpose communication module detected an error.
'05'	Reserved	
'06'	Reserved	
'07'	Reserved	
'3F'	Parameter modification error	Parameter modification error after OPEN
'40'	Response monitoring timer value setting error	
'41'	Retry count setting error	
'42'	Reserved	
'43'	Reserved	
'44'	BCC code setting error	
'80'	General purpose communication module station No. setting error	
'81'	Port No. setting error	
'82'	Message port No. setting error	
'93'	Open error	Initialization failed due to SX bus error
'94'	Open error	Initialization failed due to abnormality on general purpose communication module
'A3'	Processing impossible because in code conversion mode	General purpose communication module detected an error.
'A5'	Processing impossible because in loader mode	General purpose communication module detected an error.
'A6'	Processing impossible because self-diagnosis is being executed	General purpose communication module detected an error.

3-2 FUJI General Purpose Inverter Procedure FB "_CfdFRN"

3-2-4 Data sending/receiving

(1) Data sending/receiving procedure



Send text data, send station address, send command code and send function code are set and then send request is turned ON by the application program. FB detects the rising edge to execute the processing for sending.
When the send station address is for all stations (= 90), the receive end flag is automatically turned ON the moment sending is completed (receive error flag is also turned ON if abnormal).
When the send station address is for one station (≠ 90), the system automatically enters receiving waiting mode the moment sending is completed, executing the processing for receiving. When the delimiter between frames is detected, the receive end flag is automatically turned ON (receive error flag is also turned ON if abnormal).

3-2 FUJI General Purpose Inverter Procedure FB "_CfdFRN"

(2) Sending/receiving status list

No.	Result of sending	Remarks
'00'	Normally ended	
'01'	Send buffer has overflowed.	
'02'	Receive buffer has overflowed.	
'40'	Data send time-out	
'41'	Protocol response error	
'42'	BCC error	
'90'	General purpose communication module disconnected.	Not detected
'91'	SX bus send error	
'92'	SX bus receive error	
'A0'	Object port error	General purpose communication module detected an error.
'A3'	Processing impossible because in code conversion mode	General purpose communication module detected an error.
'A5'	Processing impossible because in loader mode	General purpose communication module detected an error.
'A6'	Processing impossible because self-diagnosis is being executed	General purpose communication module detected an error.
'C0'	Hardware error detected during receiving	General purpose communication module detected an error.
'C1'	Receive buffer has overflowed.	General purpose communication module detected an error.
'C2'	Send buffer has overflowed.	General purpose communication module detected an error.
'C3'	Send data size over	General purpose communication module detected an error.

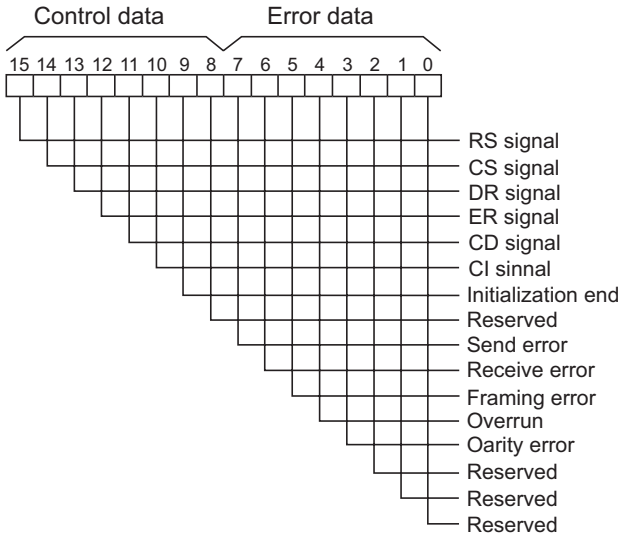
3-2 FUJI General Purpose Inverter Procedure FB "_CfdFRN"

3-2-5 RAS

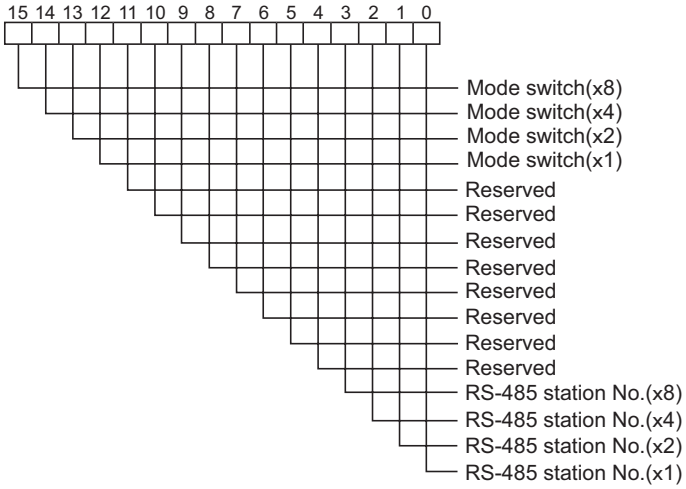
RAS information in general purpose communication is assigned as shown in the following figure. RAS data is stored in the position shown in the figure below from the start address of the device which is assigned to "RAS information parameter (WV0011) .

WM(WL)***+672	Port status
WM(WL)***+673	Status of general purpose communication module
WM(WL)***+674	Send request count
WM(WL)***+675	Send end count
WM(WL)***+676	Receive count
WM(WL)***+677	Frame detection count
WM(WL)***+678	M_OPEN status
WM(WL)***+679	M_SEND status
WM(WL)***+680	M_RECEIVE status
WM(WL)***+681	M_SEND error count
WM(WL)***+682	M_RECEIVE error count
WM(WL)***+683	Reserved
WM(WL)***+684	Reserved
WM(WL)***+685	Reserved
WM(WL)***+686	Reserved
WM(WL)***+687	Reserved
WM(WL)***+688	Reserved
WM(WL)***+689	Reserved
WM(WL)***+690	Reserved
WM(WL)***+691	Reserved

• Port status



• General purpose communication module status



3-3 FUJI General Purpose Inverter Standard Communication (FGI-BUS) Procedure FB "_CfdFVR"

3-3-1 General

The "_CfdFVR" FB communicates data between the CPU module and FUJI FVR Series general purpose inverter using the "FGI-BUS" transmission protocol. For more information of the detailed transmission parameters that are necessary to control the FVR Series general purpose inverter, refer to the manual supplied with the inverter.

*** "a" is suffixed to the name of the FB supporting array/structure.**

Note: When using FBs supporting array/structure, use V2.2.3.0 or later version of Standard loader.

<FB functions>

1) Initialization of communication port function
Initializes the RS-485 port (the setting of transmission speed, data bit length, parity bit, etc.)

2) Data sending/receiving function
Sends data from an application program in the MICREX-SX series CPU module to general purpose inverter (FVR) via the general purpose communication module, or outputs the data received via the general purpose communication module to an application program.

3) Transmission condition monitoring function
Monitors data transmission condition and outputs error information if abnormal.

<Connecting method of "_CfdFVR">
The connecting method between the general purpose communication module and FUJI FVR series general purpose inverter must be "1:N connection" by RS-485 (2-wire system).

<FB operating conditions>

System configuration:
- One FB is necessary for each communication port (RS-485) to be used. Communication with the inverters that are connected to one RS-485 system is performed by one FB.
- FUJI general purpose inverter may not be connected to the RS-232C port.
- This FB cannot be used in the mode where RS-232C/RS-485 signal conversion is enabled for the general purpose communication module.

Memory capacity:
Program area = Approx. 2.7k steps
Data memory capacity = User FB memory : 458 words
Standard memory : 794 words
System FB memory : 90 words

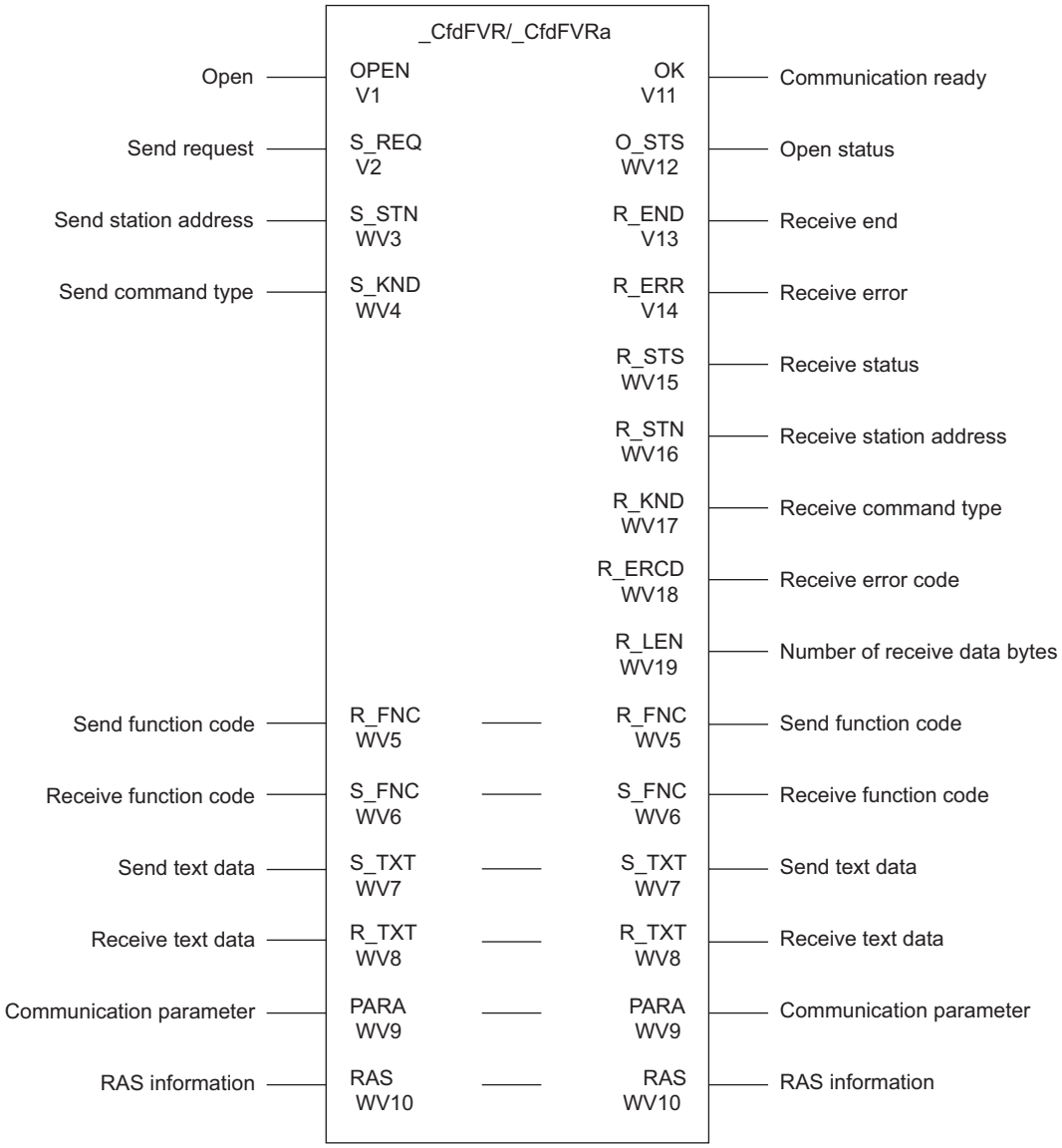
Note 1: The above list for the memory capacity includes the area for the main body of inverter procedure FB and those for sub-FBs that are called from the inverter procedure FB.
Note 2: The above list for standard memory and retain memory includes the memory capacity necessary for sending/receiving data.

* FGI-BUS: Fuji Electric General Inverter's Serial protocol

3-3 FUJI General Purpose Inverter Standard Communication (FGI-BUS) Procedure FB "_CfdFVR"

3-3-2 Specifications for _CfdFVR

(1) FB format



3-3 FUJI General Purpose Inverter Standard Communication (FGI-BUS) Procedure FB "_CfdFVR"

(2) Explanation of FB parameters

Parameter name		Data type	I/O	Description
Open (OPEN)	V0001	BOOL	IN	ON: Sends the "communication parameters" to the general purpose communication module to initialize communication. When communication becomes possible, "communication ready" turns ON. OFF: Performs the processing for ending communication. "Communication ready" turns OFF.
Send request (S_REQ)	V0002	BOOL	IN	Starts to send data. When sending has ended, this needs to be turned OFF by the application program.
Send station address (S_STN)	WV0003	WORD	IN	Stores the address of the send station.
Send command type (S_KND)	WV0004	WORD	IN	Stores the send command type.
Receive function code (R_FNC)	WV0005	WORD	IN_OUT	Stores the receive function code. * Occupies two words.
Send function code (S_FNC)	WV0006	WORD	IN_OUT	Stores the send function code. * Occupies two words.
Send text data (S_TXT)	WV0007	WORD	IN_OUT	Stores the send text data.
Receive text data (R_TXT)	WV0008	WORD	IN_OUT	Stores the receive text data.
Communication parameter (PARA)	WV0009	INT	IN_OUT	Stores the initialization parameters.
RAS information (RAS)	WV0010	* Note 1.	IN_OUT	Operating information of this FB.
Communication ready (OK)	V0011	BOOL	OUT	Turns ON when initialization has ended normally to indicate that the system is ready for sending/receiving data.
Open status (O_STS)	WV0012	WORD	OUT	2-digit hexadecimal code to indicate the result of initialization.
Receive end (R_END)	V0013	BOOL	OUT	Turns ON when receive ends.
Receive error (R_ERR)	V0014	BOOL	OUT	Turn ON if a receive error has occurred.
Receive status (R_STS)	WV0015	WORD	OUT	Code to indicate the result of receiving
Receive station address (R_STN)	WV0016	WORD	OUT	Stores the address of the receive station.
Receive command type (R_KND)	WV0017	WORD	OUT	Stores the receive command type
Receive error code (R_ERCD)	WV0018	WORD	OUT	Stores the receive error code.
Number of receive data bytes (R_LEN)	WV0019	INT	OUT	Stores the number of receive data bytes.

* Note 1

Element name	Data type
Work area for sending	WORD
Work area for receiving	WORD
Receive buffer area	WORD
Send buffer area	WORD
RAS area	INT

* For more information about data type, refer to "Appendix 1".

3-3 FUJI General Purpose Inverter Standard Communication (FGI-BUS) Procedure FB "_CfdFVR"

<Send text data; format of the memory assigned to "WV0007">

The memory that is assigned to WV0007 must be set (secured) as follows.
Specify the start address of the memory for WV0007.

		Upper order	Lower order
Start address →	WM(WL)****	Data 2	Data 1
	WM(WL)****+1	Data 4	Data 3

<Receive text data; format of the memory assigned to "WV0008">

The memory that is assigned to WV0008 must be set (secured) as follows.
Specify the start address of the memory for WV0008.

		Upper order	Lower order
Start address →	WM(WL)****	Data 2	Data 1
	WM(WL)****+1	Data 4	Data 3

3-3 FUJI General Purpose Inverter Standard Communication (FGI-BUS) Procedure FB "_CfdFVR"

<Communication parameter; format of the memory assigned to "WV0009">

The memory that is assigned to WV0009 must be set (secured) as follows.
Specify the start address of the memory for WV0009.

Start address ↓

WM(WL)***	General purpose communication module station No.
WM(WL)***+1	Port No.
WM(WL)***+2	Message port No.
WM(WL)***+3	Reserved
WM(WL)***+4	Transmission speed
WM(WL)***+5	Data bit
WM(WL)***+6	Parity bit
WM(WL)***+7	Stop bit
WM(WL)***+8 to 15	Reserved
WM(WL)***+16	Response monitoring timer
WM(WL)***+17	Retry count
WM(WL)***+18 to 39	Reserved

<RAS information; format of the memory assigned to "WV0010">

The memory that is assigned to WV0010 must be set (secured) as follows.
Specify the start address of the memory for WV0010.

Start address ↓

WM(WL)**** ⋮ WM(WL)****+255	Work area for sending (256 words)
WM(WL)****+256 ⋮ WM(WL)****+511	Work area for receiving (256 words)
WM(WL)****+512 ⋮ WM(WL)****+591	Receive buffer area (80 words)
WM(WL)****+592 ⋮ WM(WL)****+671	Send buffer area (80 words)
WM(WL)****+672 ⋮ WM(WL)****+691	RAS area (20 words)

3-3 FUJI General Purpose Inverter Standard Communication (FGI-BUS) Procedure FB “_CfdFVR”

3-3-3 Initialization

(1) Initialization parameters

In order to initialize (RS-485) communication ports which are to be used, it is necessary to set proper values for each “communication parameter” item so as to match the communication specifications of the FVR-11 series general purpose inverter. The table below shows the setting contents of these parameters.

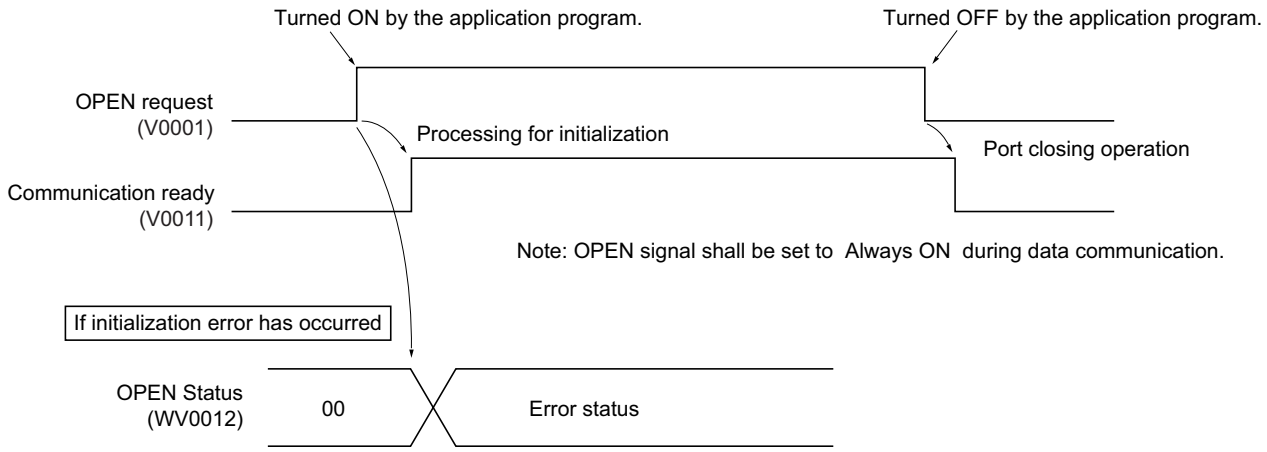
No.	Item	Description
0	General purpose communication module station No.	Sets the station number of the general purpose communication module on the SX bus.
1	Port No.	Designates an interface port on the general purpose communication module. 1: RS-485 port
2	Message port No.	Designates a port No. for sending/receiving message to/from a general purpose communication module.
3	Reserved	Not used
4	Transmission speed	Designates the transmission speed. 0: 1200, 1: 2400, 2: 4800, 3: 9600, 4: 19200 bps
5	Data bit	Designates the data bit length. When "7" is selected, 7 bits make up one data; when "8", 8 bits make up one data. 0: 7 bits 1: 8 bits
6	Parity bit	This is a bit which is added to data for the purpose of error detection. Designate the proper one to match the setting of the device at the other end. 0: None, 1: Odd, 2: Even
7	Stop bit	This bit indicates the end of data. Designate the proper one to match the setting of the device at the other end. 0: 1 bit, 2: 2 bits
8 : 15	Reserved	Not used
16	Response monitoring timer	The timer for monitoring during the period from when the CPU module (FB) sends a send request to an external device until communication ends. This value can be set in 0.01-second steps. Example: For 1 second, set this value to "100".
17	Retry count	In case of communication error, this designates how many times to retry communication.
18 : 39	Reserved	Not used

Note: No. in the above table is the number of the words from the start for communication parameter.

3-3 FUJI General Purpose Inverter Standard Communication (FGI-BUS) Procedure FB "_CfdFVR"

(2) Initialization procedure

When the OPEN (V0001) parameter of FB is turned ON, communication parameters are transferred to the general purpose communication module, which executes processing for initialization. If initialization is impossible due to a communication parameter setting error or hardware error, FB outputs the corresponding error code to the OPEN Status (WV0012).



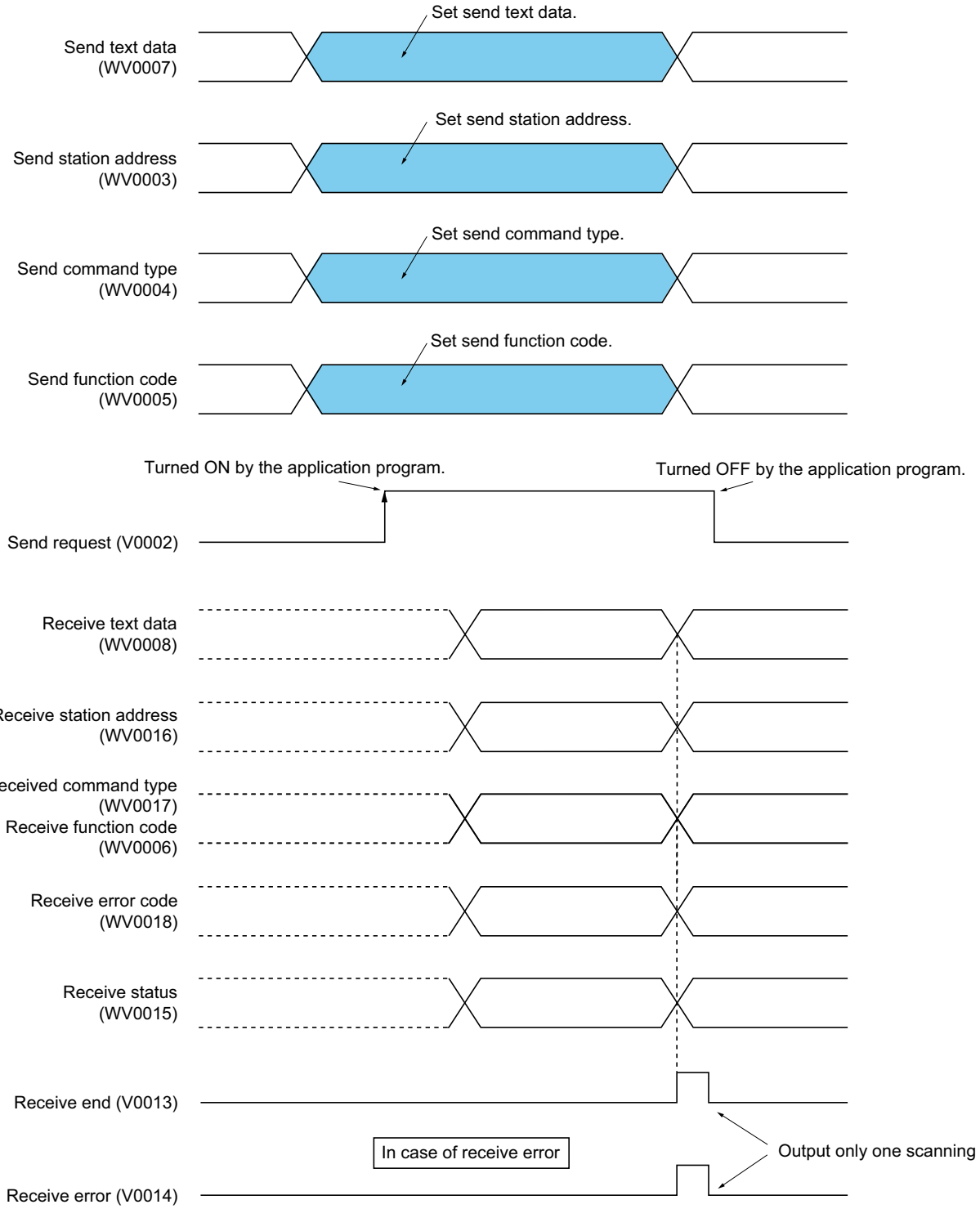
(3) OPEN status list

No.	Result of initialization	Remarks
'00'	Ended normally	
'01'	Transmission speed error	General purpose communication module detected an error.
'02'	Data bit length error	General purpose communication module detected an error.
'03'	Parity bit error	General purpose communication module detected an error.
'04'	Stop bit error	General purpose communication module detected an error.
'3F'	Parameter modification error	Parameter modification error after OPEN
'40'	Response monitoring timer value setting error	
'41'	Retry count setting error	
'80'	General purpose communication module station No. setting error	
'81'	Portl No. setting error	
'82'	Message port No. setting error	
'93'	Open error	Initialization failed due to SX bus error
'94'	Open error	Initialization failed due to abnormality on general purpose communication module
'A3'	Processing impossible because in code conversion mode	General purpose communication module detected an error.
'A5'	Processing impossible because in loader mode	General purpose communication module detected an error.
'A6'	Processing impossible because self-diagnosis is being executed	General purpose communication module detected an error.

3-3 FUJI General Purpose Inverter Standard Communication (FGI-BUS) Procedure FB "_CfdFVR"

3-3-4 Data sending/receiving

(1) Data sending/receiving procedure



Send text data, send station address, send command code and send function code are set and then send request is turned ON by the application program. FB detects the rising edge to execute the processing for sending.
When the send station address is for all stations (= 99), the receive end flag is automatically turned ON the moment sending is completed (receive error flag is also turned ON if abnormal).
When the send station address is for one station (≠ 99), the system automatically enters receiving waiting mode the moment sending is completed, executing the processing for receiving. When the delimiter between frames is detected, the receive end flag is automatically turned ON (receive error flag is also turned ON if abnormal).

3-3 FUJI General Purpose Inverter Standard Communication (FGI-BUS) Procedure FB "_CfdFVR"

(2) Sending/receiving status list

No.	Result of sending/receiving	Remarks
'00'	Normally ended	
'01'	Send buffer has overflowed.	
'02'	Receive buffer has overflowed.	
'40'	Data send time-out	
'41'	Protocol response error	
'42'	BCC error	
'90'	General purpose communication module disconnected.	Not detected
'91'	SX bus send error	
'92'	SX bus receive error	
'93'	NAK receive	
'A0'	Object port error	General purpose communication module detected an error.
'A3'	Processing impossible because in code conversion mode	General purpose communication module detected an error.
'A5'	Processing impossible because in loader mode	General purpose communication module detected an error.
'A6'	Processing impossible because self-diagnosis is being executed	General purpose communication module detected an error.
'C0'	Hardware error detected during receiving	General purpose communication module detected an error.
'C1'	Receive buffer has overflowed.	General purpose communication module detected an error.
'C2'	Send buffer has overflowed.	General purpose communication module detected an error.
'C3'	Send data size over	General purpose communication module detected an error.

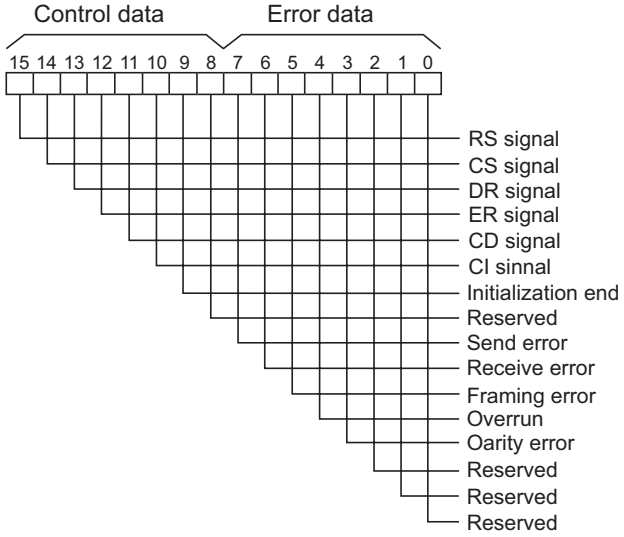
3-3 FUJI General Purpose Inverter Standard Communication (FGI-BUS) Procedure FB "_CfdFVR"

3-3-5 RAS

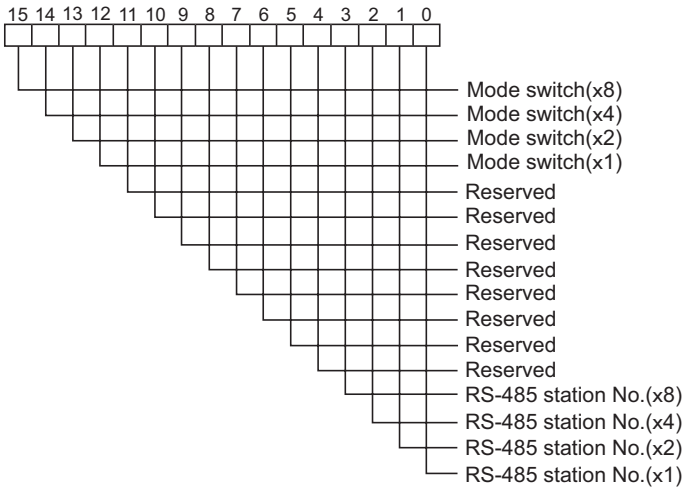
RAS information in general purpose communication is assigned as shown in the following figure. RAS data is stored in the position shown in the figure below from the start address of the device which is assigned to "RAS information parameter (WV0010) .

WM(WL)***+672	Port status
WM(WL)***+673	Status of general purpose communication module
WM(WL)***+674	Send request count
WM(WL)***+675	Send end count
WM(WL)***+676	Receive count
WM(WL)***+677	Frame detection count
WM(WL)***+678	M_OPEN status
WM(WL)***+679	M_SEND status
WM(WL)***+680	M_RECEIVE status
WM(WL)***+681	M_SEND error count
WM(WL)***+682	M_RECEIVE error count
WM(WL)***+683	Reserved
WM(WL)***+684	Reserved
WM(WL)***+685	Reserved
WM(WL)***+686	Reserved
WM(WL)***+687	Reserved
WM(WL)***+688	Reserved
WM(WL)***+689	Reserved
WM(WL)***+690	Reserved
WM(WL)***+691	Reserved

• Port status



• General purpose communication module status



3-4 Communication Protocol Included General Purpose Inverter Procedure FB "_Cfvrpr"

3-4-1 General

The "_Cfvrpr" FB communicates data, using the "FGI-BUS", between the CPU module and FUJI FVR Series general purpose inverter. The "_Cfvrpr" FB performs part of the processing under the communication protocol in the firmware in the general purpose communication module in order to reduce the number of program steps (see note).
For more information of the detailed transmission parameters that are necessary to control the FVR Series general purpose inverter, refer to the manual supplied with the inverter.

Note: This FB can be used with V2536 or later version of general purpose communication module.

*** "a" is suffixed to the name of the FB supporting array/structure.**

Note: When using FBs supporting array/structure, use V2.2.3.0 or later version of Standard loader.

<FB functions>

1) Initialization of communication port function
Initializes the RS-485 port (the setting of transmission speed, data bit length, parity bit, etc.)

2) Data sending/receiving function
Sends data from an application program in the MICREX-SX series CPU module to general purpose inverter (FVR) via the general purpose communication module, or outputs the data received via the general purpose communication module to an application program.

3) Transmission condition monitoring function
Monitors data transmission condition and outputs error information if abnormal.

<Connecting method of "_Cfvrpr">
The connecting method between the general purpose communication module and FUJI FVR series general purpose inverter must be "1:N connection" by RS-485 (2-wire system).

<FB operating conditions>

System configuration:
- One FB is necessary for each communication port (RS-485) to be used. The control of all the inverters that are connected to one RS-485 system is performed by one FB.
- FUJI general purpose inverter may not be connected to the RS-232C port.
- This FB cannot be used in the mode where RS-232C/RS-485 signal conversion is enabled for the general purpose communication module.

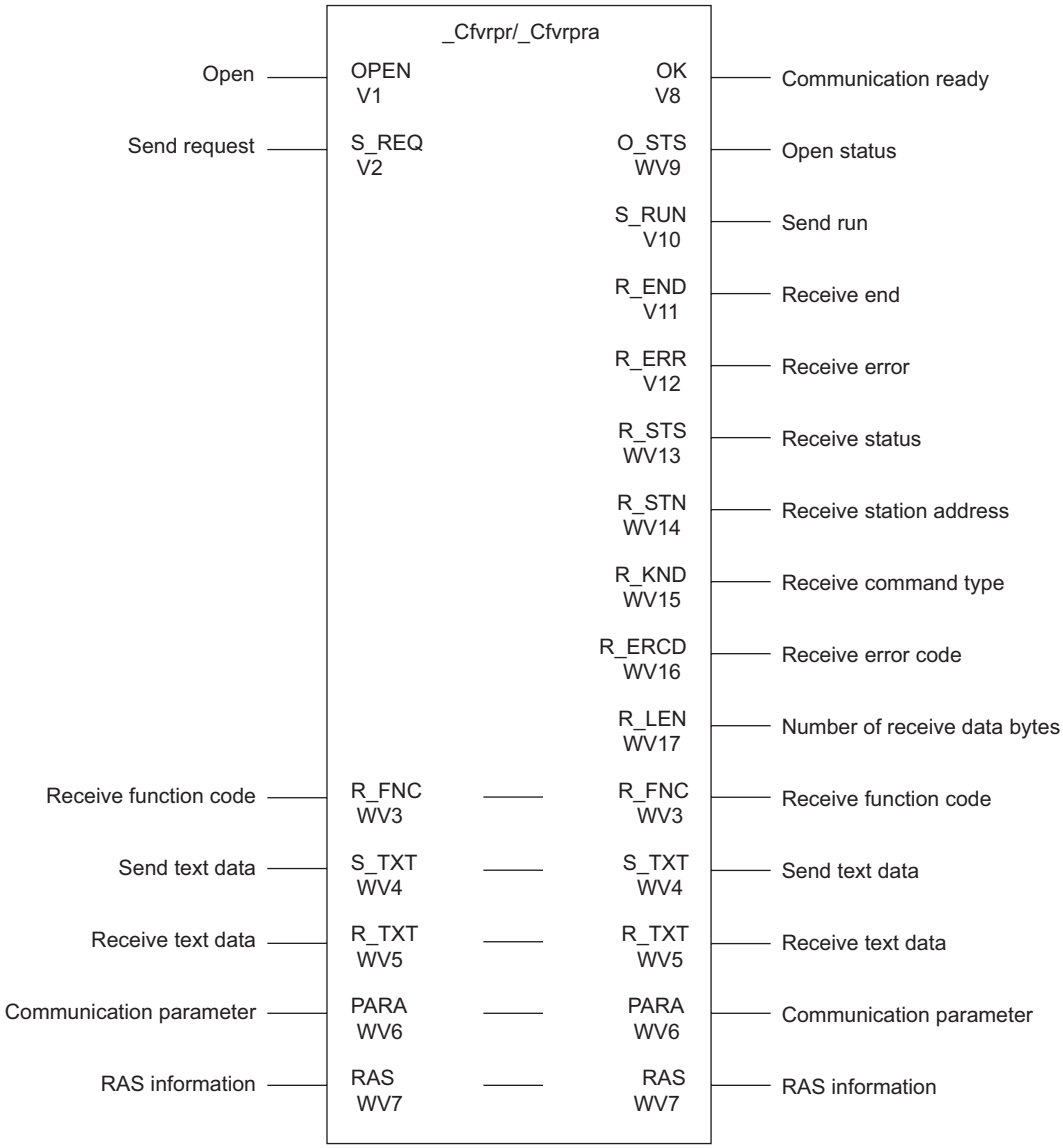
Memory capacity:
Program area = Approx. 1.6k steps
Data memory capacity = User FB memory : 260 words
Standard memory : 826 words
System FB memory : 84 words

Note 1: The above list for the memory capacity includes the area for the main body of inverter procedure FB and those for sub-FBs that are called from the inverter procedure FB.
Note 2: The above list for standard memory and retain memory includes the memory capacity necessary for sending/receiving data.

3-4 Communication Protocol Included General Purpose Inverter Procedure FB "_Cfvrpr"

3-4-2 Specifications for _Cfvrpr

(1) FB format



3-4 Communication Protocol Included General Purpose Inverter Procedure FB "_Cfvrpr"

(2) Explanation of FB parameters

Parameter name		Data type	I/O	Description
Open (OPEN)	V0001	BOOL	IN	ON: Sends the "communication parameters" to the general purpose communication module to initialize communication. When communication becomes possible, "communication ready" turns ON. OFF: Performs the processing for ending communication. "Communication ready" turns OFF.
Send request (S_REQ)	V0002	BOOL	IN	Starts to send data. When sending has ended, this needs to be turned OFF by the application program.
Receive function code (R_FNC)	WV0003	WORD	IN_OUT	Stores the function type character and function No. of receive frame. * Occupies two words.
Send text data (S_TXT)	WV0004	WORD	IN_OUT	Stores the send text data.
Receive text data (R_TXT)	WV0005	WORD	IN_OUT	Received text data is stored when the data of the station to which the inverter responded is received by the general purpose communication module. When multiple inverters are connected, the application program judges, based on receive station address (WV0014), from which station the data was sent. * Occupies two words.
Communication parameter (PARA)	WV0006	WORD	IN_OUT	Stores the initialization parameters.
RAS information (RAS)	WV0007	* Note 1.	IN_OUT	Operating information of this FB.
Communication ready (OK)	V0008	BOOL	OUT	Turns ON when initialization has ended normally to indicate that the system is ready for sending/receiving data.
Open status (O_STS)	WV0009	WORD	OUT	2-digit hexadecimal code to indicate the result of initialization.
Send run (S_RUN)	V0010	BOOL	OUT	Turns ON while data is sent to all stations.
Receive end (R_END)	V0011	BOOL	OUT	Turns ON when receive ends.
Receive error (R_ERR)	V0012	BOOL	OUT	Turns ON if a receive error has occurred. V0012 does not turn ON while NAK is received from a remote station because NAK signal is received normally. V0012 turns ON only when data is not normally received due to no response or BCC error, for example.
Receive status (R_STS)	WV0013	WORD	OUT	Code to indicate the result of receiving. In case of no response (or BCCerror), sending station code is output to the receiving station address so that it can be known which station did not respond.
Receive station address (R_STN)	WV0014	WORD	OUT	Stores the address of the receive station.
Receive command type (R_KND)	WV0015	WORD	OUT	Stores command type characters of received frame.
Receive error code (R_ERCD)	WV0016	WORD	OUT	Stores the error code sent from inverter if NAK is received from inverter.
Number of receive data bytes (R_LEN)	WV0017	INT	OUT	Stores the number of receive data bytes.

* Note 1

Element name	Data type
Work area for sending	WORD
Work area for receiving	WORD
Receive buffer area	WORD
RAS area	INT

* For more information about data type, refer to "Appendix 1".

3-4 Communication Protocol Included General Purpose Inverter Procedure FB "_Cfvrpr"

<Send text data; format of the memory assigned to "WV0004">

The memory that is assigned to WV0004 must be set (secured) as follows.
Specify the start address of the memory for WV0004.

		Upper order	Lower order
Start address→	WM(WL)****	SOH	Total number of data sending stations
	WM(WL)****+1	Station number (the units digit)	Station number (the tens digit)
	WM(WL)****+2	Command type character	ENQ
	WM(WL)****+3	Function number (the tens digit)	Function type character
	WM(WL)****+4	Added special data	Function number (the units digit)
	WM(WL)****+5	Data 2	Data 1
	WM(WL)****+6	Data 4	Data 3
	WM(WL)****+7	SOH	ETX
	WM(WL)****+8	Station number (the units digit)	Station number (the tens digit)
	WM(WL)****+9	Command type character	ENQ
	WM(WL)****+10	Data 2	Data 1
	WM(WL)****+11	Data 4	Data 3
	WM(WL)****+12	SOH	ETX
	WM(WL)****+13	Station number (the units digit)	Station number (the tens digit)
	WM(WL)****+14	Command type character	ENQ
	WM(WL)****+15	00	ETX
	⋮	⋮	⋮
	WM(WL)****+217	00	00

Note: Send data is prepared for the standard frames (14 bytes each) for maximum 31 inverter stations that can be connected plus one byte (= 218 words). The data shall be set such that unused areas become 0 (zero).

* Send data is prepared for all the inverter stations that are connected, but data is sent to or received from one station at a time due to FB internal processing.

<Receive text data; format of the memory assigned to "WV0005">

The memory that is assigned to WV0005 must be set (secured) as follows.
Specify the start address of the memory for WV0005.

		Upper order	Lower order
Start address →	WM(WL)****	Data 2	Data 1
	WM(WL)****+1	Data 4	Data 3

3-4 Communication Protocol Included General Purpose Inverter Procedure FB "_Cfvrpr"

<Communication parameter; format of the memory assigned to "WV0006">

The memory that is assigned to WV0006 must be set (secured) as follows.
Specify the start address of the memory for WV0006.

Start address ↓

WM(WL)***	General purpose communication module station No.
WM(WL)***+1	Port No.
WM(WL)***+2	Message port No.1
WM(WL)***+3	Message port No.2
WM(WL)***+4	Transmission speed
WM(WL)***+5	Data bit
WM(WL)***+6	Parity bit
WM(WL)***+7	Stop bit
WM(WL)***+8 to 15	Reserved
WM(WL)***+16	Response monitoring timer
WM(WL)***+17	Retry count
WM(WL)***+18 to 39	Reserved

<RAS information; format of the memory assigned to "WV0007">

The memory that is assigned to WV0007 must be set (secured) as follows.
Specify the start address of the memory for WV0007.

Start address ↓

WM(WL)**** ⋮ WM(WL)****+255	Work area for sending (256 words)
WM(WL)****+256 ⋮ WM(WL)****+511	Work area for receiving (256 words)
WM(WL)****+512 ⋮ WM(WL)****+532	Receive buffer area (21 words)
WM(WL)****+533 ⋮ WM(WL)****+552	Send buffer area (20 words)

<List of receive error codes (WV0016)>

Error code	Name	Description
4A(h)	Format error	Data exceeded the specified range.
4B(h)	Command error	Unspecified command code was sent.
4E(h)	Function code error	Inexistent function code was requested.
4F(h)	Write inhibit	Write request was issued during operation to a write inhibited function or a function that inhibits writing during operation.

Note: For more information, refer to the inverter specifications.

3-4 Communication Protocol Included General Purpose Inverter Procedure FB "_Cfvrpr"

3-4-3 Initialization

(1) Initialization parameters

In order to initialize each individual port of the general purpose communication module, it is necessary to set values which match the communication specifications of the object external device to the individual communication parameters. The table below shows the setting contents of these parameters.

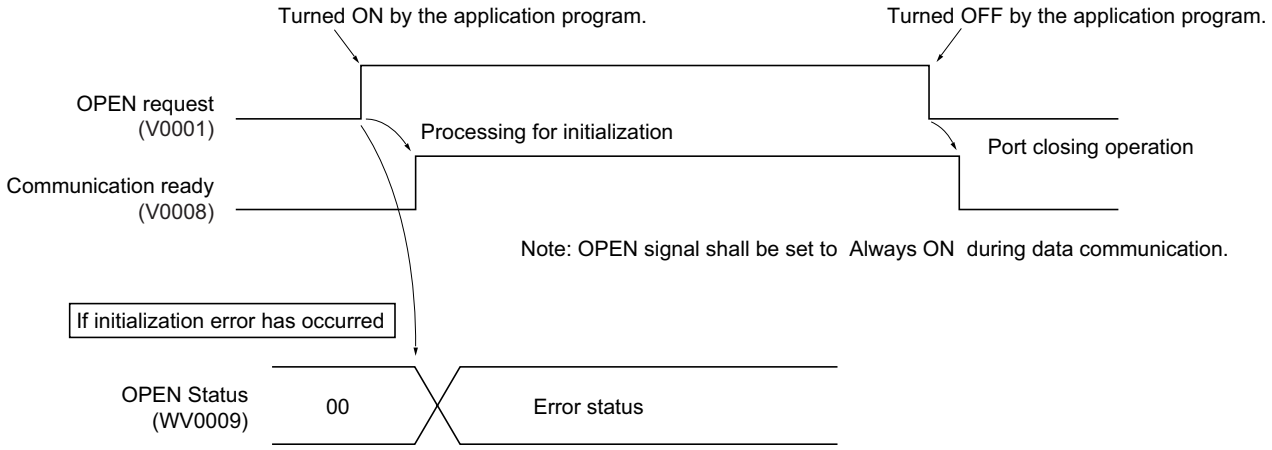
No.	Item	Description
0	General purpose communication module station No.	Sets the station number of the general purpose communication module on the SX bus.
1	Port No.	Designates an interface port on the general purpose communication module. 1: RS-485 port
2	Message port No. 1	Designates a port No. for sending/receiving message to/from a general purpose communication module. (1 to 127) Note: Avoid designating a port No. which is already used for sending/receiving messages to/from other module.
3	Message port No. 2	Designates a port No. for sending/receiving message to/from a general purpose communication module. (1 to 127) Note: Avoid designating message port No. 1 or a port No. which is already used for sending/receiving messages to/from other module.
4	Transmission speed	Designates the transmission speed. 0: 1200, 1: 2400, 2: 4800, 3: 9600, 4: 19200, 5: 38400, 6: 57600, 7: 76800, 8: 115200, 90: 300, 91:600 bps
5	Data bit	Designates the data bit length. When "7" is selected, 7 bits make up one data; when "8", 8 bits make up one data. 0: 7 bits 1: 8 bits
6	Parity bit	This is a bit which is added to data for the purpose of error detection. Designate the proper one to match the setting of the device at the other end. 0: None, 1: Odd, 2: Even
7	Stop bit	This bit indicates the end of data. Designate the proper one to match the setting of the device at the other end. 0: 1 bit, 2: 2 bits
8 : 15	Reserved	Not used
16	Response monitoring timer	The timer for monitoring during the period from when the CPU module (FB) sends data to the inverter via the general purpose communication module until a response is returned. This value can be set in 0.01-second steps. Example: For 1 second, set this value to "100". Up to 327.67 seconds can be set.
17	Retry count	Designates how many times to retry communication. Range: 1 to 32767
18 : 39	Reserved	Not used

Note: Nos. 0 to 7 are the basic transmission parameters, and their setting cannot be changed during operation. The setting of parameter Nos. 16 and 17 can be changed during operation.

3-4 Communication Protocol Included General Purpose Inverter Procedure FB "_Cfvrpr"

(2) Initialization procedure

When the OPEN (V0001) parameter of FB is turned ON, communication parameters are transferred to the general purpose communication module, which executes processing for initialization. If initialization is impossible due to a communication parameter setting error or hardware error, FB outputs the corresponding error code to the OPEN Status (WV0009).



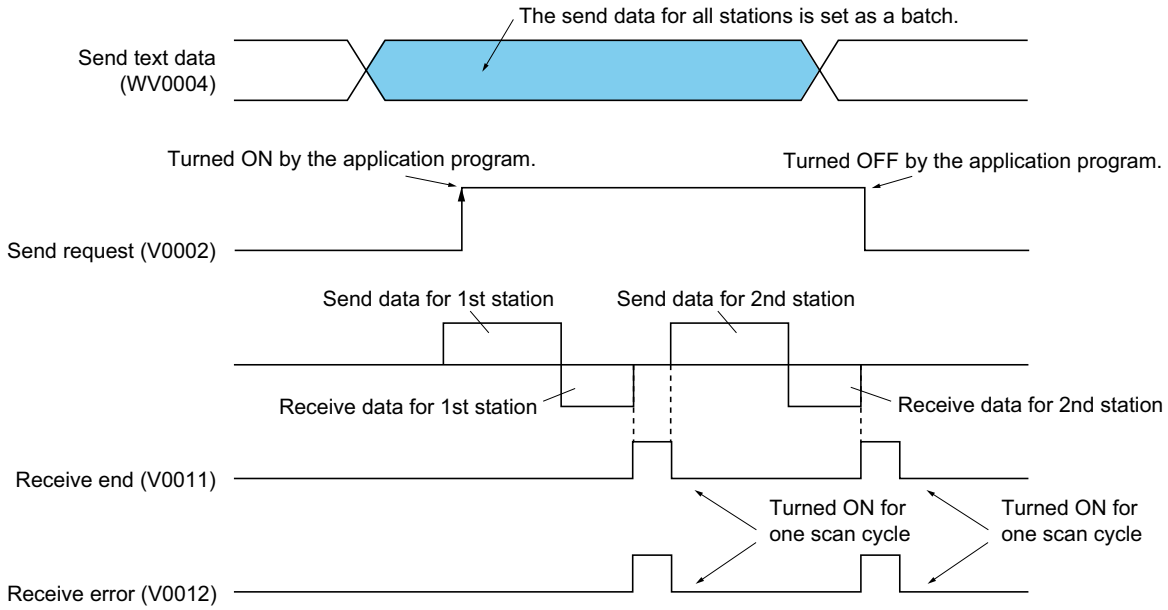
(3) OPEN status list

No.	Result of initialization	Remarks
'00'	Ended normally	
'01'	Transmission speed error	General purpose communication module detected an error.
'02'	Data bit length error	General purpose communication module detected an error.
'03'	Parity bit error	General purpose communication module detected an error.
'04'	Stop bit error	General purpose communication module detected an error.
'3F'	Parameter modification error	Parameter modification error after OPEN
'40'	Response monitoring timer value setting error	When negative
'41'	Retry count setting error	When negative
'80'	General purpose communication module station No. setting error	
'81'	Portl No. setting error	
'82'	Message port No. setting error	
'93'	Open error	Initialization failed due to SX bus error
'94'	Open error	Initialization failed due to abnormality on general purpose communication module
'A3'	Processing impossible because in code conversion mode	General purpose communication module detected an error.
'A5'	Processing impossible because in loader mode	General purpose communication module detected an error.
'A6'	Processing impossible because self-diagnosis is being executed	General purpose communication module detected an error.

3-4 Communication Protocol Included General Purpose Inverter Procedure FB "_Cfvrpr"

3-4-4 Data sending/receiving

(1) Data sending/receiving procedure



The send text data for all the stations is set as a batch, and send request is turned ON by the application program. The FB sends the data to the 1st station and sets receive status (WV0013), receive station address (WV0014), receive command type (WV0015) and receive function code (WV0003) when response data is received from the inverter on the 1st station. Then receive end flag (V0011) is turned ON for one scan cycle. During the next scan cycle, communication with the 2nd station inverter is started. When response data is received from the 2nd station after the data is sent to the 2nd station, receive status (WV0013), receive station address (WV0014), receive command type (WV0015) and receive function code (WV0003) are overwritten, and receive end flag (V0011) is turned ON again for one scan cycle.
Therefore, the setting shall be made such that the processing for receiving is started when receive end flag is turned ON.

3-4 Communication Protocol Included General Purpose Inverter Procedure FB "_Cfvrpr"

(2) Sending/receiving status list (WV0013)

No.	Result of sending/receiving	Remarks
'00'	Normally ended	
'01'	Send buffer has overflowed.	
'02'	Receive buffer has overflowed.	
'40'	Data send time-out	
'41'	Protocol response error	If the respense of remote station could not normally be received, the address of the remote station is output to receive station address (WV0014).
'42'	BCC error	
'43'	No vaild data	
'44'	Previous send data sending	
'90'	General purpose communication module disconnected.	Not detected
'91'	SX bus send error	
'92'	SX bus receive error	
'A0'	Object port error	General purpose communication module detected an error.
'A3'	Processing impossible because in code conversion mode	General purpose communication module detected an error.
'A5'	Processing impossible because in loader mode	General purpose communication module detected an error.
'A6'	Processing impossible because self-diagnosis is being executed	General purpose communication module detected an error.
'C0'	Hardware error detected during receiving	General purpose communication module detected an error.
'C1'	Receive buffer has overflowed.	General purpose communication module detected an error.
'C2'	Send buffer has overflowed.	General purpose communication module detected an error.
'C3'	Send data size over	General purpose communication module detected an error.

3-4 Communication Protocol Included General Purpose Inverter Procedure FB "_Cfvrpr"

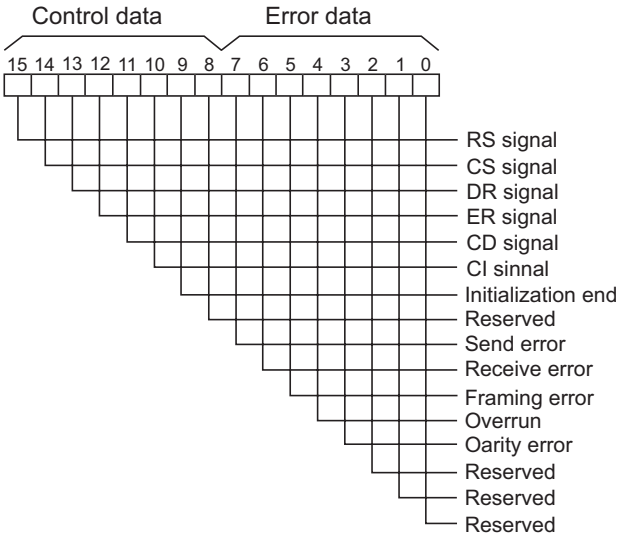
3-4-5 RAS

RAS information in general purpose communication is assigned as shown in the following figure. RAS data is stored in the position shown in the figure below from the start address of the device which is assigned to "RAS information parameter (WV0007) .

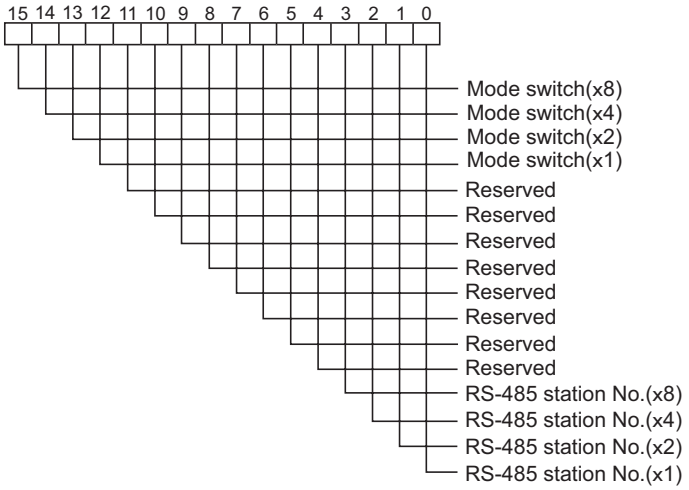
WM(WL)***+533	Port status
WM(WL)***+534	Status of general purpose communication module
WM(WL)***+535	Send request count
WM(WL)***+536	Send end count
WM(WL)***+537	Receive count
WM(WL)***+538	Frame detection count
WM(WL)***+539	M_OPEN status
WM(WL)***+540	M_SEND status
WM(WL)***+541	M_RECEIVE status
WM(WL)***+542	M_SEND error count
WM(WL)***+543	M_RECEIVE error count
WM(WL)***+544	Reserved
WM(WL)***+545	Reserved
WM(WL)***+546	Reserved
WM(WL)***+547	Reserved
WM(WL)***+548	Reserved
WM(WL)***+549	Reserved
WM(WL)***+550	Reserved
WM(WL)***+551	Reserved
WM(WL)***+552	Reserved

Note: Send end count is incremented by one when the sending of data to all stations is completed.

• Port status



• General purpose communication module status



3-5 FUJI Temperature Controller Procedure FB "_CfdPYX"

3-5-1 General

The "_CfdPYX" FB communicates data between the CPU module and FUJI PYX or PYH series temperature controller using the start-stop synchronization type transmission protocol. For more information of the detailed transmission parameters that are necessary to control the PYX or PYH series temperature controller, refer to the manual for the corresponding temperature controller.

*** "a" is suffixed to the name of the FB supporting array/structure.**

Note: When using FBs supporting array/structure, use V2.2.3.0 or later version of Standard loader.

<FB functions>

1) Initialization of communication port function
Initializes communication port to be used (the setting of transmission speed, data bit length, parity bit, etc.)

2) Data sending/receiving function
Sends data from an application program in the MICREX-SX series CPU module to FUJI PYX or PYH series temperature controller via the general purpose communication module, or outputs the data received via the general purpose communication module to an application program.

3) Transmission condition monitoring function
Monitors data transmission condition and outputs error information if abnormal.

<Connecting method of "_CfdFRN">
The connecting method between the general purpose communication module and FUJI PYX or PYH series temperature controller must be "1:N connection" by RS-485 (2-wire system).

<FB operating conditions>

System configuration:
- One FB is necessary for each communication port (RS-485) to be used. Communication with all the temperature controllers that are connected to one RS-485 system is performed by one FB.
- This FB cannot be used in the mode where RS-232C/RS-485 signal conversion is enabled for the general purpose communication module.

