MITSUBISHI
ELECTRIC

Programmable Controller

MELSEC iQ-F series

MELSEC iQ-F
Inverter Control for Automated Warehouses
Function Block Library Reference

SAFETY PRECAUTIONS

(Read these precautions before use.)

Before using this product, please read this manual and the relevant manuals introduced in this manual carefully and pay full attention to safety in order to handle the product correctly.

This manual classifies the safety precautions into two categories: [⚠ WARNING] and [⚠ CAUTION].

⚠ WARNING	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠ CAUTION	Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage.

Depending on the circumstances, procedures indicated by [⚠CAUTION] may also cause severe injury.

It is important to follow all precautions for personal safety.

Store this manual in a safe place so that it can be read whenever necessary. Always forward it to the end user.

INTRODUCTION

Thank you for purchasing the Mitsubishi Electric MELSEC iQ-F series programmable controllers.
This manual describes the module function blocks for the relevant products listed below.
It should be read and understood before attempting to install or use the module.
Always forward it to the end user.

Target module

- FX5S CPU module
- FX5UJ CPU module
- FX5U CPU module
- FX5UC CPU modules

Regarding use of this product

- This product has been manufactured as a general-purpose part for general industries, and has not been designed or manufactured to be incorporated in a device or system used in purposes related to human life.
- Before using the product for special purposes such as nuclear power, electric power, aerospace, medicine or passenger movement vehicles, consult Mitsubishi Electric.
- This product has been manufactured under strict quality control. However when installing the product where major accidents or losses could occur if the product fails, install appropriate backup or failsafe functions in the system.

Note

- If in doubt at any stage during the installation of the product, always consult a professional electrical engineer who is qualified and trained in the local and national standards. If in doubt about the operation or use, please consult the nearest Mitsubishi Electric representative.
- Since the examples indicated by this manual, technical bulletin, catalog, etc. are used as a reference, please use it after confirming the function and safety of the equipment and system. Mitsubishi Electric will accept no responsibility for actual use of the product based on these illustrative examples.
- This manual content, specification etc. may be changed, without a notice, for improvement.
- The information in this manual has been carefully checked and is believed to be accurate; however, if you notice a doubtful point, an error, etc., please consult your local Mitsubishi Electric representative. When doing so, please provide the manual number given at the end of this manual.

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RELEVANT MANUALS

Programmable controller

■Hardware, maintenance and inspection

Manual name <manual number>	Description
MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware) <SH-082452ENG>	Hardware of the CPU module, including I/O specifications, wiring, installation, and maintenance

■Function

Manual name <manual number>	Description
MELSEC iQ-F FX5 User's Manual (Application) <JY997D55401>	Basic knowledge about programming, functions of the CPU module, devices/labels, and parameter settings
MELSEC iQ-F FX5 User's Manual (Serial Communication) <JY997D55901>	N:N network, Parallel link, MELSEC Communication protocol, inverter communication, non-protocol communication, and predefined protocol support
MELSEC iQ-F FX5 User's Manual (Ethernet Communication) <JY997D56201>	Ethernet communication function of the CPU module and the Ethernet module
CC-Link IE Field Network Basic Reference Manual <SH-081684ENG>	Specifications, procedures before operation, system configuration, programming, functions, parameter settings, and troubleshooting of CC-Link IE Field Network Basic

■Programming

Manual name <manual number>	Description
MELSEC iQ-F FX5 Programming Manual (Program Design) <JY997D55701>	Program specifications (ladder, ST, FBD/LD, and SFC programs) and labels
MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks) <JY997D55801>	Specifications of the instructions and functions that can be used in programs

■Software

Manual name <manual number>	Description
GX Works3 Operating Manual <SH-081215ENG>	Explanation of system configuration, parameter settings, and online operations of GX Works3

Inverter

Manual name <manual number>	Description
FR-A800-E Instruction Manual (Startup) <IB-0600626>	Handling information and precautions for use of the inverters
FR-A800 Instruction Manual (Detailed) <IB-0600503ENG>	Explanation of specifications, function list, and maintenance and inspection of the inverters
Ethernet Function Manual <IB-0600628ENG>	Explanation of Ethernet function of the inverters
FR-E800 Instruction Manual (Connection) <IB-0600865ENG>	Explanation of installation and wiring of the inverters
FR-E800 Instruction Manual (Function) <IB-0600868ENG>	Explanation of specifications and function list of the inverters
FR-E800 Instruction Manual (Communication) <IB-0600871ENG>	Explanation of communication specifications of the inverters
FR Configurator2 Instruction Manual <IB-0600516ENG>	Explanation of system configuration, parameter settings, and online operations of FR Configurator2

Distance meter

For the following manuals, please consult the manufacturers of the distance meters.

Manual name
AMS308i Operating instructions
DL100 Operating instructions (manual product number: 8014753)

TERMS

Unless otherwise specified, this manual uses the following terms.

Term	Description
CC-Link IE Field Network Basic	CC-Link IE Field Network Basic is an FA network using the standard Ethernet. Data are communicated periodically (cyclic transmission) between the master station and remote stations using link devices.
Cyclic transmission	A function by which data are periodically exchanged among stations on the same network using link devices (RX, RY, RWw, and RWr)
Distance meter	A sensor that can measure a distance of the range from hundreds of millimeters to tens of meters. Various types of the sensors are available and users can choose it according to the measurement method or the output method for distance data.
Engineering tool	A tool used for setting up programmable controllers, programming, debugging, and maintenance
Link device	A device (RX, RY, RWr, or RWw) in a CPU module for the purpose of communicating with remote stations
Link refresh	Processing of data transfer between link devices of the network module and CPU module devices. Link refresh is performed in "END processing" of the sequence scan of the CPU module.
Master station	A station that controls the entire CC-Link IE Field Network Basic. Only one master station can be used in a network.
Positioning control	Control that moves a stacker crane used for conveyance to a target position (stop position) by using distance meters.
Remote station	A station that performs cyclic transmission with the master station on CC-Link IE Field Network Basic. This station exchanges I/O signals in units of bits and I/O data in units of words.
Stacker crane	A conveyer that stores and retrieves goods in a swift and reliable manner by controlling the following three axes: lift axis for making the loading platform go up and down; fork axis for transferring goods to the rack; travel axis for moving the wheeled platform.

GENERIC TERMS AND ABBREVIATIONS

Unless otherwise specified, this manual uses the following generic terms and abbreviations.

Generic term/abbreviation	Description
FB	An abbreviation for "Function Block". A function block is created from a ladder block repeatedly used in a sequence program so that it can be used as a component in a sequence program. Using FBs helps to develop programs more efficiently, reduce mistakes, and improve quality of programs.
FR-A800/