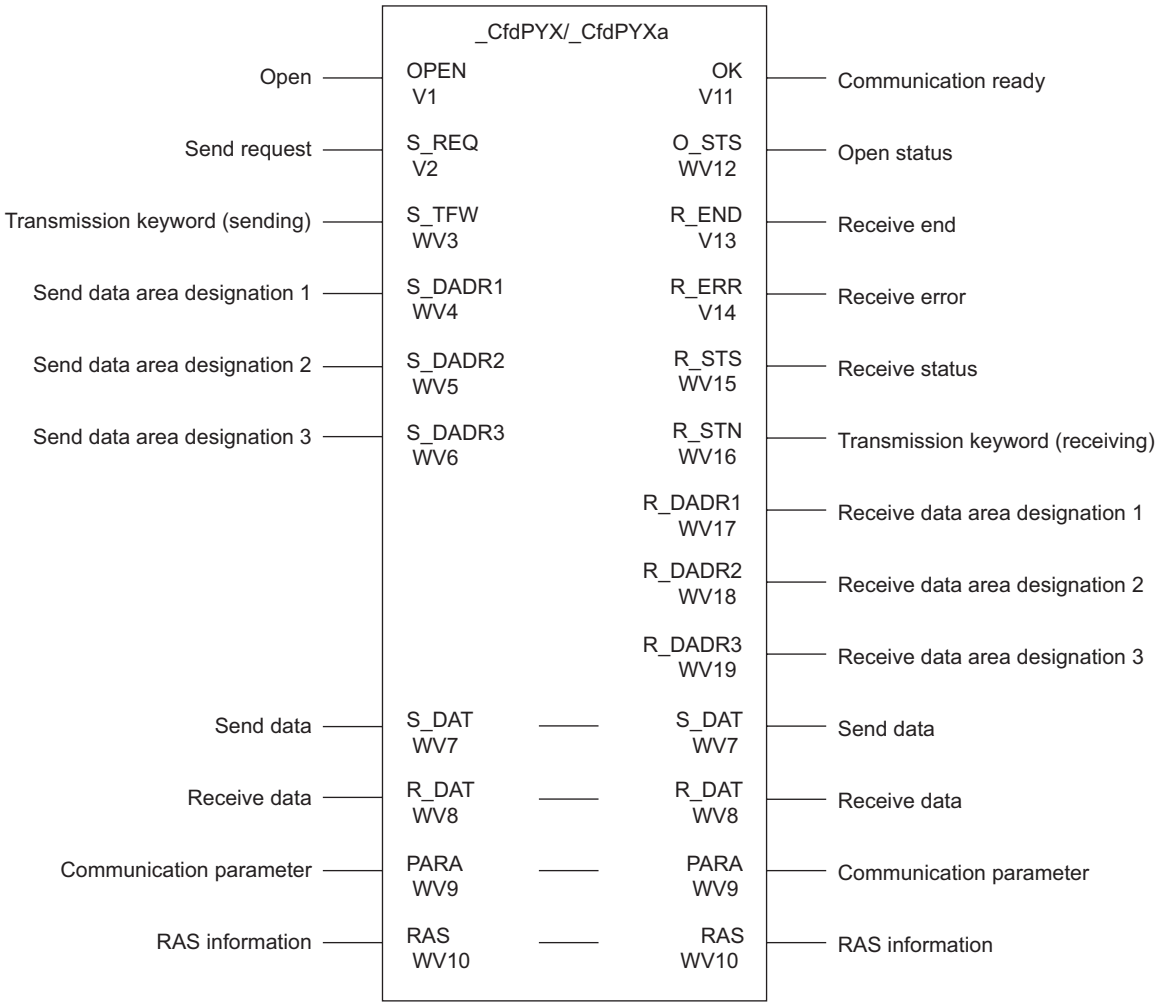
Memory capacity:
Program area = Approx. 2.2k steps
Data memory capacity = User FB memory : 400 words
Standard memory : 818 words
System FB memory : 98 words

Note 1: The above list for the memory capacity includes the area for the main body of the temperature controller procedure FB and those for sub-FBs that are called from the temperature controller procedure FB.
Note 2: The above list for standard memory and retain memory includes the memory capacity necessary for sending/receiving data.

3-5 FUJI Temperature Controller Procedure FB "_CfdPYX"

3-5-2 Specifications for _CfdPYX

(1) FB format



3-5 FUJI Temperature Controller Procedure FB "_CfdPYX"

(2) Explanation of FB parameters

Parameter name		Data type	I/O	Description
Open (OPEN)	V0001	BOOL	IN	ON: Sends the "communication parameters" to the general purpose communication module to initialize communication. When communication becomes possible, "communication ready" turns ON. OFF: Performs the processing for ending communication. "Communication ready" turns OFF.
Send request (S_REQ)	V0002	BOOL	IN	Starts to send data. When sending has ended, this needs to be turned OFF by the application program.
Transmission keyword (sending) (S_TFW)	WV0003	WORD	IN	Designates transmission keyword. There are 6 types of transmission keyword: polling, selecting, control, positive acknowledge1, positive acknowledge 2, and negative acknowledge.
Send data area designation 1 (S_DADR1)	WV0004	WORD	IN	Designates the data area for station No., file No. and extended station No.
Send data area designation 2 (S_DADR2)	WV0005	WORD	IN	Designates the data area for extended file No. and data length. However, when transmission keyword is "control", this becomes the command code area.
Send data area designation 3 (S_DADR3)	WV0006	WORD	IN	Designates the data area for the start address of file, command code and negative acknowledge cause data.
Send data (S_DAT)	WV0007	WORD	IN_OUT	Stores send data.
Receive data (R_DAT)	WV0008	WORD	IN_OUT	Stores received data.
Communication parameter (PARA)	WV0009	INT	IN_OUT	Stores the initialization parameters.
RAS information (RAS)	WV0010	* Note 1.	IN_OUT	Operating information of this FB.
Communication ready (OK)	V0011	BOOL	OUT	Turns ON when initialization has ended normally to indicate that the system is ready for sending/receiving data.
Open status (O_STS)	WV0012	WORD	OUT	2-digit hexadecimal code to indicate the result of initialization.
Receive end (R_END)	V0013	BOOL	OUT	Turns ON when receive ends.
Receive error (R_ERR)	V0014	BOOL	OUT	Turn ON if a receive error has occurred.
Receive status (R_STS)	WV0015	WORD	OUT	Code to indicate the result of receiving
Transmission keyword (receiving) (R_TFW)	WV0016	WORD	OUT	Stores transmission keyword for receiving.
Receive data area designation 1 (R_DADR1)	WV0017	WORD	OUT	Designates receive data area.
Receive data area designation 2 (R_DADR2)	WV0018	WORD	OUT	Designates receive data area.
Receive data area designation 3 (R_DADR3)	WV0019	WORD	OUT	Designates receive data area.

* Note 1

Element name	Data type
Work area for sending	WORD
Work area for receiving	WORD
Receive buffer area	WORD
Send buffer area	WORD
Parameter area	INT
RAS area	INT

* For more information about data type, refer to "Appendix 1".

3-5 FUJI Temperature Controller Procedure FB "_CfdPYX"

<Send text data; format of the memory assigned to "WV0007">

The memory that is assigned to WV0007 must be set (secured) as follows.
Specify the start address of the memory for WV0007.

	Upper order	Lower order
Start address → WM(WL)****	Data 2	Data 1
WM(WL)****+1	Data 4	Data 3
⋮	⋮	⋮
WM(WL)****+15	Data 32	Data 31

<Receive text data; format of the memory assigned to "WV0008">

The memory that is assigned to WV0008 must be set (secured) as follows.
Specify the start address of the memory for WV0008.

	Upper order	Lower order
Start address → WM(WL)****	Data 2	Data 1
WM(WL)****+1	Data 4	Data 3
⋮	⋮	⋮
WM(WL)****+15	Data 32	Data 31

3-5 FUJI Temperature Controller Procedure FB "_CfdPYX"

<Communication parameter; format of the memory assigned to "WV0009">

The memory that is assigned to WV0009 must be set (secured) as follows.
Specify the start address of the memory for WV0009.

Start address

WM(WL)***	General purpose communication module station No.
WM(WL)***+1	Port No.
WM(WL)***+2	Message port No.
WM(WL)***+3 to 15	Reserved
WM(WL)***+16	Response monitoring timer
WM(WL)***+17	Retry count
WM(WL)***+18 to 39	Reserved

<RAS information; format of the memory assigned to "WV0010">

The memory that is assigned to WV0010 must be set (secured) as follows.
Specify the start address of the memory for WV0010.

Start address

WM(WL)**** ⋮ WM(WL)****+255	Work area for sending (256 words)
WM(WL)****+256 ⋮ WM(WL)****+511	Work area for receiving (256 words)
WM(WL)****+512 ⋮ WM(WL)****+591	Receive buffer area (80 words)
WM(WL)****+592 ⋮ WM(WL)****+671	Send buffer area (80 words)
WM(WL)****+672 ⋮ WM(WL)****+711	Parameter area (40 words)
WM(WL)****+712 ⋮ WM(WL)****+731	RAS area (20 words)

3-5 FUJI Temperature Controller Procedure FB "_CfdPYX"

3-5-3 Initialization

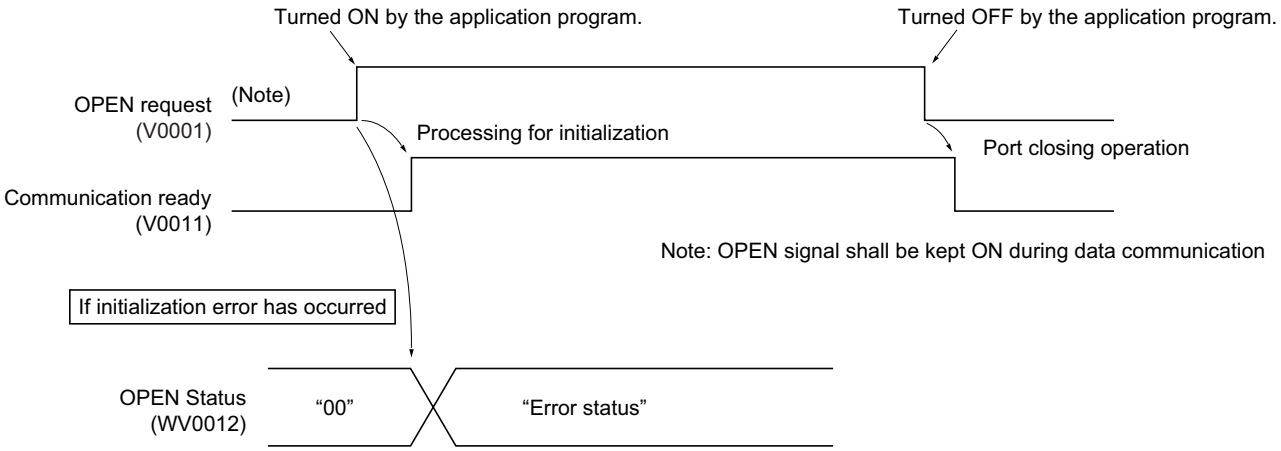
(1) Initialization parameters

In order to initialize (RS-485) communication ports which are to be used, it is necessary to set proper values for each "communication parameter" item so as to match the communication specifications of the FUJI temperature controller. The table below shows the setting contents of these parameters.

No.	Item	Description
0	General purpose communication module station No.	Sets the station number of the general purpose communication module on the SX bus.
1	Port No.	Designates an interface port on the general purpose communication module. 1: RS-232C port 0: RS-485 port
2	Message port No.	Designates a port No. for sending/receiving message to/from a general purpose communication module.
3 : 15	Reserved	Not used. Set 0 (zero) for the data.
16	Response monitoring timer	The timer for monitoring during the period from when the CPU module sends a send request to a device until communication ends. Normally set this value to "100" (one second) (in 0.01-second steps).
17	Retry count	In case of communication error, this designates how many times to retry communication.
18 : 39	Reserved	Not used. Set 0 (zero) for the data.

(2) Initialization procedure

When the OPEN (V0001) parameter of FB is turned ON, communication parameters are transferred to the general purpose communication module, which executes processing for initialization. If initialization is impossible due to a communication parameter setting error or hardware error, FB outputs the corresponding error code to the OPEN Status (WV0012).



3-5 FUJI Temperature Controller Procedure FB "_CfdPYX"

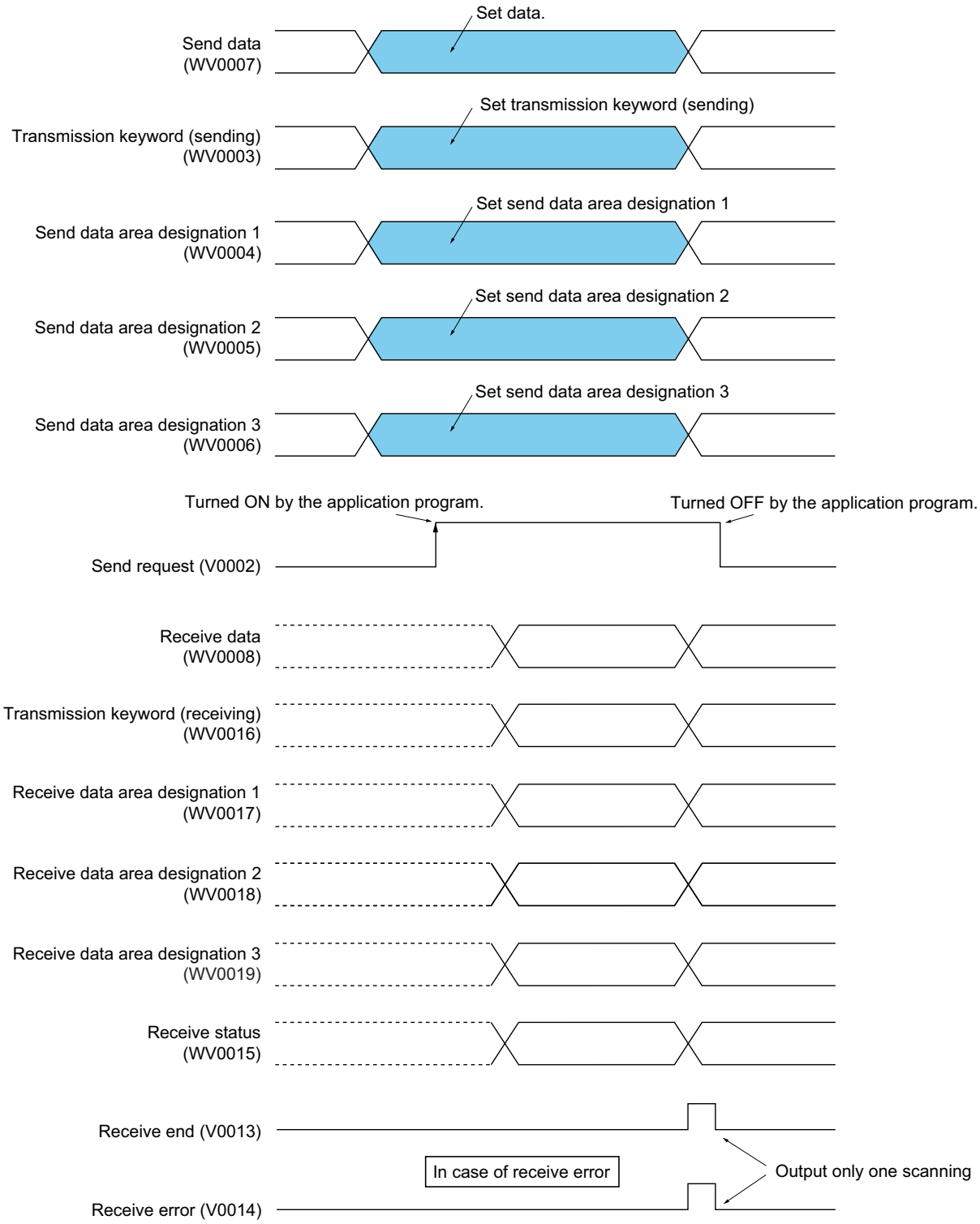
(3) OPEN status list

No.	Result of initialization	Remarks
'00'	Ended normally	
'08'	RS-485 mode setting error	General purpose communication module detected an error.
'3F'	Parameter modification error	Parameter modification error after OPEN
'40'	Response monitoring timer value setting error	
'41'	Retry count setting error	
'80'	General purpose communication module station No. setting error	
'81'	Portl No. setting error	
'82'	Message port No. setting error	
'93'	Open error	Initialization failed due to SX bus error
'94'	Open error	Initialization failed due to abnormality on general purpose communication module
'A3'	Processing impossible because in code conversion mode.	General purpose communication module detected an error.
'A5'	Processing impossible because in loader mode.	General purpose communication module detected an error.
'A6'	Processing impossible because self-diagnosis is being executed.	General purpose communication module detected an error.

3-5 FUJI Temperature Controller Procedure FB "_CfdPYX"

3-5-4 Data sending/receiving

(1) Data sending/receiving procedure



Send data, transmission keyword for sending, send data area designation 1, send data area designation 2 and send data area designation 3 are set and then send request is turned ON by the application program. The FB detects the rising edge to execute the processing for sending. When the processing for sending is completed, the FB automatically comes in receiving waiting mode, executing the processing for receiving.
When the processing for sending and receiving has completed, received data, transmission keyword for receiving, receive data area designation 1, receive data area designation 2 and receive data area designation 3 are stored, and then the receive end flag is set ON (for only one pulse). In case of transmission error, both end flag and receive error flag are set ON (for only one pulse).

3-5 FUJI Temperature Controller Procedure FB "_CfdPYX"

(2) Sending/receiving status list

No.	Result of sending/receiving	Remarks
'00'	Normally ended	
'01'	Reserved	
'02'	Send buffer has overflowed.	
'40'	Data send time-out	
'41'	Protocol response error	
'42'	BCC error	
'90'	General purpose communication module disconnected.	Not detected
'91'	SX bus send error	
'92'	SX bus receive error	
'A0'	Object port error	General purpose communication module detected an error.
'A3'	Processing impossible because in code conversion mode.	General purpose communication module detected an error.
'A5'	Processing impossible because in loader mode.	General purpose communication module detected an error.
'A6'	Processing impossible because self-diagnosis is being executed.	General purpose communication module detected an error.
'C0'	Hardware error detected during receiving	General purpose communication module detected an error.
'C1'	Receive buffer has overflowed.	General purpose communication module detected an error.
'C2'	Send buffer has overflowed.	General purpose communication module detected an error.
'C3'	Send data size over	General purpose communication module detected an error.

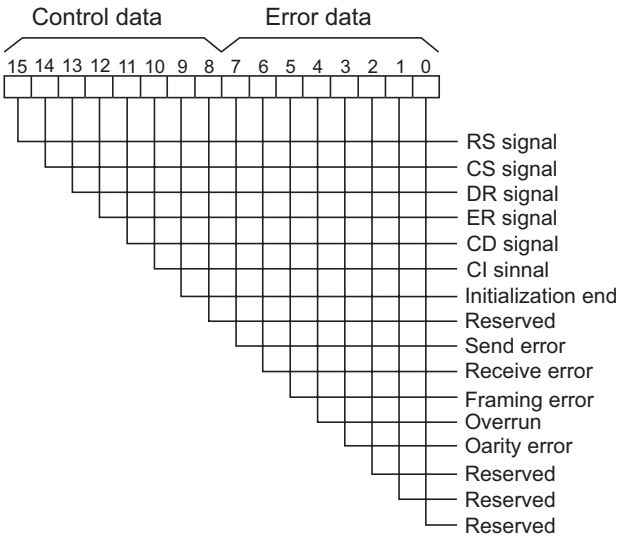
3-5 FUJI Temperature Controller Procedure FB "_CfdPYX"

3-5-5 RAS

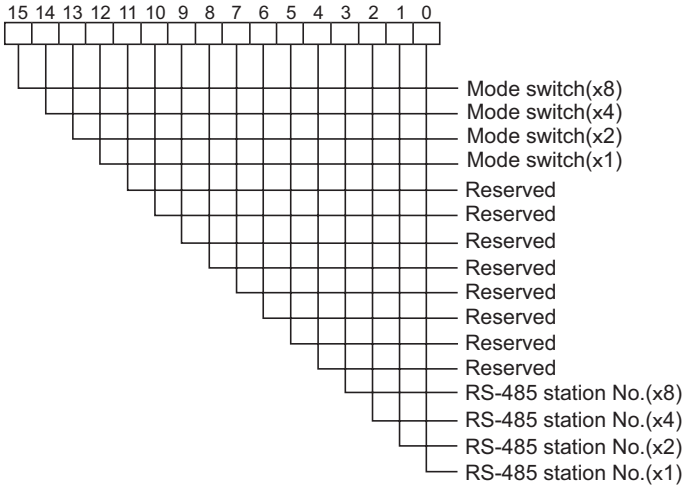
RAS information in general purpose communication is assigned as shown in the following figure. RAS data is stored in the position shown in the figure below from the start address of the device which is assigned to "RAS information parameter (WV0010) .

WM(WL)***+712	Port status
WM(WL)***+713	Status of general purpose communication module
WM(WL)***+714	Send request count
WM(WL)***+715	Send end count
WM(WL)***+716	Receive count
WM(WL)***+717	Frame detection count
WM(WL)***+718	M_OPEN status
WM(WL)***+719	M_SEND status
WM(WL)***+720	M_RECEIVE status
WM(WL)***+721	M_SEND error count
WM(WL)***+722	M_RECEIVE error count
WM(WL)***+723	Reserved
WM(WL)***+724	Reserved
WM(WL)***+725	Reserved
WM(WL)***+726	Reserved
WM(WL)***+727	Reserved
WM(WL)***+728	Reserved
WM(WL)***+729	Reserved
WM(WL)***+730	Reserved
WM(WL)***+731	Reserved

♦ Port status



♦ General purpose communication module status



3-6 FUJI Bar Code Reader Procedure FB "_CfdPK"

3-6-1 General

The "_CfdPK" FB communicates data between the CPU module and FUJI PK2 series bar code reader using the start-stop synchronization type transmission protocol. For more information of the detailed transmission parameters that are necessary to control FUJI bar code reader, refer to the manual supplied with the PK2 series bar code reader.

*** "a" is suffixed to the name of the FB supporting array/structure.**

Note: When using FBs supporting array/structure, use V2.2.3.0 or later version of Standard loader.

<FB functions>

1) Initialization of communication port function
Initialize the RS-232C port (the setting of transmission speed, data bit length, parity bit, etc.)

2) Data sending/receiving function
Sends data from an application program in the MICREX-SX series CPU module to the FUJI bar code reader via the general purpose communication module, or outputs the data received via the general purpose communication module to an application program.

3) Transmission condition monitoring function
Monitors data transmission condition and outputs error information if abnormal.

<Connecting method of "_CfdFRN">
The connecting method between the general purpose communication module and FUJI PK2 series bar code reader must be "1:1 connection" by RS-232C.

<FB operating conditions>

System configuration:
- One FB is necessary for each communication port (RS-232C) to be used.
- FUJI PK2 series bar code reader may not be connected to the RS-485 port.

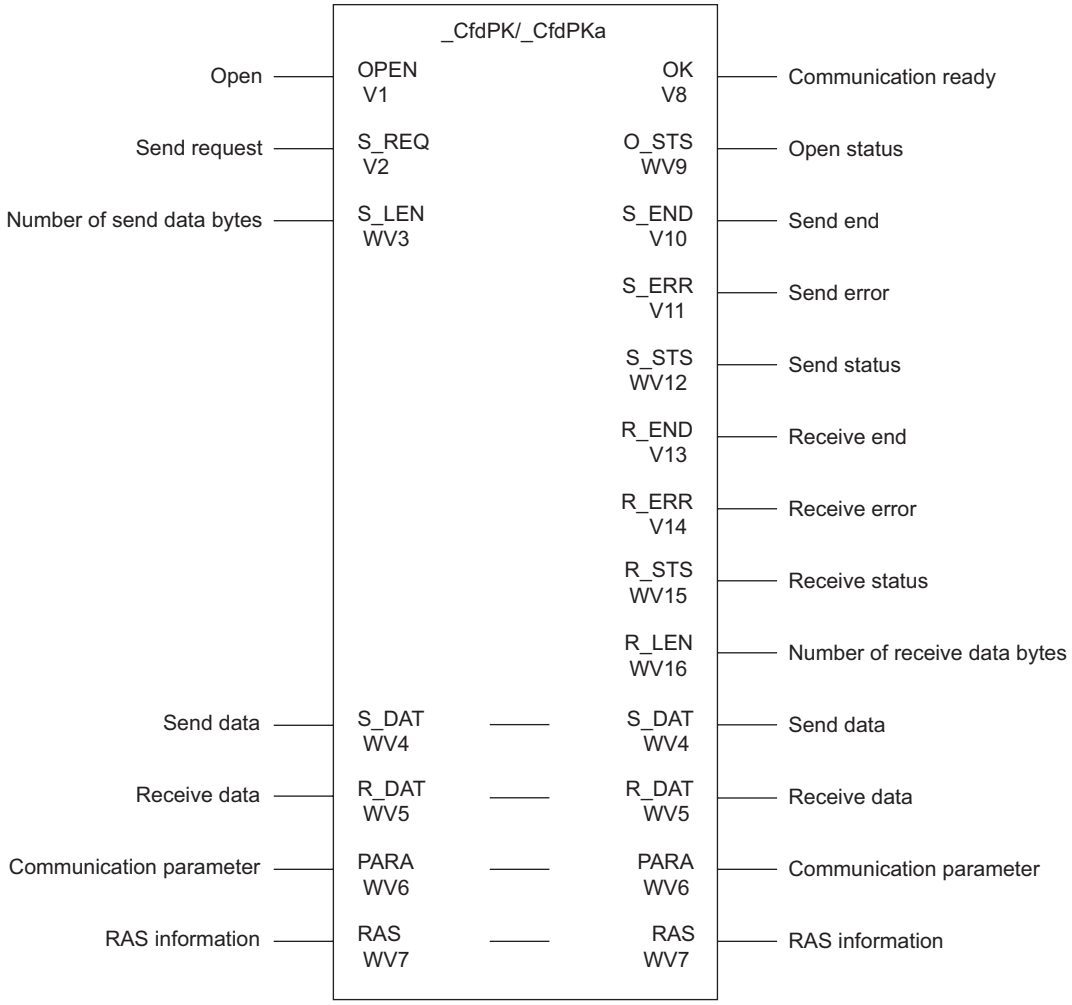
Memory capacity:
Program area = Approx. 3.3k steps
Data memory capacity = User FB memory : 478 words
Standard memory : 846 words
System FB memory : 90 words

Note 1: The above list for the memory capacity includes the area for the main body of the bar code reader procedure FB and those for sub-FBs that are called from the bar code reader procedure FB.
Note 2: The above list for standard memory and retain memory includes the memory capacity necessary for sending/receiving data.

3-6 FUJI Bar Code Reader Procedure FB "_CfdPK"

3-6-2 Specifications for _CfdPK

(1) FB format



3-6 FUJI Bar Code Reader Procedure FB "_CfdPK"

(2) Explanation of FB parameters

Parameter name		Data type	I/O	Description
Open (OPEN)	V0001	BOOL	IN	ON: Sends the "communication parameters" to the general purpose communication module to initialize communication. When communication becomes possible, "communication ready" turns ON. OFF: Performs the processing for ending communication. "Communication ready" turns OFF.
Send request (S_REQ)	V0002	BOOL	IN	Starts to send data. When sending has ended, this needs to be turned OFF by the application program.
Number of send data bytes (S_LEN)	WV0003	INT	IN	Stores the number of bytes of send data.
Send data (S_DAT)	WV0004	WORD	IN_OUT	Stores send data.
Receive data (R_DAT)	WV0005	WORD	IN_OUT	Stores received data.
Communication parameter (PARA)	WV0006	INT	IN_OUT	Stores the initialization parameters.
RAS information (RAS)	WV0007	* Note 1	IN_OUT	Operating information of this FB.
Communication ready (OK)	V0008	BOOL	OUT	Turns ON when initialization has ended normally to indicate that the system is ready for sending/receiving data.
Open status (O_STS)	WV0009	WORD	OUT	2-digit hexadecimal code to indicate the result of initialization.
Send end (S_END)	V0010	BOOL	OUT	Turns ON when sending has completed.
Send error (S_ERR)	V0011	BOOL	OUT	Turns ON if a send error has occurred.
Send status (S_STS)	WV0012	WORD	OUT	Code to indicate the result of sending.
Receive end (R_END)	V0013	BOOL	OUT	Turns ON when receive has completed.
Receive error (R_ERR)	V0014	BOOL	OUT	Turn ON if a receive error has occurred.
Receive status (R_STS)	WV0015	WORD	OUT	Code to indicate the result of receiving
Number of receive data bytes (R_LEN)	WV0016	INT	OUT	Stores the number of bytes of receive data.

* Note 1

Element name	Data type
Work area for sending	WORD
Work area for receiving	WORD
Receive buffer area	WORD
Send buffer area	WORD
Parameter area	INT
RAS area	INT

* For more information about data type, refer to "Appendix 1".

3-6 FUJI Bar Code Reader Procedure FB "_CfdPK"

<Send text data; format of the memory assigned to "WV0004">

The memory that is assigned to WV0004 must be set (secured) as follows.
Specify the start address of the memory for WV0004.

		Upper order	Lower order
Start address →	WM(WL)****	Data 2	Data 1
	WM(WL)****+1	Data 4	Data 3
		⋮	⋮
	WM(WL)****+31	Data 64	Data 63

<Receive text data; format of the memory assigned to "WV0005">

The memory that is assigned to WV0005 must be set (secured) as follows.
Specify the start address of the memory for WV0005.

		Upper order	Lower order
Start address →	WM(WL)****	Data 2	Data 1
	WM(WL)****+1	Data 4	Data 3
		⋮	⋮
	WM(WL)****+31	Data 64	Data 63

3-6 FUJI Bar Code Reader Procedure FB "_CfdPK"

<Communication parameter; format of the memory assigned to "WV0006">

The memory that is assigned to WV0006 must be set (secured) as follows.
Specify the start address of the memory for WV0006.

Start address ↓ WM(WL)***	General purpose communication module station No.
WM(WL)***+1	Port No.
WM(WL)***+2	Message port No.
WM(WL)***+3	Reserved
WM(WL)***+4	Transmission speed
WM(WL)***+5	Data bit
WM(WL)***+6	Parity bit
WM(WL)***+7	Stop bit
WM(WL)***+8 to 15	Reserved
WM(WL)***+16	Response monitoring timer
WM(WL)***+17	Start code
WM(WL)***+18	End code
WM(WL)***+19	Transmission procedure
WM(WL)***+20	Retry count
WM(WL)***+21	BCC designation
WM(WL)***+22 to 39	Reserved

<RAS information; format of the memory assigned to "WV0007">

The memory that is assigned to WV0007 must be set (secured) as follows.
Specify the start address of the memory for WV0007.

Start address ↓ WM(WL)****	Work area for sending (256 words)
WM(WL)****+255	
WM(WL)****+256	Work area for receiving (256 words)
WM(WL)****+511	
WM(WL)****+512	Receive buffer area (80 words)
WM(WL)****+591	
WM(WL)****+592	Send buffer area (80 words)
WM(WL)****+671	
WM(WL)****+672	Parameter area (40 words)
WM(WL)****+711	
WM(WL)****+712	RAS area (20 words)
WM(WL)****+731	

3-6 FUJI Bar Code Reader Procedure FB "_CfdPK"

3-6-3 Initialization

(1) Initialization parameters

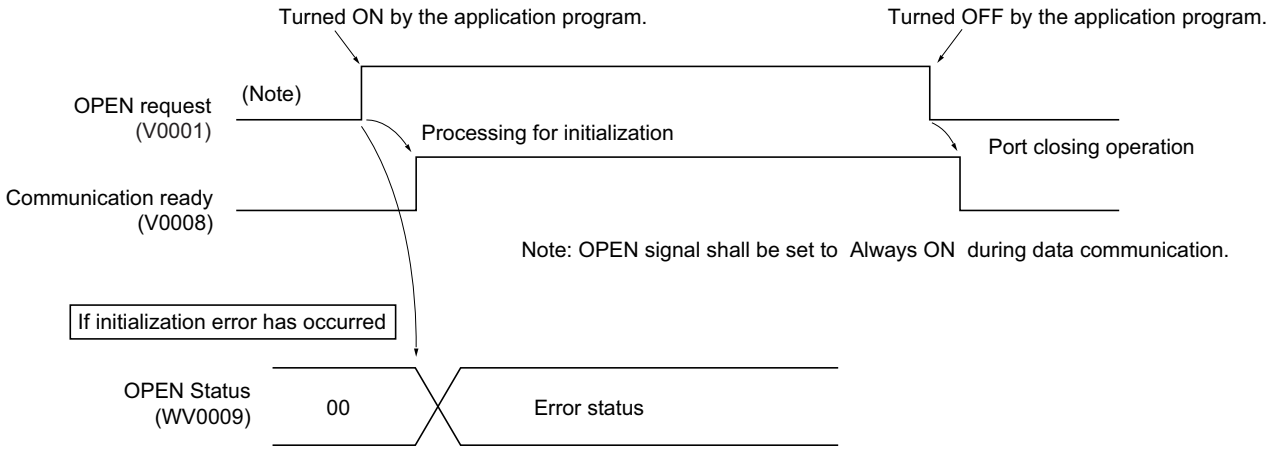
In order to initialize (RS-232C) communication ports which are to be used, it is necessary to set proper values for each "communication parameter" item so as to match the communication specifications of the PK2 series bar code reader. The table below shows the setting contents of these parameters.

No.	Item	Description
0	General purpose communication module station No.	Sets the station number of the general purpose communication module on the SX bus.
1	Port No.	Designates an interface port on the general purpose communication module. 0: RS232C port
2	Message port No.	Designates a port No. for sending/receiving message to/from a general purpose communication module.
3	Reserved	Not used
4	Transmission speed	Designates the transmission speed. 0: 1200, 1: 2400, 2: 4800, 3: 9600, 4: 19200 bps
5	Data bit	Designates the data bit length. When "7" is selected, 7 bits make up one data; when "8", 8 bits make up one data. 0: 7 bits 1: 8 bits
6	Parity bit	This is a bit which is added to data for the purpose of error detection. Designate the proper one to match the setting of the device at the other end. 0: None, 1: Odd, 2: Even
7	Stop bit	This bit indicates the end of data. Designate the proper one to match the setting of the device at the other end. 0: 1 bit, 2: 2 bits
8 : 15	Reserved	Not used
16	Response monitoring timer	The timer for monitoring during the period from when the CPU module sends a send request to a device until communication ends. Normally set this value to "100" (one second) (in 0.01-second steps).
17	Start code	Designates the start code of transmission command. 0: None, 1: STX
18	End code	Designates the end code of transmission command. 0: CR, 1: LF, 2: CR/LF, 3: ETX, 4: ETXCRF, 5: ETX/LF, 6: ETX/CR/LF
19	Transmission procedure	Designates transmission procedure. 0: Non-procedural Receives the end data simply as ead by the bar code reader. 1: ACK/NAK procedure Sends ACK when the data read by the bar code reader is received normally; NAK if a receiving error occurred.
20	Retry count	In case of communication error, this designates how many times to retry communication.
21	BCC designation	Sets whether or not to add horizontal parity for checking text data transmission error. 0: No, 1: Yes
22 : 39	Reserved	Not used

3-6 FUJI Bar Code Reader Procedure FB "_CfdPK"

(2) Initialization procedure

When the OPEN (V0001) parameter of FB is turned ON, communication parameters are transferred to the general purpose communication module, which executes processing for initialization. If initialization is impossible due to a communication parameter setting error or hardware error, FB outputs the corresponding error code to the OPEN Status (WV0009).



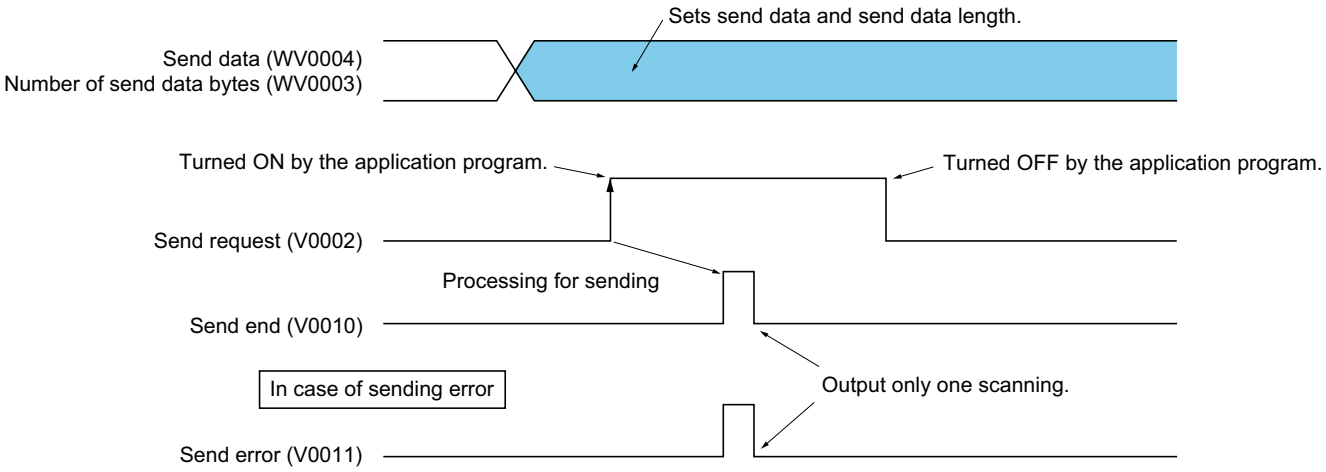
(3) OPEN status list

No.	Result of initialization	Remarks
'00'	Ended normally	
'01'	Transmission speed error	General purpose communication module detected an error.
'02'	Data bit length error	General purpose communication module detected an error.
'03'	Parity bit error	General purpose communication module detected an error.
'04'	Stop bit error	General purpose communication module detected an error.
'3F'	Parameter modification error	Parameter modification error after OPEN
'40'	Response monitoring timer value setting error	
'41'	Retry count setting error	
'42'	Start code setting error	
'43'	End code setting error	
'44'	BCC code setting error	
'45'	Retry count setting error	
'80'	General purpose communication module station No. setting error	
'81'	Port No. setting error	
'82'	Message port No. setting error	
'93'	Open error	Initialization failed due to bus error.
'94'	Open error	Initialization failed due to abnormality on general purpose communication module
'A3'	Processing impossible because in code conversion mode.	General purpose communication module detected an error.
'A5'	Processing impossible because in loader mode.	General purpose communication module detected an error.
'A6'	Processing impossible because self-diagnosis is being executed.	General purpose communication module detected an error.

3-6 FUJI Bar Code Reader Procedure FB "_CfdPK"

3-6-4 Data sending

(1) Data sending procedure



After setting send data and its data length, turn send request (V0002) ON by the application program. Then FB detects the rising edge to execute the processing for sending.
When sending has ended, send end flag (V0010) is turned ON (for only one pulse). If a send error has occurred, send end (V0010) and send error (V0011) are turned ON (for only one pulse), and corresponding error code is output to send status (WV0012) ("00" when ended normally).

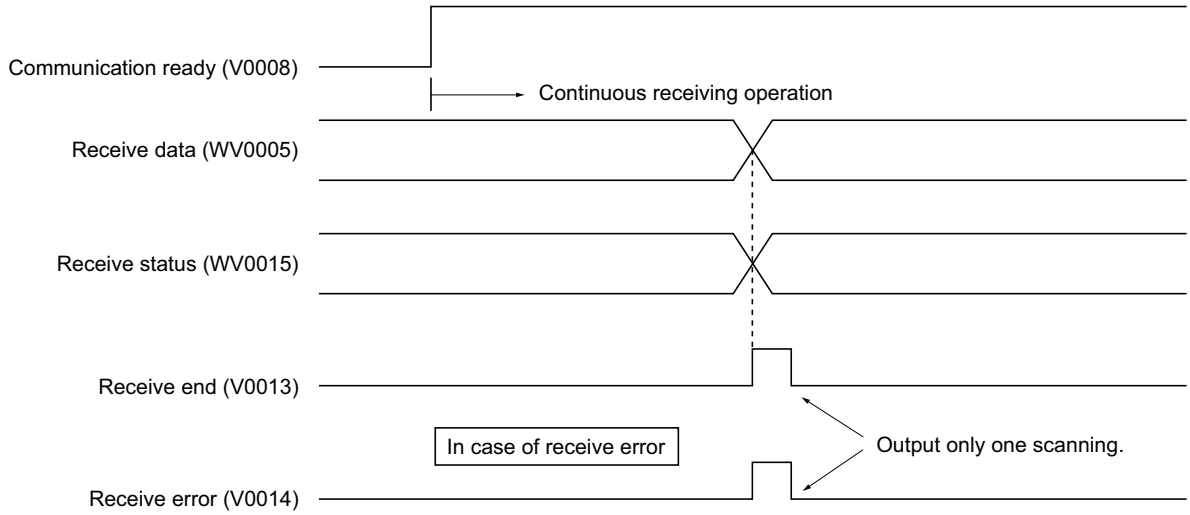
(2) Sending status list

No.	Result of sending	Remarks
'00'	Normally ended	
'01'	Send buffer has overflowed.	
'42'	BBC error	
'90'	General purpose communication module disconnected.	Not detected
'91'	SX bus send error	
'92'	SX bus receive error	Not detected
'A0'	Object port error	Specified port No. is neither 0 nor 1.
'A3'	Processing impossible because in code conversion mode	
'A5'	Processing impossible because in loader mode	
'A6'	Processing impossible because self-diagnosis is being executed	Error detection on general purpose communication module
'C0'	Hardware error detected during receiving	Error detection on general purpose communication module
'C1'	Receive buffer has overflowed.	Error detection on general purpose communication module
'C2'	Send buffer has overflowed.	Error detection on general purpose communication module
'C3'	Send data size over	Error detection on general purpose communication module

3-6 FUJI Bar Code Reader Procedure FB "_CfdPK"

3-6-5 Data receiving

(1) Data receiving procedure



While the communication ready flag is turned ON, FB checks whether the data to be received exists or not continuously, and when it exists, execute the operation for receiving. When a delimiter between data frames is detected, the received data is stored, and the receive end (V0013) flag is turned ON (for only one pulse). The result of receiving is stored in receive status (WV0015). If a receive error has occurred, receive end (V0013) and receive error (V0014) are turned ON (for only one pulse).

(2) Receiving status list

No.	Result of sending/receiving	Remarks
'00'	Ended normally	
'02'	Receive buffer has overflowed.	
'41'	Protocol response error	
'42'	BCC error	
'90'	General purpose communication module disconnected.	
'91'	SX bus send error	
'92'	SX bus receive error	
'A0'	Object port error	General purpose communication module detected an error.
'A3'	Processing impossible because in code conversion mode.	General purpose communication module detected an error.
'A5'	Processing impossible because in loader mode.	General purpose communication module detected an error.
'A6'	Processing impossible because self-diagnosis is being executed.	General purpose communication module detected an error.
'C0'	Hardware error detected during receiving (Parity error, Franming error, etc.)	General purpose communication module detected an error.
'C1'	Receive buffer has overflowed.	General purpose communication module detected an error.
'C2'	Send buffer has overflowed.	General purpose communication module detected an error.
'C3'	Number of send data over	General purpose communication module detected an error.

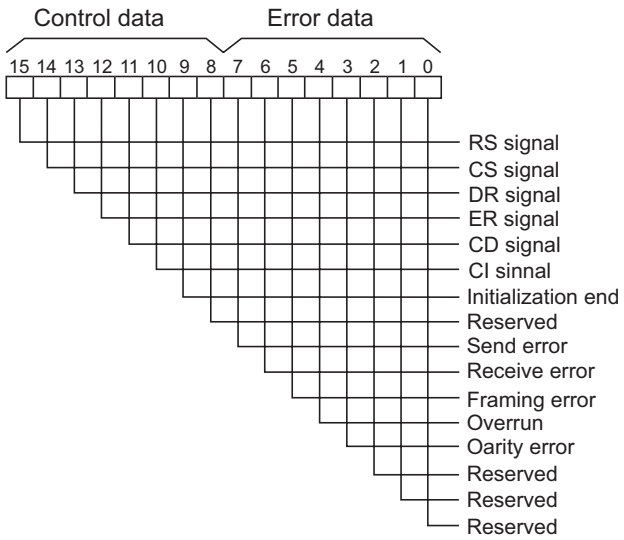
3-6 FUJI Bar Code Reader Procedure FB "_CfdPK"

3-6-6 RAS

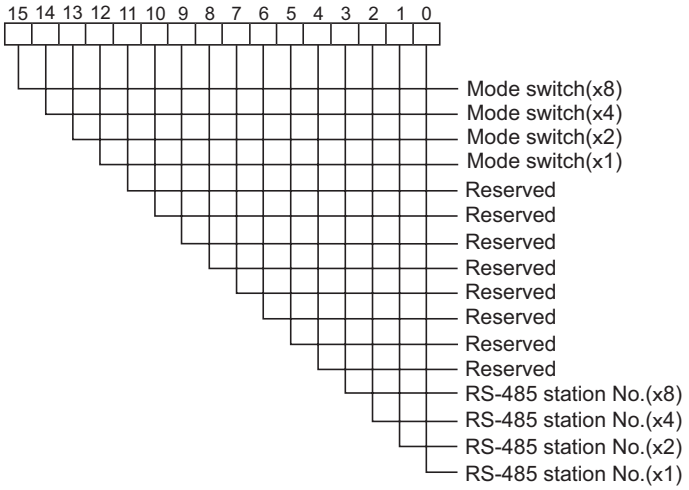
RAS information in general purpose communication is assigned as shown in the following figure. RAS data is stored in the position shown in the figure below from the start address of the device which is assigned to "RAS information parameter (WV0007) .

WM(WL)***+712	Port status
WM(WL)***+713	Status of general purpose communication module
WM(WL)***+714	Send request count
WM(WL)***+715	Send end count
WM(WL)***+716	Receive count
WM(WL)***+717	Frame detection count
WM(WL)***+718	M_OPEN status
WM(WL)***+719	M_SEND status
WM(WL)***+720	M_RECEIVE status
WM(WL)***+721	M_SEND error count
WM(WL)***+722	M_RECEIVE error count
WM(WL)***+723	Reserved
WM(WL)***+724	Reserved
WM(WL)***+725	Reserved
WM(WL)***+726	Reserved
WM(WL)***+727	Reserved
WM(WL)***+728	Reserved
WM(WL)***+729	Reserved
WM(WL)***+730	Reserved
WM(WL)***+731	Reserved

♦ Port status



♦ General purpose communication module status



3-7 MODBUS Procedure FB "_C_modm"

3-7-1 General

The "_C_modm" FB communicates data between the CPU module and FA device equipped with MODBUS interface. While there are MODBUS master and slave devices, this FB makes MICREX-SX a master device and communicates data with MODBUS slave devices. MODBUS master device may not be connected to this FB. Determine which functions to use according to the specifications for the MODBUS slave devices to be connected.

*** "a" is suffixed to the name of the FB supporting array/structure.**

Note: When using FBs supporting array/structure, use V2.2.3.0 or later version of Standard loader.

<FB functions>

1) Initialization of communication port function
Initialize communication ports to be used (the setting of transmission speed, data bit length, parity bit, etc.)

2) Data sending/receiving function
Sends data from an application program in the MICREX-SX series CPU module to MODBUS devices via the general purpose communication module, or outputs the data received via the general purpose communication module to an application program.

3) Transmission condition monitoring function
Monitors data transmission condition and outputs error information if abnormal.

4) Supported function codes
This FB supports the following functions. For the data format for individual function, refer to "3-7-2 (4) Function codes".

Function code	Function
01	Coil (output) reading
02	Input bit reading
03	Retain register reading
04	Input register reading
05	Forcible ON/OFF (1 bit)

Function code	Function
06	Retain register writing (1 word)
08	Diagnosis (see note)
0F	Forcible ON/OFF (multiple bits)
10	Retain register writing (multiple words)

Note: For more information of diagnosis, refer to MODBUS specification.

<Connecting method of "_C_modm">
The connecting method between the general purpose communication module and MODBUS devices, 1:1 connection by RS-232C and 1:N connection by RS-485 (2-wire system) are available.

<FB operating conditions>

System configuration:
- One FB is necessary for each communication port (RS-232C, RS485) to be used. One FB is used to communicate data with the MODBUS devices that are connected to one port.
- This FB can be used with V2536 or later version of the general purpose communication module.

Memory capacity:
Program area = Approx. 4.2k steps
Data memory capacity = User FBs memory : 424 words
Standard memory : 2386 words
System FBs memory : 90 words

Note 1: The above list for the memory capacity includes the area for the main body of MODBUS procedure FB and those for sub-FBs that are called from the MODBUS procedure FB.
Note 2: The above list for standard memory and retain memory includes the memory capacity necessary for sending/receiving data.

3-7 MODBUS Procedure FB "_C_modm"

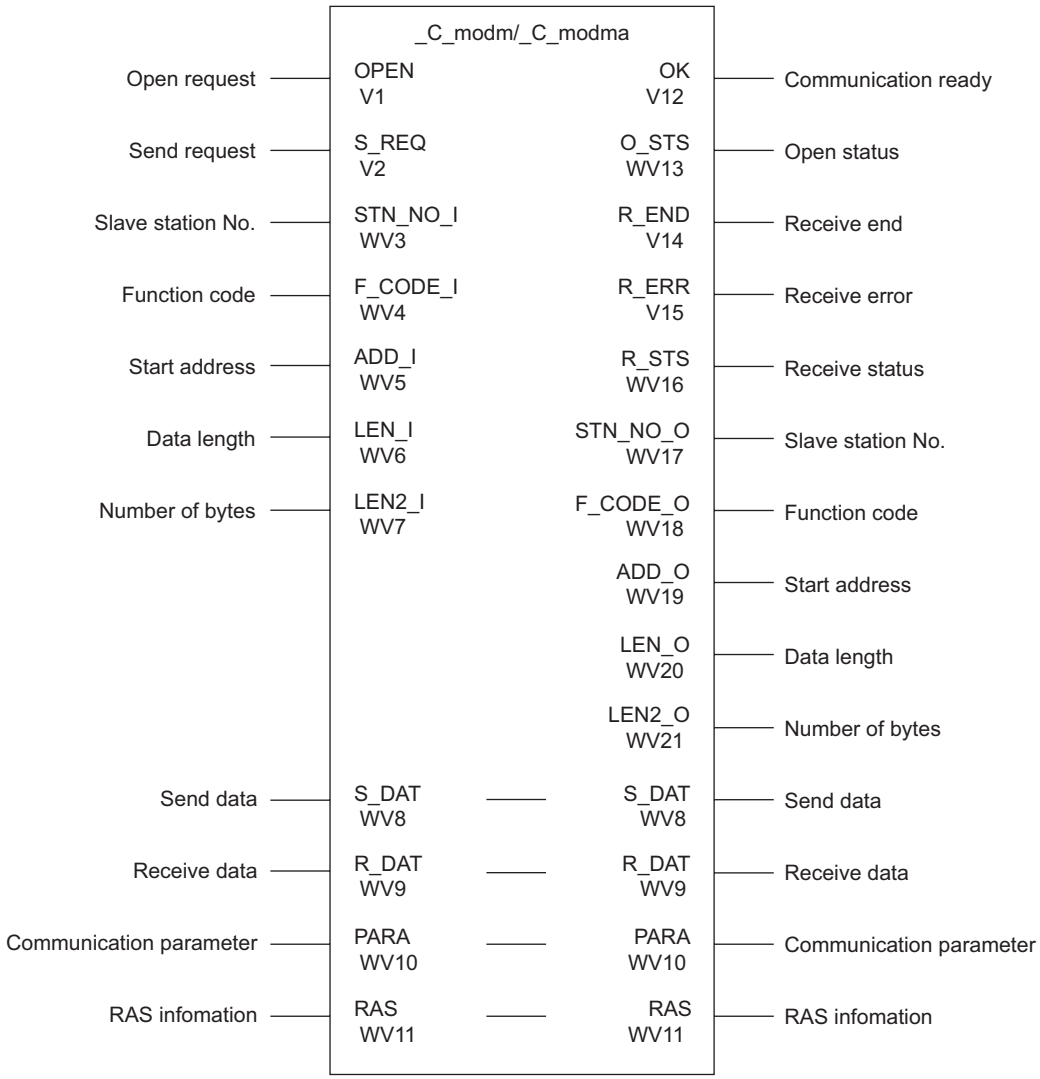
3-7-2 Specifications for _C_modm

(1) Communication specifications

Item		Specification
Transmission speed		300/600/1200/2400/4800/9600/19200/38400/57600/76800/115200 bps
Data bits		8 bits (Fixed)
Parity bit		None/odd/even
Stop bits		Selected from 1/2 bits
DCE		Selected from DTE/DCE/modem DTE mode Modem DTE mode: Turn CD ON when receiving
Signal control	DTE mode	ER: always ON
	DCE mode	DR: always ON
Signal flow control	DTE mode	Off RS: always ON; Sending: unconditional On RS: ON during sending; Sending: when CS is ON
	DCE mode	Off CS: always ON; Sending: unconditional On CS: ON when RS is ON; Sending: when ER is ON
XON/XOFF control		The prerequisite of XON/XOFF flow control is that XON or XOFF does not appear on the data.
RS-485 mode		Selected from 4-wire/2-wire
Code conversion		None (Fixed)
Error check		CRC16 (Upper order/Lower order) (Fixed)
Transmission timer value		x10ms

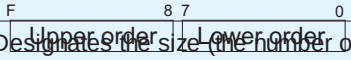
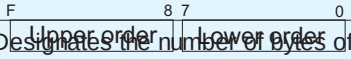
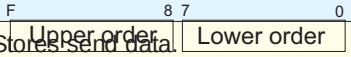
3-7 MODBUS Procedure FB "_C_modm"

(2) FB format



3-7 MODBUS Procedure FB "_C_modm"

(3) Explanation of FB parameters

Parameter name		Data type	I/O	Description
Open (OPEN)	V0001	BOOL	IN	ON: Sends the "communication parameters" to the general purpose communication module to initialize communication. When communication becomes possible, "communication ready" turns ON. OFF: Performs the processing for ending communication. "Communication ready" turns OFF.
Send request (S_REQ)	V0002	BOOL	IN	Starts to send data. When sending has ended, this needs to be turned OFF by the application program.
Slave station No. (Query) (STN_NO_I)	WV0003	INT	IN	Designates destination slave station No.
Function code (Query) (F_CODE_I)	WV0004	WORD	IN	Designates which MODBUS function to use. This code is set in the lower order byte. Example: WORD#16#0010
Start address (Query) (ADD_I)	WV0005	WORD	IN	Designates the start address of the data that becomes the object of reading or writing operation. For diagnosis (08), diagnosis code is input. Set data in the following format: 
Data length (Query) (LEN_I)	WV0006	WORD	IN	Designates the size (the number of bits or words) of read data or write data. Some functions do not use this parameter. In such case, set this item to "0000h". Set data in the following format: 
Number of bytes (LEN2_I)	WV0007	WORD	IN	Designates the number of bytes of write data when multiple bits (0F) or multiple words (10) are to be written. For other functions, set this item to "0000h". Set data in the following format. 
Send data (S_DAT)	WV0008	WORD	IN_OUT	Stores send data. For data reading or diagnosis, the data are all set to 0 (zero).
Receive data (R_DAT)	WV0009	WORD	IN_OUT	Stores received data.
Communication parameter (PARA)	WV0010	INT	IN_OUT	Stores the initialization parameters. Refer to "3-7-3 Initialization" for details.
RAS information (RAS)	WV0011	* Note 1.	IN_OUT	Operating information of this FB.
Communication ready (OK)	V0012	BOOL	OUT	Turns ON when initialization has ended normally to indicate that the system is ready for sending/receiving data.
Open status (O_STS)	WV0013	WORD	OUT	2-digit hexadecimal code to indicate the result of initialization.
Receive end (R_END)	V0014	BOOL	OUT	Turns ON when receiving has completed normally.
Receive error (R_ERR)	V0015	BOOL	OUT	Turn ON if a receive error has occurred.
Receive status (R_STS)	WV0016	WORD	OUT	Code to indicate the result of receiving
Slave station No. (Response) (STN_NO_O)	WV0017	INT	OUT	Remote slave station number is output.
Function code (Response) (F_CODE_O)	WV0018	WORD	OUT	According to the request from this FB, the value of "function code", "start address", "data length" and "the number of bytes" that are included in the response data sent form slave device are output. They are output in the same format as is set in the input (Query).
Start address (Response) (ADD_O)	WV0019	WORD	OUT	
Data length (Response) (LEN_O)	WV0020	WORD	OUT	
No. of bytes (Response) (LEN2_O)	WV0021	WORD	OUT	

3-7 MODBUS Procedure FB “_C_modm”

* Note 1

Element name	Data type
Work area for sending	WORD
Work area for receiving	WORD
Receive buffer area	WORD
Send buffer area	WORD
RAS area	INT
CRC area	WORD

* For more information about data type, refer to “Appendix 1.”

<Send data; format of the memory assigned to “WV0008”>

The memory that is assigned to WV0008 must be set (secured) as follows.
Specify the start address of the memory for WV0008.

		Upper order	Lower order
Start address →	WM(WL)****	Data 2	Data 1
	WM(WL)****+1	Data 4	Data 3
		⋮	⋮
	WM(WL)****+255	Data 512	Data 511

<Receive data; format of the memory assigned to “WV0009”>

The memory that is assigned to WV0009 must be set (secured) as follows.
Specify the start address of the memory for WV0009.

		Upper order	Lower order
Start address →	WM(WL)****	Data 2	Data 1
	WM(WL)****+1	Data 4	Data 3
		⋮	⋮
	WM(WL)****+255	Data 512	Data 511

3-7 MODBUS Procedure FB "_C_modm"

<Communication parameter; format of the memory assigned to "WV0010">

The memory that is assigned to WV0010 must be set (secured) as follows.
Specify the start address of the memory for WV0010.

Start address ↓

WM(WL)***	General purpose communication module station No.
WM(WL)***+1	Port No.
WM(WL)***+2	Message port No.1
WM(WL)***+3	Reserved
WM(WL)***+4	Transmission speed
WM(WL)***+5	Reserved
WM(WL)***+6	Parity bit
WM(WL)***+7	Stop bit
WM(WL)***+8	DCE designation
WM(WL)***+9	ER/DR signal control
WM(WL)***+10	Signal flow control
WM(WL)***+11	XON/XOFF control
WM(WL)***+12	RS-485 mode
WM(WL)***+13 to 34	Reserved
WM(WL)***+35	Response monitoring timer
WM(WL)***+36 to 39	Reserved

<RAS information; format of the memory assigned to "WV0011">

The memory that is assigned to WV0011 must be set (secured) as follows.
Specify the start address of the memoryor WV0011.

Start address ↓

WM(WL)**** ⋮ WM(WL)****+255	Work area for sending (256 words)
WM(WL)****+256 ⋮ WM(WL)****+511	Work area for receiving (256 words)
WM(WL)****+512 ⋮ WM(WL)****+1023	Receive buffer area (512 words)
WM(WL)****+1024 ⋮ WM(WL)****+1535	Send buffer area (512 words)
WM(WL)****+1536 ⋮ WM(WL)****+1555	RAS area (20 words)
WM(WL)****+1556 ⋮ WM(WL)****+1811	CRC area (256 words)

3-7 MODBUS Procedure FB "_C_modm"

(4) Function code

1) Coil reading (code: 01) / Input bit reading (code: 02)

Reads the status of the output/input bit of a slave device. The format of request message and response message is as follows:

FB terminals	Request message	Response message	FB terminals
Slave station No. (WV0003) →	Slave station No.	Slave station No.	→ Slave station No. (WV0017)
Function code (WV0004) →	Function code	Function code	→ Function code (WV0018)
Start address (WV0005) →	Start address (upper order)	Number of bytes of read data	→ Data length (WV0020)
	Start address (lower order)	Read data (lower order)	
Data length (WV0006) →	Data length (upper order)	Read data (upper order)	
	Data length (lower order)	Read data (lower order)	→ Receive data (WV0009)
	CRC (lower order)	Read data (upper order)	
	CRC (upper order)	:	
		CRC (lower order)	
		CRC (upper order)	

Notes:
1)In case of abnormal response, 80hex is added to function code (WV0018).
2)Function 01/02 does not use the number of bytes (WV0007). Set "H0000" for the WV0007 terminal. Similarly, all the variables that are connected to the "send data" terminal (WV0008) shall be set to zero.
3)CRC is automatically calculated and added to the data by this FB.
4)The number of bytes of read data is stored in the upper order byte of data length (WV0020).
5)When read data is received, its upper- and lower-order bytes are reversed as shown below.

Receive data (WV0009)

Offset address with respect to the designated start address.

+7	+6	+5	+4	+3	+2	+1	+0	+15	+14	+13	+12	+11	+10	+9	+8
+23	+22	+21	+20	+19	+18	+17	+16	+31	+30	+29	+28	+27	+26	+25	+24

3-7 MODBUS Procedure FB "_C_modm"

2) Retain register reading (code: 03)/Input register reading (code: 04)

Reads the status of the input bit of a slave device. The format of request message and response message is as follows:

FB terminals	Request message	Response message	FB terminals
Slave station No. (WV0003) →	Slave station No.	Slave station No.	→ Slave station No. (WV0017)
Function code (WV0004) →	Function code	Function code	→ Function code (WV0018)
Start address (WV0005) →	Start address (upper order)	Number of bytes of read data	→ Data length (WV0020)
	Start address (lower order)	Read data (upper order)	
Data length (WV0006) →	Data length (upper order)	Read data (lower order)	
	Data length (lower order)	Read data (upper order)	→ Receive data (WV0009)
	CRC (lower order)	Read data (lower order)	
	CRC (upper order)	:	
		CRC (lower order)	
		CRC (upper order)	

Notes:
1) In case of abnormal response, 80hex is added to function code (WV0018).
2) Function 03/04 does not use the number of bytes (WV0007). Set "H0000" for the WV0007 terminal. Similarly, all the variables that are connected to the "send data" terminal (WV0008) shall be set to zero.
3) CRC is automatically calculated and added to the data by this FB.
4) Request message specifies the number of words by data length (WV0006); response message stores is as the number of bytes of read data in the upper order byte of data length (WV0020).
5)Read data is received in the order of upper byte and lower order byte, as shown below. Therefore, word data can be accessed in units of word as it is.

Receive data (WV0009) →	Upper order byte	Lower order byte
	Upper order byte	Lower order byte
	Upper order byte	Lower order byte
	:	:

3) Forcible ON/OFF (1 bit) (code:05)

Forcibly sets ON/OFF a bit (coil) that is designated by a slave station. The format of request message and response message is as follows:

FB terminals	Request message	Response message	FB terminals
Slave station No. (WV0003) →	Slave station No.	Slave station No.	→ Slave station No. (WV0017)
Function code (WV0004) →	Function code 05h	Function code 05h	→ Function code (WV0018)
Start address (WV0005) →	Coil address (upper order)	Coin address (upper order)	→ Data length (WV0020)
	Coil address (lower order)	Coil address (lower order)	
Send data (WV0008) →	FFh(ON)/00h(OFF) (upper order)	FFh(ON)/00h(OFF) (lower order)	
	00h (lower order)	00h (lower order)	→ Receive data (WV0009)
	CRC (lower order)	CRC (lower order)	
	CRC (upper order)	CRC (upper order)	

Notes:
1) In case of abnormal response, 80hex is added to function code (WV0018).
2) Function 05 does not use data length (WV0006) and the number of bytes (WV0007). Set "H0000" for each parameter.
3) CRC is automatically calculated and added to the data by this FB.
4) Forcible ON command sets HFF00 for the start word of send data. Forcible OFF command sets H0000.

3-7 MODBUS Procedure FB "_C_modm"

4) Retain register writing (1 word) (code: 06)

Writes data in the register (1 word) that is designated by a slave device. The format of requst message and response message is as follows:

FB terminals	Request message	Response message	FB terminals
Slave station No. (WV0003) →	Slave station No.	Slave station No.	→ Slave station No. (WV0017)
Function code (WV0004) →	Function code 06h	Function code 06h	→ Function code (WV0018)
Start address (WV0005) →	Register address (upper order)	Register address (upper order)	→ Data length (WV0020)
	Register address (lower order)	Register address (lower order)	
Send data (WV0008) →	Write data (upper order)	Write data (upper order)	
	Write data (lower order)	Write data (lower order)	→ Receive data (WV0009)
	CRC (lower order)	CRC (lower order)	
	CRC (upper order)	CRC (upper order)	

Notes:
1) In case of abnormal response, 80hex is added to function code (WV0018).
2) Function 06 does not use the data length (WV0006) or the number of bytes (WV0007). Set "H0000" for each parameter.
3) CRC is automatically calculated and added to the data by this FB.
4) For send data, set the data that is to be written in the start word. Other data shall be set to all zero.

5) Forcible ON/OFF (multiple bits) (code: 0F)

Forcibly sets ON/OFF a bit (coil) that is designated by a slave station. The format of request message and response message is as follows:

FB terminals	Request message	Response message	FB terminals
Slave station No. (WV0003) →	Slave station No.	Slave station No.	→ Slave station No. (WV0017)
Function code (WV0004) →	Function code 0Fh	Function code 0Fh	→ Function code (WV0018)
Start address (WV0005) →	Start coil address (upper order)	Start coil address (upper order)	→ Start address (WV0019)
	Start coil address (lower order)	Start coil address (lower order)	
Data length (WV0006) →	No. of written bits (upper order)	No. of written bits (upper order)	→ Data length (WV0010)
	No. of written bits (lower order)	No. of written bits (lower order)	
Number of bytes (WV0007) →	Number of bytes	CRC (lower order)	
	Write data (upper order)	CRC (upper order)	
Send data (WV0008) →	Write data (lower order)		
	:		
	CRC (lower order)		
	CRC (upper order)		

Notes:
1) In case of abnormal response, 80hex is added to function code (WV0018).
2) CRC is automatically calculated and added to the data by this FB.
3) Write data shall be set with upper- and lower-order bytes reversed, as shown below:

Send data (WV0008)/Receive data (WV0009) — Offset address with respect to the designated start address.

+7	+6	+5	+4	+3	+2	+1	+0	+15	+14	+13	+12	+11	+10	+9	+8
+23	+22	+21	+20	+19	+18	+17	+16	+31	+30	+29	+28	+27	+26	+25	+24

3-7 MODBUS Procedure FB "_C_modm"

6) Retain register writing (multiple words) (code: 10)

Writes data in consecutive registers starting with the one designated by a slave device. The format of requst message and response message is as follows:

FB terminals	Request message	Response message	FB terminals
Slave station No. (WV0003) →	Slave station No.	Slave station No.	→ Slave station No. (WV0017)
Function code (WV0004) →	Function code 10h	Function code 10h	→ Function code (WV0018)
Start address (WV0005) →	Start address (upper order)	Start address (upper order)	→ Start address (WV0019)
	Start address (lower order)	Start address (lower order)	
Data length (WV0006) →	No. of written words (upper order)	No. of written words (upper order)	→ Data length (WV0020)
	No. of written words (lower order)	No. of written words (lower order)	
Number of bytes (WV0007) →	Number of bytes	CRC (lower order)	
	Write data (upper order)	CRC (upper order)	
Send data (WV0008) →	Write data (lower order)		
	:		
	CRC (lower order)		
	CRC (upper order)		

Notes:
1) In case of abnormal response, 80hex is added to function code (WV0018).
2) CRC is automatically calculated and added to the data by this FB.
3) Write data is received in the order of upper order byte and lower order byte, as show below. Therefore, word data can be accessed in units of word as it is.

Send data (WV0008) →	Upper order byte	Lower order byte
	Upper order byte	Lower order byte
	Upper order byte	Lower order byte
	:	:

7) Retain register writing (multiple words) (code: 10)

In case of abnormal response, the format of response message becomes as follows. This is common to all functions.

Abnormal response	FB terminals
Slave station No.	→ Slave station No. (WV0017)
Function code +80h	→ Function code (WV0018)
Error code	→ Lower order byte of the start word of receive data (WV0009)
CRC (lower order)	
CRC (upper order)	

<Error code list>

01h: Function code error
02h: Address setting error
03h: Read/write data count setting error

3-7 MODBUS Procedure FB "_C_modm"

3-7-3 Initialization

(1) Initialization parameters

In order to initialize each individual port of the general purpose communication module, it is necessary to set values which match the communication specifications of the object external device to the individual communication parameters. The table below shows the setting contents of these parameters.

No.	Item		Description
0	General purpose communication module station No.		Sets the station number of the general purpose communication module on the SX bus.
1	Port No.		Designates an interface port on general purpose communication module. 0: RS-232C port 1: RS-485 port
2	Message port No. 1		Designates a port No. for sending/receiving messages to/from a general purpose communication module (1 to 127). Note: Avoid designating a port No. which is already used for sending/receiving messages to/from other module.
3	Reserved		Not used
4	Transmission speed		Designates the transmission speed. 0: 1200, 1: 2400, 2: 4800, 3: 9600, 4: 19200, 5: 38400, 6: 57600, 7: 76800, 8: 115200, 90: 300, 91:600 bps
5	Reserved		Not used
6	Parity bit		This is a bit which is added to data for the purpose of error detection. Designate the proper one to match the setting of the device at the other end. 0: None, 1: Odd, 2: Even
7	Stop bit		This bit indicates the end of data. Designate the proper one to match the setting of the device at the other end. 0: 1 bit, 2: 2 bits
8	DCE designation		When signal line control is not performed, there is no difference in functions between DCE and DTE modes. The RS-232C of the general purpose communication module is of DTE specification, however, it can be used as a DCE specification interface when signal lines are converted as follows: No. 7 pin (RS) to CS No. 6 pin (DR) to ER No. 8 pin (CS) to RS No. 4 pin (ER) to DR 0: DTE, 1: DCE, 2: Modem DTE
9	ER/DR signal control		0: Off, 1: On
10	Signal flow control	DTE mode	0: Off RS: always ON; Sending: unconditional 1: On RS: ON while sending; Sending: when CS is ON
		DCE mode	0: Off CS: always ON; Sending: unconditional 1: On CS: ON when RTS is ON; Sending: when ER is ON
11	XON/XOFF control		Because communication between sender and receiver is performed asynchronously, flow control may be necessary. The receiver sends an XOFF signal to indicate that it cannot receive data for a while and then sends an XON signal to cancel the XOFF condition. To use XON/OFF control, the device at the other end must also have this function. To use flow control with XON and XOFF, XON and XOFF must not occur in data. 0: NO, 1: YES
12	RS-485 mode		Selects 4-wire or 2-wire for RS-485. 0: 4-wire, 1: 2-wire
13 : 34	Reserved		Not used

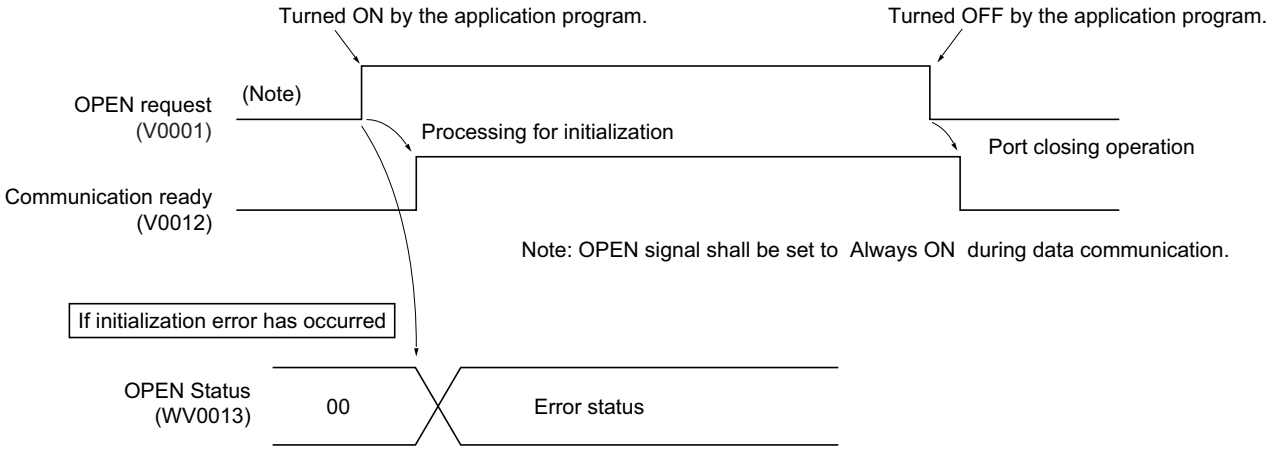
3-7 MODBUS Procedure FB “_C_modm”

35	Response monitoring timer value	The timer for monitoring during the period from when the CPU module sends a send request until receiving of reasponse is completed. This value can be set in 0.01-second steps. Example: For 1 second, set this value to "100".
36 : 39	Reserved	Not used

Note: No. in the above table is the number of words from the start of the communication parameter.

(2) Initialization procedure

When the OPEN (V0001) parameter of FB is turned ON, communication parameters are transferred to the general purpose communication module, which executes processing for initialization. If initialization is impossible due to a communication parameter setting error or hardware error, FB outputs the corresponding error code to the OPEN Status (WV0013).



3-7 MODBUS Procedure FB "_C_modm"

(3) OPEN status list

No.	Result of initialization	Remarks
'00'	Ended normally	
'01'	Transmission speed error	General purpose communication module detected an error.
'02'	Data bit length error	General purpose communication module detected an error.
'03'	Parity bit error	General purpose communication module detected an error.
'04'	Stop bit error	General purpose communication module detected an error.
'05'	DCE designation error	General purpose communication module detected an error.
'06'	Signal flow control setting error	General purpose communication module detected an error.
'07'	XON/XOFF control setting error	General purpose communication module detected an error.
'08'	RS-485 mode setting error	General purpose communication module detected an error.
'3F'	Parameter modification error	Parameter modification error after OPEN
'48'	Response monitoring timer value setting error	Specify the value of the minus.
'80'	General purpose communication module station No. setting error	
'81'	Channel No. setting error	
'82'	Message port No. setting error	
'93'	Open error	M_OPEN error
'94'	Open error	Initialization failed due to abnormality on general purpose communication module
'A3'	Processing impossible because in code conversion mode	General purpose communication module detected an error.
'A5'	Processing impossible because in loader mode	General purpose communication module detected an error.
'A6'	Processing impossible because self-diagnosis is being executed	General purpose communication module detected an error.

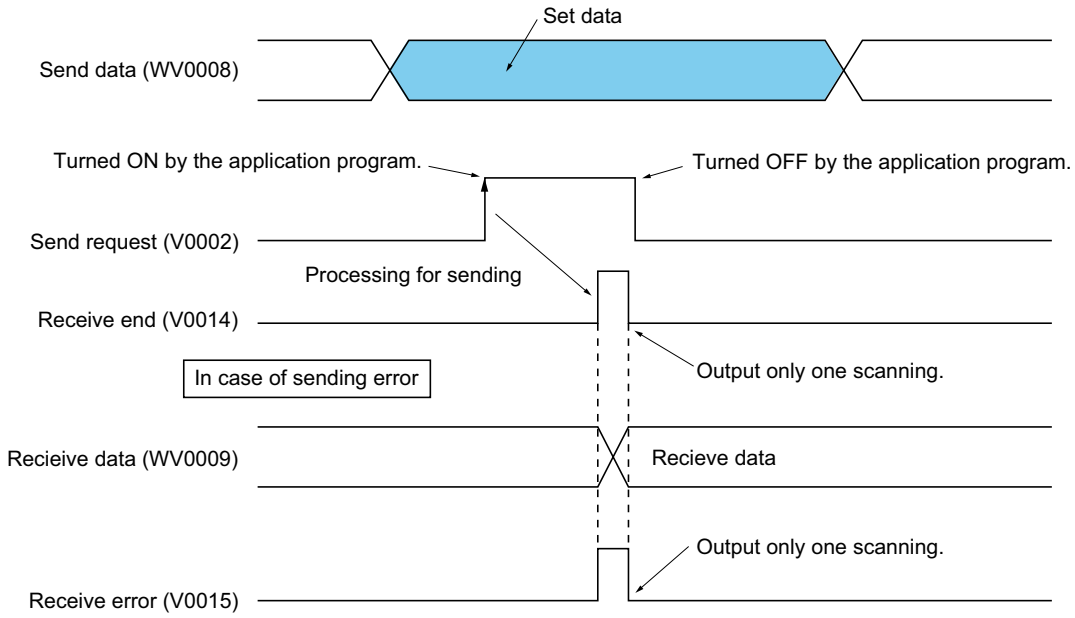
3-7 MODBUS Procedure FB "_C_modm"

3-7-4 Data sending/receiving

MODBUS protocol defines master and slave stations, and communication is performed in such manner that master station (MICREX-SX) starts communicating and slave station respond to it. The outlines of the transmission procedure are explained below:

1) Master station sends a command message to slave station.
2) Slave station checks whether or not the station No. included in the received message coincides with its own station number and, if coincides, executes the command and then sends a response message to the master station.
3) If not coincides, the slave station discards the received message and waits for next command message.

(1) Data sending/receiving procedure



After send data is set, send request is turned ON by the application program. FB detects the rising edge to execute the processing for sending.
When sending operation ends and response message is received from the slave station, receive end flag is turned ON (for only one pulse). In case of receive error, receive end and receive error flags are turned ON (for only one scanning), and the corresponding error code is output to the receive status area ("00" when ended normally).

3-7 MODBUS Procedure FB “_C_modm”

(2) Receiving status list

No.	Result of receiving	Remarks
'00'	Ended normally	
'10'	Receive buffer has overflowed.	
'11'	Unsupported function was sent.	
'12'	Unsupported function was received.	
'13'	Send station No. error	
'14'	Length 2 setting error	
'41'	Time up of response monitoring timer	
'42'	CRC error	
'90'	General purpose communication module disconnected.	
'91'	SX bus send error	
'92'	SX bus receive error	
'A0'	Object port error	General purpose communication module detected an error.
'A3'	Processing impossible because in code conversion mode.	General purpose communication module detected an error.
'A5'	Processing impossible because in loader mode	General purpose communication module detected an error.
'A6'	Processing impossible because self-diagnosis is being executed.	General purpose communication module detected an error.
'C0'	Hardware error detected during receiving	General purpose communication module detected an error.
'C1'	Receive buffer has overflowed.	General purpose communication module detected an error.
'C2'	Send buffer has overflowed.	General purpose communication module detected an error.
'C3'	Number of send data over	General purpose communication module detected an error.

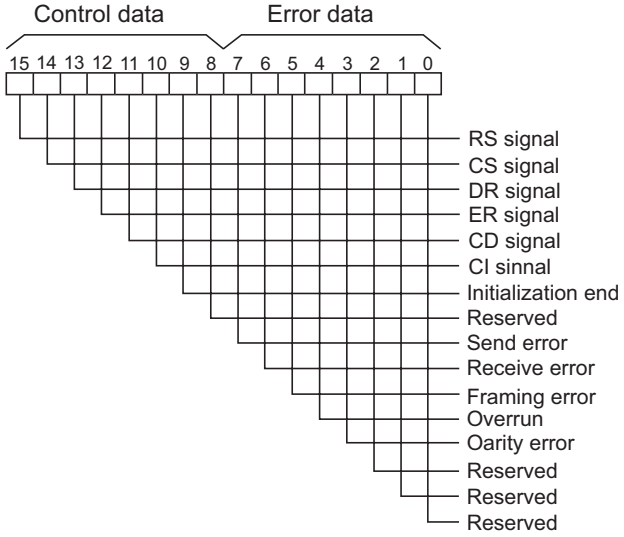
3-7 MODBUS Procedure FB "_C_modm"

3-7-5 RAS

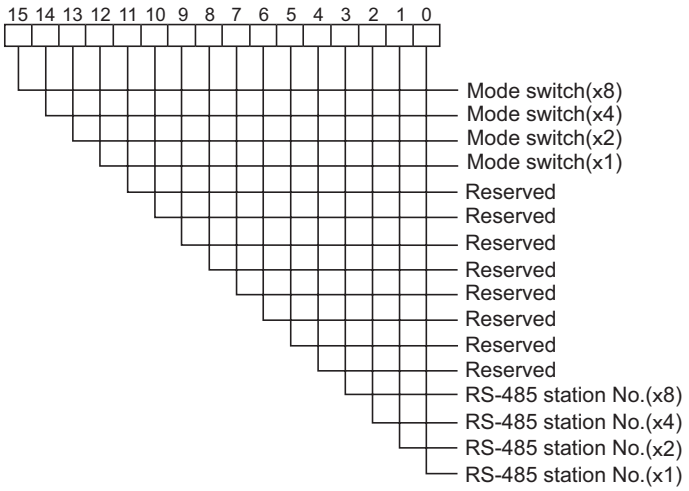
RAS information in general purpose communication is assigned as shown in the following figure. RAS data is stored in the position shown in the figure below from the start address of the device which is assigned to "RAS information parameter (WV0011)" .

WM(WL)***+1536	Port status
WM(WL)***+1547	Status of general purpose communication module
WM(WL)***+1538	Send request count
WM(WL)***+1539	Send end count
WM(WL)***+1540	Receive count
WM(WL)***+1541	Frame detection count
WM(WL)***+1542	M_OPEN status
WM(WL)***+1543	M_SEND status
WM(WL)***+1544	M_RECEIVE status
WM(WL)***+1545	M_SEND error count
WM(WL)***+1546	M_RECEIVE error count
WM(WL)***+1547	Reserved
WM(WL)***+1548	Reserved
WM(WL)***+1549	Reserved
WM(WL)***+1550	Reserved
WM(WL)***+1551	Reserved
WM(WL)***+1552	Reserved
WM(WL)***+1553	Reserved
WM(WL)***+1554	Reserved
WM(WL)***+1555	Reserved

• Port status



• General purpose communication module status



Section 4 Specifications of High-speed Counter FB

4-1 High-speed Counter Module FB

4-1-1 Overview of FB

The high-speed counter module FB is stored in the CPU module as an application to control the high-speed counter module. One FB controls one channel in a counter.

<Functional overview>

1) Initialization function

Handles settings of each operation mode:

- Pulse input format
- 16-bit/32-bit count modes
- Linear/ring operation modes

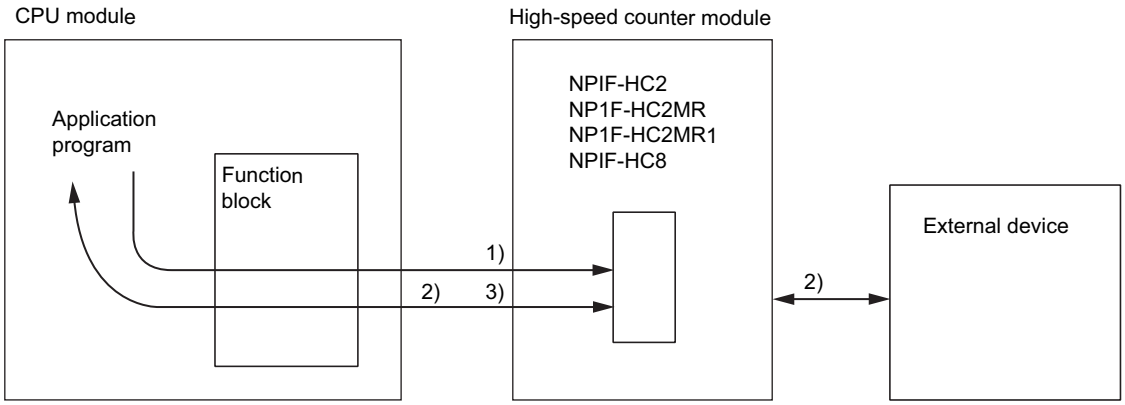
2) Main functions

Handles processing of any of the following operation modes:

- Linear operation (for NP1F-HC2/HC2MR/HC2MR1 only)
- Ring operation
- Gate operation
- Preset operation (for NP1F-HC2/HC2MR/HC2MR1 only)
- Phase-Z detection operation (for NP1F-HC2/HC2MR/HC2MR1 only)
- Comparison detection operation (for NP1F-HC2/HC2MR/HC2MR1 only)

3) Error information

Monitors the control status, and outputs error information.



Note: To use fail-soft operation mode, “2030” or newer version of high-performance/standard CPU module and “20” or newer version of counter module are necessary.

Section 4 Specifications of High-speed Counter FB

4-1 High-speed Counter Module FB

4-1-2 Memory size of FB

FB name	Target module	Program step	User FB memory	User memory
Muitifunctional high-speed counter FB (_MHCNTR/_MHCNTRa)	NP1F-HC2 NP1F-HC2MR NP1F-HC2MR1	Approx. 1.2k steps	80 words	19 words
Standard high-speed counter FB (_MHCNTH/_MHCNTHa)		Approx. 0.5k steps	42 words	13 words
Multichannel counter FB (_MHCNTM/_MHCNTMa)	NP1F-HC8	Approx. 0.35k steps	50 words	12 words

*** "a" is suffixed to the name of the FB supporting array/structure.**

Note: When using FBs supporting array/structure, use V2.2.3.0 or later version of Standard loader.

4-1-3 Operation modes of FB

The table below shows the operation modes that are available when the high-speed counter module FBs or the input/output areas of the high-speed counter module is used.

O: Available -: Unavailable

When using counter FB	NP1F-HC2/HC2MR/HC2MR1		NP1F-HC8
	High-speed couner (multifunctional version) _MHCNTR/_MHCNTRa	High-speed counter (standard version) _MHCNTH/_MHCNTHa	Multi-channel counter _MHCNTM/_MHCNTMa
Ring operation mode	O	O	O
Linear operation mode	O	-	-
Gate operation mode	O	O	O
Preset operation mode	O	-	-
Comparison detection operation mode	O	-	-
Phase-Z detection operation mode	O	-	-

When using I/O area	NP1F-HC2/HC2MR/HC2MR1	NP1F-HC8
Ring operation mode	O	O
Linear operation mode	-	-
Gate operation mode	O	O
Preset operation mode	-	-
Comparison detection operation mode	O	-
Phase-Z detection operation mode	O	-

Section 4 Specifications of High-speed Counter FB

4-1 High-speed Counter Module FB

4-1-4 Control specifications

(1) High-speed counter specifications (_MHCNTR/_MHCNTRa, _MHCNTH/_MHCNTHa)

Item		Specification
Count input signal		90-degree phase-differential two-phase signal, forward + reverse signal, pulse + sign signal
Counter	Type	Linear counter Ring counter
	Operation	Preset operation Gate operation Comparison detection operation Phase-Z detection operation
	Counting speed	With NP1F-HC2: Max.500kHz With NP1F-HC2MR: Max. 200kHz With NP1F-HC2MR1: Max. 50kHz
	Counting range	INT type: -32768 to 32767 DINT type: -2147483648 to 2147483647
	Number of channels	2 channels (One function block is required to control one channel.)
	Multiplication function	x 1, x 4 (for 90-degree phase two-phase signal only)
Comparison	Number of output points	1
	Comparison range	Same as the counting range
	Values compared	Result of comparison of count value >= value to be compared is output.
Error	Underflow	"1" when the count value exceeds the maximum negative value.
	Overflow	"1" when the count value exceeds the maximum positive value.
	Error monitoring timer 1	SX bus error
	Error monitoring timer 2	Scan was performed the specified number of times without any response after data was written to the register.
	Parameter error 1	Data exceeding the specified bit size was set.
	Parameter error 2	The preset value and comparison value are out of the range.

(2) Multichannel counter specifications (_MHCNTM/_MHCNTMa)

Item		Specification
Count input signal		90-degree phase-differential two-phase signal, forward + reverse signal, pulse + sign signal
Counter	Type	Ring counter
	Operation	Gate operation
	Counting speed	50kHz
	Counting range	INT type: -32768 to 32767 DINT type: -2147483648 to 2147483647
	Number of channels	8 channels (One function block is required to control one channel.)
	Multiplication function	x 1, x 4 (for 90-degree phase two-phase signal only)

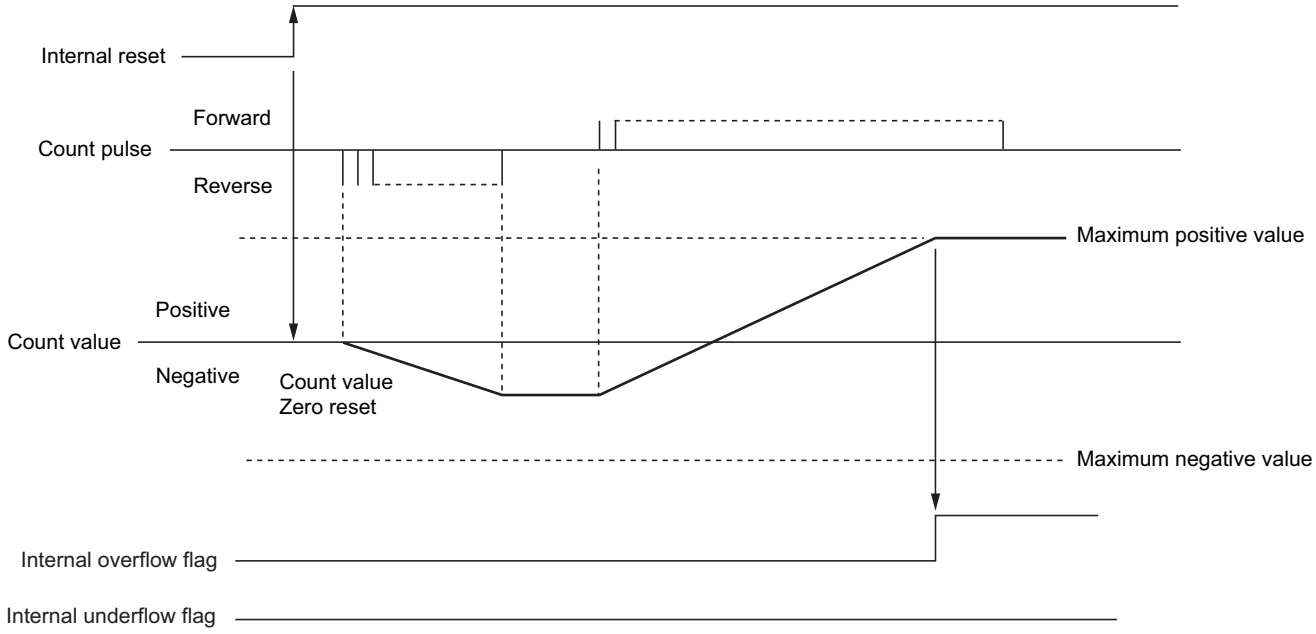
Section 4 Specifications of High-speed Counter FB

4-1 High-speed Counter Module FB

4-1-5 Details of operation modes

(1) Linear operation mode

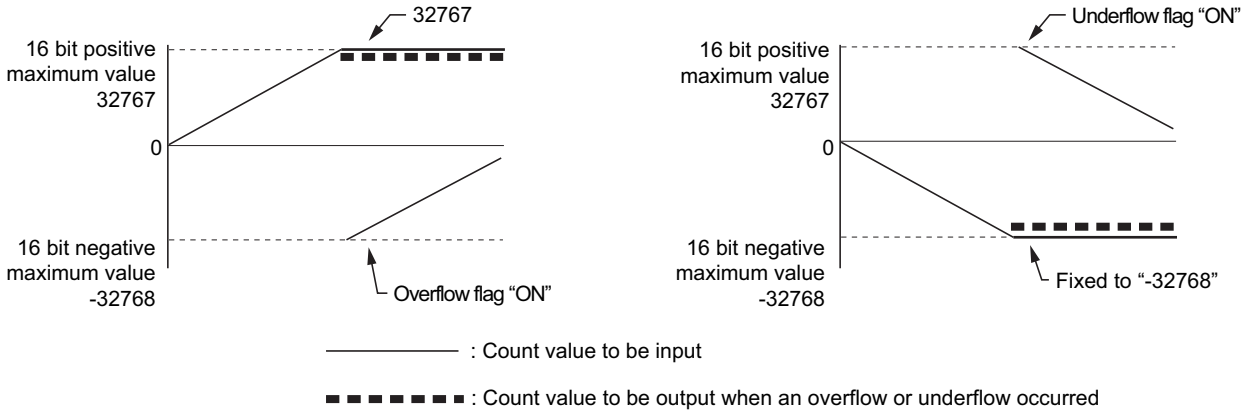
FB is set to select linear operation mode, input pulse format and 16-/32-bit counter. Overflow/underflow flag is cleared by internal reset signal.
If an overflow or underflow flag is detected, count value is set to the positive or negative maximum value.



Note 1: The NP1F-HC8 has no “Linear operation” function.
Note 2: When linear operation mode is used, be sure to use expansion FB (_MHCNTR/_MHCNTRa).

<Linear operation counting range>

1) When 16-bit is specified with NP1F-HC2/HC2MR/HC2MR1



- **Overflow**

  If the UP counting is performed when count value is 32767, overflow flag is set in the error signal and bit data registers, and positive maximum value 32767 is set as the count value to be output.

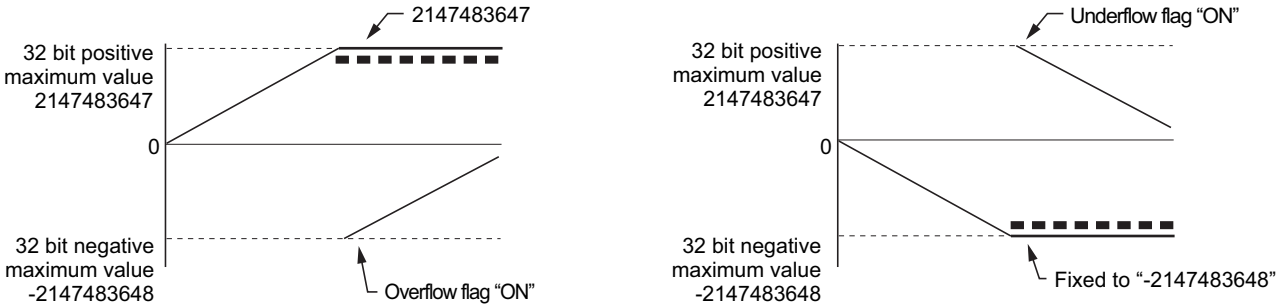
- **Underflow**

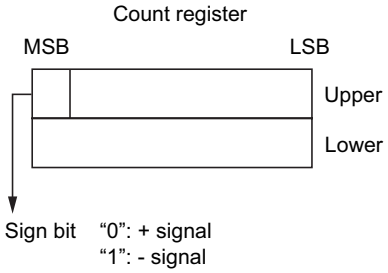
  If the DOWN counting is performed when count value is -32768, underflow flag is set in the error signal and bit data registers, and negative maximum value -32768 is set as the count value to be output.

Section 4 Specifications of High-speed Counter FB

4-1 High-speed Counter Module FB

2) When 32-bit is specified with NP1F-HC2/HC2MR/HC2MR1





- **Overflow**

  If the UP counting is performed when count value is 2147483647, overflow flag is set in the error signal and bit data registers, and positive maximum value 2147483647 is set as the count value to be output.

- **Underflow**

  If the DOWN counting is performed when count value is -2147483648, underflow flag is set in the error signal and bit data registers, and negative maximum value -2147483648 is set as the count value to be output.

Section 4 Specifications of High-speed Counter FB

4-1 High-speed Counter Module FB

(2) Preset operation mode

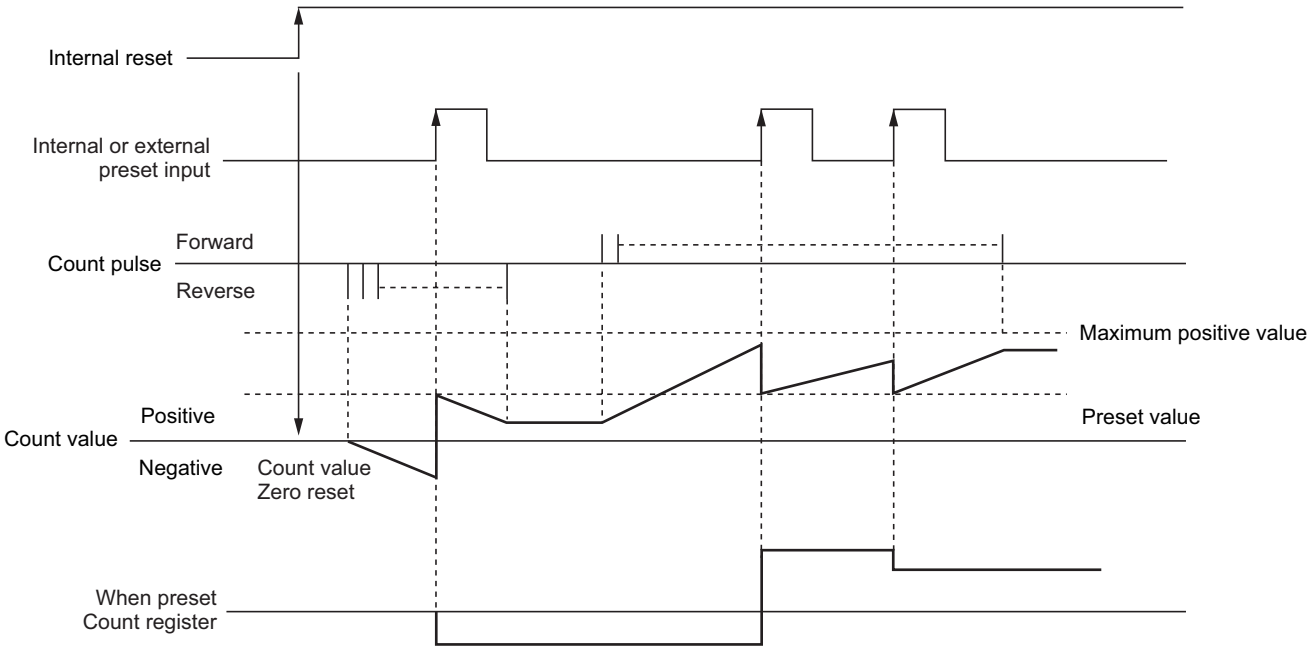
Preset operation is the operation to store the current count value in the preset count register and then rewrite the current count value to an arbitrary value (preset value). The following two methods are available for preset:

- **Internal preset**

  Preset by user application program, where bit command signal 1 of expansion FB, “preset operation/phase-Z detection operation selection enable” is turned on while “preset operation/phase-Z detection operation selection” is turned off. (The expansion FB comes in preset mode select condition.)
  Then, when internal preset command of expansion FB is turned on, preset value is changed to the count value.

- **External preset**

  Bit command signal of expansion FB, “preset operation/phase-Z detection operation selection enable” is turned on, while “preset operation/phase-Z detection operation” is turned off. (The expansion FB comes in preset mode select condition.)
  When an external terminal (preset input) is input, preset value is changed to the count value.



Note 1: Even while pulses are being input, preset is performed at the rising edge of preset input signal.
Note 2: When preset operation mode is used, be sure to use expansion FB (_MHCNTR/_MHCNTRa).

Section 4 Specifications of High-speed Counter FB

4-1 High-speed Counter Module FB

(3) Gate operation (NP1F-HC2/HC2MR/HC2MR1/HC8)

When gate operation mode is selected for linear operation or ring operation, pulses are counted while the internal gate is on or the external gate input is in the count-enabled state. (Linear operation mode is not available with NP1F-HC8.)
When gate input is disabled, pulses are not counted even if pulses are input.
When gate operation mode is not selected, always set in the pulse-counting-enabled state. Otherwise, pulses cannot be counted in other operation modes.

(3) Phase-Z detection operation (NP1F-HC2/HC2MR/HC2MR1)

The current count value is set to the count value at preset operation/phase-Z detection when the origin LS input signal is ON at the rising edge of ON to OFF of the phase-Z detection signal of the external connection signal.

(4) Comparison detection operation (NP1F-HC2/HC2MR/HC2MR1)

By setting comparison detection operation mode for the bit command 1 register, comparison between the count value and comparison value is allowed. Resetting will disable it.
The comparison result is output to the bit information signal and external connection terminal when the count value is equal to or greater than the comparison value.

*** Data which is changeable for setting during FB operation are as follows:**

- Internal reset
- Internal gate (when gate operation mode is selected.)
- Internal preset command (when preset operation mode is selected.)
- Comparison value (when comparison detection mode is selected.)
- Preset value (when preset mode is selected.)

Section 4 Specifications of High-speed Counter FB

4-1 High-speed Counter Module FB

4-1-6 Error information

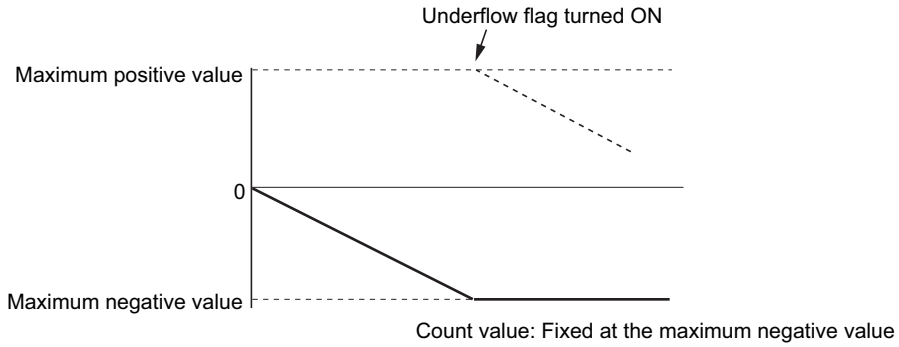
The FB always monitors the state of control, and outputs error information to the bit information.
The following describes the error types, cause of errors, and handling of errors.

(1) Linear operation underflow

When the counter attempts to count down from the maximum negative value, an underflow flag is set.

<Handling of the error>

The counter holds the maximum negative value as the count value and waits for an internal reset.
After the internal reset signal is turned on and the count value is cleared to zero, the counter restarts its processing.

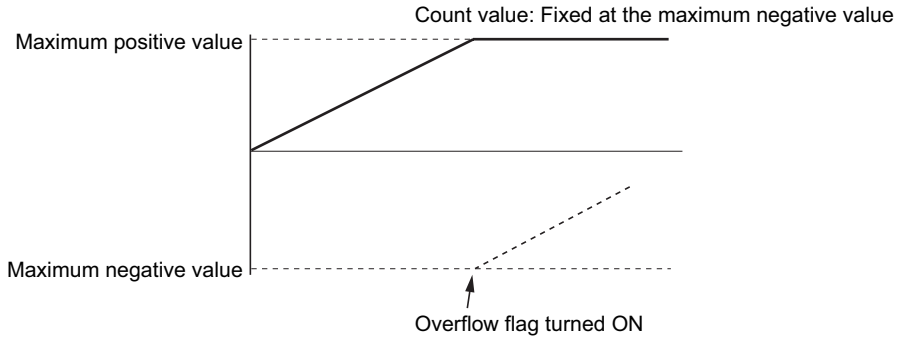


(2) Linear operation overflow

When the counter attempts to count up from the maximum positive value, an overflow flag is set.

<Handling of the error>

The counter holds the maximum positive value as the count value and waits for an internal reset.

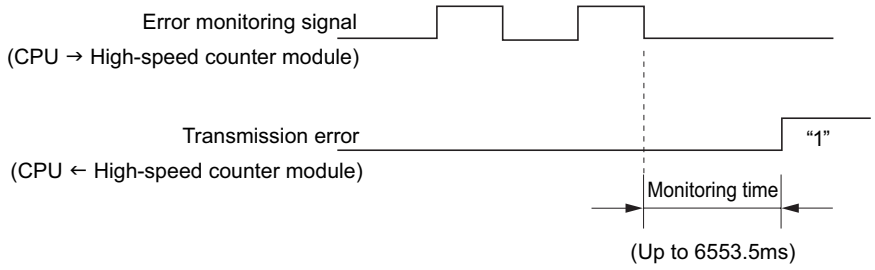


(3) Transmission error

Data transmission between the CPU and the high-speed counter module is checked.
At initialization, the error monitoring time is set. Then, the CPU continues to send error monitoring signals to the high-speed counter module. When the high-speed counter module cannot receive an error monitoring signal within the specified time by some reason, it generates a transmission error signal. Transmission errors are supported only for channel 1.

<Handling of the error>

The alarm is reset with the alarm reset signal. After internal reset is turned on, the counter continues its processing.



Section 4 Specifications of High-speed Counter FB

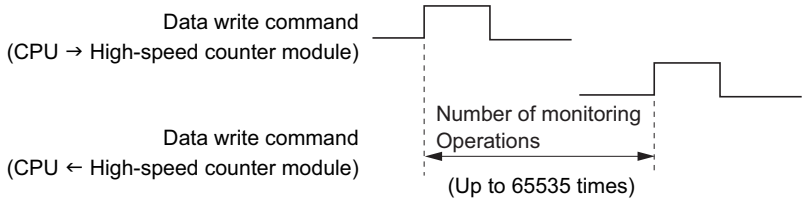
4-1 High-speed Counter Module FB

(4) Register write monitoring time-up

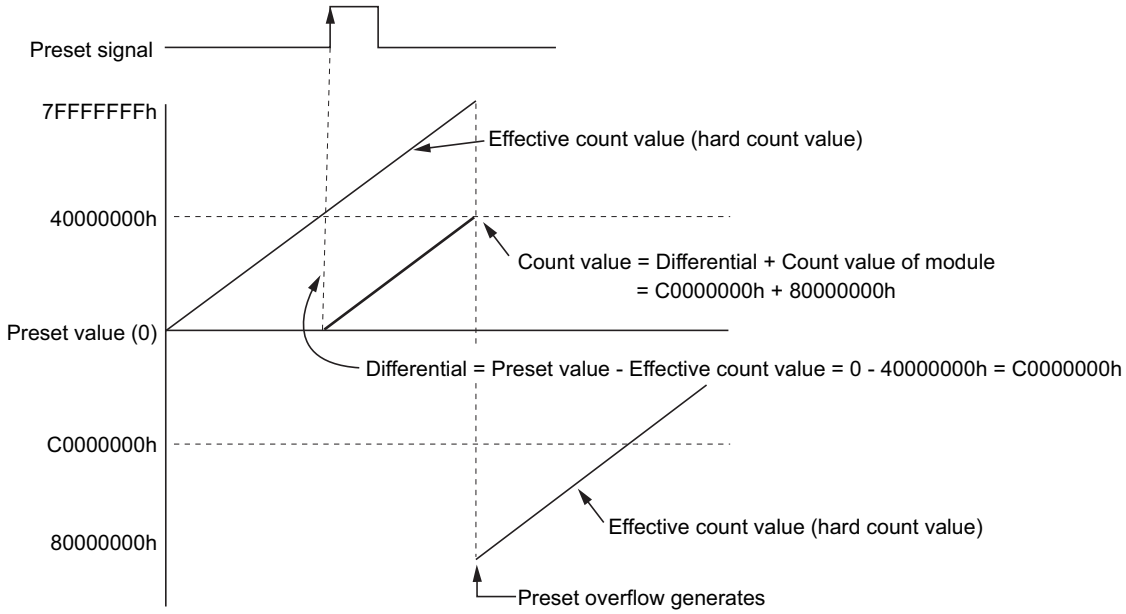
Data written from the CPU to the high-speed counter module is checked.
When the response time to data written from the high-speed counter module to the CPU could not reach the number of monitoring scan operations after the CPU outputs the data write command to the high-speed counter module, the register write monitoring timer error signal is generated.
The data write response signal is checked once at a each scan operation.

<Handling of the error>

The register write monitoring timer error signal is reset with the alarm reset signal.
Register write monitoring time-up is reset when restarted after changing the register write monitoring value. (During linear operation/preset operation)



(5) Preset overflow (During linear operation mode/preset operation)



The function block outputs an actual count value of module with a differential added. Although the user does not usually need to consider this, it is necessary to consider the difference when changing the count value using a preset value.
When a preset value is inappropriate as shown in the figure above, an overflow occurs while the count value is output.

<Handling of the error>

The counter holds the maximum value (7FFFFFFFh/7FFFH) as the count value and waits for an internal reset. After the internal reset (the count value is cleared to zero), the counter restarts its processing.

Section 4 Specifications of High-speed Counter FB

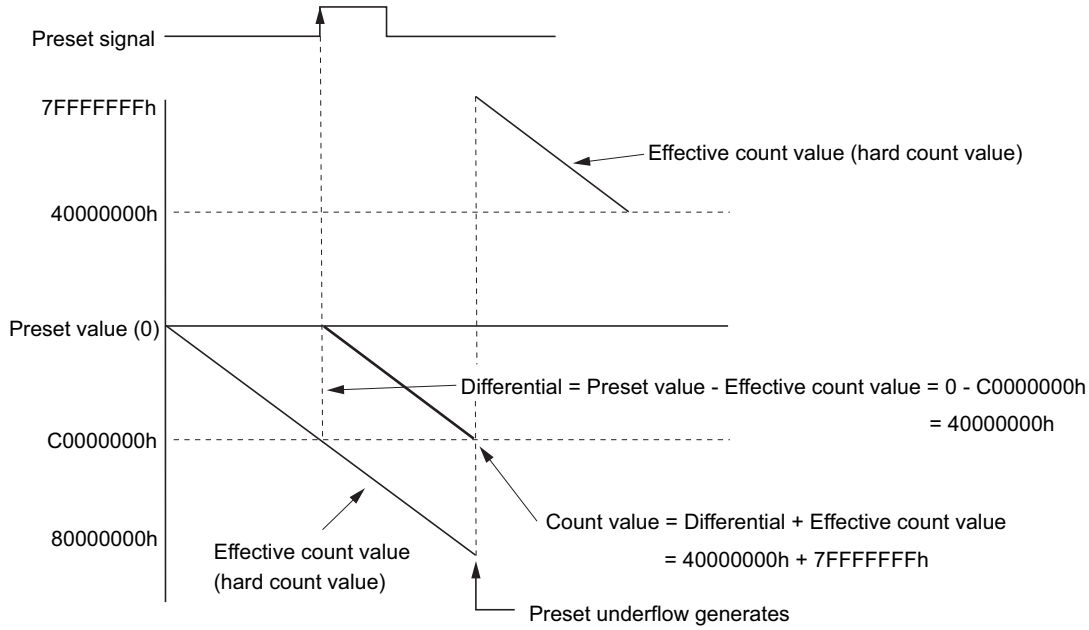
4-1 High-speed Counter Module FB

(6) Preset underflow (During linear operation mode/preset operation)

The function block outputs an actual count value of module with a differential added. Although the user does not usually need to consider this, it is necessary to consider the difference when changing the count value using a preset value.
When a preset value is inappropriate as shown in the figure below, an underflow occurs while the count value is output.

<Handing of the error>

The counter holds the holds the maximum value (80000000h/8000h) as the count value and waits for an internal reset. After the internal reset (the count value is cleared to zero), the counter restarts its processing.



(7) Parameter error 1

When a comparison value, preset value, error monitoring timer 1, or error monitoring timer 2 has an invalid format, or the setting value is out of the range, a parameter error 1 occurs.
For example, 32-bit data is specified when 16 bits are selected for the count value.

<Handling of the error>

After initialization, wait for a change of the setting value, and the counter continues its processing when the setting value has been changed.
During operation, the counter continues its processing with the appropriate previous value.

Section 4 Specifications of High-speed Counter FB

4-1 High-speed Counter Module FB

(8) Parameter error 2

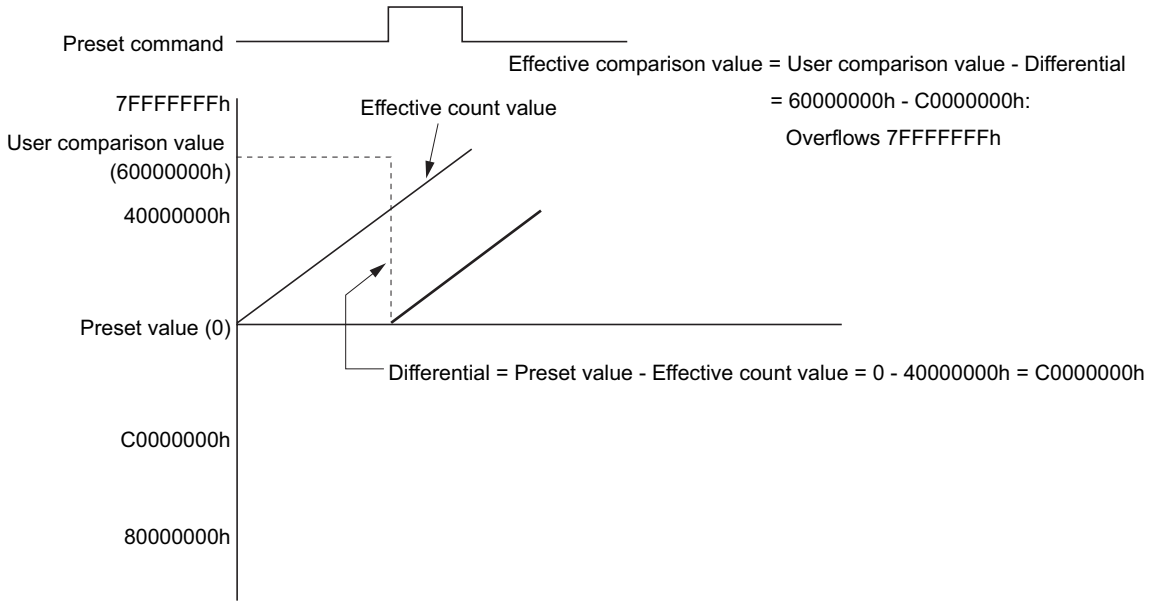
The hardware detects comparisons. Thus, the effective comparison value (hard comparison value) specified in the hardware must be calculated from the user comparison value. When there is a change for preset operation or user comparison value, the effective comparison value is calculated using the following formula:

Effective comparison value = User comparison value - Differential

The parameter error occurs when the calculated effective comparison value is out of the range, as shown in the figure below:

<Handling of the error>

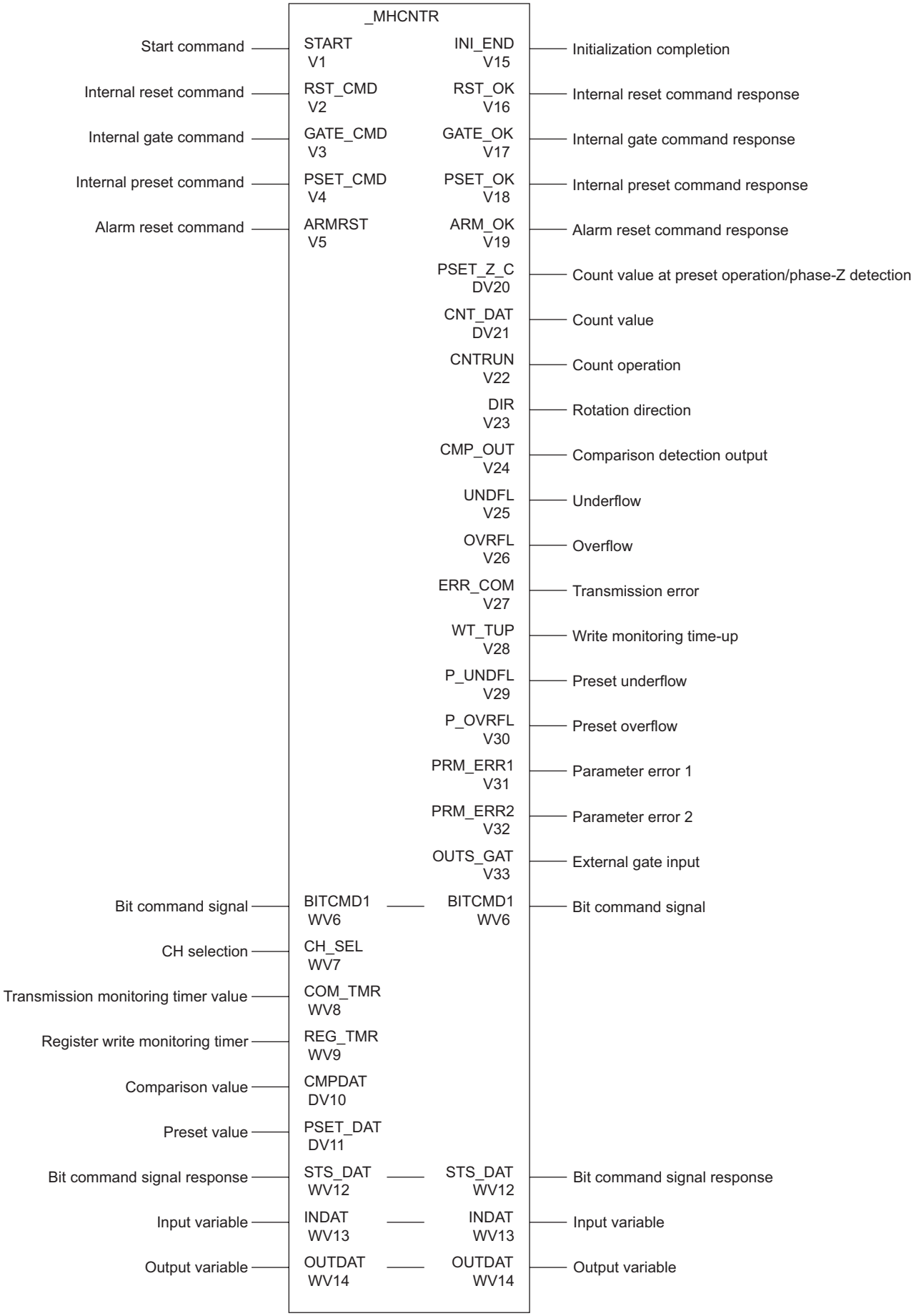
The counter continues its processing with the appropriate previous value.



4-1 High-speed Counter Module FB

4-1-7 High-speed counter FB (muitifunctional version) _MHCNTR/_MHCNTRa

(1) FB format



4-1 High-speed Counter Module FB

(2) Description of FB parameters

Prameter		Data type	I/O	Description
Start command (START)	V0001	BOOL	IN	Rising edge: Waiting for internal reset command (Valid when "ON") Falling edge: Waiting for the rising edge of the start command * When using both CH1 and CH2, start up them simultaneously.
Internal reset command (RST_CMD)	V0002	BOOL	IN	Rising edge: Outputs the reset command to the high-speed counter module.
Internal gate command (GATE_CMD)	V0003	BOOL	IN	Command when gate operation is enabled. ON: Enables the module to count OFF: Forbids the module to count
Internal preset command (PSET_CMD)	V0004	BOOL	IN	Command when preset operation is enabled. Rising edge: Performs preset
Alarm reset command (ARMRST)	V0005	BOOL	IN	Command valid only when an alarm (for a transmission error or register monitoring time-up) is generated. Rising edge: Alarm reset
Bit command signa (BITCMD1)	WV0006	* Note 1	IN_OUT	Refer to <Signal assignment of bit command signal>. (Two-word area is required.)
CH selection (CH_SEL)	WV0007	INT	IN	Specifies the channel of the counter. 0: CH1, 1: CH2
Transmission monitoring timer value (COM_TMR)	WV0008	UINT	IN	Valid when the value in the error monitoring timer register of the high-speed counter module is used and CH1 is specified. Up to 6553.5 ms by 0.1ms Setting "0" disables transmission monitoring and no transmission errors will be generated.
Register write monitoring timer (REG_TMR)	WV0009	UINT	IN	Timer to monitor the response after data is written to the register in the high-speed counter module. The unit is a single scan action, and up to 65535 scan actions are countable. Setting "0" disables monitoring.
Comparison value (CMPDAT)	DV0010	DINT	IN	Comparison value that is used in comparison detection mode. Enabled when comparison detection mode (comparison detection operation selection of bit command signal) is not selected. 16-bit selected: -32768 to 32767 32-bit selected: -2147483648 to 2147483647
Preset value (PSET_DAT)	DV0011	DINT	IN	Preset value that is used in preset mode. Enabled when preset mode (preset operation/phase-Z detection operation selection enabnle or preset operation/ phase-Z operation selection of bit command signal) is not selected. 16-bit selected: -32768 to 32767 32-bit selected: -2147483648 to 2147483647
Bit command signal response (STS_DAT)	WV0012	* Note 2	IN_OUT	Refer to <Signal assignment of bit command signal>. (Two-word area is required.)
Input variable (INDAT)	WV0013	WORD	IN_OUT	Specifies the input first address and the output first address of the high-speed counter module.
Output variable (OUTDAT)	DV0014	DWORD	IN_OUT	
Initialization completion (INI_END)	V0015	BOOL	OUT	Turned on after the start command has been raised and initialization has been completed.
Internal reset command response (RST_OK)	V0016	BOOL	OUT	Used as the response signal to the internal reset command.
Internal gate command response (GATE_OK)	V0017	BOOL	OUT	Response signal used when gate operation is enabled. Used as the response signal to the internal gate command.
Internal preset command response (PSET_OK)	V0018	BOOL	OUT	Response signal used when preset operation is enabled. Rising edge: Performs preset
Alarm reset command response (ARM_OK)	V0019	BOOL	OUT	Used as the response signal to the alarm reset command when alarm (for a transmission error or register monitoring time-up) is generated.

4-1 High-speed Counter Module FB

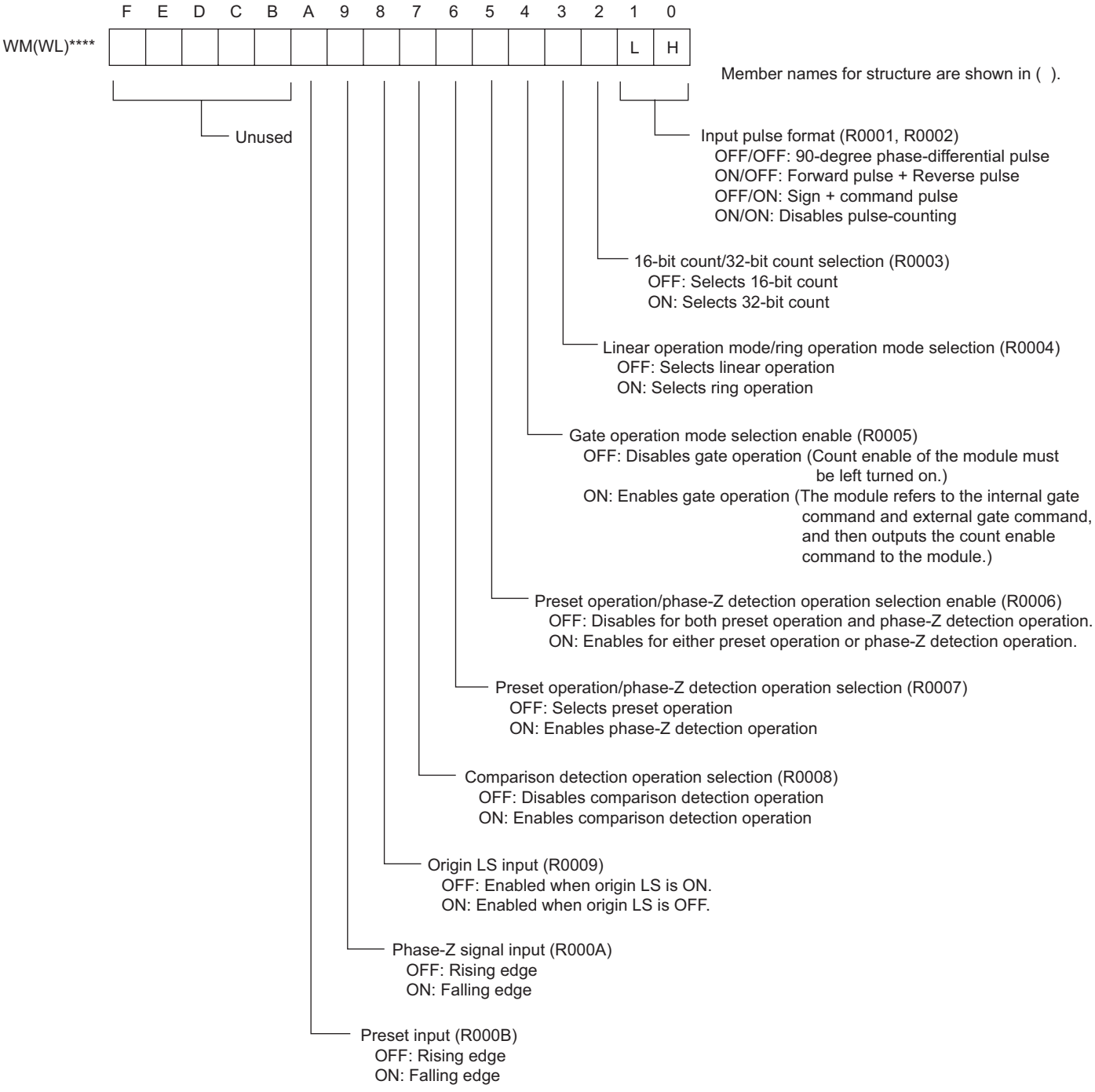
Count value at preset operation /phase-Z detection (PSET_Z_C)	DV0020	DINT	OUT	When preset operation is selected: outputs the value used when presetting is performed. When phase-Z detection operation is selected: outputs the value used when phase-Z is detected.
Count value (CNT_DAT)	DV0021	DINT	OUT	Outputs the counter value to be input. When preset operation mode is selected, the value actually input is different from the counter value. 16-bit selected: -32768 to 32767 32-bit selected: -2147483648 to 2147483647
Count operation (CNTRUN)	V0022	BOOL	OUT	ON during counting operation of the high-speed counter module. OFF: Stopped ON: Counting
Rotation direstion (DIR)	V0023	BOOL	OUT	Outputs the current rotation direction of the high-speed counter module. OFF: Forward ON: Reverse
Comparison detection output (CMP_OUT)	V0024	BOOL	OUT	Detection signal enabled when comparison detection mode is selected. Outputs comparison detection of the high-speed counter module. OFF: When Counter value < Comparison value ON: When Counter value >= Comparison value
Underflow (UNDFL)	V0025	BOOL	OUT	Turned on when an underflow occurs from the specified 16 bits or 32 bits in linear operation. The underflow is cleared by rising the internal reset signal.
Overflow (OVRFL)	V0026	BOOL	OUT	Turned on when an overflow occurs from the specified 16 bits or 32 bits in linear operation. The overflow is cleared by rising the internal reset signal.
Transmission error (ERR_COM)	V0027	BOOL	OUT	Enabled only for CH1 and when the transmission error monitoring timer is not "0". Outputs a transmission error of the high-speed counter module. The state is cleared by turning on the alarm reset command.
Write monitoring time-up (WT_TUP)	V0028	BOOL	OUT	Enabled only when the value in the register write monitoring time is not "0". Turned on when the high-speed counter module does not return a response signal within the time specified in the write monitoring timer (the number of scan counts). The state is cleared by turning on the start command after changing the value of the regisiter write monitoring timer.
Preset underflow (P_UNDFL)	V0029	BOOL	OUT	Enabled only when preset operation mode is selected. Turned on when the preset value underflows the specified 16 bits or 32 bits. The state is cleared by turning on the internal reset signal. * Refer to "4-1-6 (6) Preset underflow" for the details.
Preset overflow (P_OVRFL)	V0030	BOOL	OUT	Enabled only when preset operation mode is selected. Turned on when the preset value overflows the specified 16 bits or 32 bits. The state is cleared by turning on the internal reset signal. * Refer to "4-1-6 (5) Preset overflow" for the details.
Parameter error 1 (PRM_ERR1)	V0031	BOOL	OUT	Turned on when the specified value is out of the range (has a format failure). The state is cleared by changing the value and turning on the internal reset command.
Parameter error 2 (PRM_ERR2)	V0032	BOOL	OUT	When preset operation mode is selected: Turned on when the preset command has been raised and the preset value has been changed or when differentials are detected, or an overflow or underflow has occurred when counting the value to be output. (Enabled only when the 16-bit counter is specified.) * Refer to "4-1-6 Error information" for the details.
External gate input (OUTS_GAT)	V0033	BOOL	OUT	Outputs the external gate input state to be set from the high-speed counter module. Data from the high-speed counter module is inverted to output.

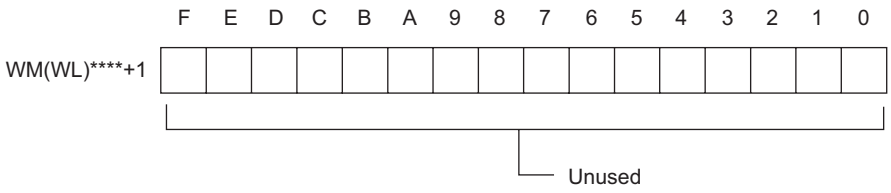
Section 4 Specifications of High-speed Counter FB _MHCNTR

4-1 High-speed Counter Module FB

*** Note 1: Signal assignment of bit cpmmand signal WV0006**

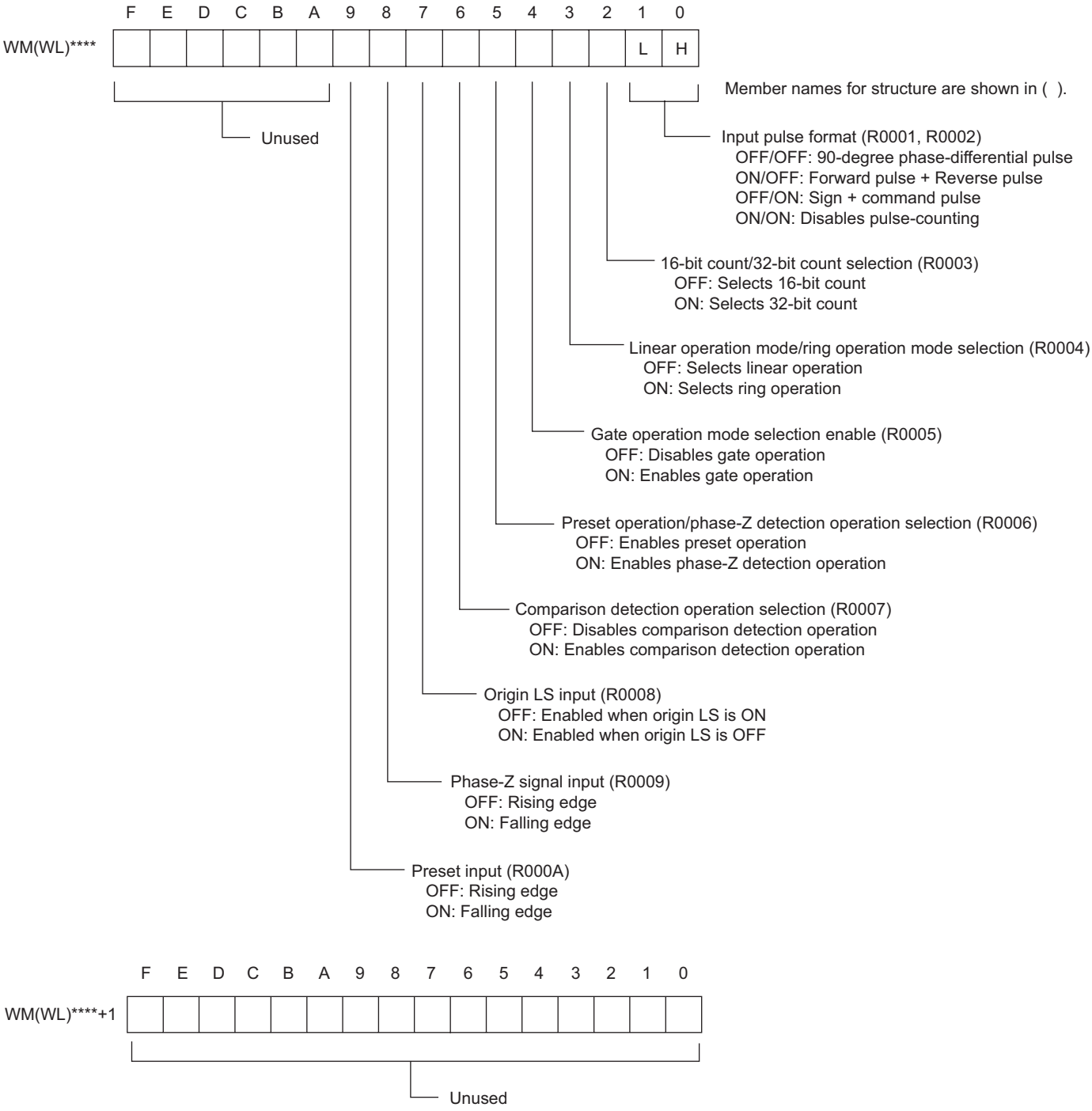
At the rising edge of the start command (V0001), this area is reflected to the high-speed counter module.





4-1 High-speed Counter Module FB

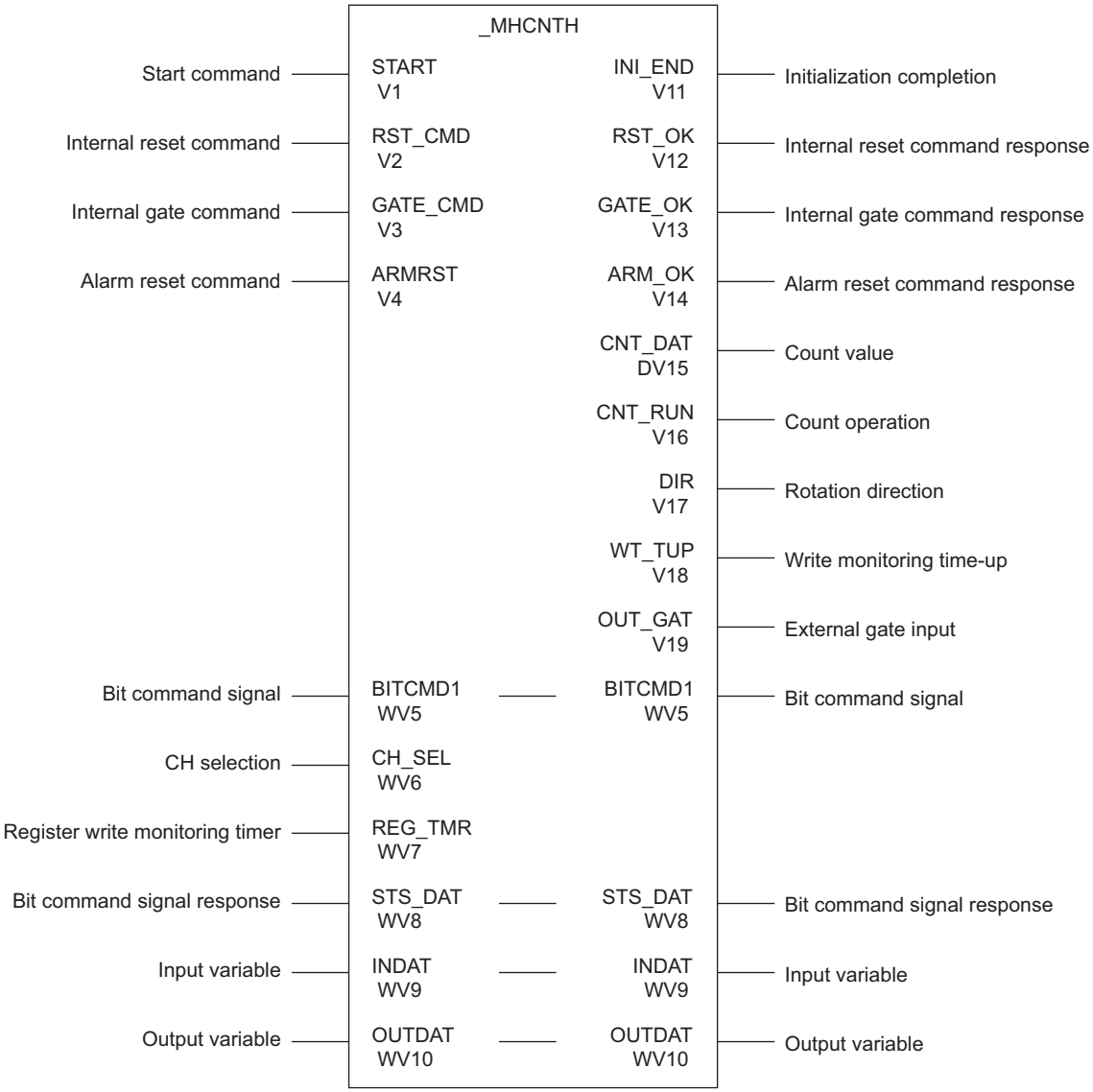
*** Note 2: Signal assignment of bit command signal response WV0012**



4-1 High-speed Counter Module FB

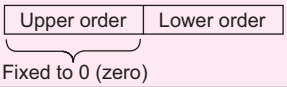
4-1-8 High-speed counter FB (standard version) _MHCNTH/_MHCNTHa

(1) FB format



4-1 High-speed Counter Module FB

(2) Description of FB parameters

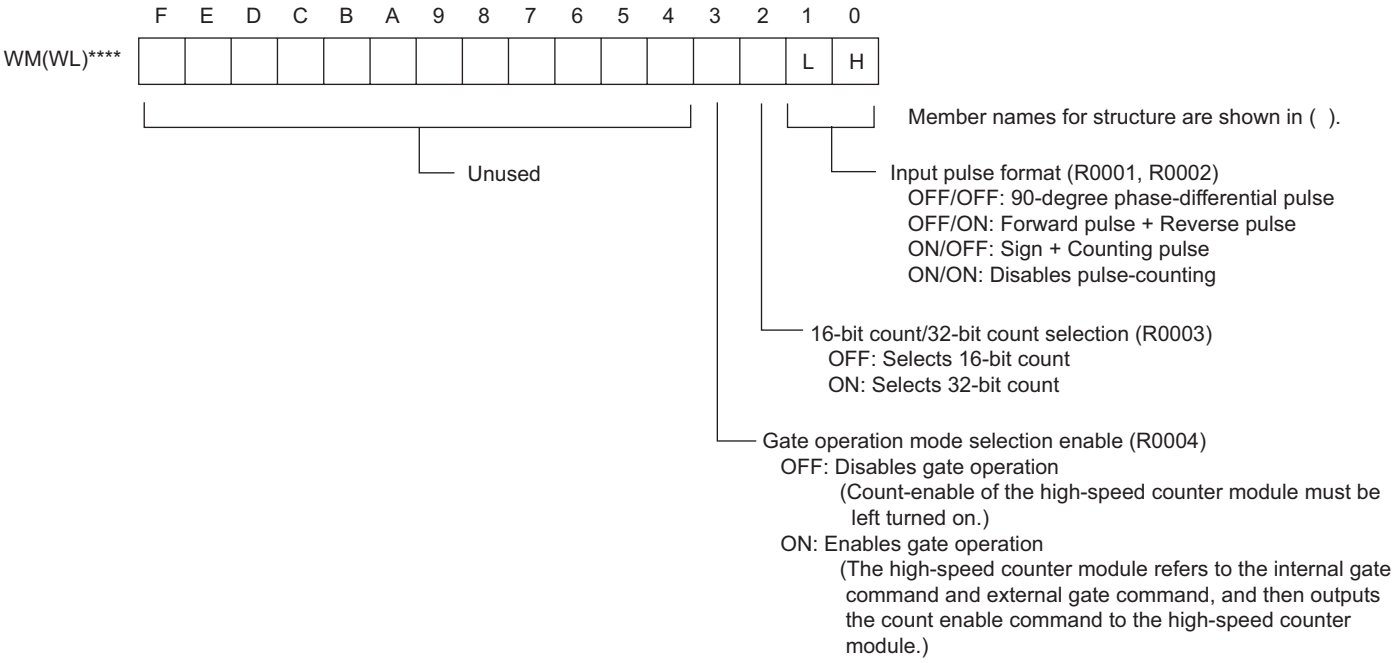
Parameter		Data type	I/O	Description
Start command (START)	V0001	BOOL	IN	At the rising edge of this signal, processing to operate the counter FB is performed.
Internal reset command (RST_CMD)	V0002	BOOL	IN	If this signal is turned on while start command is on, reset command is output to the high-speed counter module. (At the rising edge of this signal)
Internal gate command (GATE_CMD)	V0003	BOOL	IN	Command when gate operation is enabled. ON: Enables the module to count OFF: Forbits the module to count
Alarm reset command (ARMRST)	V0004	BOOL	IN	Command enabled only when an alarm (for a transmission error or register monitoring time-up) is generated. Rising edge: Alarm reset
Bit command signal (BITCMD1)	WV0005	* Note 1	IN_OUT	Refer to <Signal assignment of bit command signal>. (Two-word area is required.)
CH selection (CH_SEL)	WV0006	INT	IN	Specifies the channel of the counter. 0: CH1, 1: CH2
Register write monitoring timer (REG_TMR)	WV0007	UINT	IN	Timer to monitor the response after data is written to the register in the high-speed counter module. The unit is a single scan action, and up to 65535 scan actions are countable. Setting "0" disables monitoring.
Bit command signal response (STS_DAT)	WV0008	* Note 2	IN_OUT	Refer to <signal assignment of bit command signal response>. (Two-word area is required.)
Input variable (INDAT)	WV0009	WORD	IN_OUT	Specifies the input first address and the output first address of the high-speed counter module.
Output variable (OUTDAT)	DV0010	DWORD	IN_OUT	
Initialization completion (INI_END)	V0011	BOOL	OUT	Turned on after the start command has been raised and initialization has been completed.
Internal reset command response (RST_OK)	V0012	BOOL	OUT	Used as the response signal to the internal reset command.
Internal gate command response (GATE_OK)	V0013	BOOL	OUT	Response signal used when gate operation is enabled. Used as the response signal to the internal gate command.
Alarm reset response (ARM_OK)	V0014	BOOL	OUT	Used as the response signal to the alarm reset command when alarm (for a transmission error or register monitoring time-up) is generated.
Count value (CNT_DAT)	DV0015	DINT	OUT	Outputs the counter value to be input. 16-bit selected: -32768 to 32767 32-bit selected: -2147483648 to 2147483647 * When 16 bit is selected, only lower-order word is used. 
Count operation (CNT_RUN)	V0016	BOOL	OUT	ON during counting operation of the high-speed counter module. OFF: Stopped ON: Counting
Rotation direstion (DIR)	V0017	BOOL	OUT	Outputs the current rotation direction of the high-speed counter module. OFF: Forward ON: Reverse
Write monitoring time-up (WT_TUP)	V0018	BOOL	OUT	Enabled only when the value in the register write monitoring time is not "0". Turned on when the high-speed counter module does not return a response signal within the time specified in the write monitoring timer (the number of scan counts). The state is cleared by turning on the start command after changing the value of the regisiter write monitoring timer.
External gate input (OUT_GATE)	V0019	BOOL	OUT	Outputs the external gate input state to be set from the high-speed counter module. Data from the high-speed counter module is inverted to output.

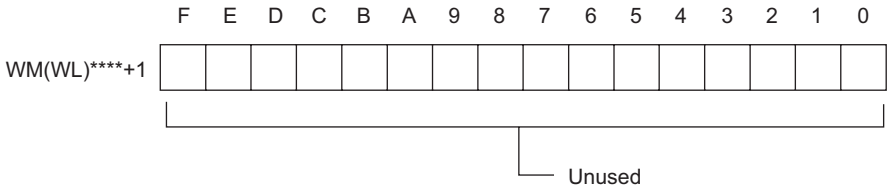
Section 4 Specifications of High-speed Counter FB _MHCNTH

4-1 High-speed Counter Module FB

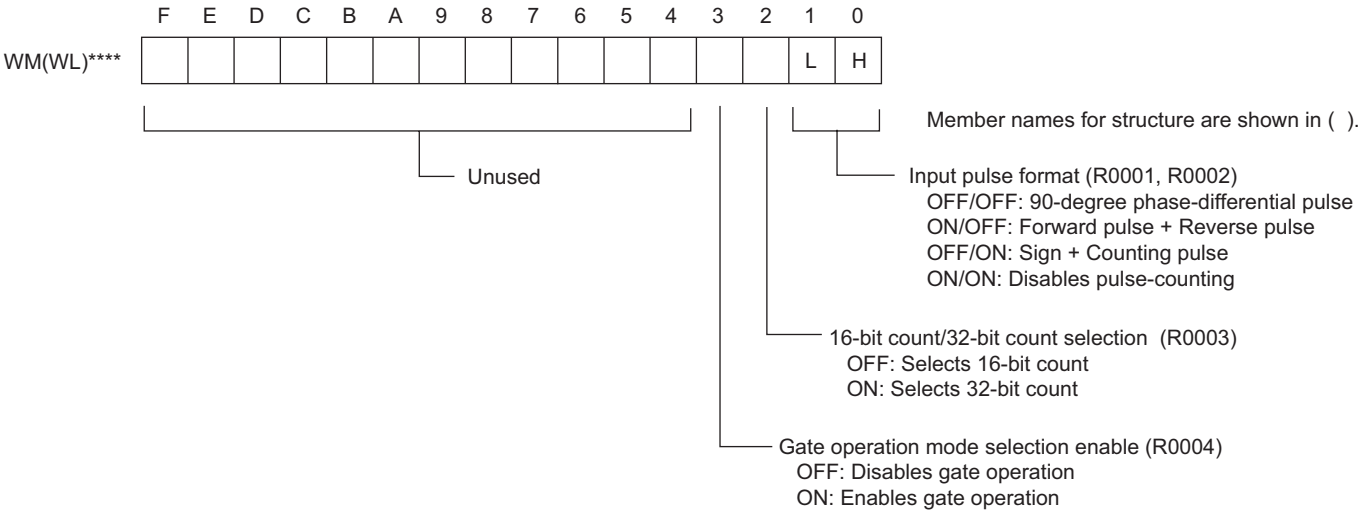
*** Note 1: Signal assignment of bit cpmmand signal WV0005**

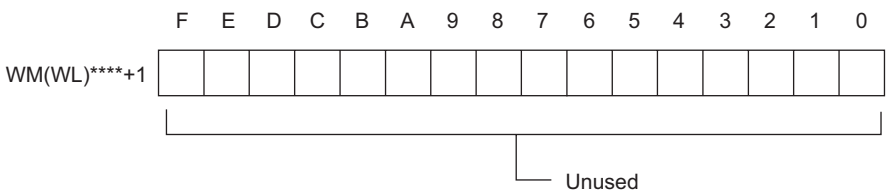
At the rising edge of the start command (START), this area is reflected to the HC8 module.





*** Note 2: Signal assignment of bit cpmmand signal response WV0008**

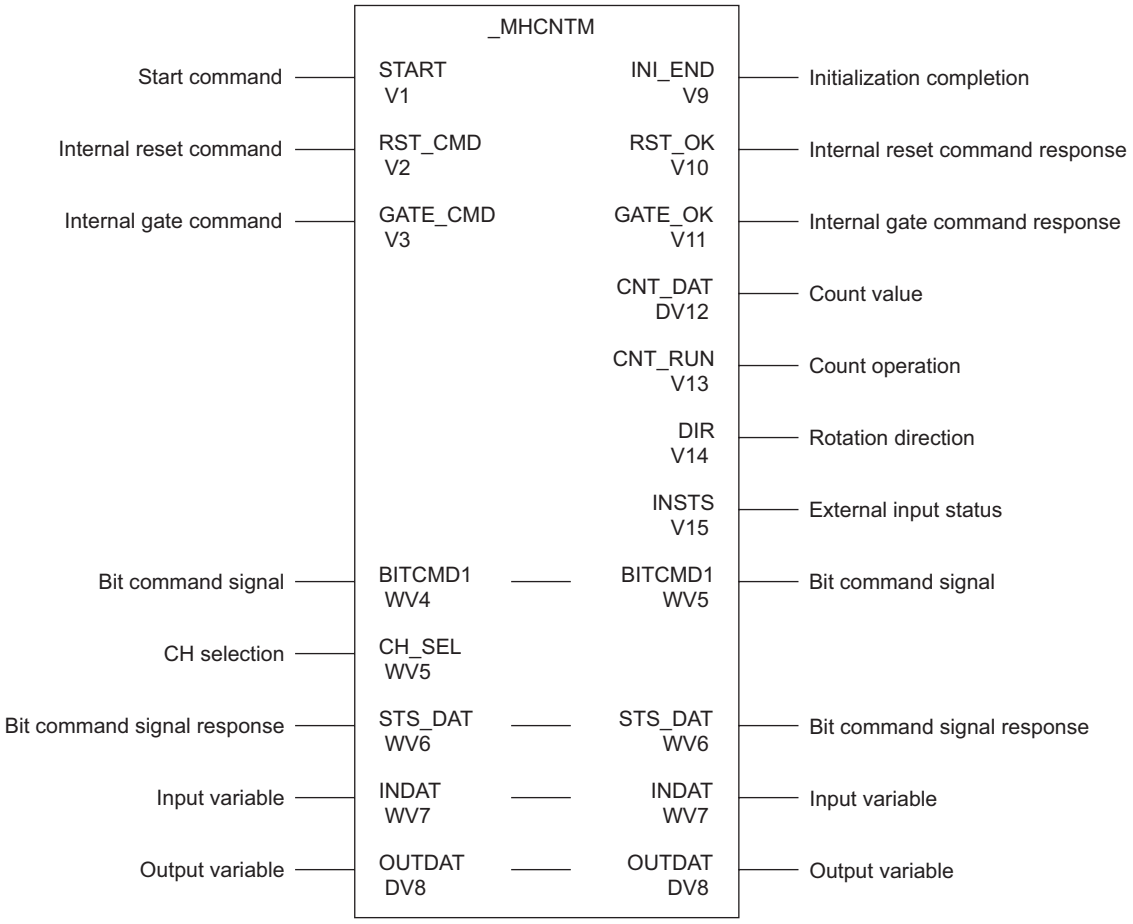




4-1 High-speed Counter Module FB

4-1-9 Multichannel counter FB _MHCNTM/_MHCNTMa

(1) FB format



4-1 High-speed Counter Module FB

(2) Description of FB parameters

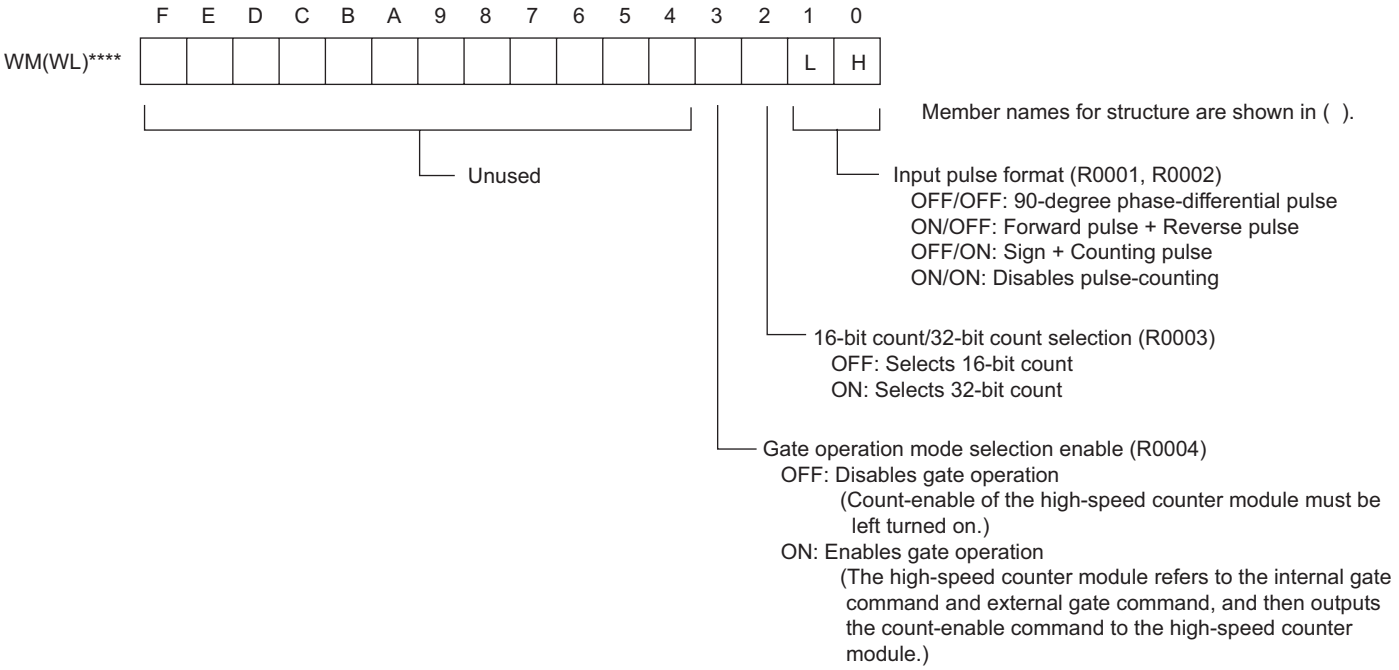
Prameter		Data type	I/O	Description
Start command (START)	V0001	BOOL	IN	At the rising edge of this signal, processing to operate the counter FB is performed.
Internal reset command (RST_CMD)	V0002	BOOL	IN	If this signal is turned on while start command is on, reset command is output to the high-speed counter module. (At the rising edge of this signal)
Internal gate command (GATE_CMD)	V0003	BOOL	IN	Command when gate operation is enabled. ON: Turns on the external input changeover signal of the high-speed counter module. OFF: Turns off the external input changeover signal of the high-speed counter module.
Bit command signal (BITCMD1)	WV0004	* Note 1	IN_OUT	Refer to <Signal assignment of bit command signal>. (Two-word area is required.)
CH selection (CH_SEL)	WV0005	INT	IN	Specifies the channel of the counter. 0: CH1, 1: CH1 2: CH2, 3: CH3, 4: CH4, 5: CH5, 6: CH6, 7:CH7
Bit command signal response (STS_DAT)	WV0006	* Note 2	IN_OUT	Refer to <signal assignment of bit command signal response>. (Two-word area is required.)
Input variable (IN_DAT)	WV0007	WORD	IN_OUT	Specifies the input first address and the output first address of the high-speed counter module.
Output variable (OUT_DAT)	DV0008	DWORD	IN_OUT	
Initialization completion (INI_END)	V0009	BOOL	OUT	Turned on after the start command has been raised and initialization has been completed.
Internal reset command response (RST_OK)	V0010	BOOL	OUT	Used as the response signal to the internal reset command.
Internal gate command response (GATE_OK)	V0011	BOOL	OUT	Response signal used when gate operation is enabled. Used as the response signal to the internal gate command.
Count value (CNT_DAT)	DV0012	DINT	OUT	Outputs the counter value to be input. 16-bit selected: -32768 to 32767 32-bit selected: -2147483648 to 2147483647
Count operation (CNT_RUN)	V0013	BOOL	OUT	ON during counting operation of the high-speed counter module OFF: Stopped ON: Counting
Rotation direstion (DIR)	V0014	BOOL	OUT	Outputs the current rotation direction of the high-speed counter module. OFF: Forward ON: Reverse
External input status (INSTS)	V0015	BOOL	OUT	Indicates the external input status of the status signal of the high-speed counter module. OFF: OFF ON: ON

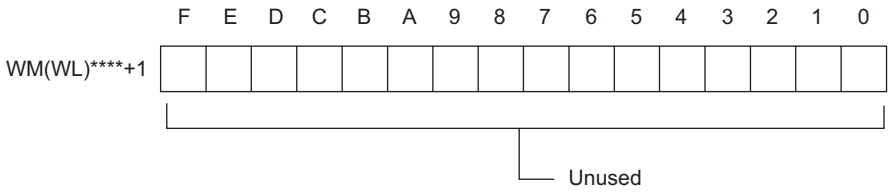
Section 4 Specifications of High-speed Counter FB _MHCNTM

4-1 High-speed Counter Module FB

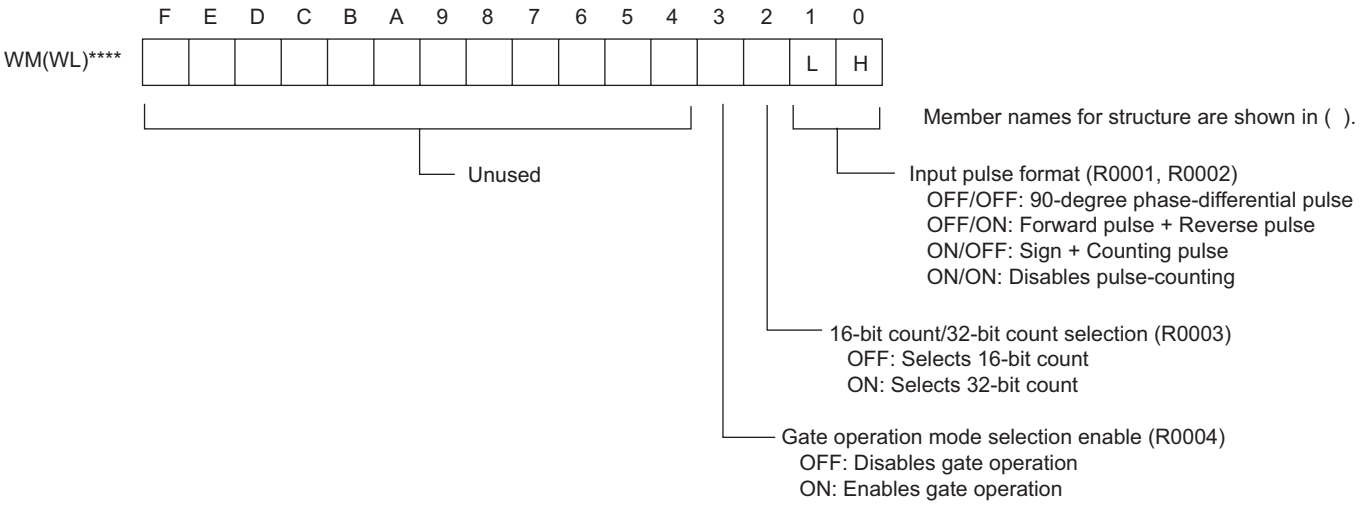
*** Note 1: Signal assignment of bit cpmmand signal WV0004**

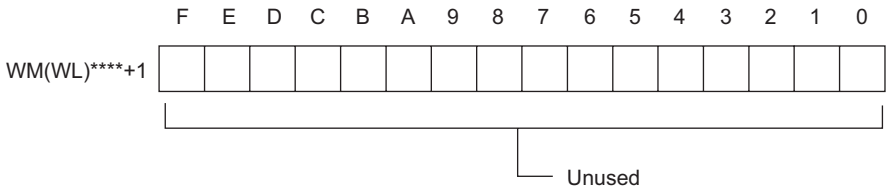
At the rising edge of the start command (START), this area is reflected to the HC8 module.





*** Note 2: Signal assignment of bit cpmmand signal response WV0006**





4-2 High-speed Input Module Counter FB

4-2-1 Overview of FB

The high-speed counter function can be realized by using the high-speed input module (NP1X3206-A) together with the high-speed input counter expansion FB.

<Functional overview>

1) Pulse input format selection

- 90 phase difference pulse
- Positive rotation pulse + Negative rotation pulse
- Pulse command + Sign signal

2) Operation mode

- Ring operation
- Gate operation
- Reset operation

3) Counting range

- Signed binary 16 bits (–32768 to 32767)
- Signed binary 32 bits (–2147483648 to 2147483647)

4-2-2 Memory size of FB

FB name	Positioning control module	Program step	User FB memory	User memory
HIgh-speed input FB (_MHCNTD/_MHCNTDa)	NP1X3206-A	Approx. 0.35k steps	46 words	10 words

*** “a” is suffixed to the name of the FB supporting array/structure.**

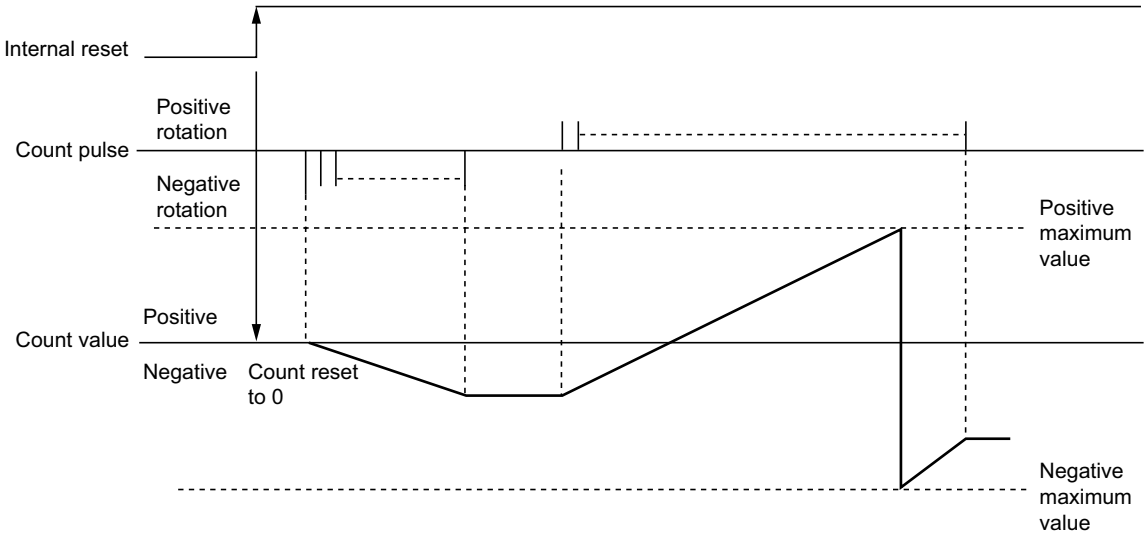
Note: When using FBs supporting array/structure, use V2.2.3.0 or later version of Standard loader.

4-2 High-speed Input Module Counter FB

4-2-3 Count operation mode

(1) Ring operation mode

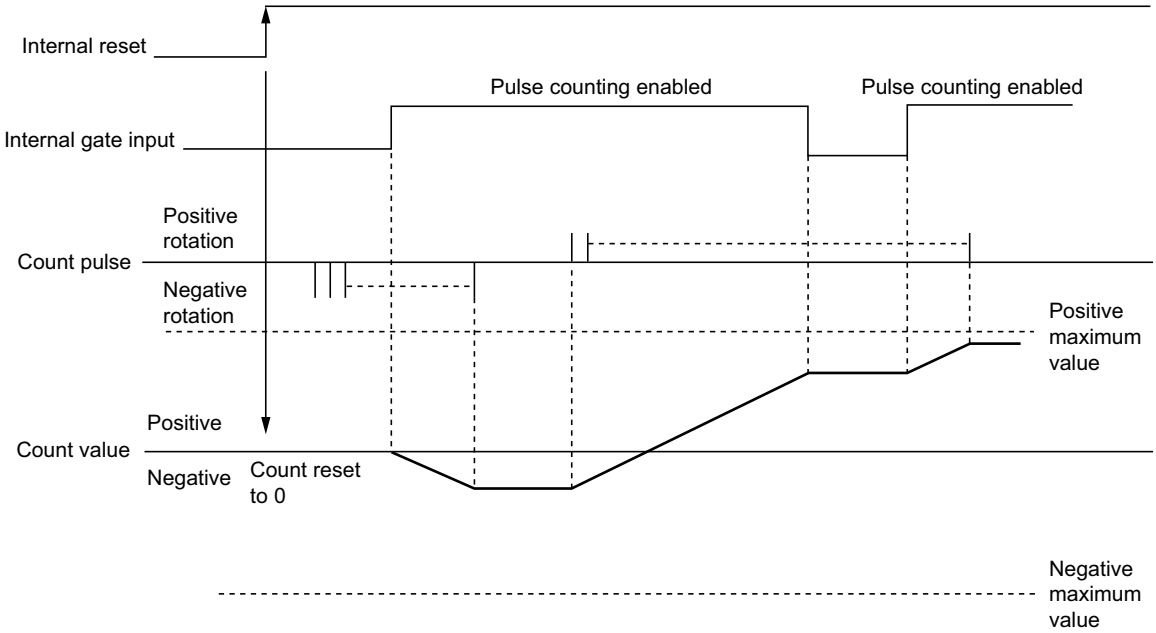
Input pulse mode and 16-/32-bit count selection are set by the function block (FB). No overflow or underflow occurs.



* The counting range can be set to 16- or 32-bit signed binary value by internal setting.

(2) Gate operation mode

Pulse counting is performed when the internal gate input is in count enabled state.
Internal gate: Counting enabled when the 4th bit of the bit command signal is ON. (Setting required for every four channels.)

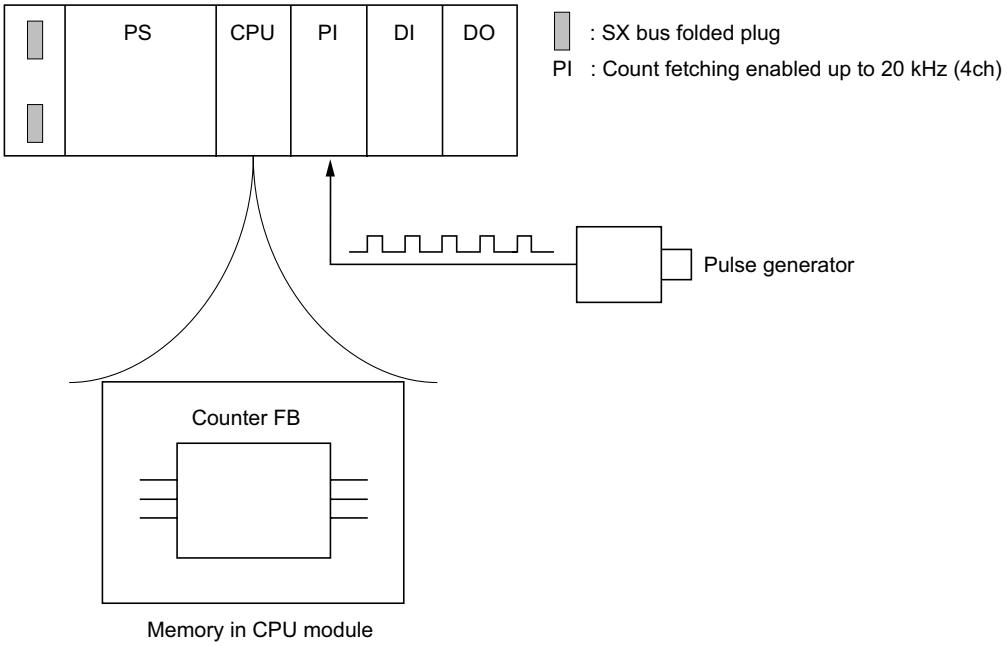


* Pulse counting is performed only when the internal gate input is in count enabled state.
  When the gate input is in the count disabled state, no pulse counting occurs for pulse inputs, if any.
* The counting range can be set to 16- or 32-bit signed binary value by internal setting.

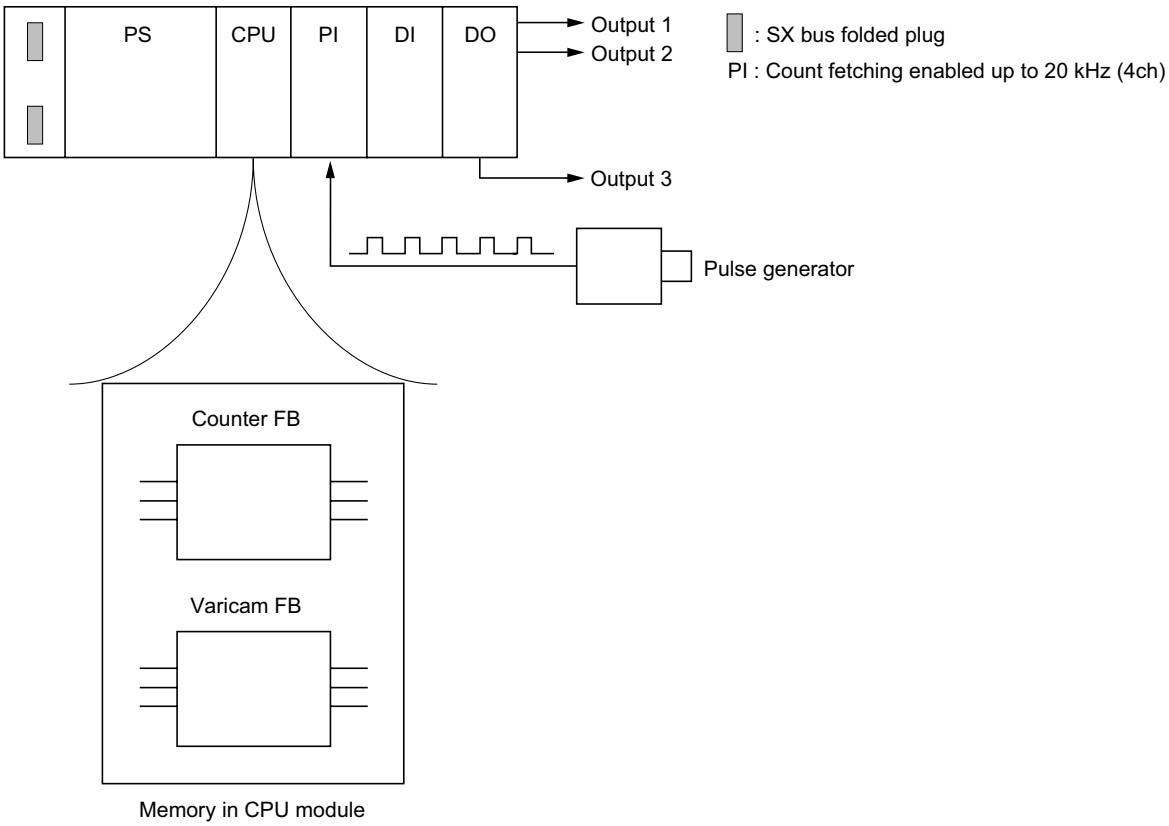
4-2 High-speed Input Module Counter FB

4-2-4 Sample applications of counter expansion FB

(1) Counting pulses from outside

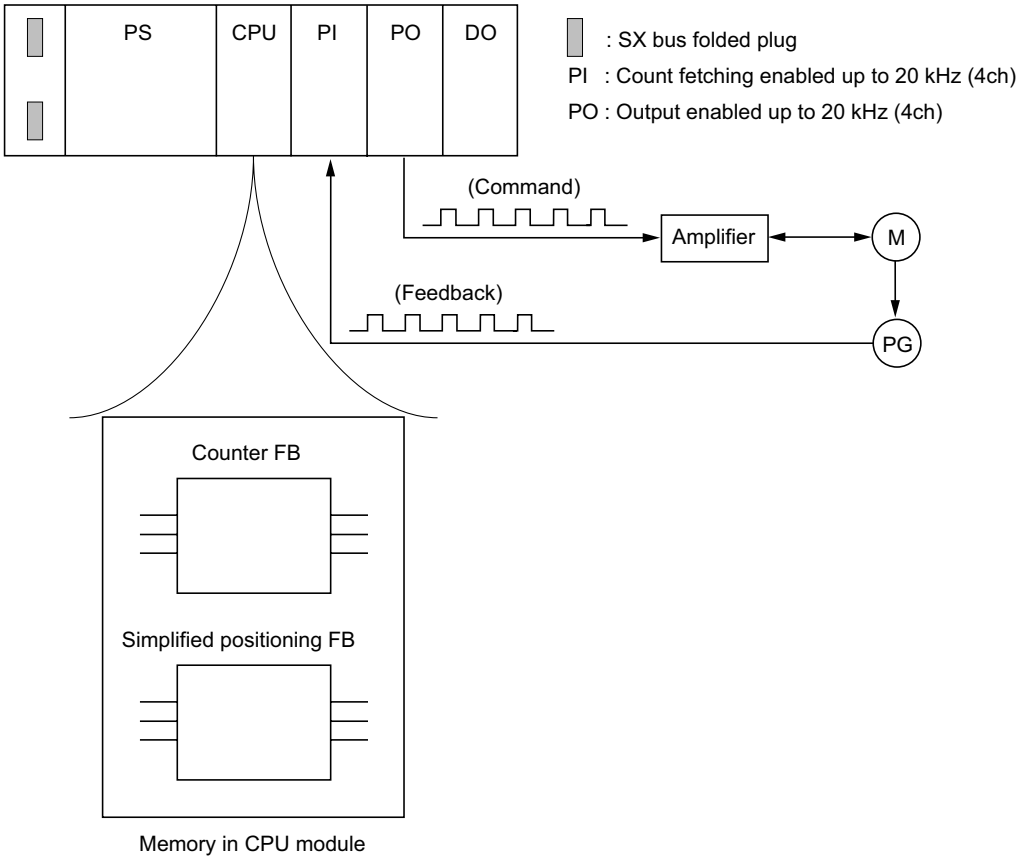


(2) Making output when a certain angle (pulses) is attained (Varicam control)



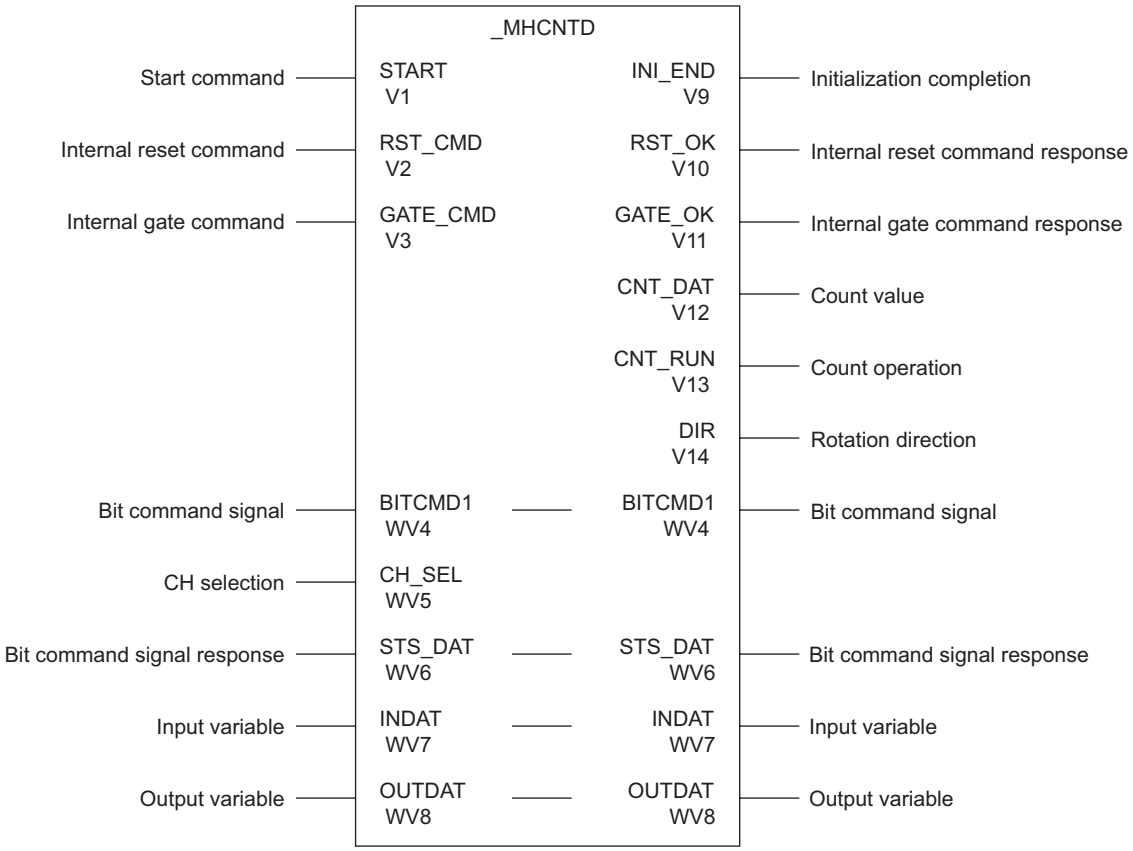
4-2 High-speed Input Module Counter FB

(3) Simplified position control (to know work location)



4-2-5 Details of high-speed input module counter FB

(1) FB format



4-2 High-speed Input Module Counter FB

(2) Description of FB parameters

Prameter		Data type	I/O	Description
Start command (START)	V0001	BOOL	IN	ON: Starts initialization processing (counter current value clear processing). When initialization processing has completed, initialization completion is turned ON. At the start command rising edge, the signal status of bit command signal is reflected to the high-speed input module.
Internal reset command (RST)	V0002	BOOL	IN	ON: For the high-speed input module, sets current value clear command ON.
Internal gate command (GATE_CMD)	V0003	BOOL	IN	Command signal to be used when gate operation mode is enabled by count operation mode. ON: For the high-speed input module, sets count enable command ON. OFF: For the high-speed input module, sets count enable command OFF.
Bit command signal (BIT_CMD1)	WV0004	* Note 1	IN_OUT	Refer to <Signal assignment of bit command signal WV0004>. (Two-word area is required.)
CH selection (CH_SEL)	WV0005	INT	IN	For expansion FB, CH specification is enabled only for "0", "1", "2" or "3".
Bit command signal response (STS_DAT)	WV0006	* Note 2	IN_OUT	Refer to <signal assignment of bit command signal response WV0006>. (Two-word area is required.)
Input variable (INDAT)	WV0007	WORD	IN_OUT	Specifies the first address of the high-speed input module. Example: For the SX bus station No. 10 of the high-speed input module, enter "WX10.0".
Output variable (OUTDAT)	WV0008	WORD	IN_OUT	Specifies the output first address of the high-speed input module (first address + 9). Example: For the SX bus station No. 10 of the high-speed input module, enter "WY10.9".
Initialization completion (INI_END)	V0009	BOOL	OUT	Turned ON after the start command (V0001) has been raised and initialization has been completed.
Internal reset command response (RST_OK)	V0010	BOOL	OUT	Used as a response signal for internal reset command (V0010).
Internal gate command response (GATE_OK)	V0011	BOOL	OUT	Response signal for gate operation mode enable command.
Count value (CNT_DAT)	DV0012	DINT	OUT	Outputs the count value. The output range varies depending on the 16-/32-bit count selection. 16-bit specification: 8000 to 7FFF, -32768 to 32767 32-bit specification: 80000000 to 7FFFFFFF, -2147483648 to 2147483647
Count operation (CNT_RUN)	V0013	BOOL	OUT	Outputs the high-speed input module counting status. ON: Disabled OFF: Enabled
Rotation diresion (DIR)	V0014	BOOL	OUT	Indicates the status of the signal input to the high-speed input module. ON: Forward OFF: Reverse

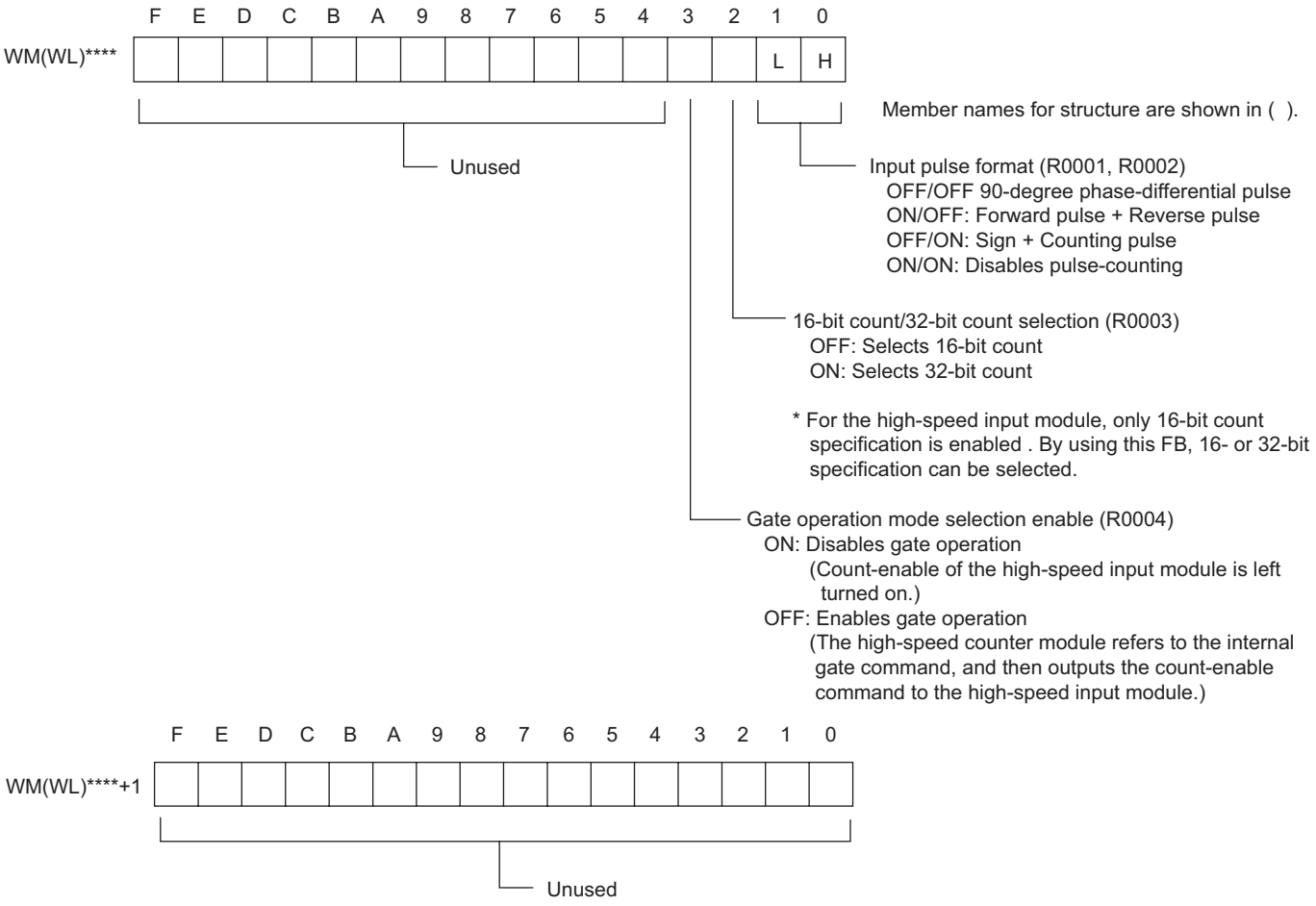
* For information about the data type, refer to “Appendix 1”.

4-2 High-speed Input Module Counter FB

*** Note 1: Bit command signal; device format assigned to WV0004**

The device that is assigned to WV0004 must be set (secured) as follows.

- At the rising edge of the start command (V0001), this area is reflected to the high-speed counter module.

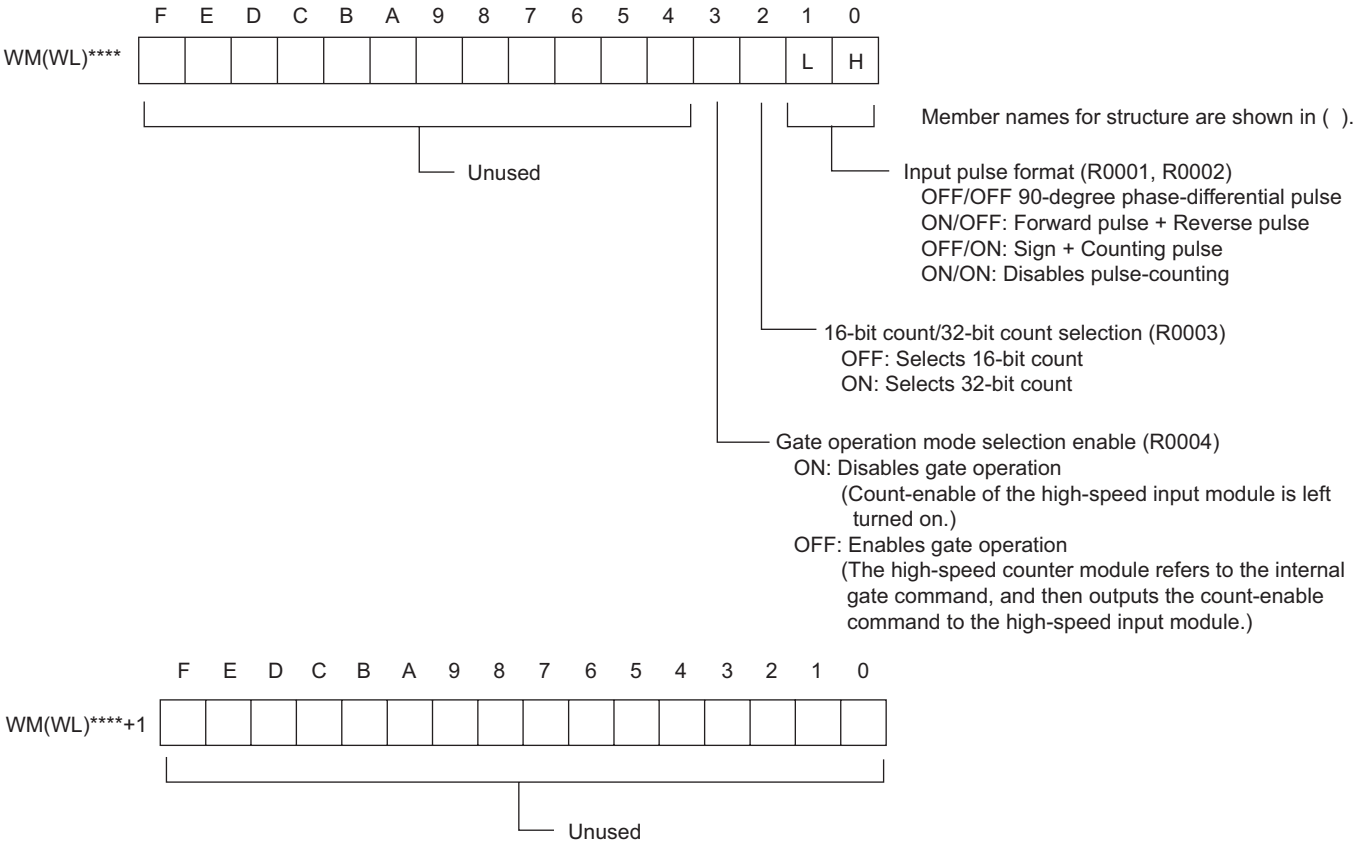


4-2 High-speed Input Module Counter FB

*** Note 2: Bit command signal response; device format assigned to WV0006**

The device that is assigned to WV0006 must be set (secured) as follows.

- At the rising edge of the start command (V0001), this area is reflected to the high-speed counter module.



4-2-6 Settings for ring and gate operations

Settings for ring and gate operations using the high-speed input counter expansion FB are given below.

(1) Ring operation

1) Set CH specification (WV0005) (INT type).
   - The high-speed input module has counter functions for a maximum of four channels.
2) Set bit command signal (WV0004).
   - Set the input pulse format.
   - Set the 16- or 32-bit counter to be used.
     (The high-speed input module is a 16-bit ring counter.)
3) Start command (V0001)
   - Performs initialization processing.

(2) Gate operation

1) Set CH specification (WV0005) (INT type).
   - The high-speed input module has counter functions for a maximum of four channels.
2) Set bit command signal (WV0004).
   - Set the input pulse format.
   - Set the 16- or 32-bit counter to be used.
     (The high-speed input module is a 16-bit ring counter.)
   - Set gate operation enable.
3) Set internal gate command (V0003).
4) Start command (V0001)
   - Performs initialization processing.

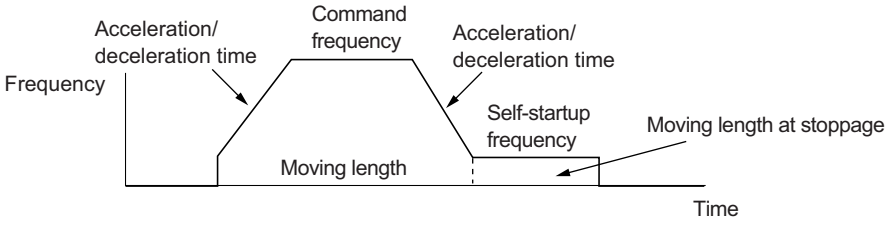
Section 5 Specifications of Simple Positioning FB

_MSMOV
_MSMVDAT

5-1 Overview of Simple Positioning

Simple positioning expansion FB is a one-axis PTP positioning FB dedicated to the high-speed output module having the pulse train output function (type: NP1Y32T09P1-A). This FB issues a pulse train command, referring to adjustment data, such as moving length pulse, command frequency and acceleration/deceleration time.

<Positioning command pattern>



Note 1: The pulse train output function of the high-speed output module has no function to control the number of pulses. Therefore, the positioning accuracy at stoppage is determined by self-startup frequency and the startup period of simple positioning FB. (A certain error is inevitable when stopping.)
Note 2: Simple positioning FB checks error when stopping. Therefore, this error is not accumulated even when positioning operation is repeated.

<Structure of simple positioning FB>

Simple positioning FB consists of the following FBs:

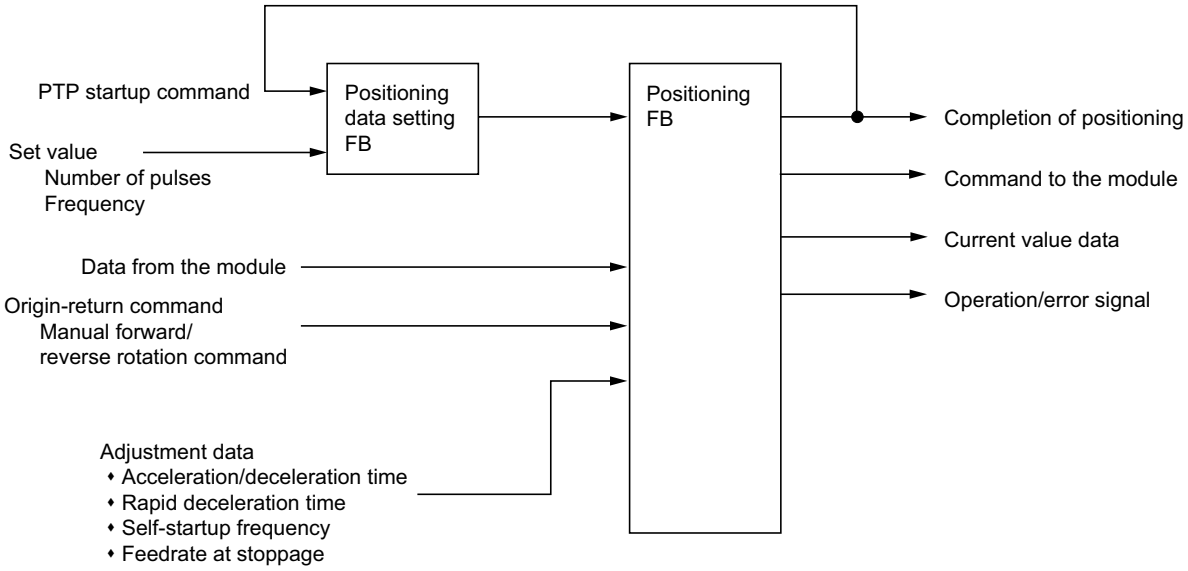
1) Positioning FB (function block)

This FB executes positioning according to pulse train command.
It has 3 operational functions: PTP positioning, manual operation and origin-return operation.

2) Positioning data setting FB (function block)

This FB sets the number of pulses for moving length and command frequency.
This FB is connected to the positioning FB to use. See the image of connection of simple positioning FB shown below.

<Image of connection of simple positioning FB>



5-2 Specifications of Simple Positioning FB

5-2-1 Functions of simple positioning FB

Number of control axes	1 axis
Positioning function	PTP positioning, manual operation, origin-return operation
Acceleration/deceleration characteristic	Trapezoidal acceleration and deceleration, 2-step motion (for PTP positioning)
Operation mode	Finite length (ABS/INC selectable) Infinite length (INC only)
Monitoring function	High-speed limiter, ±OT, ±SOT, error check at stopping

5-2-2 Simple positioning FB list

Name	Description
Positioning FB _MSMOV/_MSMOVa	One-axis positioning operation FB Executes PTP positioning, manual operation and origin-return operation.
Data setting FB _MSMVDAT	PTP positioning data setting FB Multiple point setting is possible when cascaded.

* “a” is suffixed to the name of the FB supporting array/structure.

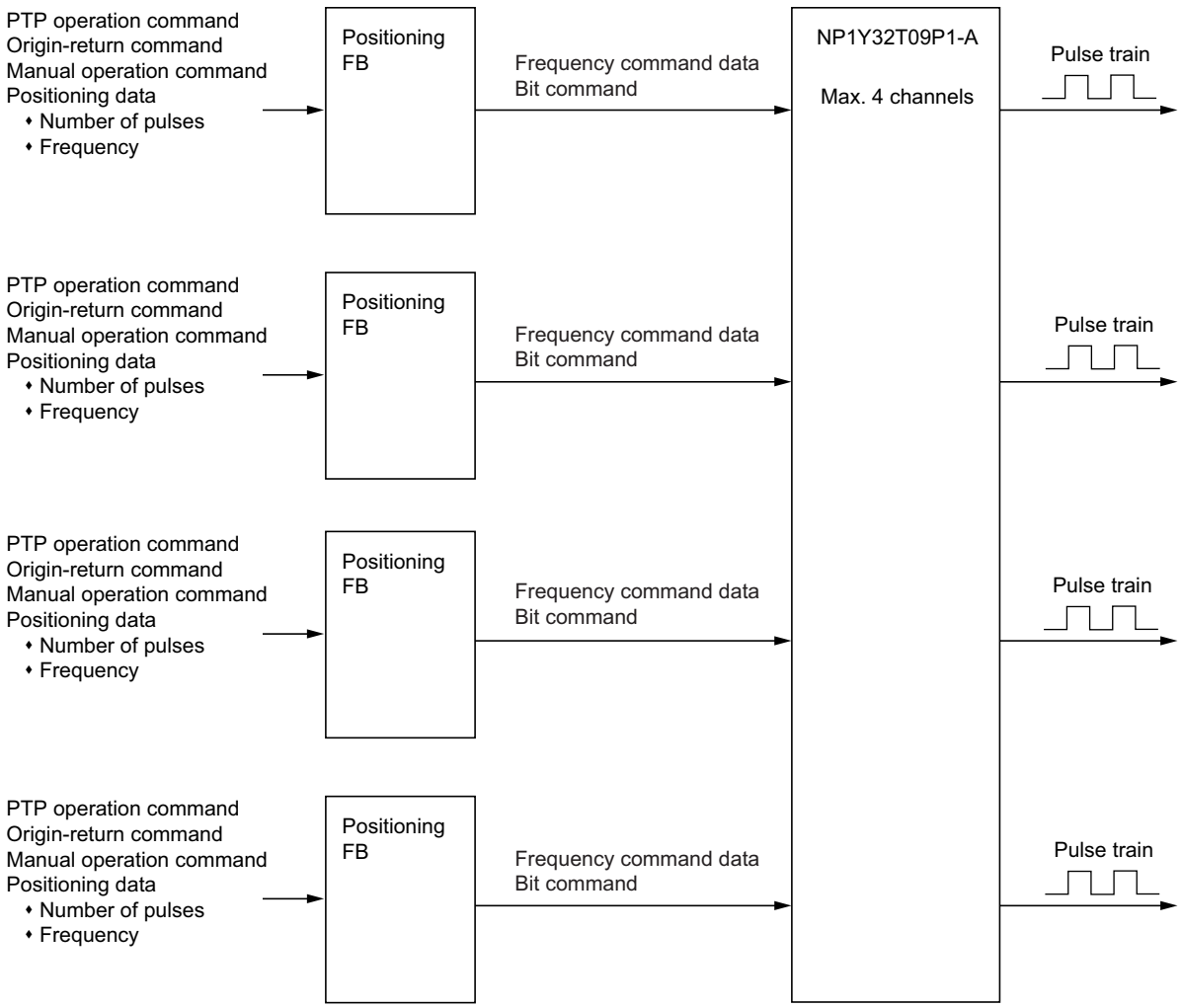
5-2-3 Memory size of simple positioning FB

FB name	Positioning control module	User program size	User FB memory	System FB memory
Positioning FB _MSMOV/_MSMOVa	NP1Y32T09P1-A	Approx. 2.9k steps (Note)	Total: 510 words	8 words
Data setting FB _MSMVDAT				

Note: Values shown in the table above are samples when one each of data setting FB is used. When two or more data setting FBs are used, values will be slightly increased.

5-2 Specifications of Simple Positioning FB

5-2-4 Placement of positioning FB

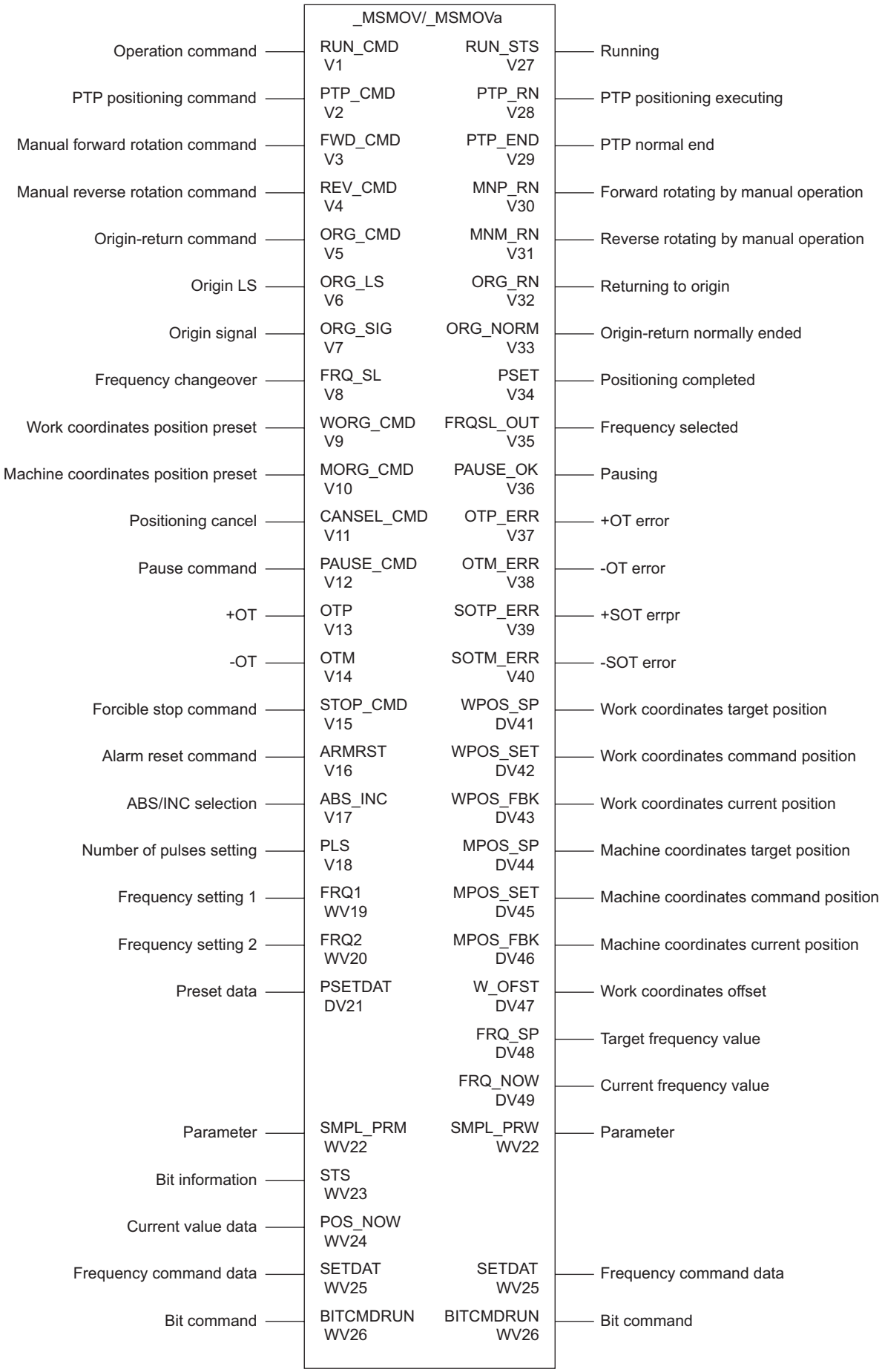


5-2 Specifications of Simple Positioning FB

5-2-5 Positioning FB _MSMOV

(1) FB format

* "a" is suffixed to the name of the FB supporting array/structure.



5-2 Specifications of Simple Positioning FB

(2) Description of FB parameters

Prameter		Data type	I/O	Description
Operation command (RUN_CMD)	V0001	BOOL	IN	While this signal is ON, "running"(V0027) is turned ON to enable positioning. When positioning is enabled, various operation commands are accepted. a) PTP positioning command b) Manual forward rotation command c) Manual reverse rotation command d) Origin-return command When this signal is turned OFF, "running" output is turned OFF and this FB is initialized.
PTP positioning command (PTP_CMD)	V0002	BOOL	IN	At the rising edge of this FB, PTP positioning is executed. While PTP positioning is executed, "PTP positioning executing" signal is ON. When PTP positioning ended normally, "PTP positioning normal end" signal is turned ON.
Manual forward rotation command (FWD_CMD)	V0003	BOOL	IN	While "manual forward rotation command" is ON, manual rotation is executed. (forward) While manual forward rotation is executed, "forward rotating by manual operation" signal is ON. The movement of manual forward rotation takes place in the direction to increase the current position value.
Manual reverse rotation command (REV_CMD)	V0004	BOOL	IN	While "manual reverse rotation command" is manual rotation is executed. (reverse) While manual reverse rotation is executed, "reverse rotating by manual operation" signal is ON. The movement of manual reverse rotation takes place in the direction to decrease the current position value.
Origin-return command (ORG_CMD)	V0005	BOOL	IN	When the rising edge of this signal, origin-return operation is executed. While returning to origin, "returning to origin" signal (V0032) is ON. When origin-return operation ended normally, "origin-return normally ended" signal (V0033) is turned ON.
Origin LS (ORG_LS)	V0006	BOOL	IN	When this signal is turned ON, origin LS is detected. When this signal is turned ON while returning to origin, frequency is changed over to self-startup frequency.
Origin signal (ORG_SIG)	V0007	BOOL	IN	At the rising edge of this signal after passing the origin LS, origin is detected to finish the origin-return operation. Making the rising edge of this signal the origin of machine coordinate system, the target position, command position and current position in the machine coordinate system are cleared to zero. At the same time, the target position, command position and current position in the work coordinate system are preset to the set value of floating zero.
Frequency changeover (FRQ_SL)	V0008	BOOL	IN	OFF: Frequency setting 1, ON: Frequency setting 2 "Frequency changeover" is enabled during PTP positioning or manual operation. The status of "frequency changeover" output, or the response to "frequency selected" command, which is sent from the positioning FB is arbitrarily changed over by "frequency changeover" command.
Work coordinates position preset (WORG_CMD)	V0009	BOOL	IN	At the rising edge of this signal, the work coordinates position is preset.
Machine coordinates position preset (MOPRG_CMD)	V0010	BOOL	IN	At the rising edge of this signal, the machine coordinates position is preset.
Positioning cancel (CANSEL_CMD)	V0011	BOOL	IN	At the rising edge of this signal, PTP positioning or origin-return operation is stopped.

5-2 Specifications of Simple Positioning FB

Pause command (PAUSE_CMD)	V0012	BOOL	IN	Operation is halted when this signal is turned ON. While pulse output is stopped by "pause command", "pausing" signal is ON.
+OT (OTP)	V0013	BOOL	IN	+OT error occurs if this signal is turned ON during positioning operation. When +OT error is detected, "+OT error" signal (V0037) is turned ON.
-OT (OTM)	V0014	BOOL	IN	-OT error occurs if this signal is turned ON during positioning operation. When -OT error is detected, "-OT error" signal (V0038) is turned ON.
Forcible stop command (STOP_CMD)	V0015	BOOL	IN	Operation is forcibly stopped if this signal is turned ON. (corresponding to emergency stop)
Alarm reset command (ARMRST)	V0016	BOOL	IN	When error causes are removed, at the rising edge of this signal, error signal is reset.
ABS/INC selection (ABS_INC)	V0017	BOOL	IN	Selects absolute position command or relative position command. OFF: Absolute position command ON: Relative position command (See note.)
Number of pulses setting (PLS)	DV0018	DINT	IN	Set value for the position data for PTP positioning.
Frequency setting 1 (FRQ1)	WV0019	INT	IN	Set value for the frequency data for PTP positioning or manual operation Frequency setting 1 (0 to 20,000Hz) Frequency setting 2 (0 to 20,000Hz)
Frequency setting 2 (FRQ2)	WV0020	INT	IN	
Preset data (PSET_DAT)	DV0021	DINT	IN	Preset value for position data Preset to this value when "work coordinates position preset" or "machine coordinates position preset" is used.
Parameter (SMPL_PRM)	WV0022	ARRAY	IN_OUT	Assigns the address where the set value for simple positioning FB parameter is stored. * For more information, refer to "5-4 Parameters for Simple Positioning Expansion FB".
Bit information (STS)	WV0023	WORD	IN	Read value of the bit information from the high-speed output module Specifies the module offset address 0 (CH0, CH1), or 1 (CH2, CH3). * If the SX bus station No. of the module is 5 and CH2 is controlled, assign "WX5.1".
Current value data (POS_NOW)	WV0024	INT	IN	Read value of the current value data from the high-speed output module Specifies the module offset address 2 (CH0), 3 (CH1), 4 (CH2) or 5 (CH3). * If the SX bus station No. of the module is 5 and CH2 is controlled, assign "WX5.4".
Frequency command data (SETDAT)	WV0025	INT	IN_OUT	Frequency command data to the high-speed output module Specifies the module offset address 8 (CH0), 9 (CH1), 10 (CH2) or 11 (CH3). * If the SX bus station No. of the module is 5 and CH2 is controlled, assign "WY5.10" to this terminal.
Bit command (BITDAT)	WV0026	WORD	IN_OUT	Bit command data to the high-speed output module Specifies the module offset address 6 (CH0, CH1) or 7 (CH2, CH3). * If the SX bus station No. of the module is 5 and CH2 is controlled, assign "WY5.7".
Running (RUN_STS)	V0027	BOOL	OUT	This signal is turned ON when positioning is enabled and various operation commands (PTP positioning, manual operation and origin-return commands) can be accepted.
PTP positioning executing (PTP_RN)	V0028	BOOL	OUT	While PTP positioning is executed, this signal is ON.
PTP normal end (PTP_END)	V0029	BOOL	OUT	When PTP positioning ended normally (when positioned at instructed position), this signal is turned ON. Each time PTP positioning is started, this signal is reset.

5-2 Specifications of Simple Positioning FB

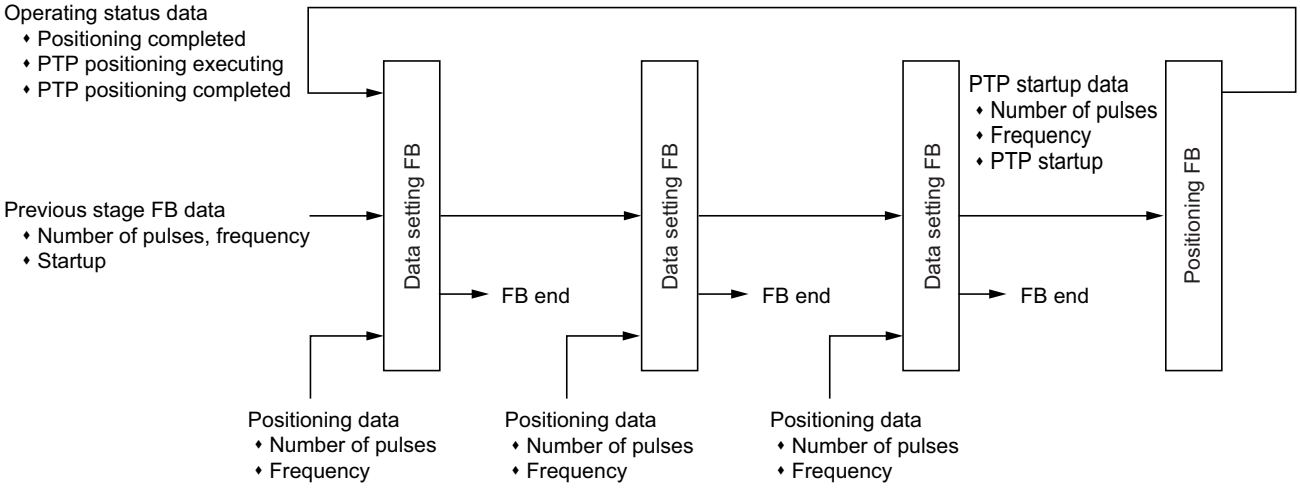
Forward rotating by manual operation (MNP_RN)	V0030	BOOL	OUT	While manual forward rotation is executed, this signal is ON. The movement of forward rotating by manual operation takes place in the direction to increase the current position value.
Reverse rotating by manual operation (MNM_RN)	V0031	BOOL	OUT	While manual reverse rotation is executed, this signal is ON. The movement of reverse rotating by manual operation takes place in the direction to decrease the current position value.
Returning to origin (ORG_RN)	V0032	BOOL	OUT	While returning to origin, this signal is ON.
Origin-return normally ended (ORG_NORM)	V0033	BOOL	OUT	When origin-return operation ended normally (when machine origin is detected) or when machine coordinates position preset is used, this signal is turned ON. Each time origin-return operation is started, this signal is reset.
Positioning completed (PSET)	V0034	BOOL	OUT	When positioning is completed, this signal is turned ON. When this signal is ON, new startup command (PTP positioning, manual operation, originreturn operation) are accepted.
Frequency selected (FRQSL_OUT)	V0035	BOOL	OUT	While PTP positioning or origin-return operation is executed, the currently selected frequency setting is indicated. This signal is the response signal to "frequency changeover" (V0008). OFF: Frequency setting 1 ON: Frequency setting 2
Pausing (PAUSE_OK)	V0036	BOOL	OUT	While pulse output is stopped by "pause command", this signal is ON.
+OT error (OTP_ERR)	V0037	BOOL	OUT	If +OT error is detected, this signal is turned ON.
-OT error (OTM_ERR)	V0038	BOOL	OUT	If -OT error is detected, this signal is turned ON.
+SOT error (SOTP_ERR)	V0039	BOOL	OUT	If +SOT error is detected, this signal is turned ON.
-SOT error (SOTM_ERR)	V0040	BOOL	OUT	If -SOT error is detected, this signal is turned ON.
Work coordinates target position (WPOS_SP)	DV0041	DINT	OUT	Target position data in work coordinate system
Work coordinates command position (WPOS_SET)	DV0042	DINT	OUT	Command position data in work coordinate system
Work coordinates current position (WPOS_FBK)	DV0043	DINT	OUT	Current position data in work coordinate system
Machine coordinates target position (MPOS_SP)	DV0044	DINT	OUT	Target position data in machine coordinate system
Machine coordinates command position (MPOS_SET)	DV0045	DINT	OUT	Command position data in machine coordinate system
Machine coordinates current position (MPOS_FBK)	DV0046	DINT	OUT	Current position data in machine coordinate system
Work coordinates offset (W_OFST)	DV0047	DINT	OUT	Offset for work coordinates with respect to machine coordinates
Target frequency value (FRQ_SP)	WV0048	INT	OUT	Target frequency value data
Current frequency value (FRQ_NOW)	WV0049	INT	OUT	Current value data for command frequency

Note: When infinite length mode is selected, “ABC/INC selection” data is ignored (All positions are specified by relative position data).
The movement of manual forward rotation takes place in the direction to increase the current position value.

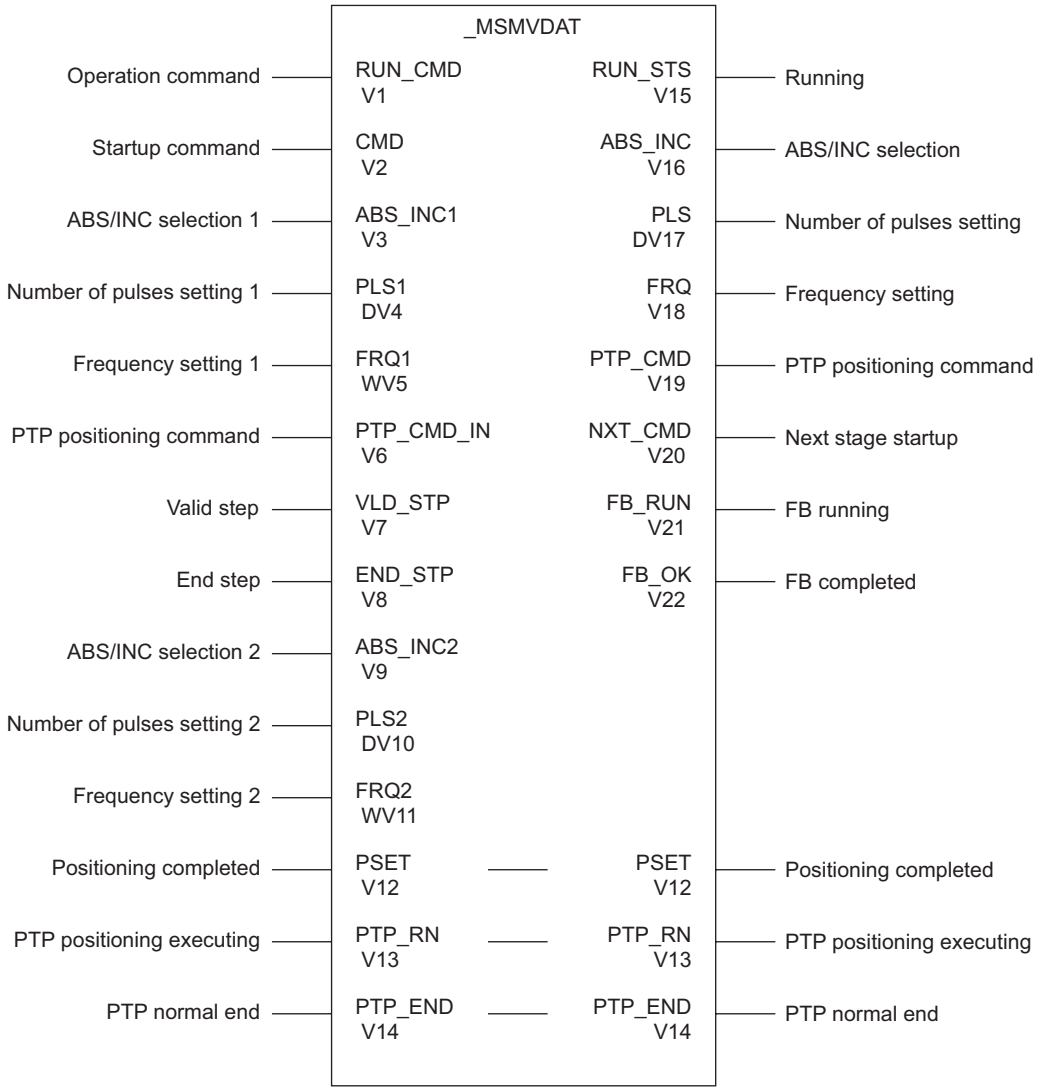
5-2 Specifications of Simple Positioning FB

5-2-6 Data setting FB _MSMVDAT

This FB sets the data for simple PTP positioning.
PTP positioning becomes possible when the output of data setting FB is connected to positioning FB.
Data setting FB allows cascade connection, as shown in the figure below.



(1) FB format



5-2 Specifications of Simple Positioning FB

(2) Description of FB parameters

Prameter		Data type	I/O	Description
Operation command (RUN_CMD)	V0001	BOOL	IN	While this signal is ON, "running" output is turned on to enable the data setting FB. While this signal is OFF, "running" output is turned OFF, and the data setting FB is initialized. When initialized, the signal and data from the preceding stage pass through said data setting FB to be output as they are. Output signals of the data setting FB, or "FB running" and "FB completed" are turned OFF.
Startup command (CMD)	V0002	BOOL	IN	"PTP positioning command" output (V0013) is turned ON at the rising edge of this signal. For the second and following stages, the "next stage startup command" output from the preceding stage is connected.
ABS/INC selection 1 (ABS_INC1)	V0003	BOOL	IN	PTP positioning signal from the preceding stage FB (See note.) Till "startup command" is enabled, signal from the preceding FB passes through the data setting FB to be output, as it is, to positioning FB.
Number of pulses setting 1 (PLS1)	DV0004	DINT	IN	PTP positioning signal from the preceding stage FB (See note.) Till "startup command" is enabled, signal from the preceding FB passes through the data setting FB to be output, as it is, to positioning FB.
Frequency setting 1 (FRQ1)	WV0005	INT	IN	PTP positioning signal from the preceding stage FB (See note.) Till "startup command" is enabled, signal from the preceding FB passes through the data setting FB to be output, as it is, to positioning FB.
PTP positioning command (PTP_CMD_IN)	V0006	BOOL	IN	PTP positioning signal from the preceding stage FB (See note.) Till "startup command" is enabled, signal from the preceding FB passes through the data setting FB to be output, as it is, to positioning FB.
Valid step (VLD_STP)	V0007	BOOL	IN	When this signal is ON, the positioning data of the data setting FB takes effect. If "startup command" is enabled when this signal is OFF, "FB completed" and "next stage startup" signals are turned ON.
End step (END_STP)	V0008	BOOL	IN	When this signal is OFF, "next stage startup"(V0014) signal is turned ON the moment the positioning with the data setting FB is completed. When this signal is ON, the data setting FB becomes the end step. At the end step, "next stage startup"(V0014) signal is not turned ON even when the positioning with the data setting FB is completed. When "valid step" signal is OFF, "next stage startup"(V0014) signal is turned ON even if this signal is ON.
ABS/INC selection 2 (ABS_INC2)	V0009	BOOL	IN	Selected setting signal to the local FB When "startup command" is enabled, the setting signal of the local FB is output to the positioning FB.
Number of pulses setting 2 (PLS2)	DV0010	DINT	IN	Number of pulses setting data to the local FB When "startup command" is enabled, the setting data signal of the local FB is output to the positioning FB.
Frequency setting 2 (FRQ2)	WV0011	INT	IN	Frequency setting data to the local FB When "startup command" is enabled, the setting data signal of the local FB is output to the positioning FB.
Positioning completed (PSET)	V0012	BOOL	IN_OUT	Assigns positioning completion signal output from positioning FB. When this signal is ON, "startup command" is accepted.
PTP positioning executing (PTP_RN)	V0013	BOOL	IN_OUT	PTP positioning executing signal output from positioning FB When positioning is executed using own data (when "FB running" is ON), "PTP positioning command" is turned OFF if it is detected that "PTP positioning executing" signal is ON.
PTP normal end (PTP_END)	V0014	BOOL	IN_OUT	PTP normal end signal output from positioning FB When positioning is executed using own data, "FB completed" signal is turned ON at the rising edge of "PTP normal end" signal. At the same time, "next stage startup" command is turned ON (when not specified as end step).

5-2 Specifications of Simple Positioning FB

Running (RUN_STS)	V0015	BOOL	OUT	This signal is turned ON when the data setting FB is enabled and commands to the positioning FB take effect.
ABS/INC selection (ABS_INC)	V0016	BOOL	OUT	Select command to positioning FB
Number of pulses setting (PLS)	DV0017	DINT	OUT	Number of pulses setting data command to positioning FB
Frequency setting (FRQ)	WV0018	INT	OUT	Frequency setting data command to positioning FB
PTP positioning command (PTP_CMD)	V0019	BOOL	OUT	PTP positioning command signal to positioning FB
Next stage startup (NXT_CMD)	V0020	BOOL	OUT	While positioning is executed using the set value data of the local FB, this signal is ON.
FB running (FB_RUN)	V0021	BOOL	OUT	While positioning is executed using the set value data of this FB, this signal is ON.
FB completed (FB_OK)	V0022	BOOL	OUT	When the PTP positioning using the set value data of this FB is completed successfully, this signal is turned ON.

Note: When data setting FBs are cascaded, the signal and data from the preceding stage FB are passed to the next stage FBs in order.

5-3 Details of Positioning Function

5-3-1 Positioning operation condition

1) When “operation command” is ON, “running” signal is turned ON to enable positioning.
2) When positioning is enabled, various operation commands (PTP positioning, manual operation and origin-return commands) are accepted.
3) When “running” signal is ON, the rewriting of the following signals in the parameter area is not reflected on the control of this FB.
   - Axis selection: Select from Ch0 to Ch3
   - Rotation direction changeover: Selection of forward pulse output, in the direction to increase the current value, or reverse pulse output
   - Pulse output type selection: Select either “forward pulse + reverse pulse” or “sign + pulse train”
   - Origin-return direction: Select either the direction to decrease the current value or the direction to increase the current value
   - Infinite length mode selection: Select either finite length mode or infinite length mode

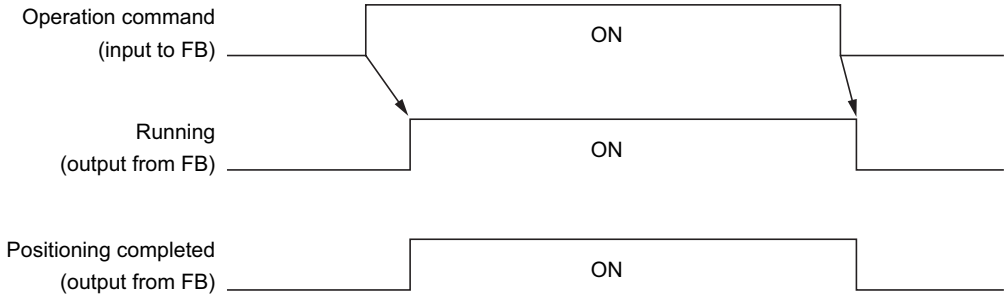
   When “running” signal is ON, the current value data from the high-speed output module is continuously monitored to update the position data in the work coordinate system as well as the position data in the machine coordinate system.
4) When “operation command” signal is ON, “running” signal is turned ON and this FB is initialized in the following manner:
   - BOOL signal output from this FB : all ON
     (±OT and ±OT errors are also reset.)
   - Position data : Cleared to zero
   - Offset for work coordinates : Cleared to zero
   - Target frequency and current frequency data : Cleared to zero
   - Frequency command data : Input value is output as it is.
   - Bit command : Input value is output as it is.

Note: If positioning is being executed when “operation command” signal changes from ON to OFF, “running” output signal is turned OFF after positioning is completed and “positioning completed” is turned ON. At that time, “positioning completed” signal is turned ON only for one cycle.

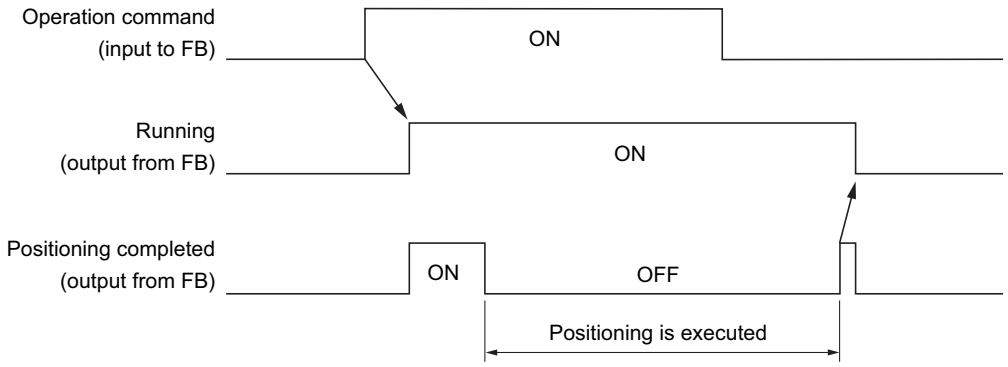
Signal timing is shown below:

(1) “Operation command” is turned OFF when positioning is completed

*1: Not accepted because manual reverse rotation is being executed at the rising edge of “manual forward rotation command”.



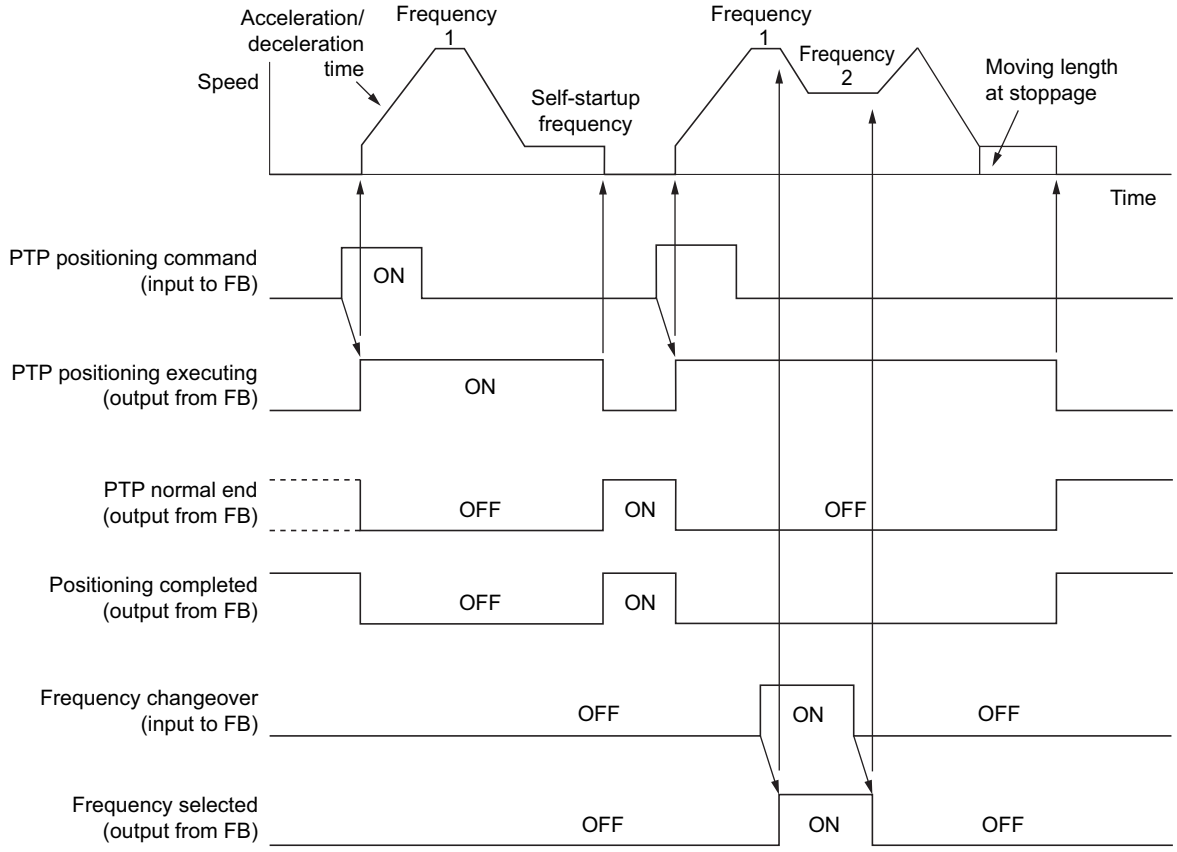
(2) “Operation command” is turned OFF in the middle of positioning



5-3 Details of Positioning Function

5-3-2 PTP positioning operation

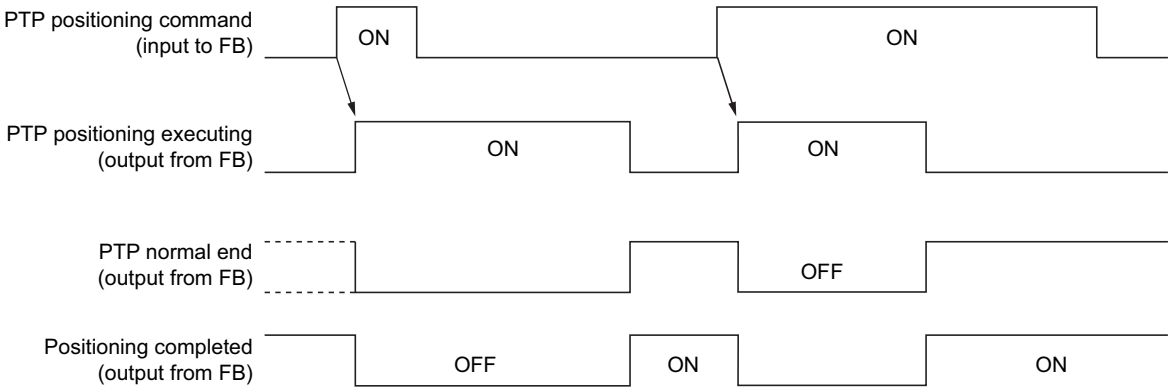
PTP positioning is started at the rising edge of “PTP positioning command”.
PTP positioning operation pattern is shown below:



- Trapezoidal acceleration or deceleration is performed. (Acceleration/deceleration time is registered to the parameter area.)
- Positioning is executed by two-step motion.
  In the vicinity of target position, the feedrate of self-startup frequency is used.
  The federate at self-startup frequency (the federate at stoppage) is registered to the parameter area.
- Deceleration point is automatically detected.
- Frequency can be changed over during operation.
  Two types of frequency can be set, which is selected with “frequency changeover” command.
  The data at the time of changeover is read at the rising edge of “frequency changeover” command.
  Even when frequency setting data is rewritten, target frequency does not change unless “frequency changeover” command status is changed.
- Either absolute position setting or relative position setting can be selected (when finite length mode is set)
  In infinite length mode, all data are processed as relative position data
- While PTP positioning is executed, “PTP positioning executing” signal is turned ON.
- Each time PTP positioning is started, “PTP normal end” signal is turned OFF.
  When the positioning at target point is completed successfully, “PTP normal end” signal is turned ON. If the positioning at target point ended unsuccessfully due to “positioning cancel” or “forcible stop command”, “PTP normal end” signal continues to be OFF.

5-3 Details of Positioning Function

- "PTP positioning command" is accepted when "PTP normal end" signal is ON. In the following cases, "PTP positioning command" is not accepted:
  1) When "operation command" is OFF
  2) When "PTP normal end" signal is OFF
  3) When one of "manual forward rotation command", "manual reverse rotation command", "forward rotating by manual operation" and "reverse rotating by manual operation" is ON.
  4) When either "origin-return command" or "returning to origin" is ON.
  5) When one of "+OT error", "–OT error", "+SOT error" and "–SOT" error is ON.
  6) When either "+OT" or "–OT" signal is ON.
     (±OT error occurs at the rising edge of "PTP positioning command".)
  7) When "positioning cancel" signal is ON
  8) When "forcible stop command" signal is ON
- ±OT error is detected while PTP positioning is executed, "PTP positioning executing" signal is turned OFF after operation is stopped.
- If PTP positioning command is issued for a position that is out of ±SOT range, positioning is executed at software OT position. After the positioning at software OT position is completed, ±SOT error signal is turned ON.



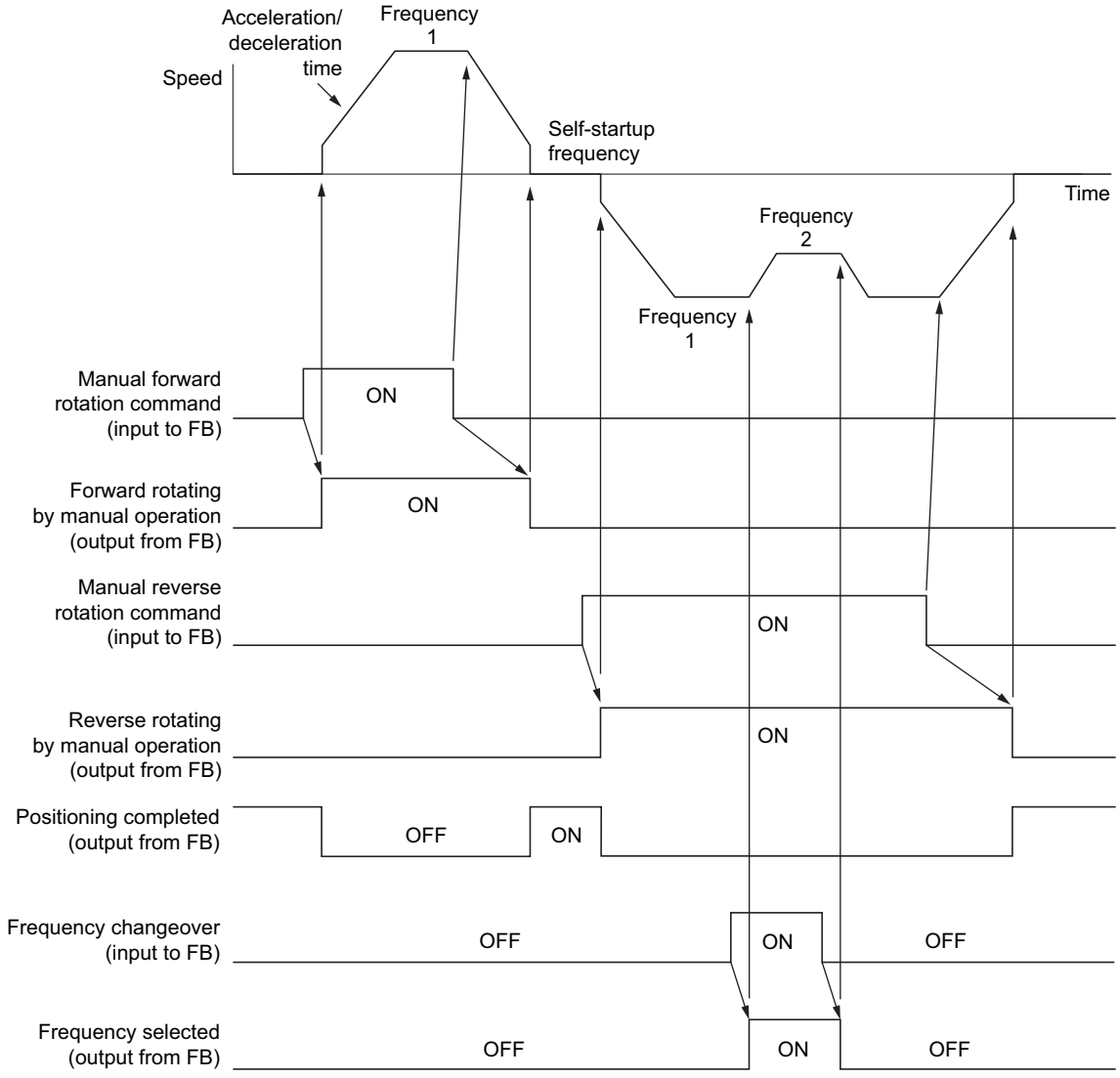
- When positioning is completed, "PTP positioning executing" signal is turned OFF.
- When positioning is completed, "PTP normal end" signal is turned ON.
- When positioning is completed, "positioning completed" signal is turned ON.

5-3 Details of Positioning Function

5-3-3 Manual operation

Manual forward or reverse operation is started when the rising edge of “manual forward rotation command” or “manual reverse rotation command” is detected, and the operation is continued while the said command is ON.
While manual forward or reverse rotation is executed, “forward rotating by manual operation” or “reverse rotating by manual operation” is ON.

<Manual operation pattern>



- Trapezoidal acceleration or deceleration is performed.
  (Acceleration/deceleration time is registered to the parameter area.)
- Frequency can be changed over during operation.
  Two types of frequency can be set, which is selected with “frequency changeover” command.
  The data at the rising edge of “frequency changeover” command is read.
  Even when frequency setting data is rewritten, target frequency does not change unless “frequency changeover” command status is changed.

5-3 Details of Positioning Function

- "Manual forward rotation command" and "manual reverse rotation command" are accepted when "positioning completed" signal is ON.

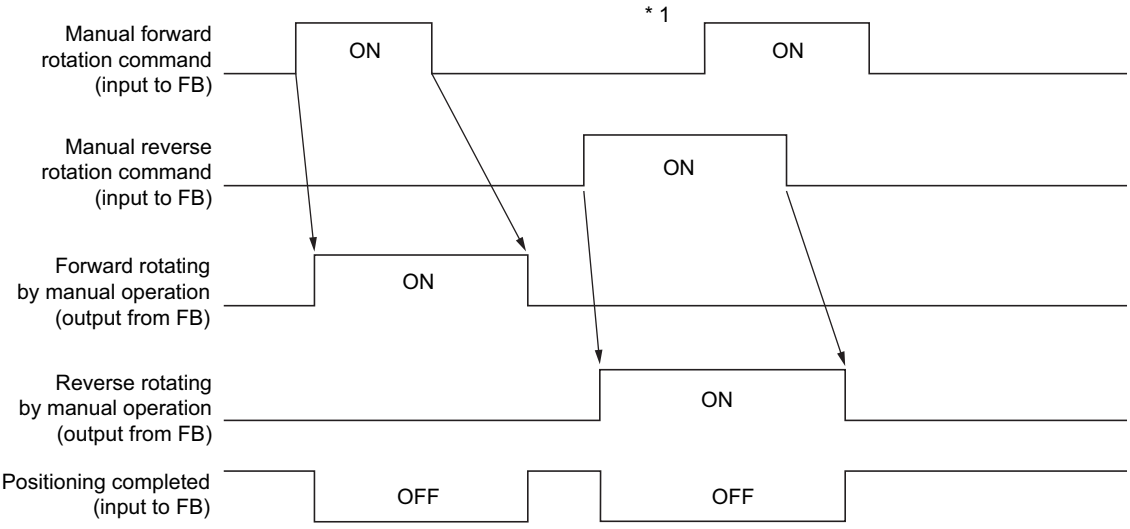
  In the following cases, neither "manual forward rotation command" nor "manual reverse rotation command" is accepted:

  1) When "running" signal is ON
  2) When "positioning completed" signal is ON
  3) When either "PTP positioning command" or "PTP positioning executing" is ON
  4) If "manual reverse rotation command" or "reverse rotating by manual operation" is ON (when "manual forward rotation command" is issued)
  5) If "manual forward rotation command" or "forward rotating by manual operation" is ON (when "manual reverse rotation command" is issued)
  6) When either "origin-return command" or "returning to origin" is ON.
  7) When "+OT error" or "+SOT error" is detected (during manual forward rotation)
  8) When "-OT error" or "-SOT error" is detected (during manual reverse rotation)
  9) When "+OT" signal is ON ("+OT error" immediately occurs at the rising edge of "manual forward rotation command".)
  10) When "-OT" signal is ON ("-OT error" immediately occurs at the rising edge of "manual reverse rotation command".)
  11) When "forcible stop command" is ON

- If +OT error is detected while manual forward rotation is executed, "forward rotating by manual operation" signal is turned ON after the operation is stopped.
- During manual forward rotation, no positioning is executed beyond +SOT range.
- If manual forward rotation is continued, the system finally stops at +SOT position.
  (After stopping at +SOT position, "+SOT error" signal is turned ON.)
- If -OT error is detected while manual reverse rotation is executed, "reverse rotating by manual operation" signal is turned OFF after the operation is stopped.
- During manual reverse rotation, no positioning is executed beyond -SOT range.
- If manual reverse rotation is continued, the system finally stops at -SOT position.
  (After stopping at -SOT position, "-SOT error" signal is turned ON.)

Note: Manual forward rotation is disabled when +OT error, –OT error, +SOT or -SOT error is detected.
(Manual forward/reverse rotation is possible even when these errors are detected.)

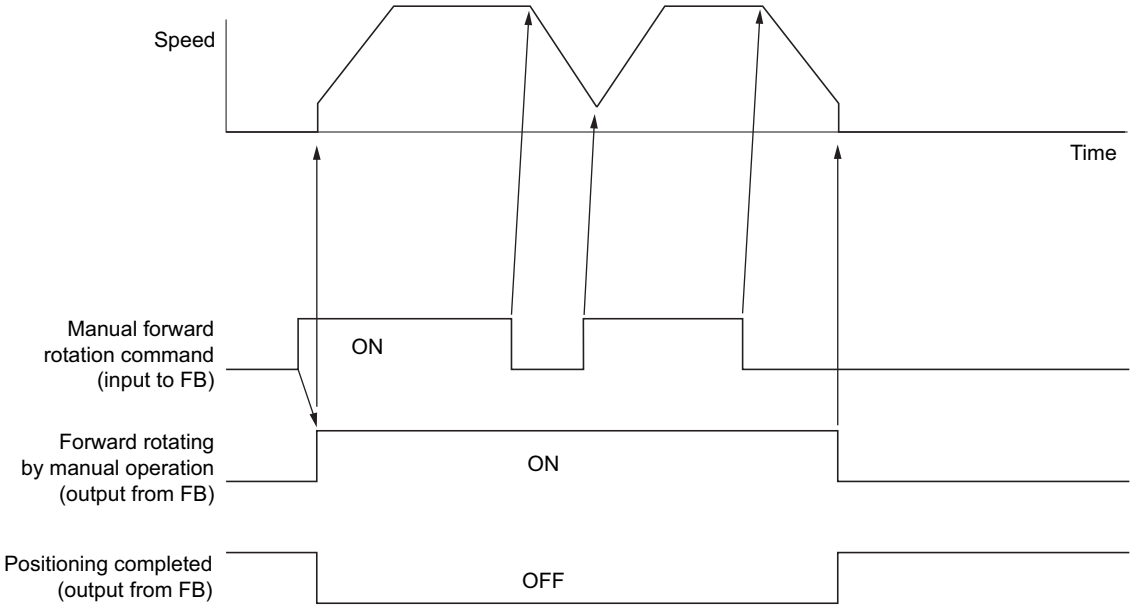
- For manual forward/reverse rotation command, not only the rising edge but also the level of ON are checked.
- Therefore, even if "manual forward rotation command" is turned ON while manual reverse rotation is executed, the mode won't be changed to manual forward rotation after manual reverse rotation is completed.
  (When manual reverse rotation command is turned OFF and then manual forward rotation command is turned ON, manual forward rotation will be executed.)



5-3 Details of Positioning Function

*1 “Manual forward rotation command” is not accepted during manual reverse rotation. Even when manual forward rotation command continues to be ON, forward rotation won’t take place after manual reverse rotation is completed.

The command will be accepted when “manual forward rotation command” or “manual reverse rotation command” is once turned OFF while manual forward or reverse rotation is being executed and then “manual forward rotation command” or “manual reverse rotation command” is turned ON again while “forward rotating by manual operation” or “reverse rotating by manual operation” signal is still ON.

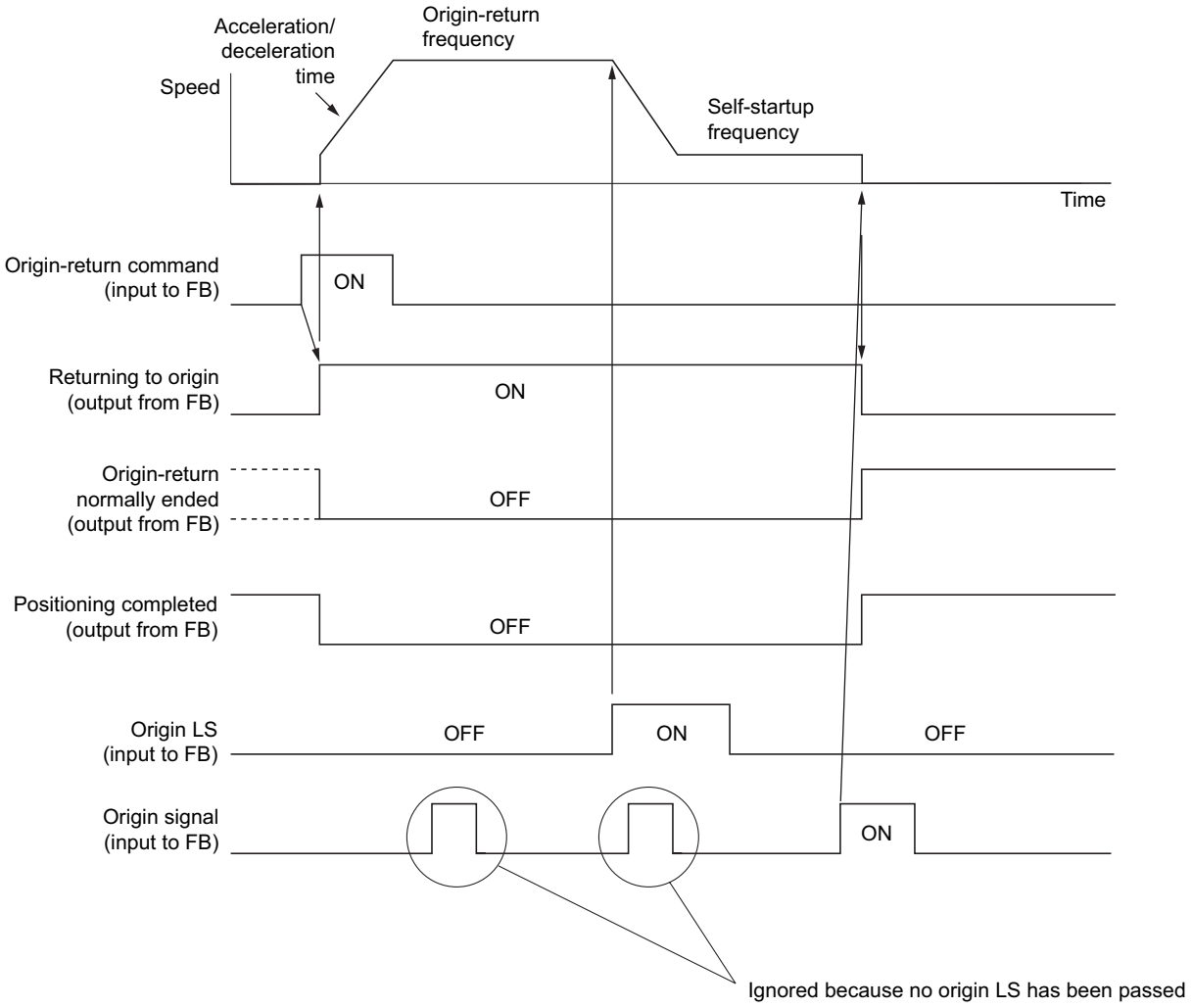


5-3 Details of Positioning Function

5-3-4 Origin-return operation

Origin-return operation is started at the rising edge of “origin-return command”.

<Origin-return operation pattern>



- Trapezoidal acceleration or deceleration is performed.
  (Acceleration/deceleration time is registered to the parameter area.)
- Origin-return frequency and origin-return direction are registered to the parameter area.
- When “origin LS” signal is turned ON, feedrate is changed to the value for self-startup frequency.
  (Self-startup frequency is registered to the parameter area.)
- The rising edge of “origin signal” after “origin LS” signal is turned OFF made to be the origin of the machine coordinate system.
  At the origin of machine coordinate system, pulse output is stopped, and origin-return operation is completed.
  Origin signal detected before “origin LS” is passed is ignored.
- The origin of machine coordinate system is made to be the floating origin, and the position data in the work coordinate system is preset.
  (Floating origin data is registered to the parameter area.)
- After the completion of origin-return operation, the target position and command position in the machine coordinate system are set to “0”, and the target position and command position in the work coordinate system are set to the values with respect to the floating origin.
  (At the same time, offset for work coordinates is set to the value with respect to the floating origin.)

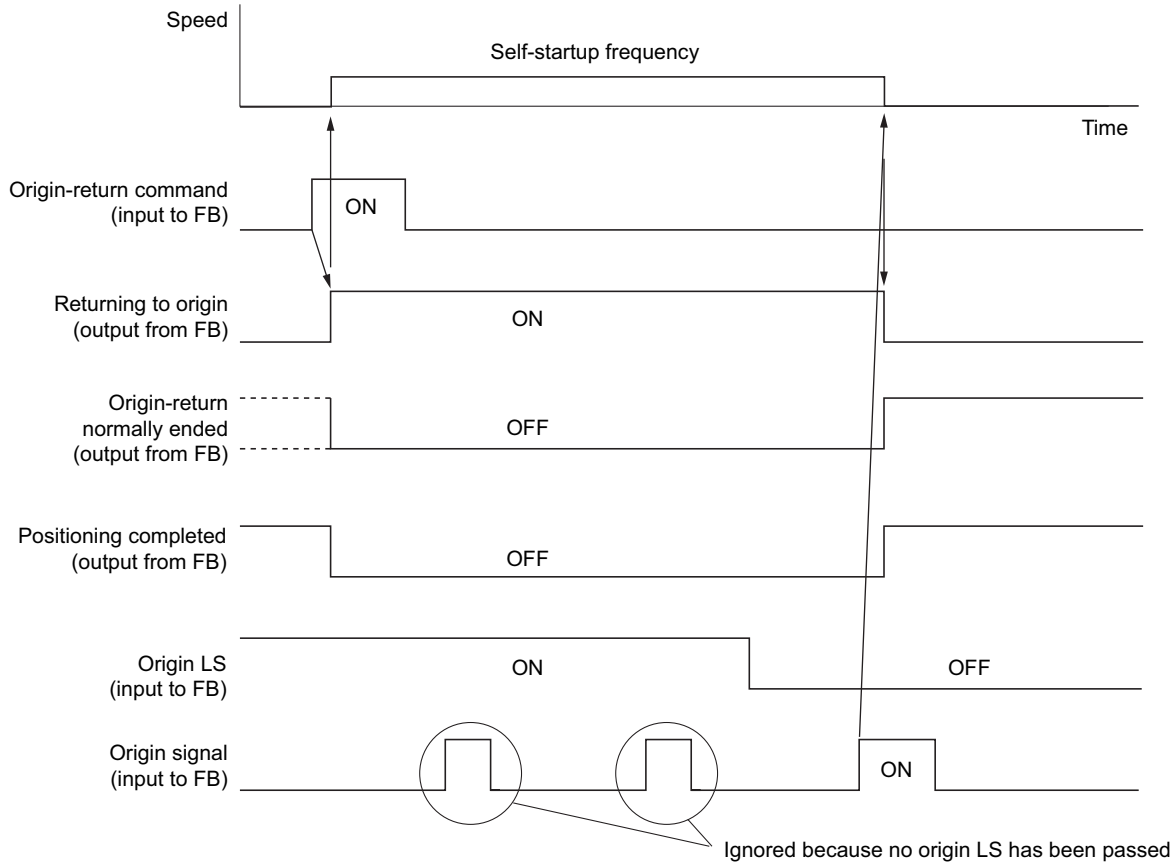
5-3 Details of Positioning Function

- "Origin-return command" is accepted when "positioning completed" signal is ON.

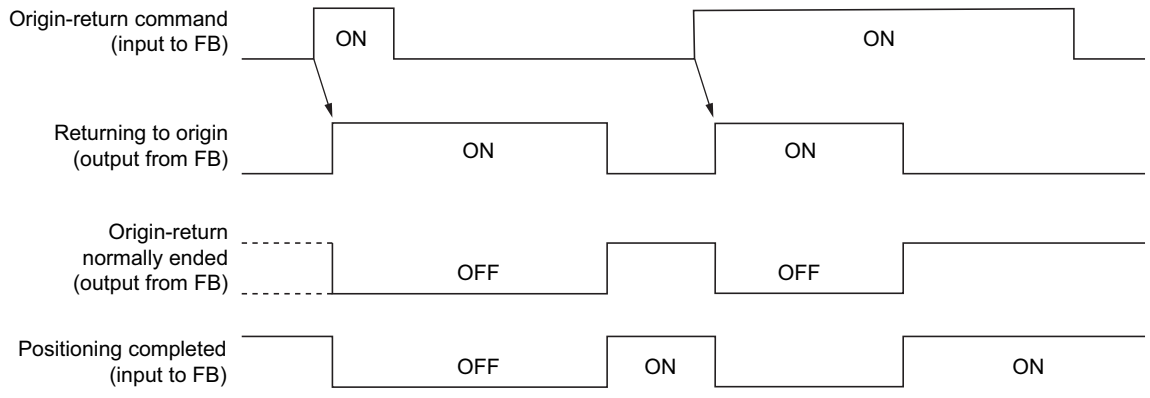
  In the following cases, "origin-return command" is not accepted:

  1) When "running" signal is OFF
  2) When "positioning completed" signal is OFF
  3) When either "PTP positioning command" or "PTP positioning executing" is ON
  4) When one of "manual forward rotation command", "manual reverse rotation command", "forward rotating by manual operation" and "reverse rotating by manual operation" is ON
  5) When OT error detection signal in the origin-return direction is ON
  6) When OT signal in the origin-return direction is ON
     ("+OT error" or "-OT error" is detected at the rising edge of "origin-return command".)
  7) When "positioning cancel" command is ON
  8) When "forcible stop command" is ON

- If an OT error in the origin-return direction is detected during origin-return operation, "returning to origin" signal is turned OFF after the operation is stopped.
- If "origin LS" signal is ON at the rising edge of "origin-return command" feederate becomes the value for self-startup frequency.



"PTP normal end" signal is turned ON when origin-return operation is completed.
"Positioning completed" signal is turned ON when positioning is completed.

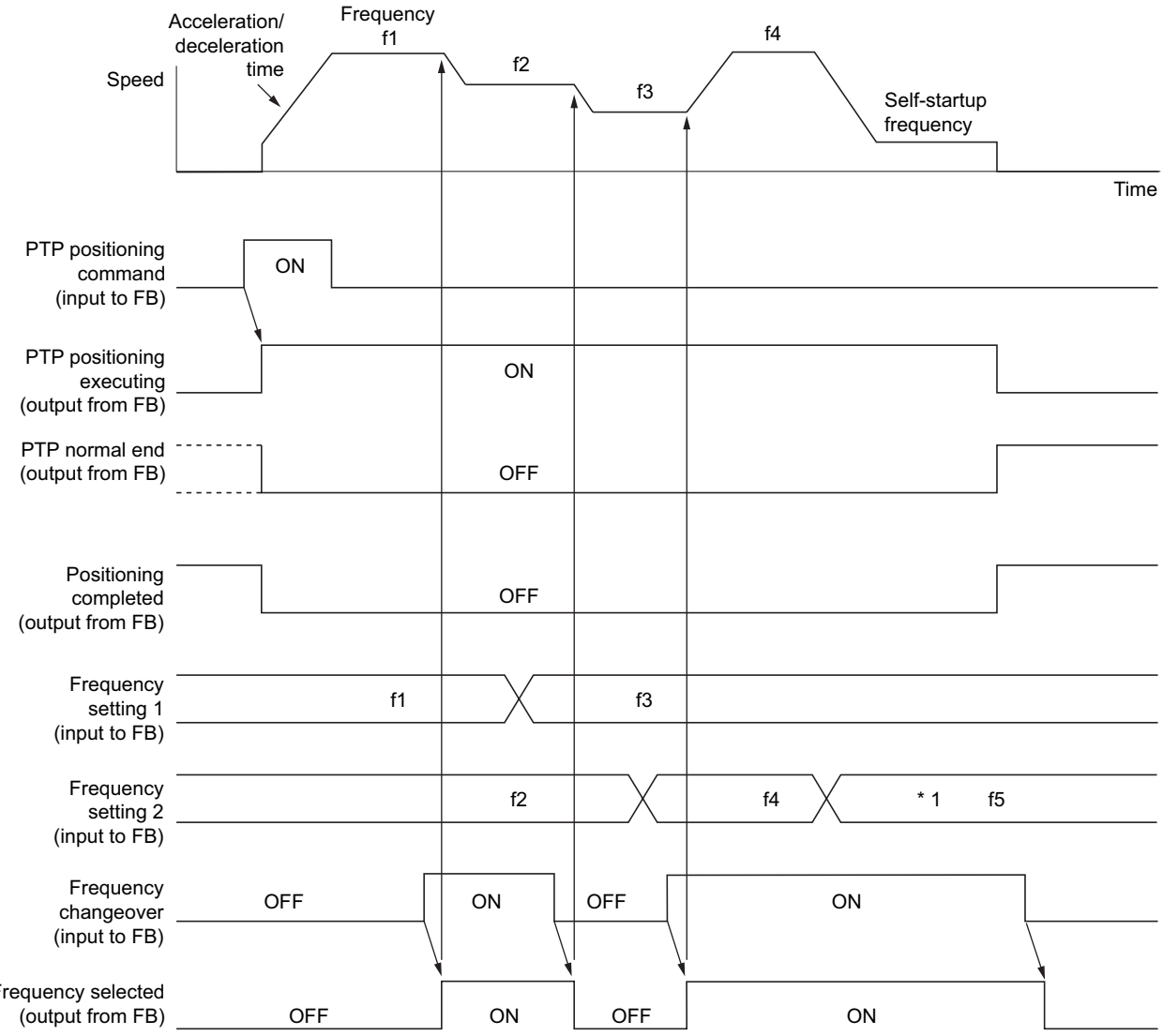


5-3 Details of Positioning Function

5-3-5 Frequency changeover

Command frequency can be changed over during PTP positioning or manual operation.
"Frequency changeover" signal is used to change over command frequency.
Frequency changeover command = OFF: "Frequency setting 1" is selected.
Frequency changeover command = ON: "Frequency setting 2" is selected.

<Frequency changeover operation pattern>



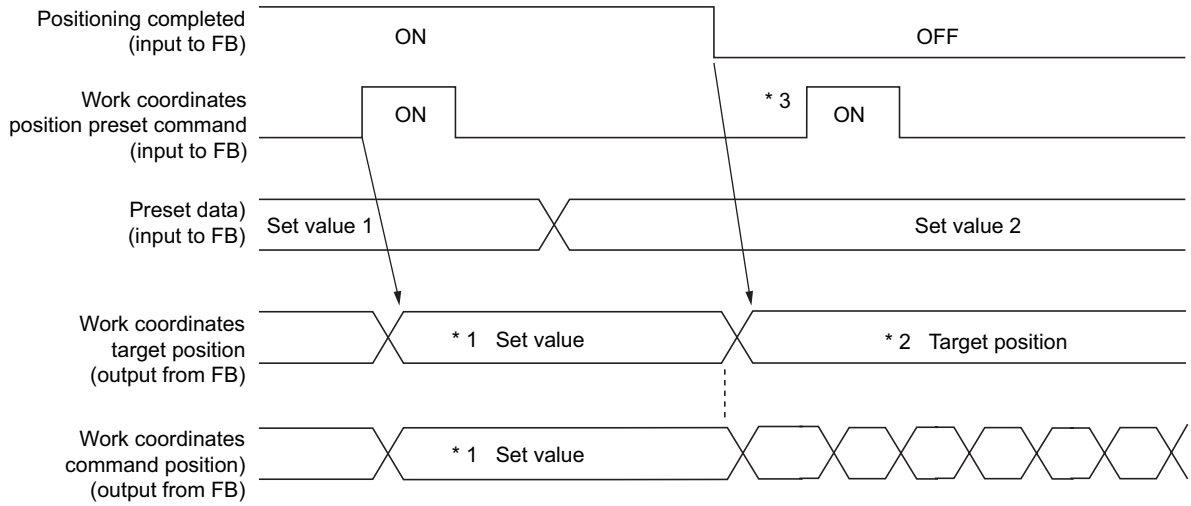
- Frequency can be changed over during PTP positioning or manual operation.
  (Frequency cannot be changed over during origin-return operation.)
- At the rising edge of "PTP positioning command", "manual forward rotation command" or "manual reverse rotation command", the frequency that is selected by "frequency changeover" command is made to be the target frequency.
  (OFF: Frequency setting 1, ON: Frequency setting 2).
- Each time the status of "frequency changeover" command is changed between "OFF" and "ON", the target frequency is changed over.
  At the rising edge: Frequency setting 2, At the falling edge: Frequency setting 1
- When only the set value is changed, the target frequency is not changed.
  To change the frequency, it is necessary to change over the status of "frequency changeover" signal.
  (*1 In the above figure, frequency is not changed from f4 to f5.)
- When the frequency set value is lower than the self-startup frequency, operation is performed using the self-startup frequency.
  If "Frequency set value" < "Self-startup frequency", operation is performed using the self-startup frequency.
- "Frequency selected" signal indicates the currently selected status.

5-3 Details of Positioning Function

5-3-6 Work coordinates position preset

At the rising edge of “work coordinates position preset command”, the position data in the work coordinates system is preset. “Work coordinates position preset command” is accepted when positioning is completed (when “positioning completed” signal is ON).

<Timing chart for “work coordinates position preset command” signal>



*1 Preset to the set value 1.
*2 For PTP positioning or origin-return operation, changed over to the target position.
*3 Not accepted because positioning is being executed

- “Work coordinates position preset command” presets the target position and command position in the work coordinate system to the set values.
  “Work coordinates current position” is calculated from the preset value and the error at stoppage.
- “Work coordinates offset” is also updated.
- The position data in the machine coordinate system is not rewritten by “work coordinates position preset command”.
- Example of the position data preset by “work coordinates position preset command” is shown below.

<Position data after preset by “work coordinates position preset command”>

Position data	Value before preset	Value after preset	Remarks
Target position and command position in work coordinate system	50,000	30,000	Preset value
Current position in work coordinate system	50,006	30,006	Preset value + Error at stoppage
Target position and command position in machine coordinate system	10,000	10,000	Unchanged
Current position in machine coordinate system	10,006	10,006	Unchanged
Error at stoppage	6	6	Unchanged
Work coordinates offset	40,000	20,000	Difference of command position
Preset data	30,000		

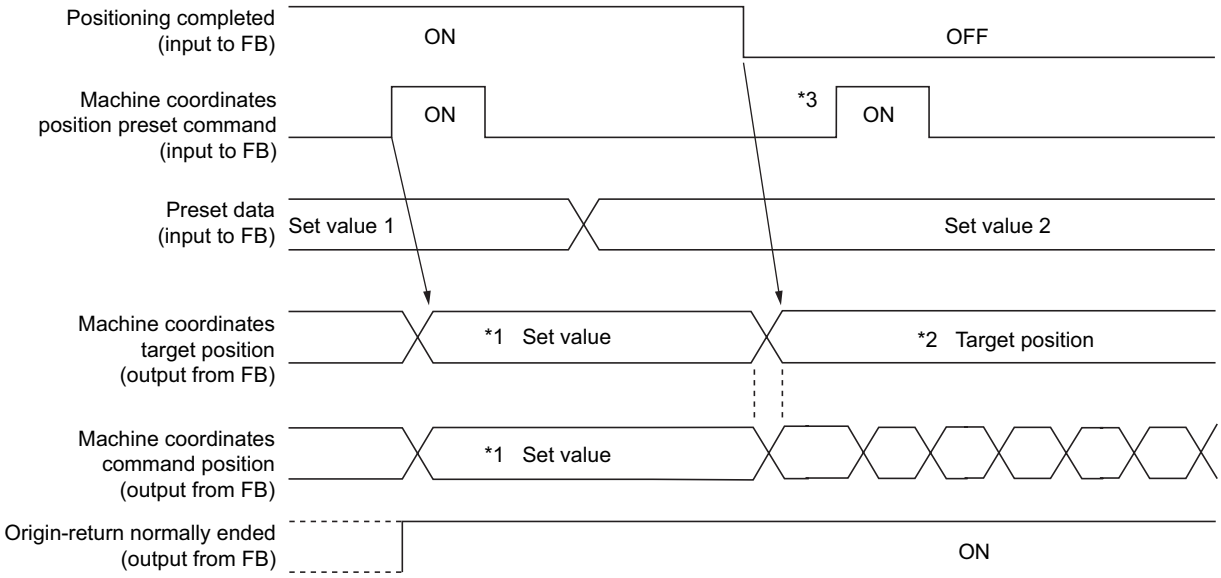
- The target position and command position in work coordinate system are changed to the preset values.
- The current position in work coordinate system becomes the preset value added by the error.
- Work coordinates offset becomes the “preset value” subtracted by “machine coordinates command position”.

5-3 Details of Positioning Function

5-3-7 Machine coordinates position preset

At the rising edge of “machine coordinates position preset command”, the position data in the machine coordinates system is preset. (The position data in work coordinate system is also updated.)
“Origin-return normally ended” signal is turned ON (“PTP normal end” signal does not change).
“Machine coordinates position preset command” is accepted when positioning is completed (when “positioning completed” signal is ON).

<Timing chart for “machine coordinates position preset command” signal>



*1 Preset to the set value 1.
*2 For PTP positioning or origin-return operation, changed over to the target position.
*3 Not accepted because positioning is being executed

- “Machine coordinates position preset command” presets the target position and command position in the machine coordinate system to the set values.
- “Machine coordinates current position” is calculated from the preset value and the error at stoppage.
- The position data in the work coordinate system becomes “the position data in machine coordinate system” added by the “set value of floating origin”.
- “Work coordinates offset” is preset to the set value of floating origin.
  The position data preset by “machine coordinates position preset command” is shown below.

<Position data after preset by “machine coordinates position preset command” (example)>

Position data	Value before preset	Value after preset	Remarks
Target position and command position in machine coordinate system	20,000	10,000	Preset value
Current position in machine coordinate system	20,006	10,006	Preset value + Error at stoppage
Target position and command position in work coordinate system	35,000	15,000	Machine coordinates + Set value of floating origin
Current position in work coordinate system	35,006	15,006	Machine coordinates + Set value of floating origin
Error at stoppage	6	6	Unchanged
Work coordinates offset	15,000	5,000	Set value of floating origin
Preset data	10,000		
Set value of floating origin	5,000		

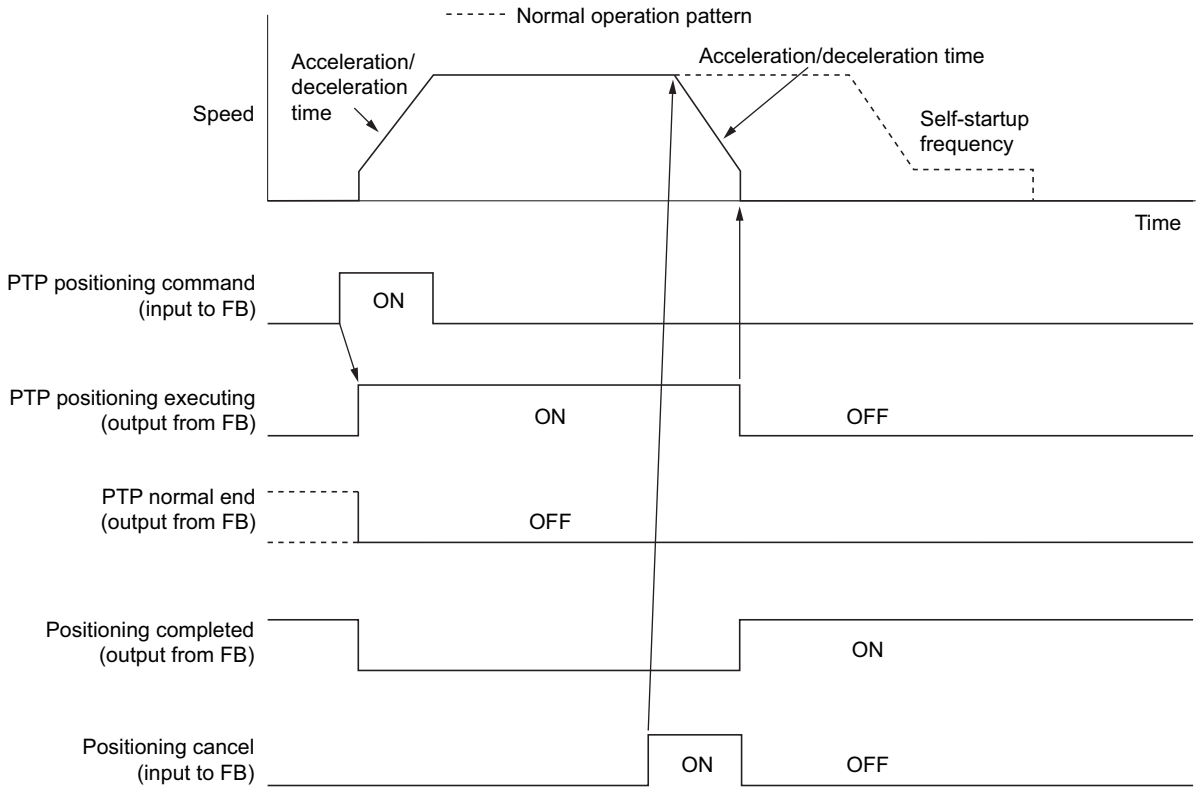
- The target position and command position in machine coordinate system are changed to the preset values.
- The current position in machine coordinate system becomes the preset value added by the error.
- Work coordinates offset becomes “the position data in machine coordinate system” added by “the set value of floating origin”.
- Work coordinates offset becomes “the set value of floating origin”.

5-3 Details of Positioning Function

5-3-8 Cancellation of positioning

At the rising edge of “positioning cancel” command during PTP positioning or origin-return operation, positioning is halted. When positioning is halted, deceleration takes place by the set value of ordinary acceleration/deceleration time. After pulse output is stopped, “positioning completed” signal is turned ON, and “PTP positioning executing” and “returning to origin” signals are turned OFF.

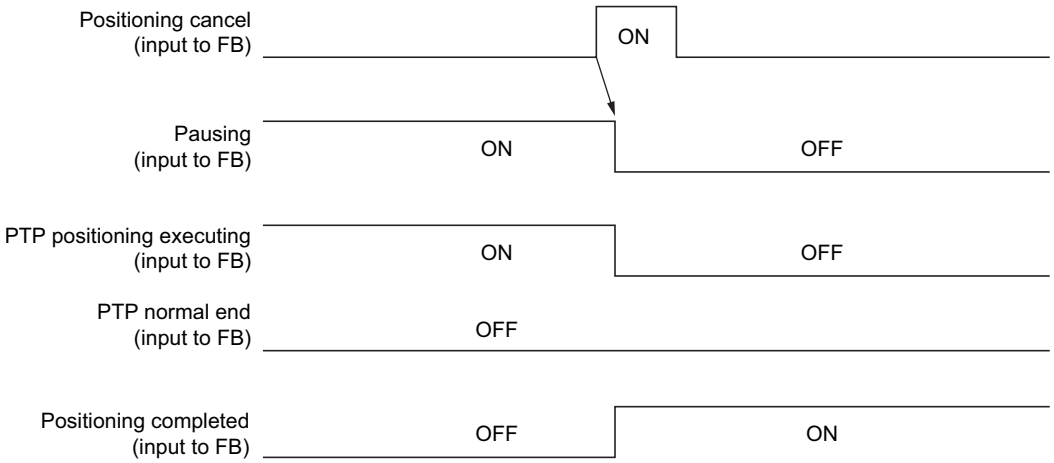
<Operation pattern under “positioning cancel” command>



- “Positioning cancel” command is accepted during PTP positioning or origin-return operation.
  (“Positioning cancel” command is disabled during manual operation.)
- Deceleration time under “positioning cancel” command is the acceleration/deceleration time that is set by parameter.
  (The same as ordinary deceleration curve during positioning operation.)
- When pulse output is stopped by “positioning cancel” command, “positioning completed” signal is turned OFF.
  “PTP positioning executing” and “returning to origin” signals are turned OFF.
  Neither “PTP normal end” signal nor “origin-return normally ended” signal is turned ON.
- If the target position is reached while decelerating under “positioning cancel” command, pulse output is immediately stopped. In this case, PTP positioning operation is regarded as completed successfully. (For example, when “Positioning cancel” command is issued when decelerating)
- Also during origin-return operation, if the origin is detected while decelerating under “positioning cancel” command, pulse output is stopped. (Also in this case, origin-return operation is regarded as completed successfully.)

5-3 Details of Positioning Function

- “Positioning cancel” command is issued while operation is halted, “pausing” signal is turned OFF.



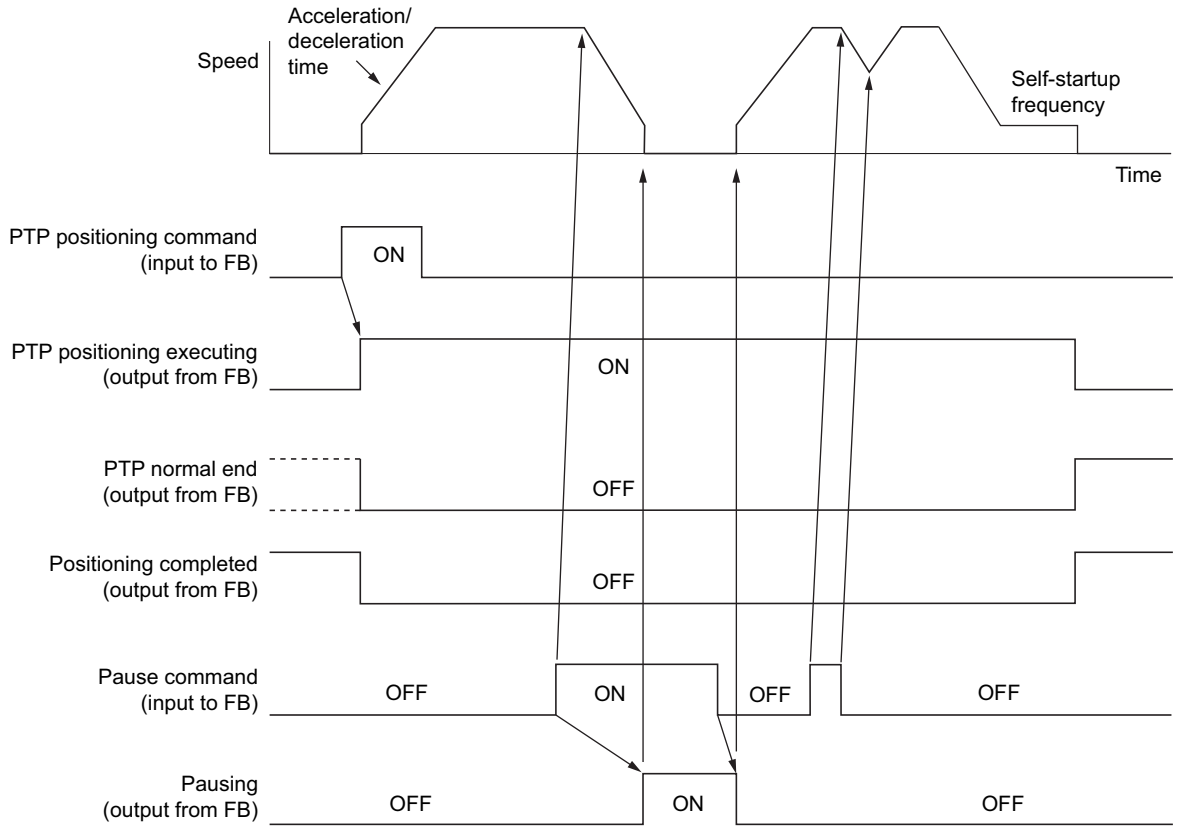
- Neither “PTP positioning command” nor “origin-return command” is accepted if “positioning cancel” command is ON at the rising edge of “PTP positioning command” or “origin-return command”.

5-3 Details of Positioning Function

5-3-9 Pause

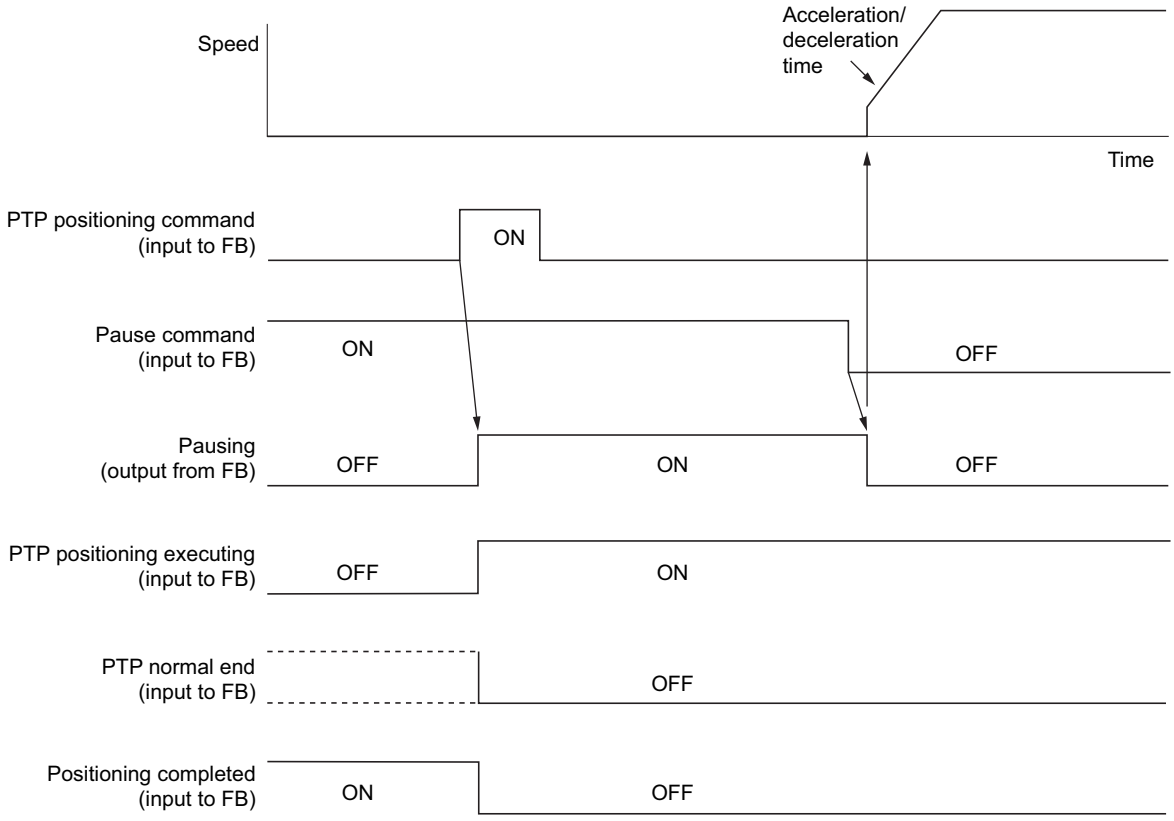
If “pause command” is turned ON during PTP positioning or origin-return operation, pulse train command output is stopped. (When “pause command” is turned OFF, pulse train output is resumed.)
While operation is halted and pulse train output is stopped, “pausing” signal is turned ON.

<Operation pattern under “pause command”>



- “Pause command” is enabled during PTP positioning or origin-return operation.
  (“Pause command” is disabled during manual operation.)
- When “pause command” is turned OFF again, positioning operation is resumed.
- While pulse output is stopped by “pause command”, “positioning completed” signal continues to be OFF.
  “PTP positioning executing” and “returning to origin” signals also continue to be ON.
- If “pause command” is turned OFF while decelerating under “pause command”, acceleration takes place to immediately reach the set frequency. In this case, because pulse output is not stopped, “pausing” signal continues to be OFF.
- While “positioning completed” signal is ON. “pausing” signal continues to be OFF.
  (Even when “pause command” is turned ON, “pausing” signal will continue to be OFF.)
- If “pause command” is ON at the rising edge of “PTP positioning command” or “origin-return command”, “pausing” signal is immediately turned ON. (No pulse is output.)
  At the same time, “positioning completed” signal is turned OFF, “PTP normal end” signal (or “origin-return normally ended” signal) is turned OFF, and “PTP positioning executing” signal (or “returning to origin” signal) is turned ON.

5-3 Details of Positioning Function



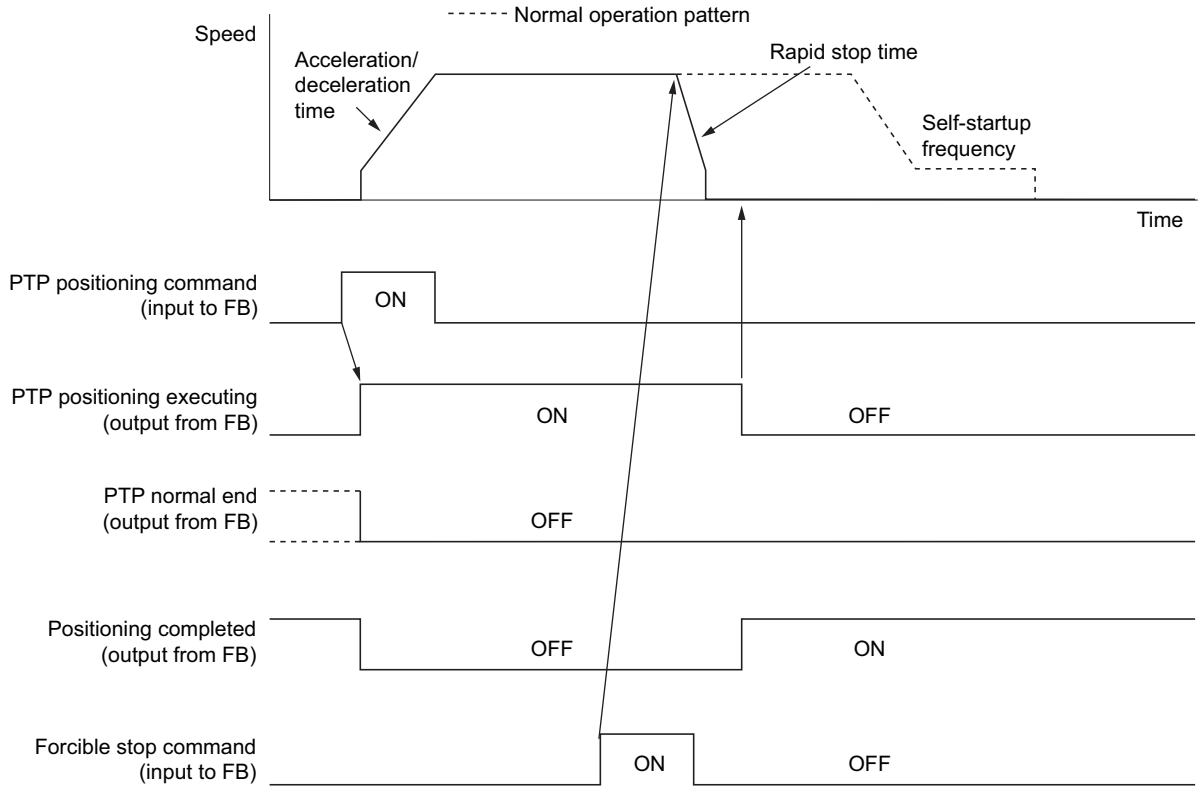
- If the target position is reached while decelerating under “pause command”, pulse output is immediately stopped. In this case, PTP positioning operation is regarded as completed successfully. (For example, when “pause command” is issued when decelerating)
- Also during origin-return operation, if the origin is detected while decelerating under “pause command”, pulse output is stopped. Also in this case, origin-return operation is regarded as completed successfully.
- Even when “pause command” is accepted, if PTP positioning or origin-return operation is completed successfully while stopping, “pausing” signal is not turned ON.

5-3 Details of Positioning Function

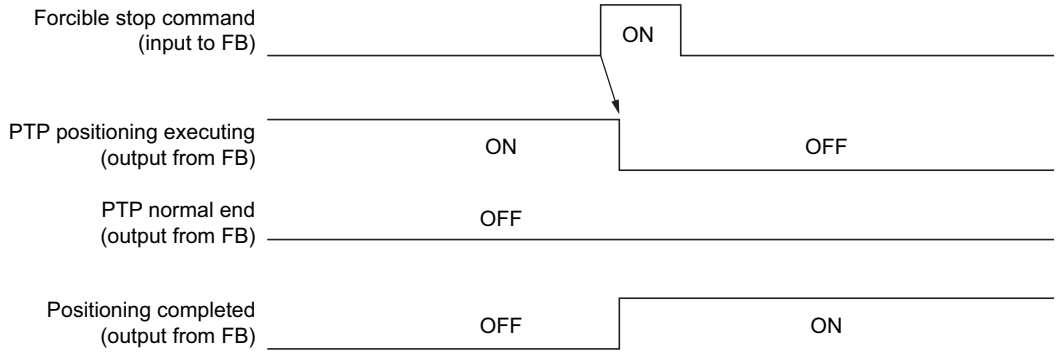
5-3-10 Forcible stop

If “forcible stop command” is turned ON during PTP positioning operation, positioning operation is stopped. When positioning operation is stopped by “forcible stop command”, deceleration takes place by the (parameter) set value of rapid stop time. After pulse output is stopped, “positioning completed” signal is turned ON, and “PTP positioning executing” and “returning to origin” signals are turned OFF.

<Operation pattern under “forcible stop command”>

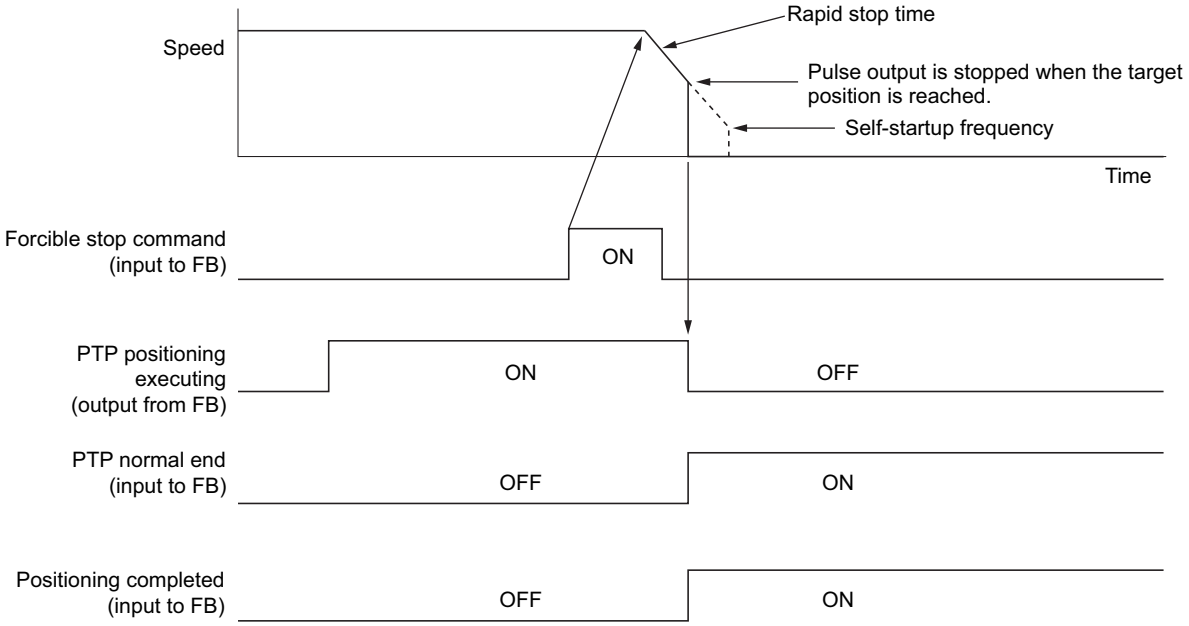


- “Forcible stop command” is accepted during PTP positioning operation, manual operation or origin-return operation.
- Deceleration time under “forcible stop command” depends on the (parameter) set value of rapid stop time. However, if the set value of rapid stop time is larger than the set value of acceleration/deceleration time, the latter is referred to.
  When “Rapid stop time” <= “Acceleration/deceleration time”, rapid stop time is used.
  When “Rapid stop time” > “Acceleration/deceleration time”, acceleration/deceleration time is used.
- When pulse output is stopped by “forcible stop command”, “positioning completed” signal is turned ON. “PTP positioning executing”, “forward rotating by manual operation” or “reverse rotating by manual operation” and “returning to origin” signals are turned OFF.
- If “forcible stop command” is issued while operation is halted by “pause command”, “pausing” signal is turned OFF.

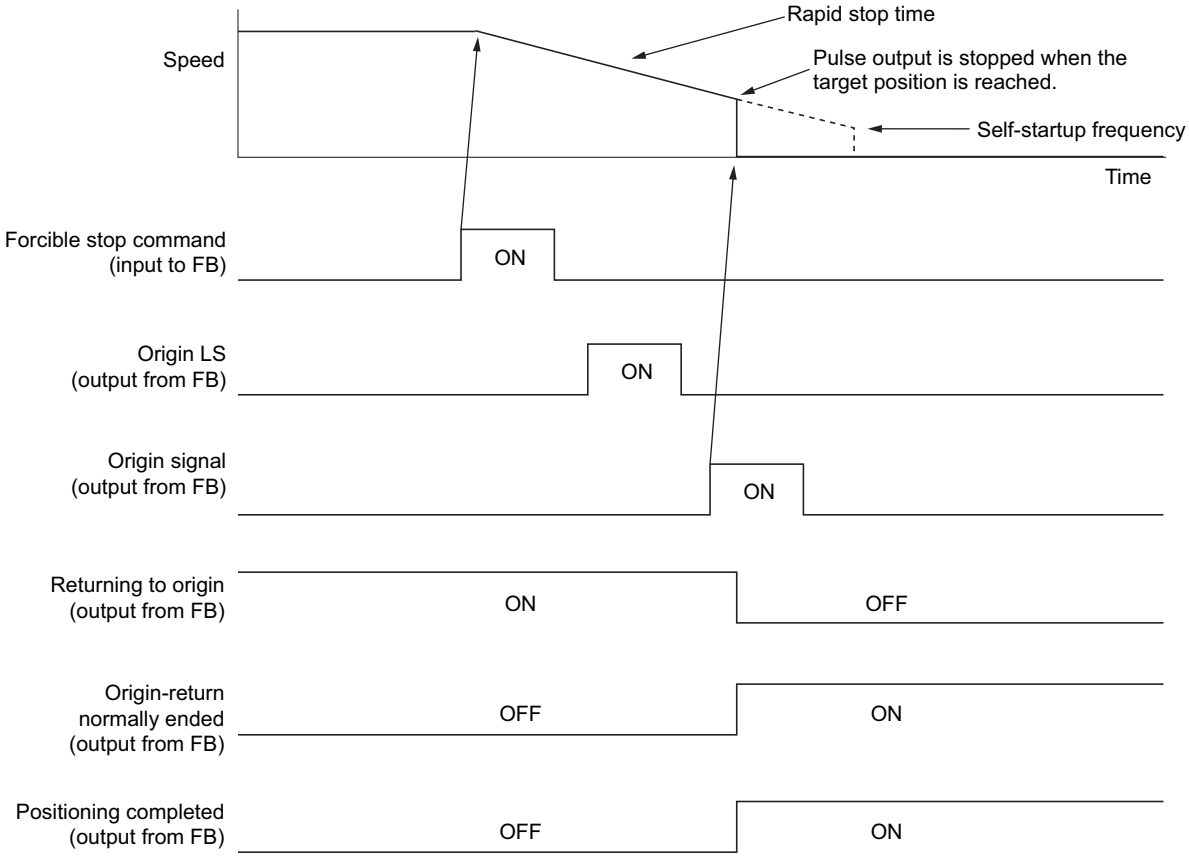


5-3 Details of Positioning Function

- If “forcible stop command” is ON at the rising edge of “PTP positioning command”, “manual forward rotation command”, “manual reverse rotation command” or “origin-return command”, none of “PTP positioning command”, “manual forward rotation command”, “manual reverse rotation command” and “origin-return command” is accepted.
- If the target position is reached while decelerating under “forcible stop command” during “PTP positioning operation”, pulse output is stopped. In this case, PTP positioning operation is regarded as completed successfully.



- Also during origin-return operation, if the origin is detected while decelerating under “forcible stop command”, pulse output is stopped. In this case, origin-return operation is regarded as completed successfully.

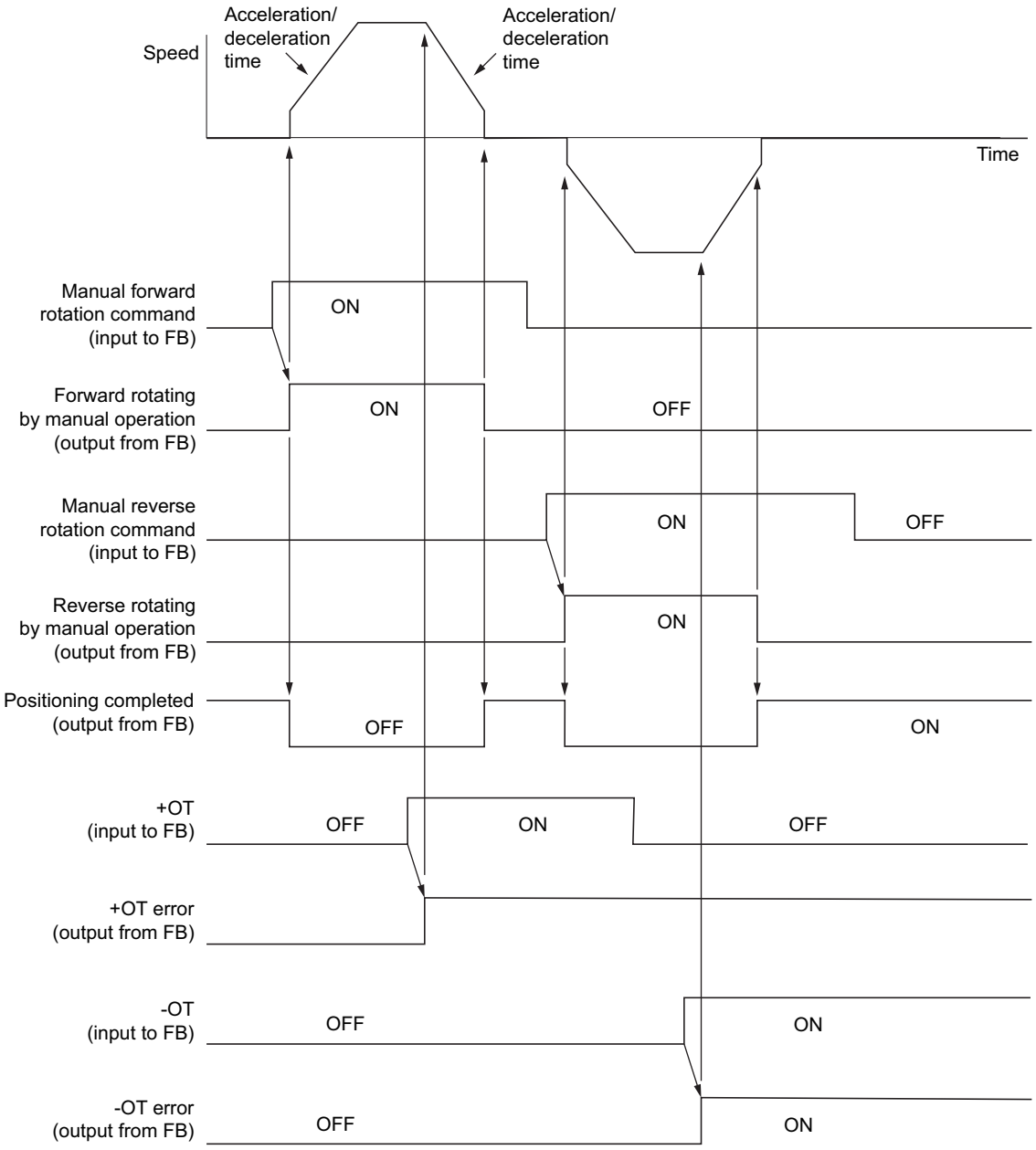


5-3 Details of Positioning Function

5-3-11 OT error

"+OT error" or "–OT error" occurs if "+OT" or "-OT" signal is turned ON during positioning operation (while pulse is being output). If positioning is stopped due to an OT error being detected, acceleration takes place by the set value of ordinary acceleration/ deceleration time.
After pulse output is stopped, "positioning completed" signal is turned ON, and "PTP positioning executing", "forward rotating by manual operation", "reverse rotating by manual operation" and "returning to origin" signals are turned OFF.

<Operation pattern when an OT error is detected>



- The deceleration time when an OT error is detected depends on the (parameter) set value of ordinary acceleration/ deceleration time.
- When pulse output is stopped due to an OT error detected, "positioning completed" signal is turned ON.
  "PTP positioning executing", "forward rotating by manual operation", "reverse rotating by manual operation" and "returning to origin" signals are turned OFF.
- While pulse output is stopped, no OT error is detected even if "+OT" or "-OT" signal is turned ON.
  (Also when pulse output is stopped by "pause command", no OT error is detected.
- When decelerating under "forcible stop command", OT error is detected if pulse is being output. However, for the deceleration curve, priority is given to forcible stop time.

5-3 Details of Positioning Function

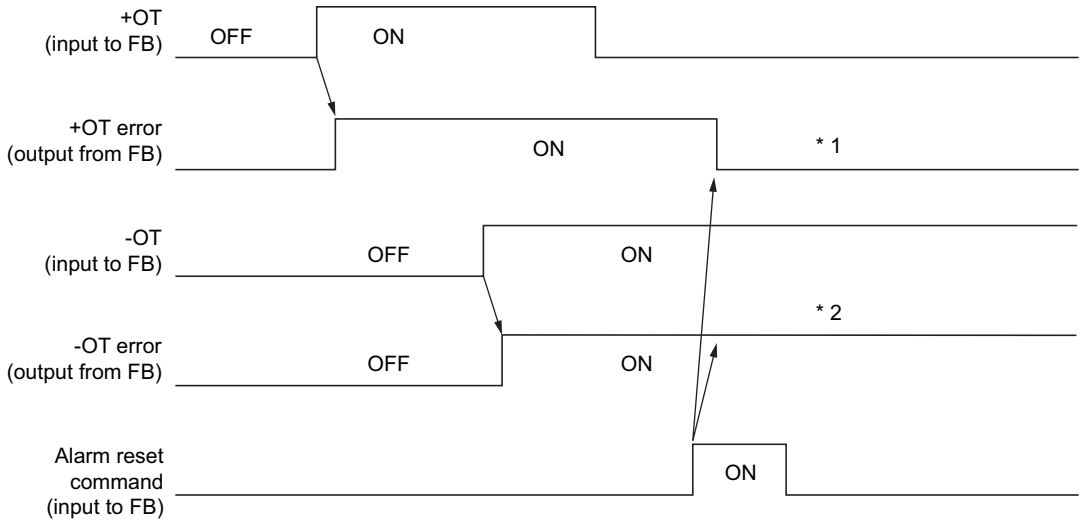
- OT error detecting method depends on operation mode.

  1) During PTP positioning operation
  - OT error occurs if either “+OT” or “-OT” signal is turned ON.
    If either “+OT error” or “-OT error” is detected, positioning operation is stopped. When either “+OT error” or “-OT error” is turned ON, “PTP positioning command” is not accepted.

  2) During manual operation
  - During forward rotation, “+OT error” occurs if it is detected that “+OT” signal is ON.
  - During reverse rotation, “-OT error” occurs if it is detected that “-OT” signal is ON.
  - OT signal that is opposite to the operating direction is not monitored. Even when an opposite direction OT is detected, if the OT signal in the operating direction is OFF, manual operation command is accepted. If an OT error in the operating direction is detected, positioning operation is stopped.

  3) During origin-return operation
  - When returning in the reverse direction, “-OT error” occurs if it is detected that “-OT” signal is ON.
  - When returning in the forward direction, “+OT error” occurs if it is detected that “+OT” signal is ON.
  - OT signal that is opposite to the returning direction is not monitored.
    Even when an opposite direction OT is detected, if the OT signal in the returning direction is OFF, “origin return command” is accepted. If an OT error in the returning direction is detected, positioning operation is stopped.

- OT error is reset at the rising edge of “alarm reset” command after error causes are removed (after “+OT” or “-OT” signal is turned OFF).
  Unless error causes are removed (when “+OT” or “-OT” signal is ON), error signal is not cleared.



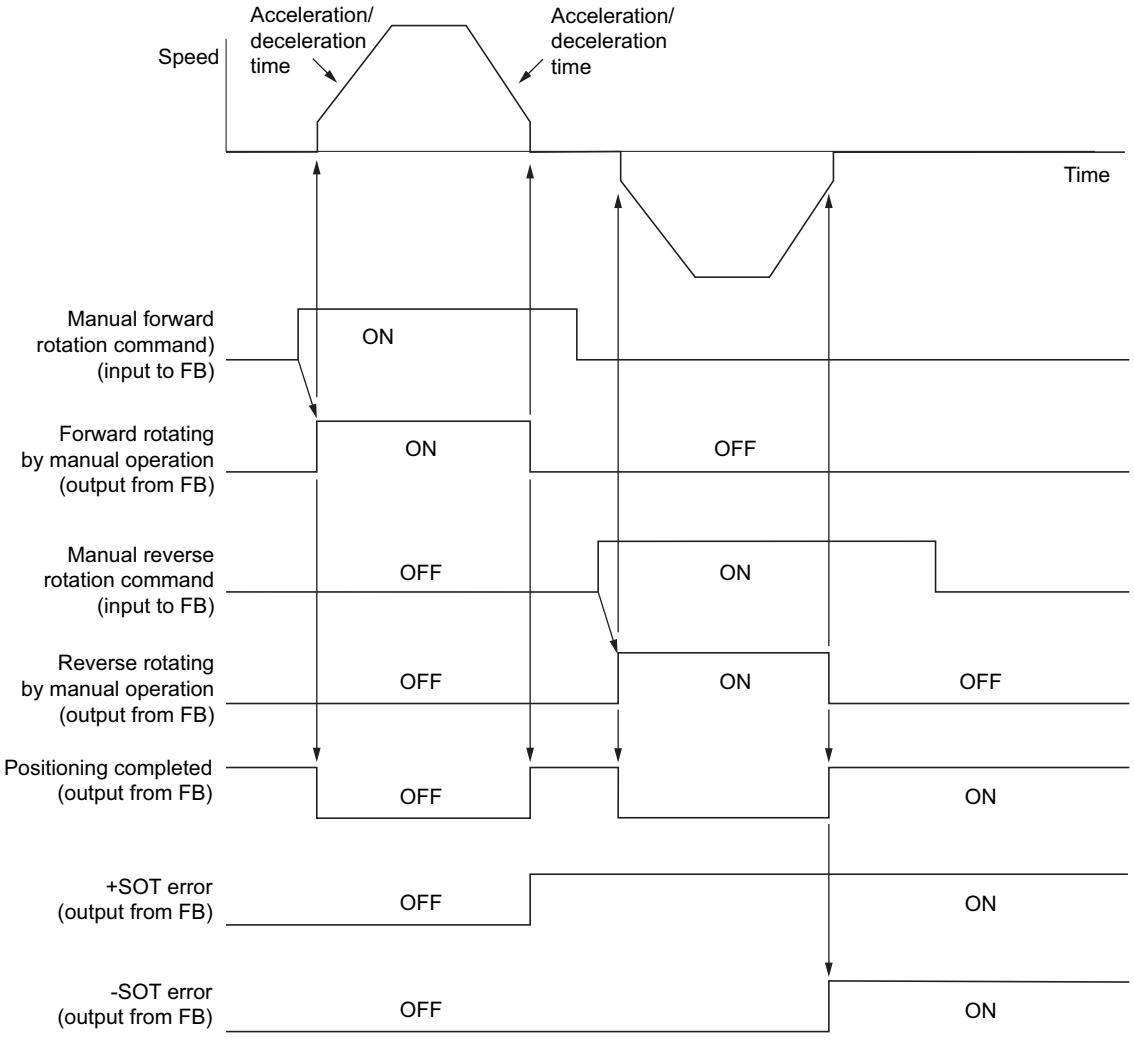
*1 “+OT error” signal is reset because “+OT” signal is OFF.
*2 “-OT error” signal is not reset because “-OT” signal is ON.

5-3 Details of Positioning Function

5-3-12 SOT error

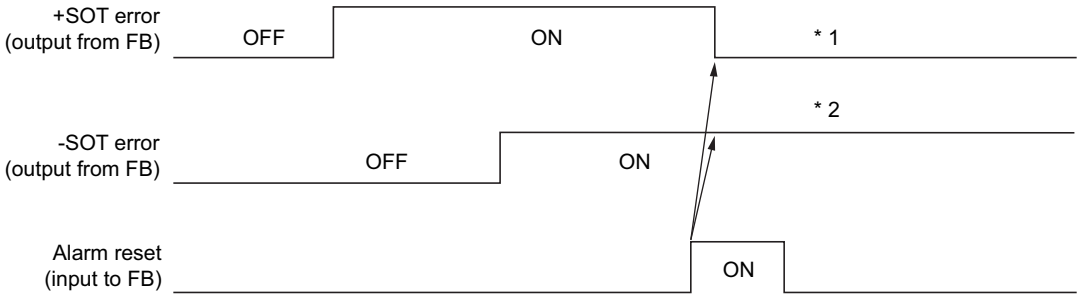
- In finite length mode, “+SOT error” or “-SOT error” occurs if “machine coordinates command position” is beyond the software OT range.
  When “machine coordinates command position” >= “Software OT range in positive direction”, “+SOT error” is detected.
  When “machine coordinates command position” <= “Software OT range in negative direction”, “–SOT error” is detected.
  Software OT range is registered to the parameter area.
- During PTP positioning operation in finite length mode, if a position beyond the software OT range is instructed, positioning is performed at the software OT position.
  When positioning at software OT position is completed, “+SOT error” or “-SOT error” signal is turned ON.
- For manual operation in finite length mode, operation is stopped at software OT position.
  When stopped, “+SOT error” or “-SOT error” signal is turned ON
- For origin-return operation in finite length mode, no SOT error is detected in the returning direction.
  Even when “+SOT error” or “-SOT error” is detected, origin-return operation is executed.
- In infinite length mode, no SOT error is monitored.

<Operation pattern for SOT error detection>



5-3 Details of Positioning Function

- SOT error is reset at the rising edge of “alarm reset” command, after error causes are removed (after “machine coordinates command position” returns within the software OT detection range).
  Unless error causes are removed (when “machine coordinates command position” is out of the software OT detection range), error signal is not cleared.



*1 When “machine coordinates command position” < “software OT range in positive direction”, “+SOT error” signal is reset.
*2 When “machine coordinates command position” <= “software OT range in negative direction”, “-SOT error” signal is not reset.

When origin-return operation is completed successfully, both “+SOT error” and “-SOT error” signals are reset.

- For PTP positioning or manual operation in finite length mode, no positioning is performed beyond the software OT range.
- When positioning at software OT position is completed, “+SOT error” or “-SOT error” signal is turned ON.
  At the same time, “positioning completed” signal is turned ON. “PTP positioning executing”, “forward rotating by manual operation” and “reverse rotating by manual operation” are turned OFF.
- During PTP positioning or manual operation, even when the software OT range data that is set by parameter is rewritten, it won’t be reflected on the operation. (The data just after startup takes effect.)
- Till positioning in finite length mode is completed, SOT error is continuously monitored.
- When positioning at software OT position is performed during PTP positioning operation in finite length mode, “PTP normal end” signal is not turned ON except the case that the target position coincides with the SOT position.
- During origin-return operation, no SOT error is detected.
  However, when origin-return operation is stopped (by “positioning cancel command” or “forcible stop command”, SOT is checked after operation is stopped. (Check at the completion of positioning)

- SOT error detecting method slightly differs with operation mode (in finite length mode).

  1) During PTP positioning operation
     - The software OT range in the operating direction is checked when started up.
       If either “+SOT error” or “-SOT error” signal is ON, “PTP positioning command” is not accepted.

  2) During manual operation
     - During forward rotation, the checking of software OT range is made in positive direction.
     - During reverse rotation, the checking of software OT range is made in negative direction.
     - Even when an SOT error is detected in the direction opposite to the operating direction, manual operation commands are accepted if no SOT error is detected in the operating direction.

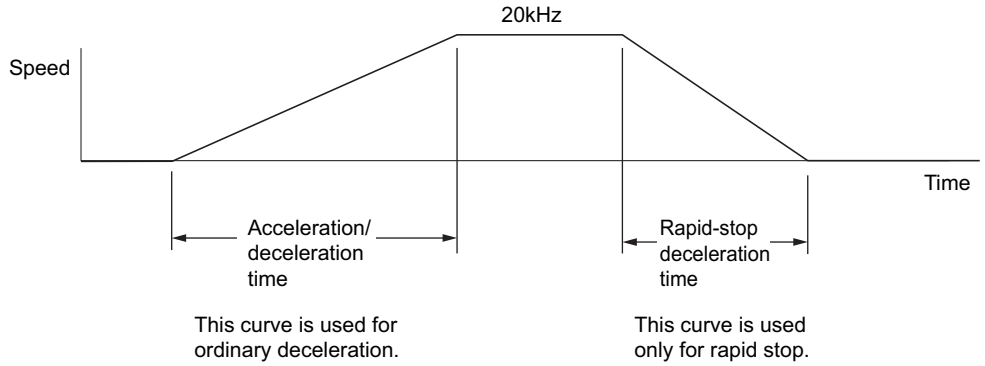
  3) During origin-return operation
     - No Sot error is detected during operation.
     - Even when an SOT error is detected in the returning direction, origin-return operation is executed.
       When origin-return operation is completed successfully, SOT error signal is cleared.

5-3 Details of Positioning Function

5-3-13 Acceleration and deceleration

- For acceleration/deceleration data, the acceleration/deceleration time to change seed from 0 Hz to 20 kHz, or vice versa, is registered in the parameter area, in 1-ms steps.
- There are two types of acceleration/deceleration data, as shown below:
  a) Ordinary acceleration/deceleration time : The data used for acceleration/deceleration purpose other than forcible stop
  b) Rapid stop time : The deceleration data used for forcible stop

<Acceleration/deceleration time and rapid-stop deceleration time>



- This FB can calculate acceleration and deceleration even without fixed-cycle startup.
  The method to calculate acceleration/deceleration is described below.

a) Current frequency at the occurrence of event	fs	Hz
b) Target frequency	fo	Hz
c) Maximum frequency, 20 kHz	fmax	Hz
d) Acceleration/deceleration time	T	m s
e) Elapsed time after the event occurred	t	m s
f) Frequency when time t has elapsed	fpv	Hz

When fs <= fo,
fpv = fs + {(fmax x t)/T}
The target speed is reached if fpv >= fo.

When fs > fo,
fpv = fs - {(fmax x t)/T}
The target speed is reached if fpv <= fo.

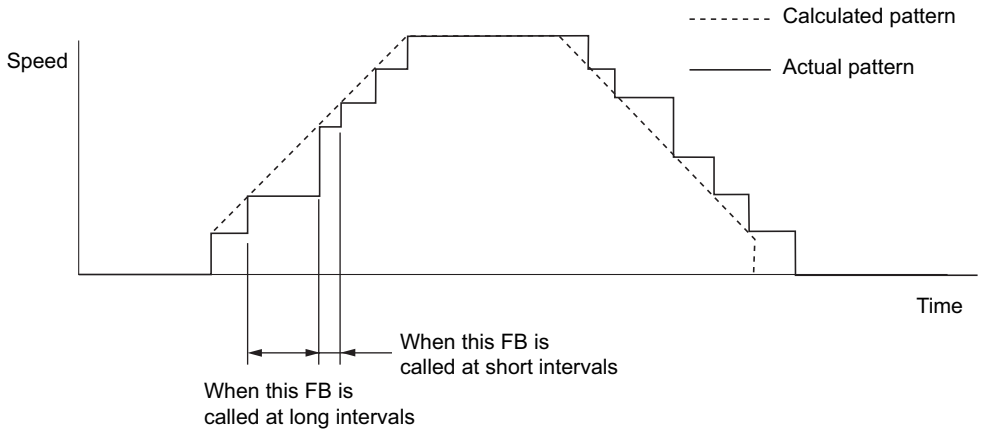
5-3 Details of Positioning Function

Event types and the current and target frequencies at event occurrence are shown below:

<Event types and frequency data>

Event	Current frequency fs	Target frequency fo	Remarks
PTP positioning command, manual forward/reverse rotation command, origin-return command	Self-startup frequency	Frequency setting 1 or frequency setting 2	By frequency changeover command
Frequency changeover	Current frequency	Frequency setting 1 or frequency setting 2	By frequency changeover command
Deceleration point detection (PTP)	Current frequency	Self-startup frequency	Pulse output is stopped when the target position is reached.
Origin LS detection	Current frequency	Self-startup frequency	Pulse output is stopped when the origin is detected.
Manual forward/reverse rotation command OFF	Current frequency	Self-startup frequency	Stopped when self-startup frequency is reached
Pause command ON	Current frequency	Self-startup frequency	Stopped when self-startup frequency is reached
Pause command OFF (when pulse output is stopped)	Self-startup frequency	Frequency setting 1 or frequency setting 2	By frequency changeover command
Pause command OFF (when pulse is being output)	Current frequency		
Positioning cancel	Current frequency	Self-startup frequency	Stopped when self-startup frequency is reached
OT detection	Current frequency	Self-startup frequency	Stopped when self-startup frequency is reached
SOT detection	Current frequency	Self-startup frequency	Pulse output is stopped when SOT position is reached.
Forcible stop command	Current frequency	Self-startup frequency	Stopped when self-startup frequency is reached

- The relation between calculated acceleration/deceleration curve and actual acceleration/deceleration curve is shown below (during manual operation).



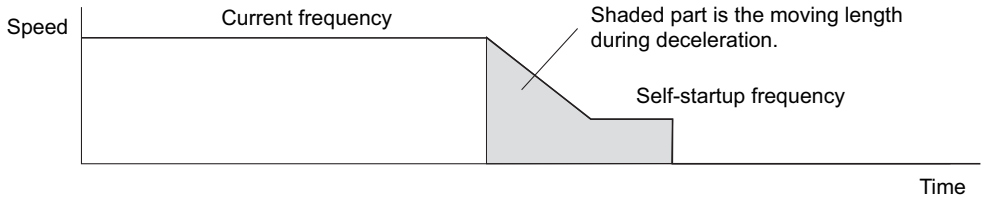
- For acceleration, actual position is slightly behind the calculated pattern.
- For deceleration, actual position is slightly ahead of the calculated pattern.

5-3 Details of Positioning Function

5-3-14 Deceleration point detection

During PTP positioning operation, deceleration point is automatically detected.

<Moving length during deceleration>

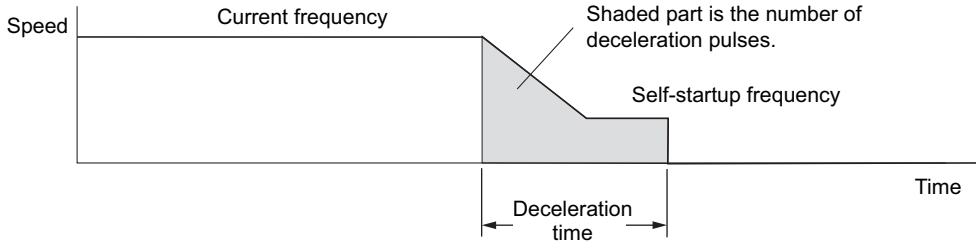


- The moving length during deceleration is calculated using the following formula:

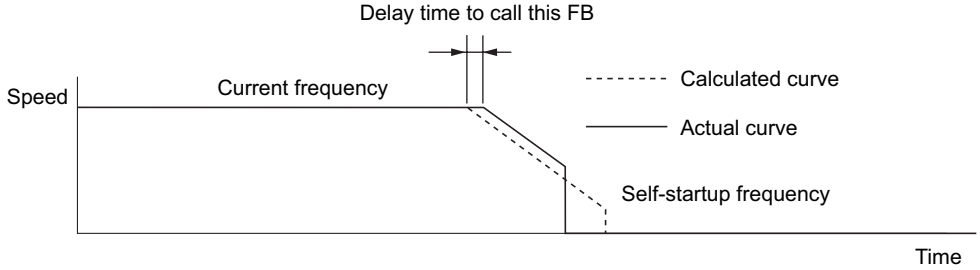
a) Current frequency	fs	Hz
b) Maximum frequency, 20 kHz	fmax	Hz
c) Acceleration/deceleration time	T	ms
d) Moving length at stoppage	Ps	pulses
e) Deceleration time from current frequency to 0 Hz	td	ms
f) Number of deceleration pulses from current frequency to 0 Hz	Po	pulses
g) Moving length during deceleration	Pd	pulses

  - Deceleration time: td = (T x fs) / fmax
  - Number of deceleration pulses: Po = (fs x td) / 2
  - Moving length during deceleration: Pd = Po + Ps
  - Deceleration starts at the position where the number of remaining pulses (Pr) to the target position becomes as follows: Pr <= Pd

- Deceleration time and the number of deceleration pulses are approximated by the number of pulses to frequency 0 Hz.



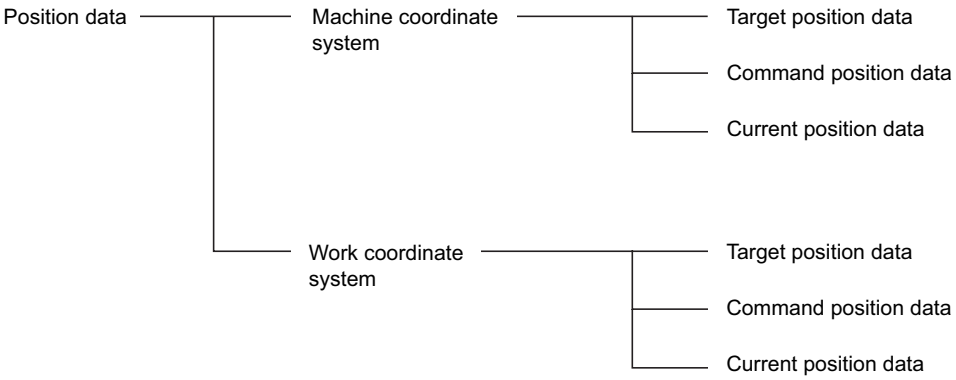
- The simple positioning expansion FB starts processing for deceleration when the deceleration point is passed.
- If the moving length at stoppage is small, the target position may be reached while decelerating. In this case, pulse output is stopped in the middle of deceleration.
  In order to surely perform the processing for stopping by two-step motion, the moving length at stoppage must be greater than the following value:
  "Moving length at stoppage" > "Maximum set value of frequency" x "Maximum time interval to call the simple positioning expansion FB"



5-3 Details of Positioning Function

5-3-15 Position data management

The simple positioning expansion FB outputs the position data in machine coordinate system and the position data in work coordinate system. For both coordinate systems, there are 3 types of position data: target position, command position and current position, as shown below.



- For PTP positioning operation, the number of output pulses is calculated, referring to the position data in work coordinate system.

  1) When absolute position is set:
  "Number of output pulses" = "Set value for the number of pulses" - "Current position in work coordinate system"
  2) When relative position is set:
  "Number of output pulses" = "Set value for the number of pulses" - "Number of error pulses"
  "Number or error pulses" = "Command position" - "Current position"

- Position data is DINT type (in the range from 2147483647 to –2147483648).
  If position data is greater than the "+" side maximum value to result in overflow, it is set to the "-" side maximum value.
  (0 → 2147483647 → -2147483648 → 0)
  If position data is smaller than the "-" side maximum value to result in underflow, it is set to the "+" side maximum value.
  (0 → -2147483648 → 2147483647 → 0)

(1) Target position data

Target position data is updated each time PTP positioning or origin-return operation is started.

1) For PTP positioning operation
   - The target position in work coordinate system is rewritten to the value calculated from the number of pulses data.
     When absolute position is set: "Target position in work coordinate system" = "Set value for the number of pulses"
     When relative position is set : "Target position in work coordinate system" = "Command position in work coordinate system + Set value for the number of pulses"
   - The target position in machine coordinate system is calculated from the target position in work coordinate system and offset.
     "Target position in machine coordinate system" = "Target position in work coordinate system" – "Offset"

2) For origin-return operation
   - The target position in work coordinate system and the target position in machine coordinate system become as follows:
     "Target position in work coordinate system" = "Set value of floating origin"
     "Target position in machine coordinate system" = "0"

3) For manual operation
   - During manual operation, target position data is not updated.

4) At completion of positioning
   - When positioning is completed, target position data is not updated.

5) When "work coordinates position preset" is used
   - The target position data in work coordinate system becomes as follows:
     "Target position data in work coordinate system" = "Preset value"
     When the position in work coordinate system is preset, offset is also updated.

6) When "machine coordinates position preset" is used
   - The target position data in machine coordinate system becomes as follows:
     "Target position data in machine coordinate system" = "Preset value"
     The target position data in work coordinate system becomes as follows:
     "Target position data in work coordinate system" = "Target position data in machine coordinate system" + "Set value of floating origin"
   - When the position in machine coordinate system is preset, offset is changed to the set value of floating origin.

(2) Current position data

For both machine coordinate system and work coordinate system, current position data is updated to the current value data that is sent from the high-speed output module.

"Current position" = "Current position + {"Current value of current value data" – "Previous value of current value data"}

1) For PTP positioning operation
For both machine coordinate system and work coordinate system, current position data is updated to the current value data that is sent from the high-speed output module.

2) For origin-return operation
Till machine origin is detected, for both machine coordinate system and work coordinate system, current position data is updated to the current value data that is sent from the high-speed output module.
If the origin, which is the point to detect the rising edge of "origin signal" for the first time after "origin LS" is passed, is reached during origin-return operation, the current position data in machine coordinate system is cleared to zero.
The current position data in work coordinate system is preset to the set value of floating origin.
(After that, the current position is updated to the current value data that is sent from the high-speed output module.)

3) During manual operation
For both machine coordinate system and work coordinate system, current position data is updated to the current value data that is sent from the high-speed output module.

4) When "work coordinates position preset" is used
The current position data in work coordinate system becomes as follows:
"Current position in work coordinate system" = "Preset value" – "Number of error pulses"

5) When "machine coordinates position preset" is used
The current position data in machine coordinate system becomes as follows:
"Current position data in machine coordinate system" = "Preset value" – "Number of error pulses"
The current position data in work coordinate system becomes as follows:
"Current position data in work coordinate system" = "Current position data in machine coordinate system" + "Set value of floating origin"

(3) Command position data

- During positioning operation (when "positioning completed" signal is OFF), command position data is generally the same as the current position data.
  "Command position" = "Current position"
- After PTP positioning or origin-return operation is completed successfully, command position data becomes the same as the target position data till pulse output is started by the next command.
  "Command position" = "Target position"
- When positioning is completed (when "positioning completed" signal is ON), command position data is not updated (the value at completion is held).

1) For PTP positioning operation
- For both machine coordinate system and work coordinate system, after pulse output is started by "PTP positioning command" till PTP positioning is completed successfully,
  "Command position data" = "Current position data"
  When PTP positioning is completed successfully,
  "Command position data" = "Target position data"

2) For origin-return operation
- For both machine coordinate system and work coordinate system, after pulse output is started by "origin-return command" till the origin is detected successfully,
  "Command position data" = "Current position data"
  When origin-return operation is completed successfully, the same as the target position data,
  "Command position data in work coordinate system" = "Set value of floating origin"
  "Command position data in machine coordinate system" = 0"
- If origin-return operation did not complete successfully due to cancel or forcible stop command, command position data coincides with current position data when positioning is completed. (The error at stoppage is "0".)

3) During manual operation
- When pulse is being output under manual forward/reverse rotation command,
  "Target position data" = "Current position data"
- After the end of manual operation, target position data coincides with current position data when pulse output is stopped. (The error at stoppage is "0".)

4) When a software OT error is detected
- When positioned at a software OT position during PTP positioning or manual operation, the command position data in machine coordinate system is set to the values of software OT detected position.
- In this case, the command position data in work coordinate system becomes as follows:
  "Command position in work coordinate system" = "Software OT detected position" + "Offset"

5-3 Details of Positioning Function

5) When positioning is completed
- When positioning is completed, command position data is not updated.

6) When “work coordinates position preset” is used
- The target position data in work coordinate system becomes as follows:
  “Target position in work coordinate system” = “Preset value”

7) When “machine coordinates position preset” is used
- The target position data in machine coordinate system becomes as follows:
  “Target position in machine coordinate system” = “Preset value”

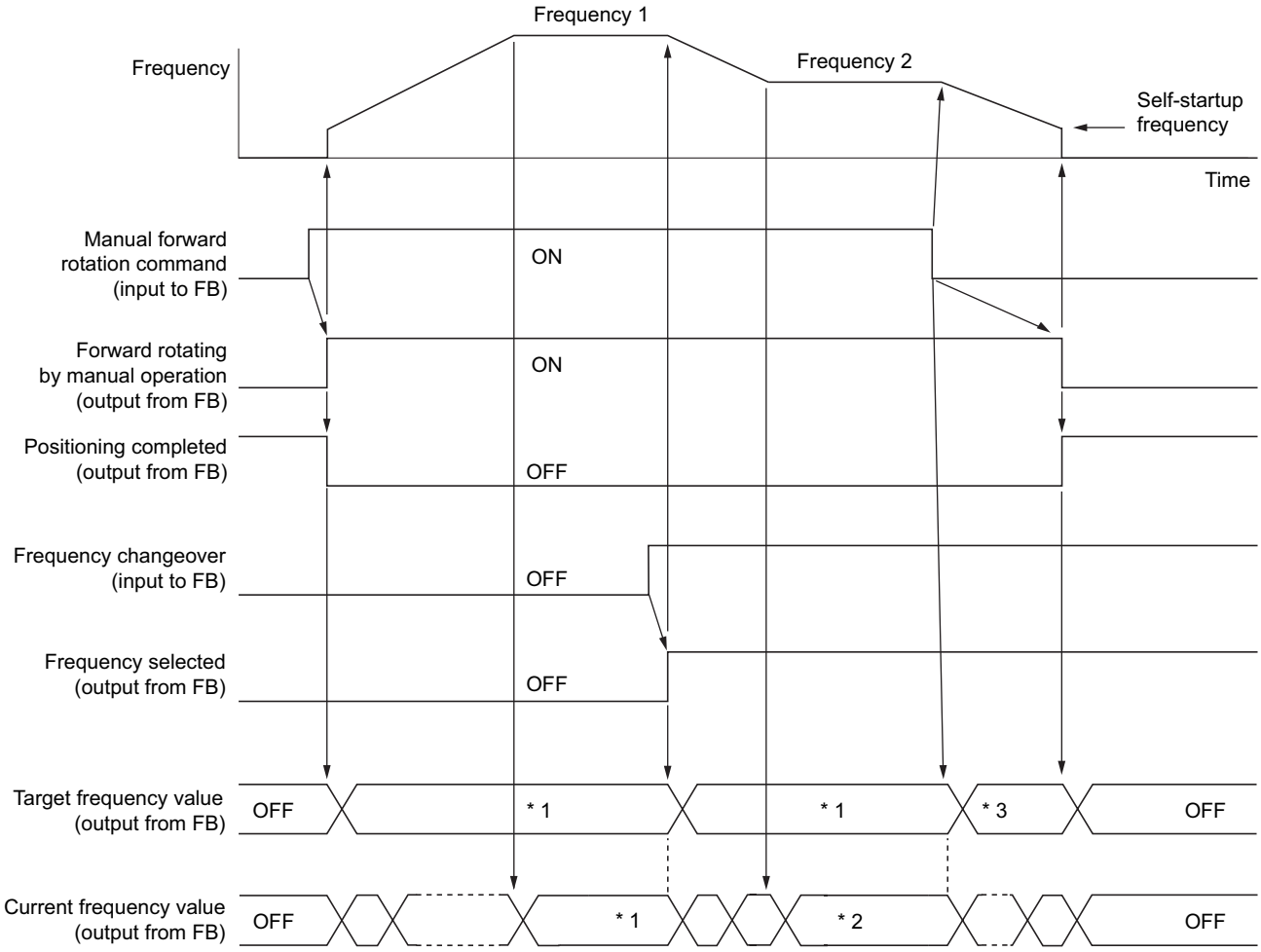
  The target position data in work coordinate system becomes as follows:
  “Target position in work coordinate system” = “Target position in machine coordinate system” + “Set value of floating origin”

5-3 Details of Positioning Function

5-3-16 Frequency data management

The simple positioning expansion FB outputs target frequency and current frequency data.

<Timing to update frequency data> (Example of manual forward rotation)



*1 Frequency setting 1
*2 Frequency setting 2
*3 Self-startup frequency

- When positioning is completed, both target value and current value are set to 0 (zero).
- Target frequency value is changed over when acceleration/deceleration is started.
- Current frequency value dynamically changes during acceleration/deceleration.
  (Becomes the same as the target value when target frequency is reached)
- While decelerating to stop pulse output, self-startup frequency becomes the target value.

5-3 Details of Positioning Function

5-3-17 Operation when the data setting FB is used

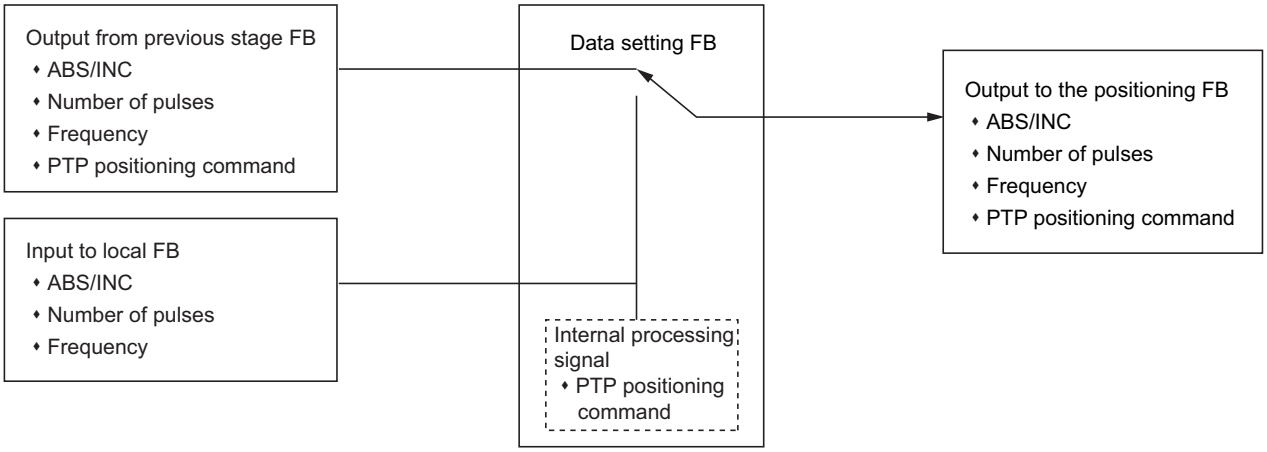
Till the rising edge of “startup command” signal is detected, the data setting FB outputs the following command signals and positioning data as they are received from the previous stage FB.

1) ABS/INC selection
2) Number of pulses setting
3) Frequency setting
4) PTP positioning command

The following signals are kept at OFF.

1) “Next stage startup command”
2) “FB running”
3) “FB completed”

<Status before “startup command” signal is detected>

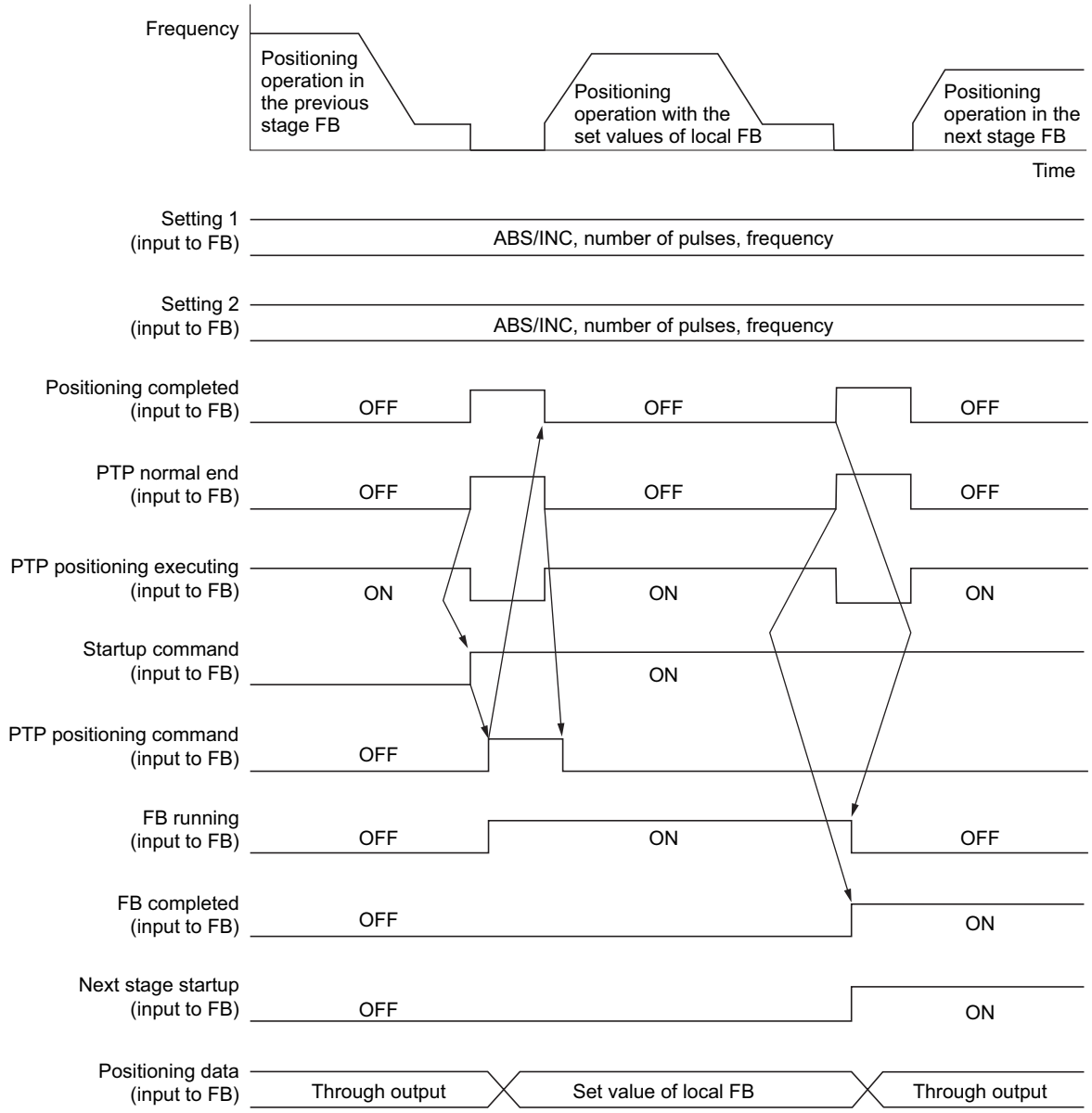


5-3 Details of Positioning Function

5-3-18 Outputting the set data of local FB (when the data setting FB is used)

When the rising edge of “startup command” is detected, the set value data of local FB is output to the positioning FB. At the same time, “PTP positioning command” is issued to the positioning FB.

<Timing of startup for cascade connection>

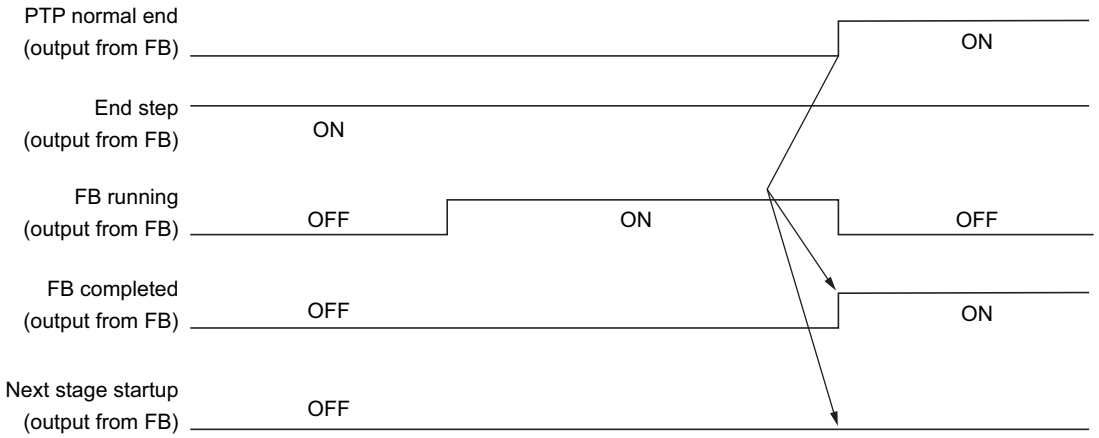


- For a cascaded intermediate step, “next stage startup command” output of the previous stage FB is connected to the “startup command” signal.
- For the first step, first “startup command” signal is necessary. (SW, etc.)
- The rising edge of “startup command” signal is accepted when “positioning completed” signal is ON.
  The simple positioning expansion FB is started even when both “positioning completed” signal and “startup command” signal are ON at the same time.
  (When “positioning completed” signal is turned ON after “startup command” signal is turned ON, “startup command” signal won’t be accepted.)
- When the rising edge of “startup command” signal is detected, the set data of local FB is output, and “PTP positioning command”, “FB running” and “next stage startup command” signals are turned ON.
  (The simple positioning expansion FB changes over these signals at the same time. The positioning FB accepts the simultaneously changed over signals.)
- “PTP positioning command” is turned OFF when “PTP positioning executing” signal from the positioning FB is turned ON. (when the simple positioning expansion FB is running).
- At the rising edge of “positioning completed” signal, “FB running” signal is turned OFF.
- At the rising edge of “PTP normal end” signal from the positioning FB, “FB completed” signal is turned ON.

5-3 Details of Positioning Function

- At the rising edge of “PTP normal end” signal from the positioning FB, “next stage startup command” signal is turned ON. (when not the end step)
- When operation is stopped by “forcible stop command” or “OT error”, because “PTP normal end” continues to be OFF. “FB completed” and “next stage startup” signals also continue to be OFF.
  The following steps are not started (when cascaded):

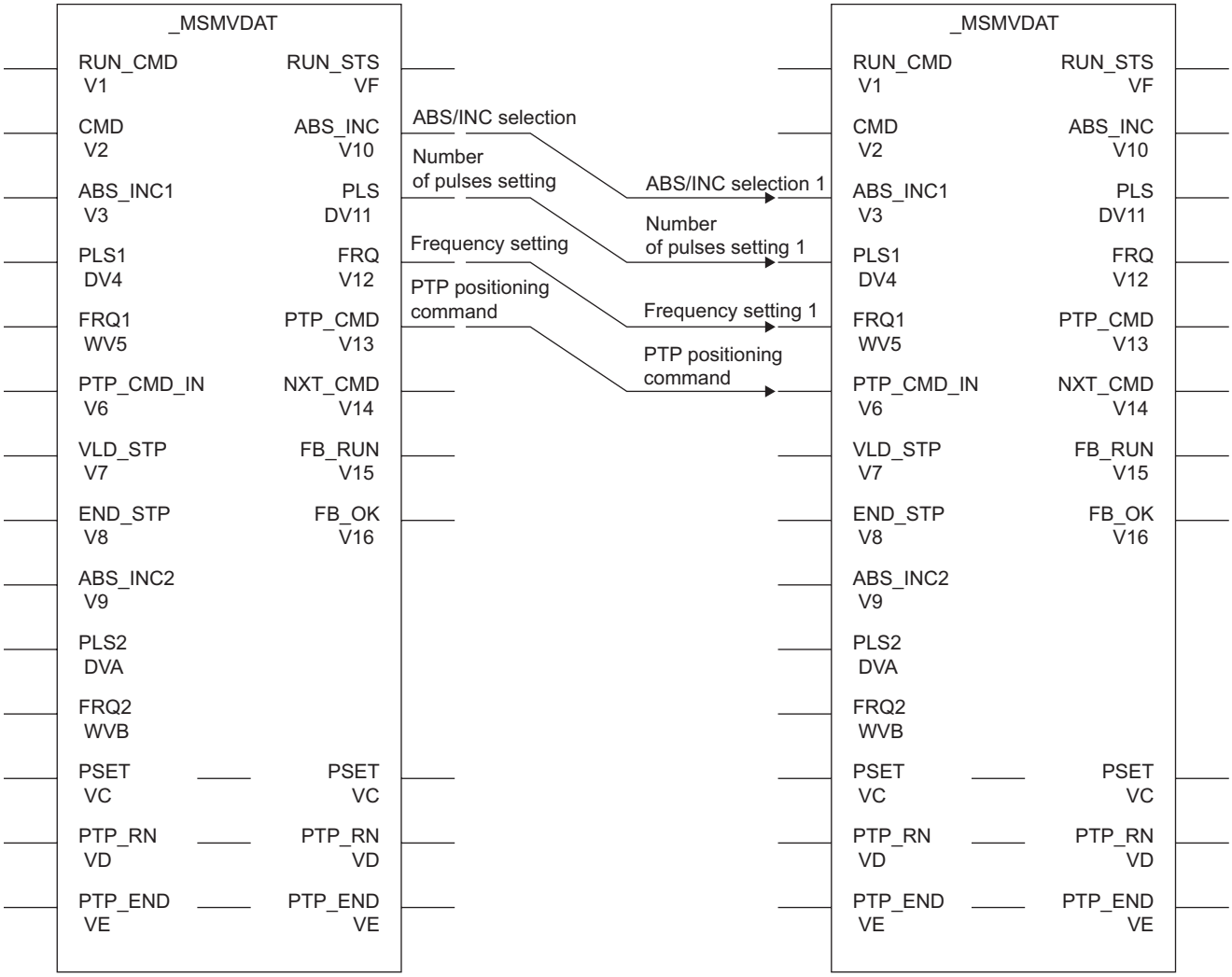
1) Timing chart for “end step” command and “next stage startup command” signal
   When “end step” command is ON, “next stage startup command” signal is not turned ON even if PTP positioning operation is completed successfully.
   For “end step” signal, the status at the rising edge of “PTP normal end” signal takes effect.



- When “valid step” command is OFF, “startup command” signal is output to the next stage as it is.
  For “valid step” command, the status at the rising edge of “startup command” takes effect.
- When either “FB completed” signal or “next stage startup command” signal is turned ON, the status of the following output signals is held (while “FB running” signal is ON).
  a) FB running : OFF
  b) FB completed) : ON
  c) Next stage startup : ON
- When either “FB completed” signal or “next stage startup command” signal is turned ON, the status of the above mentioned 3 output signals does not change even if the status of “end step” or “valid step” is changed over.
- When either “FB completed” signal or “next stage startup command” signal is turned ON, the set data of the following command signals from the previous stage is output.
  a) ABS/INC selection
  b) Number of pulses data
  c) Frequency data
  d) PTP positioning command

5-3 Details of Positioning Function

- Sample connection of data setting FB is shown below:



- When unnecessary, “PTP positioning command” of the 1st stage FB should be turned OFF.
  Because the signal is output till the rising edge of “startup command” is detected, the positioning FB is started if “PTP positioning command” is turned ON.
- In the initial state where “running” signal is OFF, the following signals are output:
  (a) ABS/INC1, (b) Number of pulses setting 1, (c) Frequency setting 1, and (d) PTP positioning command 1
  When data setting FBs are used for manual operation and frequency is changed over during manual operation, the setting of manual operation frequency 1 or manual operation frequency 2 can be connected to the frequency setting 1 of the 1st stage data setting FB.

5-4 Parameters for Simple Positioning Expansion FB

Set the parameters for the simple positioning expansion FB as follows:

	F — 0	
WM(WL)****	Parameter No. 10	(* Moving length at stoppage *)
WM(WL)****+2	Parameter No. 11	(* Floating origin setting *)
WM(WL)****+4	Parameter No. 12	(* Software OT range in + direction *)
WM(WL)****+6	Parameter No. 13	(* Software OT range in – direction *)
WM(WL)****+8	Parameter No. 14	(* Reserved *)
WM(WL)****+10	Parameter No. 15	(* Reserved *)
WM(WL)****+12	Parameter No. 16	(* Reserved *)
WM(WL)****+14	Parameter No. 17	(* Reserved *)
WM(WL)****+16	Parameter No. 8	(* Rapid stop time *)
WM(WL)****+17	Parameter No. 9	(* Ordinary acceleration time *)
WM(WL)****+18	Parameter No. A	(* Self-startup frequency *)
WM(WL)****+19	Parameter No. B	(* High-speed limiter *)
WM(WL)****+20	Parameter No. C	(* Origin-return frequency *)
WM(WL)****+21	Parameter No. D	(* Reserved *)
WM(WL)****+22	Parameter No. E	(* Reserved *)
WM(WL)****+23	Parameter No. F	(* Reserved *)
WM(WL)****+24	(* Not used *)	

Bit No.	F — 8	7	6	5	4	3	2	1	0

- Bit 0: Parameter No. 0 (* Axis selection *)
- Bit 1: Parameter No. 1 (* Direction of rotation changeover *)
- Bit 2: Parameter No. 2 (* Pulse output type selection *)
- Bit 3: Parameter No. 3 (* Origin-return direction *)
- Bit 4: Parameter No. 4 (* Infinite length mode selection *)
- Bit 5: Parameter No. 5 (* Reserved *)
- Bit 6: Parameter No. 6 (* Reserved *)
- Bit 7: Parameter No. 7 (* Reserved *)

5-4 Parameters for Simple Positioning Expansion FB

5-4-1 Simple positioning parameter specifications

Parameter No.	Name	Data type	Unit	Setting range	Initial value	Remarks
0	Axis selection	BOOL		0,1	0	
1	Direction of rotation changeover	BOOL		0,1	0	
2	Pulse output type selection	BOOL		0,1	0	
3	Origin-return direction	BOOL		0,1	0	
4	Infinite length mode selection	BOOL		0,1	0	
5	Reserved	BOOL		0,1	0	
6	Reserved	BOOL		0,1	0	
7	Reserved	BOOL		0,1	0	
8	Rapid stop time	INT	ms	1 to 32767	500	
9	Ordinary acceleration/deceleration time	INT	ms	1 to 32767	1000	
A	Self-startup frequency	INT	Hz	1 to 20000	1000	
B	High-speed limiter	INT	Hz	250 to 20000	20000	
C	Origin-return frequency	INT	Hz	1 to 20000	10000	
D	Reserved	INT			0	
E	Reserved	INT			0	
F	Reserved	INT			0	
10	Moving length at stoppage	DINT	Pulses	0 to 2^{31}-1	200	
11	Floating origin setting	DINT	Pulses	-2^{31}-1 to 2^{31}-1	0	
12	Software OT range in + direction	DINT	Pulses	0 to 2^{31}-1	2^{31}-1	
13	Software OT range in - direction	DINT	Pulses	0 to 2^{31}-1	2^{31}-1	
14	Reserved	DINT			0	
15	Reserved	DINT			0	
16	Reserved	DINT			0	
17	Reserved	DINT			0	

<Description of FB parameters>

1) Parameter No. 0: Axis selection

This parameter selects an axis for the output module with pulse output function.
OFF: CH0 and CH2 are enabled.
ON: CHh1 and CH3 are enabled.

2) Parameter No. 1: Direction of rotation changeover

This parameter selects the relation between the direction to increase the current position value and the command pulse output from the output module with pulse output function.
OFF: Forward rotation command (forward pulse output) for the direction to increase the current position value
ON: Reverse rotation command (reverse pulse output) for the direction to increase the current position value
This setting is not the signal that is directly passed to the “direction of rotation” bit command of the output module with pulse output function. The positioning FB changes over the bit command signal of the output module with pulse output function, referring to the direction to increase the current position value and the setting of this parameter.

3) Parameter No. 2: Pulse output type selection

This parameter selects the type of pulse that is output from the output module with pulse output function.
OFF: Forward pulse + reverse pulse
ON: Sign + command pulse
The setting of this parameter is reflected on the “pulse output type” bit command of the output module with pulse output function.

4) Parameter No. 3: Origin-return direction

This parameter selects a direction for origin-return operation,
OFF: Returns to origin in the direction to decrease the current position value.
ON: Returns to origin in the direction to increase the current position value.

5) Parameter No. 4: Infinite length mode selection

This parameters selects either finite length mode or infinite length mode.
OFF: Finite length mode
ON: Infinite length mode

<Point for use>

- In finite length mode, positioning is made by reciprocal action when absolute position is set.
  For PTP positioning operation, ABS or INC can be selected.
  In finite length mode, software OT error is monitored.
- In infinite length mode, positioning is made by rotary action in one direction.
  For PTP positioning operation, ABS or INC can be selected.
  (Default is INC.)
  In infinite length mode, software OT error is not monitored.

6) Parameter No. 8: Rapid stop time

This parameter sets the timer value for deceleration under “forcible stop command”.
For rapid stop time, the time to change speed from 20 kHz to 0 Hz is set (in 1-ms steps).

Note: The positioning FB uses either rapid stop time or ordinary acceleration/deceleration time, whichever is smaller, for forcible stop.

7) Parameter No. 9: Ordinary acceleration/deceleration time

This parameter sets the timer value for deceleration under “forcible stop command”.
For acceleration/deceleration time, the time to change speed from 20 kHz to 0 Hz is set (in 1-ms steps).

Note: The positioning FB uses either rapid stop time or ordinary acceleration/deceleration time, whichever is smaller, for forcible stop.

8) Parameter No. A: Self-startup frequency

This parameter sets the low-speed side frequency for 2-step motion positioning.
When the frequency set value for positioning is smaller than this setting, pulse is output at the frequency of this setting.
When “Target frequency setting value” < “Self-startup frequency”, self-startup frequency is used.
For origin-return operation, frequency is changed over to self-startup frequency when origin LS is detected.

9) Parameter No. B: High-speed limiter

High-speed side limiter value for command frequency
When the frequency set value for positioning is smaller than this setting, pulse is output at the frequency of this setting.
When “Target frequency setting value” > “High-speed limiter”, high-speed limiter value becomes the target frequency.

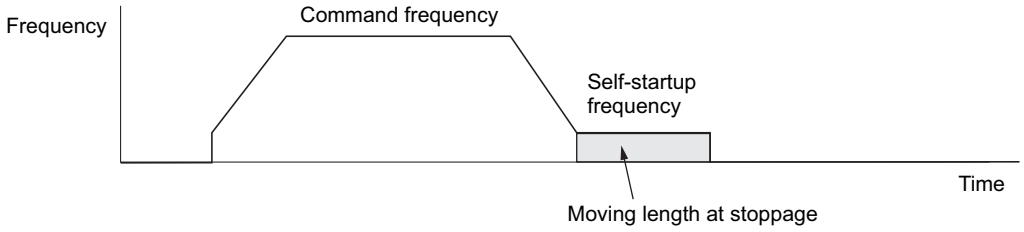
Note: High-speed limiter takes precedence of self-startup frequency.
When “High-speed limiter” < “Self-startup frequency”, operation is made regarding high-speed limiter value as selfstartup frequency.

10) Parameter No. C: Origin-return frequency

This parameter sets the command frequency that is used till origin LS is detected during origin-return operation.

11) Parameter No. 10: Moving length at stoppage

This parameter sets the feedrate for 2-step motion PTP positioning.



Note: If the moving length at stoppage is too small, the target position may be reached while decelerating.
In this case, pulse output is stopped before self-startup frequency is reached.

5-4 Parameters for Simple Positioning Expansion FB

12) Parameter No. 11: Floating origin setting

- When origin-return operation is completed successfully, the position data in work coordinate system is preset to the set data of floating origin.
  When origin-return operation is completed successfully, the target position and command position data in machine coordinate system are cleared to zero at the position of machine origin. Therefore, the relation between the position data in machine coordinate system and the position data in work coordinate system after returning to origin becomes as follows:
  "Position data in work coordinate system" = "Position data in machine coordinate system" + "Set value of floating origin"
- "Machine coordinates position preset" command presets both the position in machine coordinate system and the position in work coordinate system.
  The relation between the position data in work coordinate system and the position data in machine coordinate system after preset becomes as follows:
  "Position data in work coordinate system" = "Position data in machine coordinate system" + "Set value of floating origin"

Note: When "work coordinates position preset" command is executed, the "set value of floating origin" term (offset) in the above expression becomes as follows:
"Offset" = "Preset value" – "Current command position in machine coordinate system"

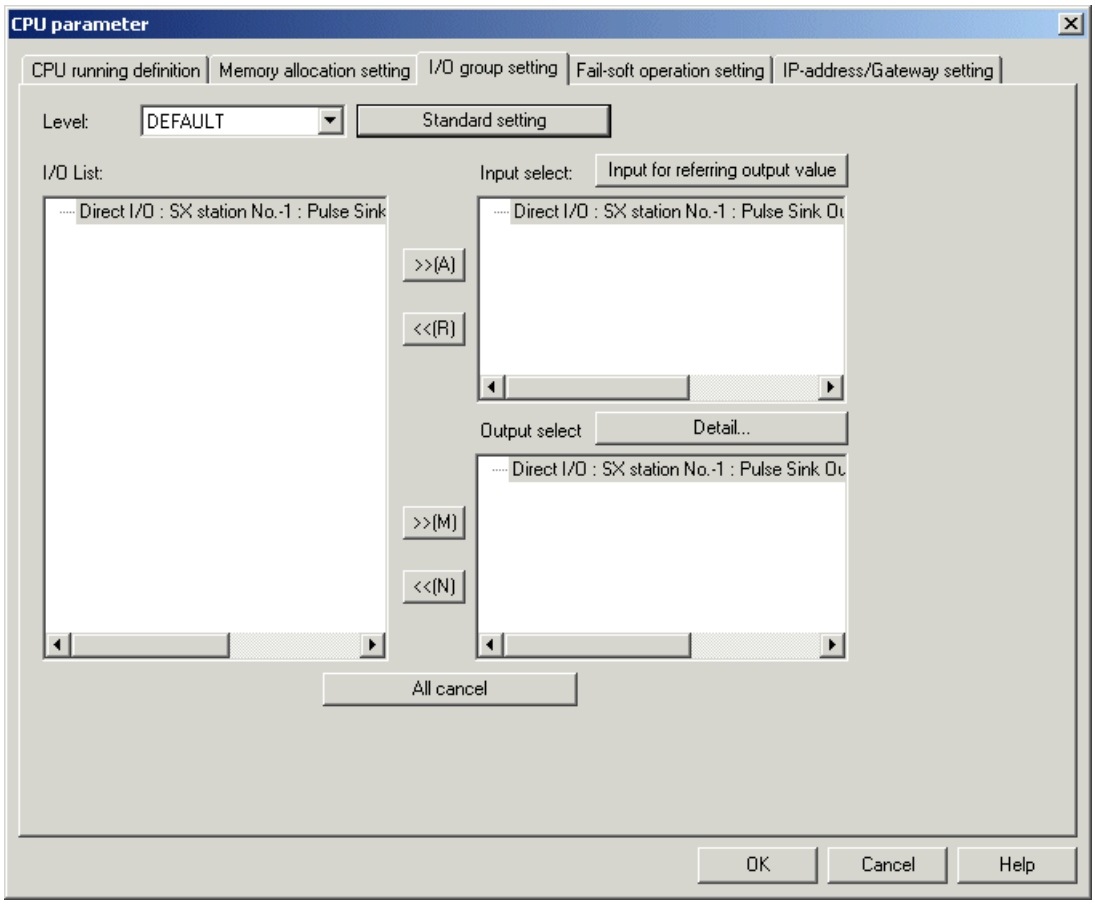
13) Parameter Nos. 12 and 13: Software OT range in ±direction

- These parameters set software OT detection range.
  If command position in machine coordinate system falls out of the OT range, SOT error occurs.
  If "command position in machine coordinate system" >= "Software OT range in + direction", +SOT error is detected.
  If "command position in machine coordinate system" <= "Software OT range in – direction", –SOT error is detected.
- Software OT range in ±direction is absolute value data.
  When infinite length mode is selected, no SOT error is detected.

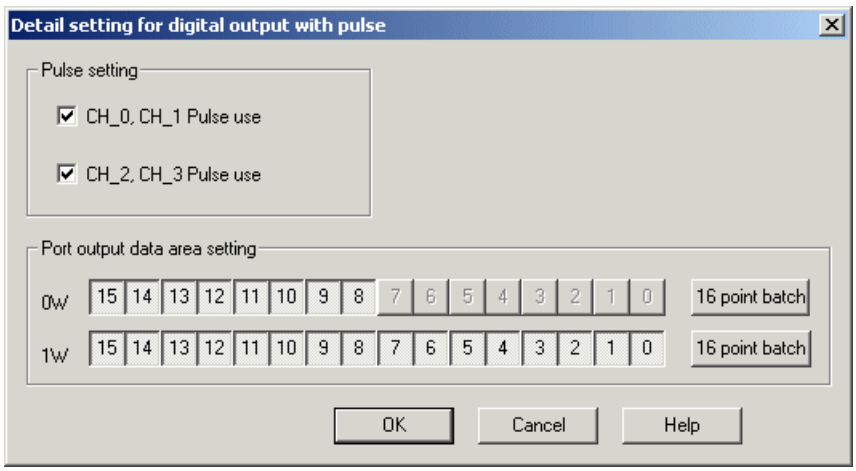
5-5 Pulse Output Setting for High-speed Output Module

To use this FB, it is necessary to make “pulse setting” for the digital high-speed output module.

◆ On the [I/O group setting] window on the [CPU parameter] dialog of the program loader, register the digital high-speed output module as shown below:



◆ Then, click the [Detail...] button to display the [Detail setting for digital output with pulse] dialog. Set ON the checkbox for channels to be used for pulse setting.



Section 6 Specifications of User ROM Card FB

6-1 Overview of User ROM Card FB

The SPH2000 series has expansion FBs for user ROM cards, for reading and writing data between the user ROM card (CF card) mounted in the CPU module and CPU module-internal application programs.

* The user ROM card FBs are contained on the SX-Programmer Standard product CD.

6-1-1 List of user ROM card FBs

Function name	FB name	FB Overview
Write CSV file	_F_WRITE_CSV_DI	Writes data to a file in the user ROM card in CSV format.
Read CSV file	_F_READ_CSV_DI	Reads data from a CSV-format file in the user ROM card to the user data area.
Append CSV file	_F_APPEND_CSV_DI	Appends a row of data to the end of an existing CSV-format file.
Append file	_F_APPEND	Appends data to the end of a file in the user ROM card in binary format.
Delete file	_F_DELETE	Deletes an existing file in the user ROM card.
Read file with offset	_F_OFFSET_READ	Reads data in the user ROM card by specifying the offset position from the beginning of data and read size.
Read free capacity	_F_GET_DRV_SIZE	Reads the total memory capacity and free capacity of the user ROM card.
Create file name	_F_CREATE_FNAME	Concatenates character type data and creates a file name.

6-1-2 Memory capacity for using user ROM card FB

FB name	Program area	User FB memory	System FB memory	Standard memory or Retain memory
_F_WRITE_CSV_DI	1101 steps	318 words	170 words	2560 words
_F_READ_CSV_DI	522 steps	274 words	60 words	340 words
_F_APPEND_CSV_DI	818 steps	296 words	120 words	340 words
_F_APPEND	536 steps	232 words	80 words	1140 words
_F_DELETE	360 steps	192 words	50 words	140 words
_F_OFFSET_READ	536 steps	206 words	20 words	1140 words
_F_GET_DRV_SIZE	232 steps	212 words	20 words	10 words
_F_CREATE_FNAME	194 steps	36 words	0 words	520 words

Note 1: The above list for the memory capacity includes the area for the main body of user ROM card FB and those for sub-FBs that are called from the user ROM card FB.

Note 2: The above list for standard memory and retain memory includes the memory capacity necessary for reading/writing data.

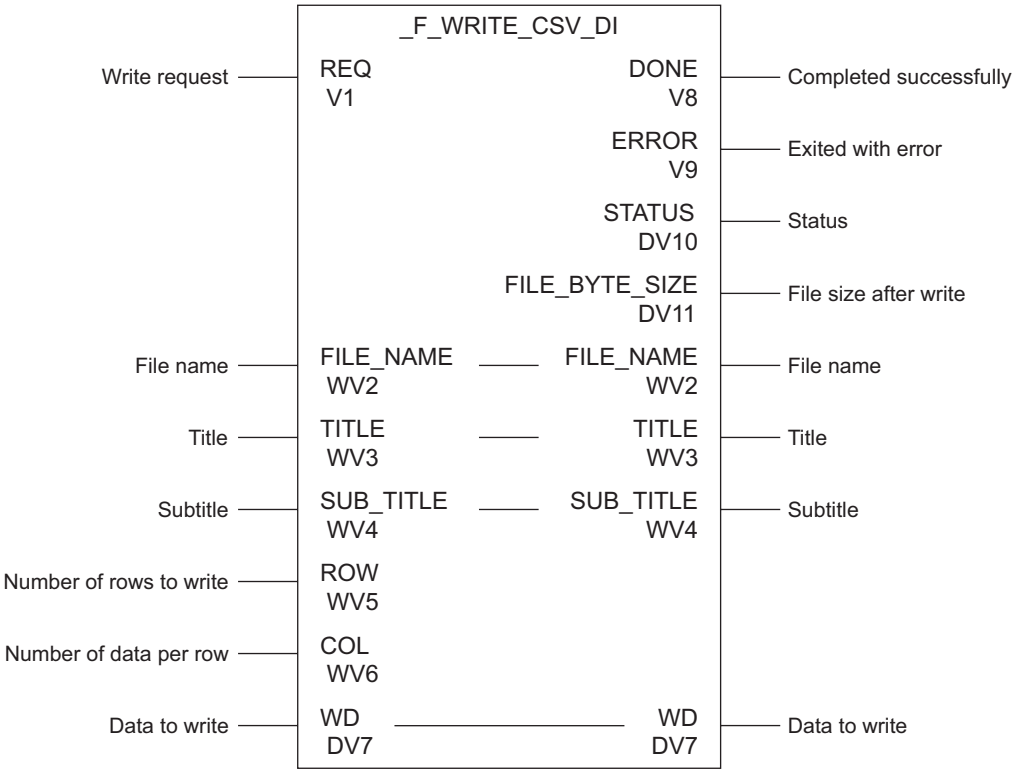
Section 6 Specifications of User ROM Card FB

6-2 Specifications of each FB

6-2-1 Write CSV file (_F_WRITE_CSV_DI)

This FB writes data in SPH_CPU to the specified file in the specified folder in the user ROM card in CSV format (overwrite).

(1) FB format



(2) Operation specifications

1) Data is written at the rising edge of REQ. If the data write is completed successfully, DONE is turned ON for 1 scan. If the data write fails, ERROR is turned ON for 1 scan and the cause of the error is output to STATUS.
2) If the specified folder or file does not exist, new one is created.
3) A title (specified in TITLE) can be specified at the head of the CSV file, and a subtitle (specified in SUB_TITLE) on the second row.
4) Prepare data to write in array of DINT (double integer) format. The data of the size specified in ROW and COL is written in CSV format.

Note: Do not change a value of the I/O parameters (FILE_NAME , TITLE, SUB_TITLE and WD) while this FB is executed. If it is changed, the values written to the file are not guaranteed.

Section 6 Specifications of User ROM Card FB

6-2 Specifications of each FB

(3) Description of parameters

Parameter name		Type	Description
Write request REQ	V1	Input	Writes data to a file at the rising edge of this signal.
File name FILE_NAME	WV2	I/O	Specifies the name of the destination file in folder + file name format. There is no need to specify a drive name. ◆ The maximum length of a file name is 255 single-byte characters (127 double-byte characters in Shift-JIS code) including an extension. ◆ The following folder has been created for project operation in the user ROM card. Do not use the file or folder names below. File name: PASSWORD.DAT Folder names: \PROJECT, \OTHER
Title TITLE	WV3	I/O	Specifies the data (title) to write to the first row of the CSV file.
Subtitle SUB_TITLE	WV4	I/O	Specifies the data (subtitle) to write to the second row of the CSV file.
Number of rows to write ROW	WV5	Input	Specifies the number of rows to write (max. 10).
Number of data per row COL	WV6	Input	Specifies the number of data (columns) per row to write (max. 100).
Data to write WD	DV7	I/O	Specifies the data to write.
Completed successfully DONE	V8	Output	Turned ON for 1 scan if the data write is completed successfully.
Exited with error ERROR	V9	Output	Turned ON for 1 scan and terminates the operation if the data write fails.
Status STATUS	DV10	Output	Outputs a status that indicates the cause of the error if the data write fails. See "6-2-9 Status" for more information about statuses.
File size after write FILE_BYTE_SIZE	DV11	Output	Outputs the size of the file after data is written in bytes.

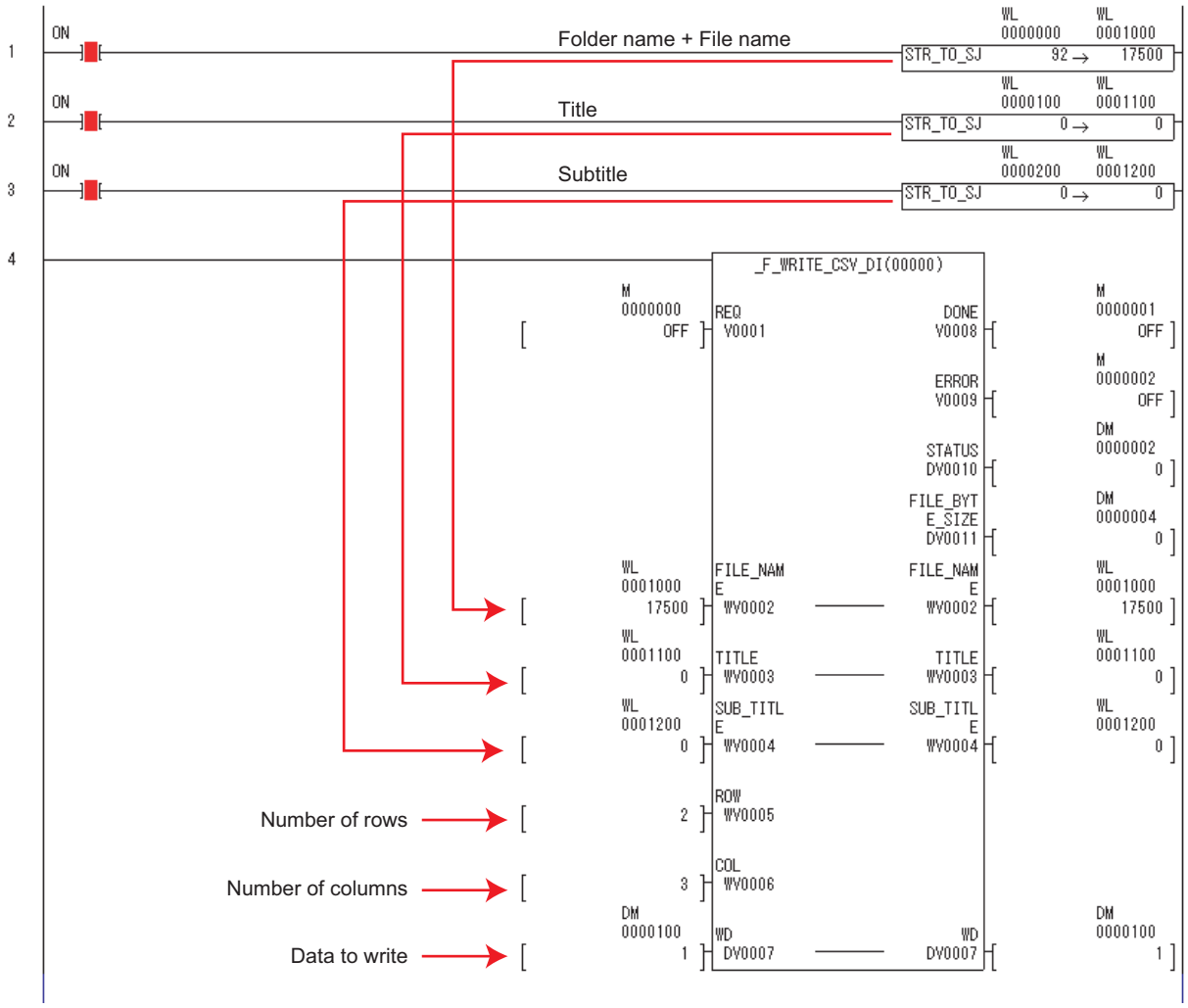
Note: The following single-byte characters cannot be used for a folder name and file name: " * , / : < = > ? \ |

Section 6 Specifications of User ROM Card FB

6-2 Specifications of each FB

(4) Sample program

Data that is stored in and after DM100 is written to the user ROM card with 2 rows by 3 columns. “Folder name + File name” and “Title” are prepared by the initial value setting function of SX-Programmer Standard.



Data in CPU

DM100	1
DM102	2
DM104	3
DM106	4
DM108	5
DM110	6
DM112	7
DM114	8

Data written to a file

	1	2	3
1	DATE080505		
2			
3	1	2	3
4	4	5	6
5			

Title

Subtitle

If no title (first row) or no subtitle (second row) is set, each row becomes blank.

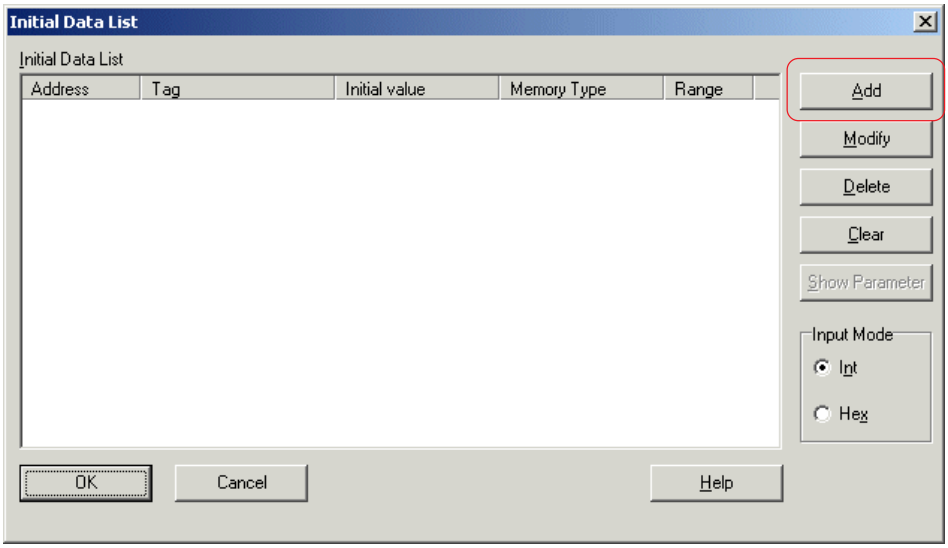
Data

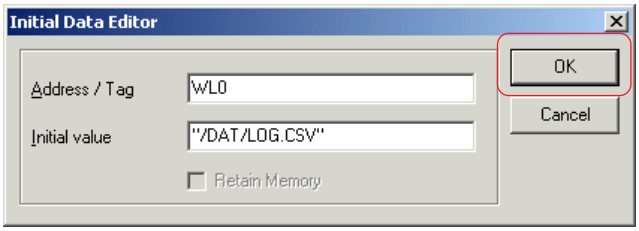
Section 6 Specifications of User ROM Card FB

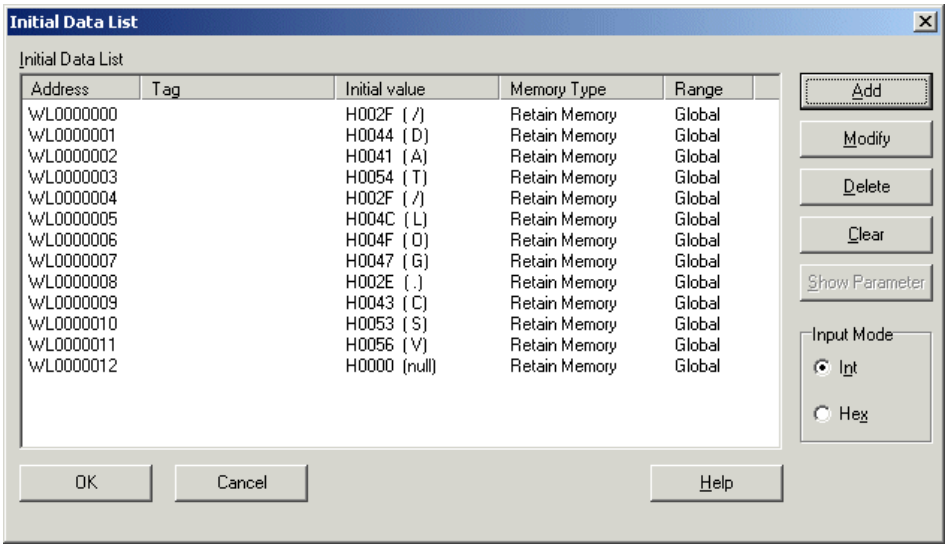
6-2 Specifications of each FB

<Setting folder name + file name, title and subtitle>

It is convenient to set the folder name + file name, title and subtitle as initial values in the data memory. Make the setting with the [Initial Data List...] command in the [PLC functions] menu.







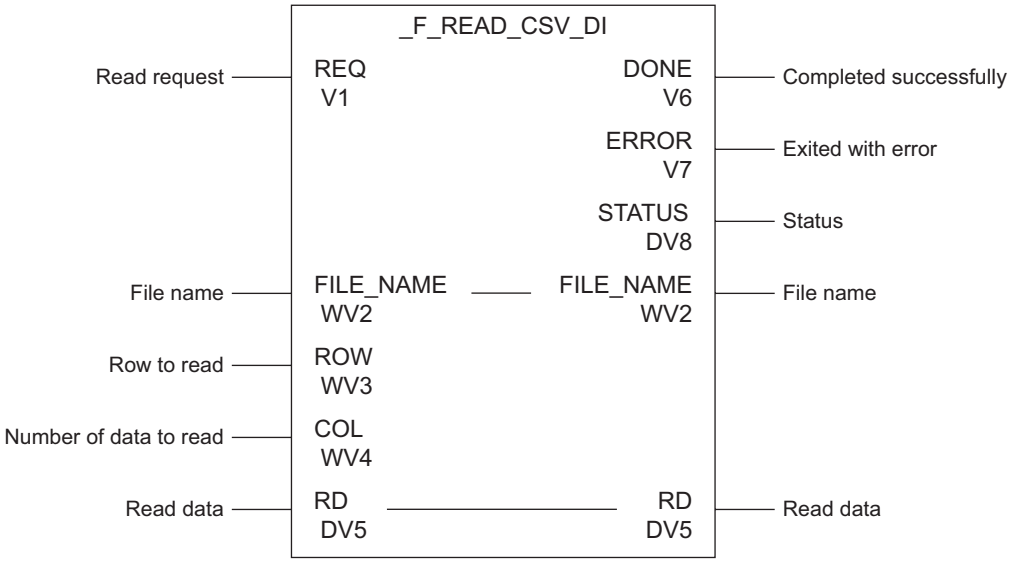
Section 6 Specifications of User ROM Card FB

6-2 Specifications of each FB

6-2-2 Read CSV file (_F_READ_CSV_DI)

This FB reads data from a CSV-format file in the user ROM card to SPH_CPU.

(1) FB format



(2) Operation specifications

1) Data is read at the rising edge of REQ. If the data read is completed successfully, DONE is turned ON for 1 scan. If the data read fails, ERROR is turned ON for 1 scan and the cause of the error is output to STATUS.
2) Specify the row No. to read and the number of data per row. The read data is stored in RD in DINT (double integer) format.

Note: Do not change a value of the I/O parameters (FILE_NAME and RD) while this FB is executed. If it is changed, the values read from the file are not guaranteed.

(3) Description of parameters

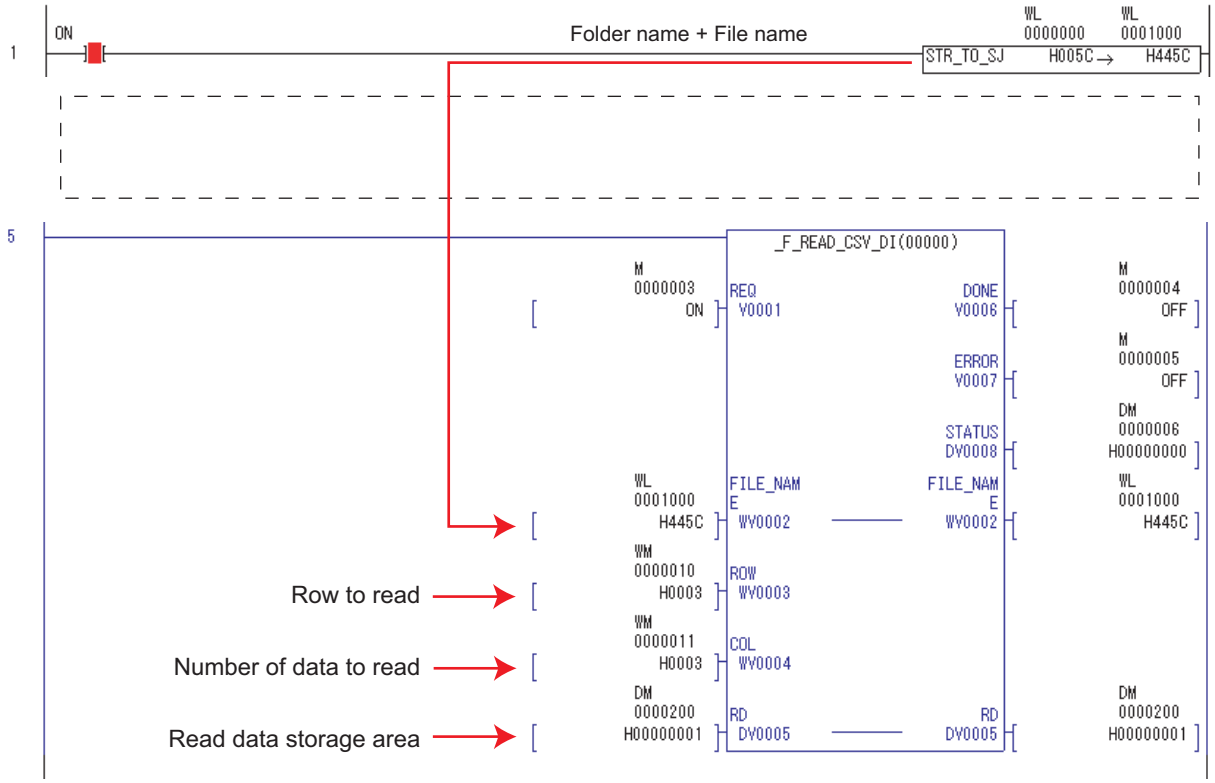
Parameter name		Type	Description
Read request REQ	V1	Input	Reads data from a file at the rising edge of this signal.
File name FILE_NAME	WV2	I/O	Specifies the name of the destination file in folder + file name format. There is no need to specify a drive name. ◆ The maximum length of a file name is 255 single-byte characters (127 double-byte characters in Shift-JIS code) including an extension.
Row to read ROW	WV3	Input	Specifies the rows of data to read.
Number of data to read COL	WV4	Input	Specifies the number of data to read (max. 100).
Read data RD	DV5	Input	Converts read data to DINT type and stores it.
Completed successfully DONE	V6	Output	Turned ON for 1 scan if the data read is completed successfully.
Exited with error ERROR	V7	Output	Turned ON for 1 scan and terminates the operation if the data read fails.
Status STATUS	DV8	Output	Outputs a status that indicates the cause of the error if the data read fails. See "6-2-9 Status" for more information about statuses.

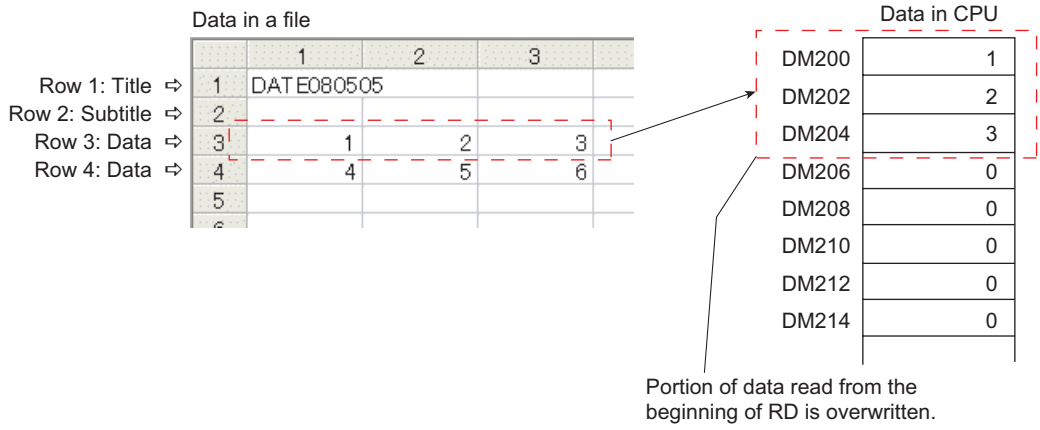
Section 6 Specifications of User ROM Card FB

6-2 Specifications of each FB

(4) Sample program

Data is read from a CSV-format file in the user ROM card to SPH_CPU (in and after DM200).





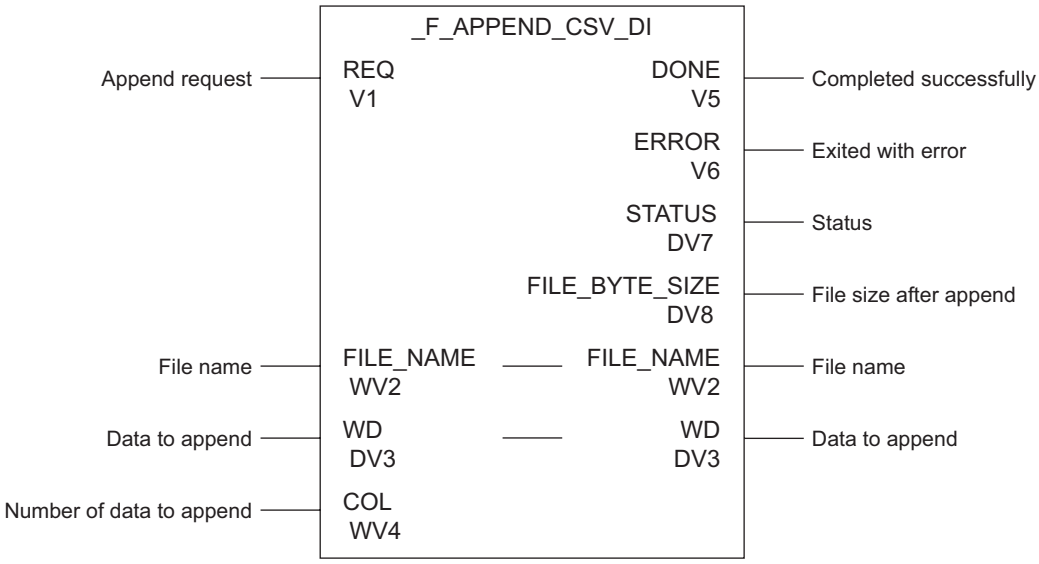
Section 6 Specifications of User ROM Card FB

6-2 Specifications of each FB

6-2-3 Append CSV File (_F_APPEND_CSV_DI)

This FB appends one row of data to an existing CSV file.

(1) FB format



(2) Operation specifications

1) Data is written at the rising edge of REQ. If the data write is completed successfully, DONE is turned ON for 1 scan. If the data write fails, ERROR is turned ON for 1 scan and the cause of the error is output to STATUS.
2) One row of data of the size specified in COL is appended to the end of the CSV file.

Note: Do not change a value of the I/O parameters (FILE_NAME and WD) while this FB is executed. If it is changed, the values appended to the file are not guaranteed.

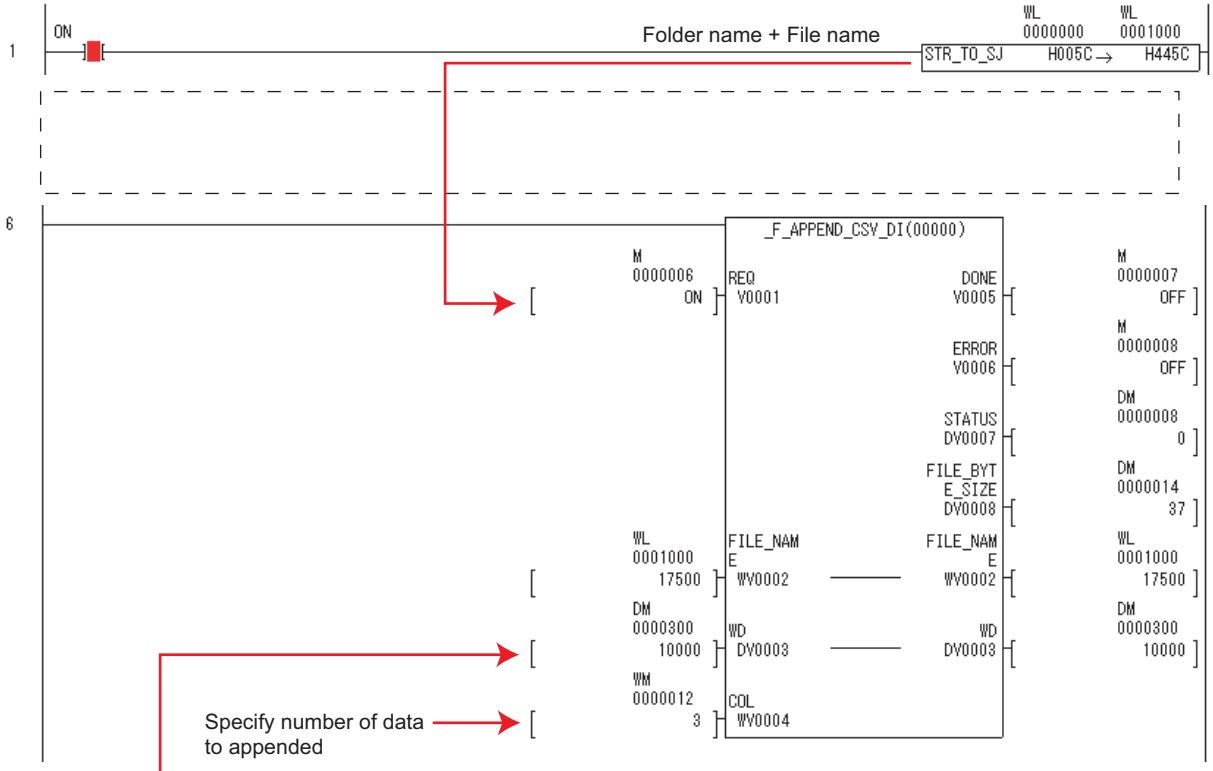
(3) Description of parameters

Parameter name		Type	Description
Append request REQ	V1	Input	Appends one row of data to the end of the file in CSV format at the riging edge of this signal.
File name FILE_NAME	WV2	I/O	Specifies the name of the destination file in folder + file name format. There is no need to specify a drive name. ◆ The maximum length of a file name is 255 single-byte characters (127 double-byte characters in Shift-JIS code) including an extension. ◆ The following folder has been created for project operation in the user ROM card. Do not use the file or folder names below. File name: PASSWORD.DAT Folder names: \PROJECT, \OTHER
Data to append WD	DV3	I/O	Stores the data to append (Max. 100 per row).
Number of data to append COL	WV4	Input	Sets the number of data to append.
Completed successfully DONE	V5	Output	Turned ON for 1 scan if the data append is completed successfully.
Exited with error ERROR	V6	Output	Turned ON for 1 scan and terminates the operation if the data append fails.
Status STATUS	DV7	Output	Outputs a status that indicates the cause of the error if the data append fails. See "6-2-9 Status" for more information about statuses.
File size after append FILE_BYTE_SIZE	DV8	Output	Outputs file size after data is appended in bytes.

Section 6 Specifications of User ROM Card FB

6-2 Specifications of each FB

(4) Sample program



Data in CPU

DM300	10000
DM302	20000
DM304	30000
DM306	40000
DM308	50000
DM310	60000
DM312	70000
DM314	80000

Data written in a file

Row 1: Title ⇨
Row 2: Subtitle ⇨
Row 3: Data ⇨
Row 4: Data ⇨
Row 5: Appended data ⇨

	1	2	3
1	DATE080505		
2			
3	1	2	3
4	4	5	6
5	10000	20000	30000
6			

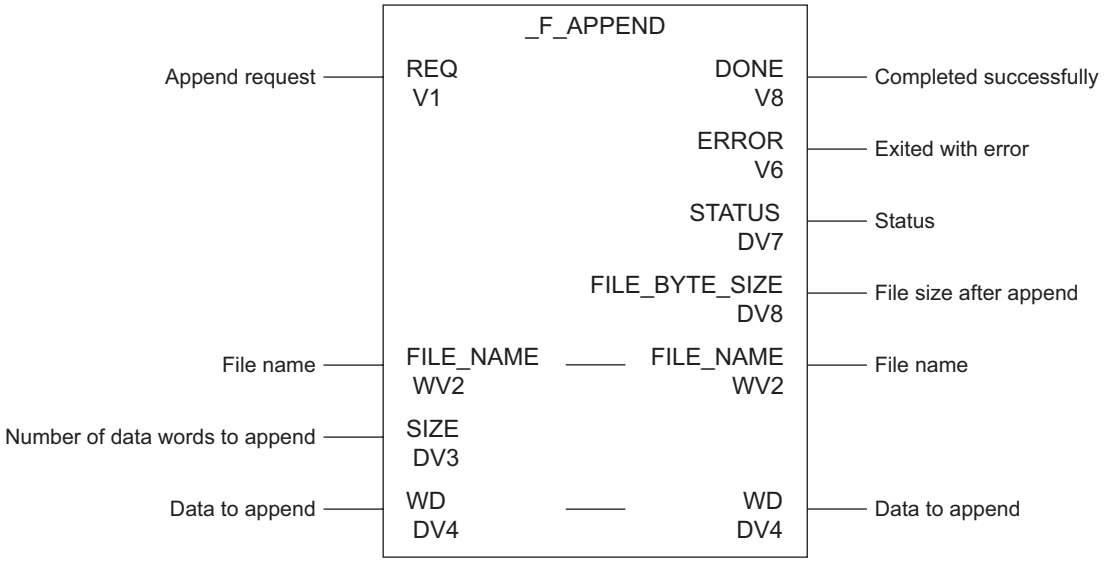
Section 6 Specifications of User ROM Card FB

6-2 Specifications of each FB

6-2-4 Append File (_F_APPEND)

This FB appends data to the end of a file in the user ROM card in binary format.
This FB cannot be used for CSV-format files.

(1) FB format



(2) Operation specifications

1) Data is written at the rising edge of REQ. If the data write is completed successfully, DONE is turned ON for 1 scan. If the data write fails, ERROR is turned ON for 1 scan and the cause of the error is output to STATUS.
2) One row of data of the size specified in SIZE is appended to the end of the CSV file.

Note: Do not change a value of the I/O parameters (FILE_NAME and WD) while this FB is executed. If it is changed, the values appended to the file are not guaranteed.

(3) Description of parameters

Parameter name		Type	Description
Append request REQ	V1	Input	Appends one row of data to the end of the file in binary format at the riging edge of this signal.
File name FILE_NAME	WV2	I/O	Specifies the name of the destination file in folder + file name format. There is no need to specify a drive name. ◆ The maximum length of a file name is 255 single-byte characters (127 double-byte characters in Shift-JIS code) including an extension. ◆ The following folder has been created for project operation in the user ROM card. Do not use the file or folder names below. File name: PASSWORD.DAT Folder names: \PROJECT, \OTHER
Data to append WD	DV3	I/O	Stores the data to append (Max. 500 double words).
Number of data words to append SIZE	WV4	Input	Sets the size of data to append in words.
Completed successfully DONE	V5	Output	Turned ON for 1 scan if the data append is completed successfully.
Exited with error ERROR	V6	Output	Turned ON for 1 scan and terminates the operation if the data append fails.
Status STATUS	DV7	Output	Outputs a status that indicates the cause of the error if the data append fails. See "6-2-9 Status" for more information about statuses.
Size after append FILE_BYTE_SIZE	DV8	Output	Outputs file size after data is appended in bytes.

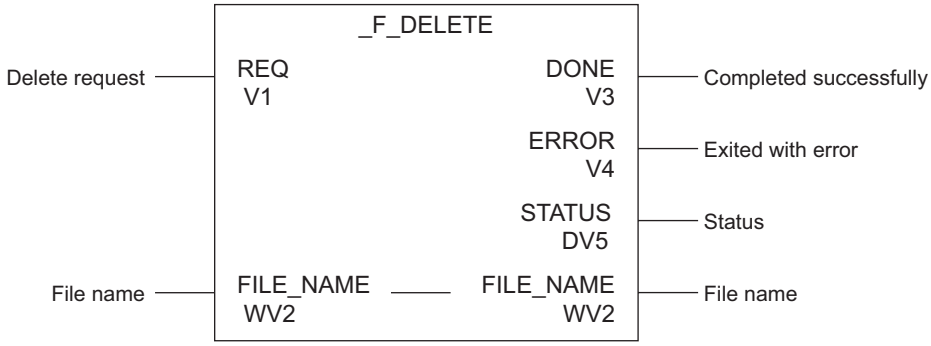
Section 6 Specifications of User ROM Card FB

6-2 Specifications of each FB

6-2-5 Delete File (_F_DELETE)

This FB delets the specified file in the user ROM card.

(1) FB format



(2) Operation specifications

1) Data is deleted at the rising edge of REQ. If the file deletion is completed successfully, DONE is turned ON for 1 scan. If the data deletion fails, ERROR is turned ON for 1 scan and the cause of the error is output to STATUS.

Note: Do not change a value of FILE_NAME while this FB is executed. If it is changed, the FB operation is not guaranteed.

(3) Description of parameters

Parameter name		Type	Description
Delete request REQ	V1	Input	Deletes a file at the riging edge of this signal.
File name FILE_NAME	WV2	I/O	Specifies the name of the destination file in folder + file name format. There is no need to specify a drive name. ◆ The maximum length of a file name is 255 single-byte characters (127 double-byte characters in Shift-JIS code) including an extension. ◆ The following folder has been created for project operation in the user ROM card. Do not use the file or folder names below. File name: PASSWORD.DAT Folder names: \PROJECT, \OTHER
Completed successfully DONE	V3	Output	Turned ON for 1 scan if the file deletion is completed successfully.
Exited with error ERROR	V4	Output	Turned ON for 1 scan and terminates the operation if the file deletion fails.
Status STATUS	DV5	Output	Outputs a status that indicates the cause of the error if the file deletion fails. See "6-2-9 Status" for more information about statuses.

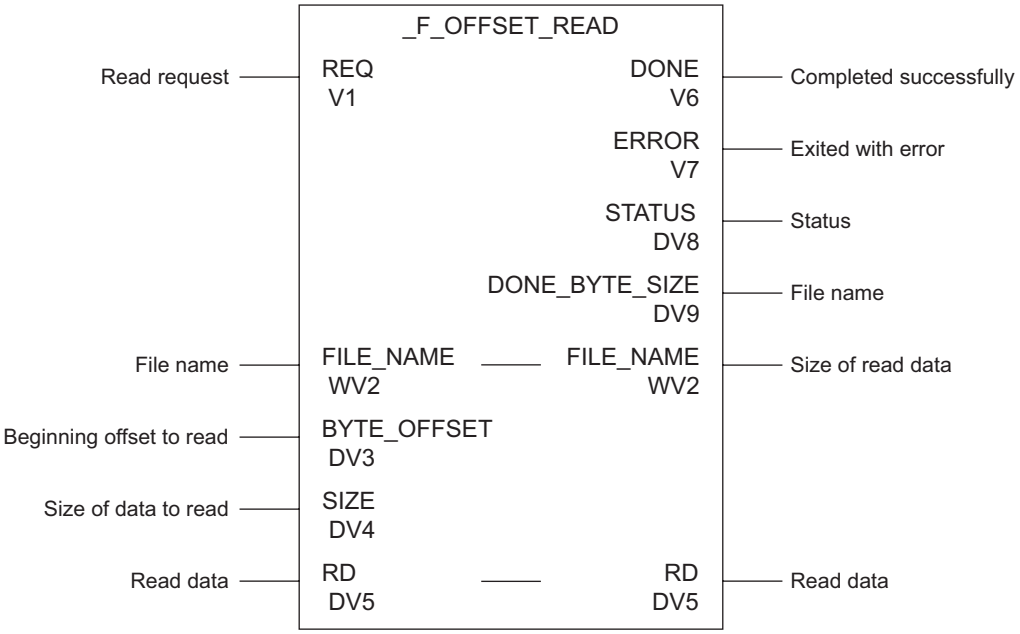
Section 6 Specifications of User ROM Card FB

6-2 Specifications of each FB

6-2-6 Read file with offset (_F_OFFSET_READ)

This FB reads data from the specified file in the specified folder in the user ROM that is written with _F_WRITE FB, by specifying the offset position from the beginning of data and read size.

(1) FB format



(2) Operation specifications

1) Data is read at the rising edge of REQ. If the data read is completed successfully, DONE is turned ON for 1 scan. If the data read fails, ERROR is turned ON for 1 scan and the cause of the error is output to STATUS.
2) Specify the data to read by specifying the offset position (in bytes) from the beginning of data and read size (in words).

Note: Do not change a value of the I/O parameters (FILE_NAME and RD) while this FB is executed. If it is changed, the values read from the file are not guaranteed.

(3) Description of parameters

Parameter name		Type	Description
Read request REQ	V1	Input	Reads data from a file at the rising edge of this signal.
File name FILE_NAME	WV2	I/O	Specifies the name of the destination file in folder + file name format. There is no need to specify a drive name. ◆ The maximum length of a file name is 255 single-byte characters (127 double-byte characters in Shift-JIS code) including an extension.
Beginning offset to read BYTE_OFFSET	DV3	Input	Specifies the start position of data to read by specifying the offset position from the beginning of data (in bytes).
Size of data to read SIZE	DV4	Input	Specifies the size of data to read in words.
Read data RD	DV5	I/O	Stores the read data in array of DINT format.
Completed successfully DONE	V6	Output	Turned ON for 1 scan if the data read is completed successfully.
Exited with error ERROR	V7	Output	Turned ON for 1 scan and terminates the operation if the data read fails.
Status STATUS	DV8	Output	Outputs a status that indicates the cause of the error if the data read fails. See "6-2-9 Status" for more information about statuses.
Size of read data DONE_BYTE_SIZE	DV9	Output	Outputs the size of the read data in bytes.

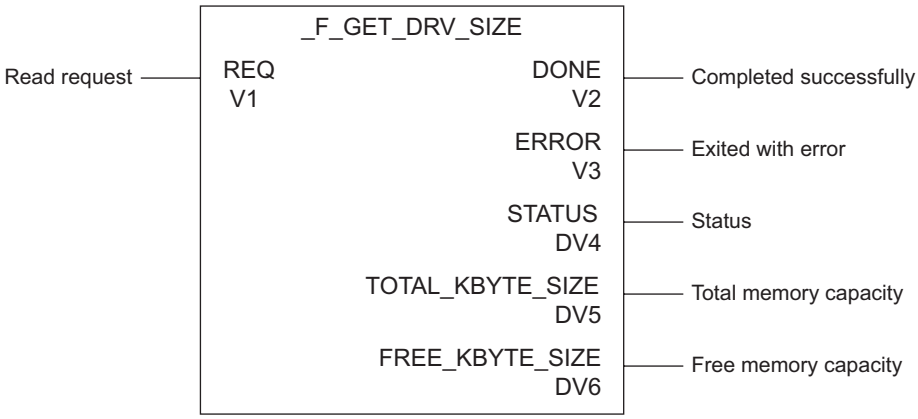
Section 6 Specifications of User ROM Card FB

6-2 Specifications of each FB

6-2-7 Read free capacity (_F_GET_DRV_SIZE)

This FB reads the total capacity and free capacity of the user ROM card mounted in the CPU module in units of 1024 bytes.

(1) FB format



(2) Operation specifications

1) Data is read at the rising edge of REQ. If the data read is completed successfully, DONE is turned ON for 1 scan. If the data read fails, ERROR is turned ON for 1 scan and the cause of the error is output to STATUS.

(3) Description of parameters

Parameter name		Type	Description
Read request REQ	V1	Input	Reads the total memory capacity and free capacity of the user ROM card mounted in the CPU at the rising edge of this signal.
Completed successfully DONE	V2	Output	Turned ON for 1 scan if the data read is completed successfully.
Exited with error ERROR	V3	Output	Turned ON for 1 scan and terminates the operation if the data read fails.
Status STATUS	DV4	Output	Outputs a status that indicates the cause of the error if the file read fails. See "6-2-9 Status" for more information about statuses.
Total memory capacity TOTAL_KBYTE_SIZE	DV5	Output	Stores the total memory capacity of the user ROM card in units of 1024 bytes.
Free memory capacity FREE_KBYTE_SIZE	DV6	Output	Stores the free memory capacity of the user ROM card in units of 1024 bytes.

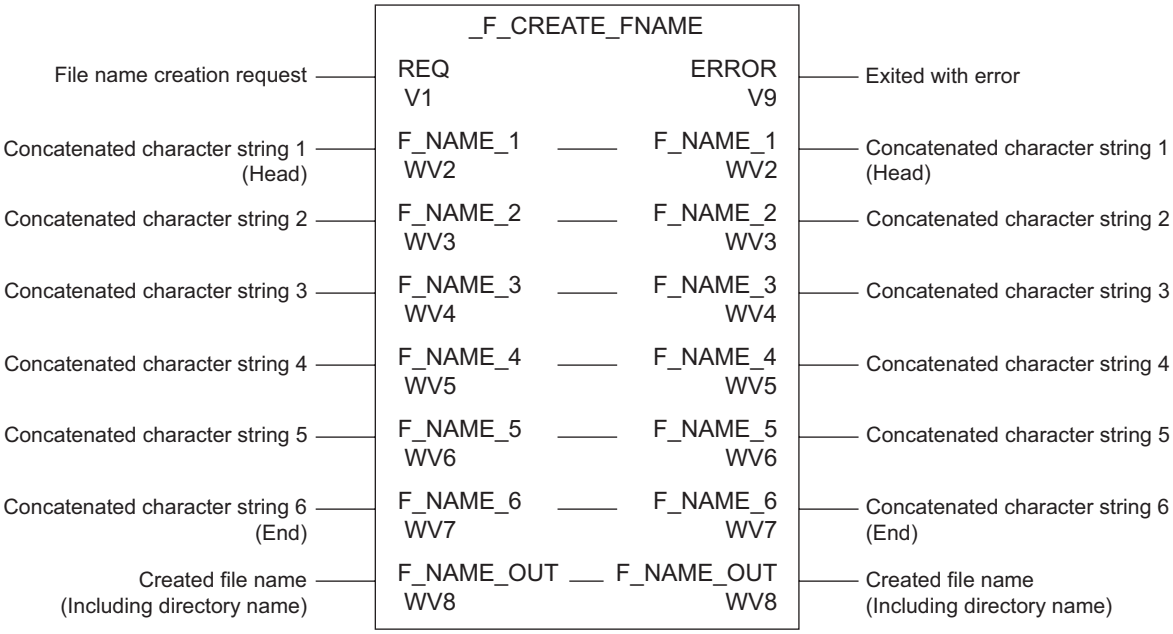
Section 6 Specifications of User ROM Card FB

6-2 Specifications of each FB

6-2-8 Create file name (_F_CREATE_FNAME)

This FB creates a file name of the user ROM card FB. A file name can be up to 255 single-byte characters or 127 double-byte characters long in Shift-JIS

(1) FB format



(2) Operation specifications

1) The character type data connected to F_NAME1 to F_NAME6 are concatenated and output to F_NAME_OUT at the rising edge of REQ. If the operation fails, ERROR is turned ON.

(3) Description of parameters

Parameter name		Type	Description
File name creation request REQ	V1	Input	Concatenates character type data and outputs the file name at the rising edge of this signal.
Concatenated character string 1 (Head) F_NAME_1	WV2	I/O	Specifies the file name in folder name + file name format.
Concatenated character string 2 F_NAME_2	WV3	I/O	
Concatenated character string 3 F_NAME_3	WV4	I/O	
Concatenated character string 4 F_NAME_4	WV5	I/O	
Concatenated character string 5 F_NAME_5	WV6	I/O	
Concatenated character string 6 (End) F_NAME_6	WV7	I/O	
Created file name F_NAME_OUT	WV8	I/O	Stores the concatenated file name in Shift-JIS code.
Exited with error ERROR	V9	Output	Turned ON if the number of characters of the specified file name exceeds 255 single-byte characters and remains ON until the next FB execution is completed successfully.

Section 6 Specifications of User ROM Card FB

6-2 Specifications of each FB

6-2-9 Status

Status	Name	Cause
13000001h	Converted data storage area error	The data converted to DINT type cannot be stored in the specified area of the CPU memory because there is not enough space. * In this case, data is stored to the extent possible.
14000001h	File being accessed	The file cannot be accessed because another file access FB or loader is accessing it.
14000002h	File access resource full	The file access limit (max. 5 files) is exceeded.
21000001h	Area specification error	The specified area exceeds memory boundaries.
21000002h	File name length error	The specified file name string contains 0 characters, or exceeds 255 characters.
22000001h	File name error	The specified file name string contains illegal characters (\ / : ; * ? < > |).
22000002h	File name not set	No file name is set.
22000003h	Append size error	The size of data to be appended by F_APPEND exceeds 1000 words, or SIZE of _F_OFFSET_READ is 0 or exceeds 1000 words.
23000001h	Structure definition error	An illegal code is stored in structure definition data.
23000002h	CSV conversion error	An illegal character code (non-Shift JIS code) that cannot be converted to CSV is detected.
23000003h	Matrix specification error	An illegal number of rows or elements is specified.
23000004h	TITLE character string byte length error	The length of TITLE or SUB_TITLE character strings exceeds 512 bytes.
32000002h	User ROM card not set	The user ROM card is not mounted in the CPU module, or a faulty user ROM card is mounted.
32000003h	Read data storage area error	Data size to be read is larger than the read data storage area.
32000004h	User ROM card access error	An illegal value is detected from the user ROM card while accessing it.
32000005h	User ROM write-protected	The destination file or folder is write-protected.
32000006h	File specification error	The specified file does not exist when reading or deleting data.
32000008h	User ROM card error	The file system of the user ROM card is corrupted.
32000009h	No free space in user ROM card	The data cannot be written because there is no free space in the user ROM card.
32001001h	File size exceeded	An attempt is made to append data to a file of 1Mbyte or more.
33000002h	CSV file error	An illegal character code that cannot be converted to CSV is detected, or the length of rows in the CSV file exceeds the specified value.
33000003h	CSV/structure definition mismatch	Number of CSV file sequences < Structure definition
33000004h	CSV element specification error	The element specified by the CSV element specification does not exist.

Appendix 1 Data Type and Range

<Data type and range>

Data type	Range	Input example
BIT(BOOL)	0,1	on, off
INT	-32768 to 32767	123
DINT	-2147483648 to 2147483647	100
UINT	0 to 65535	1000
UDINT	0 to 4294967295	10000
WORD	0000 to FFFF	H0000, H1234, HABCD
DWORD	00000000 to FFFFFFFF	H00000000, H12345678, HABCDEF10

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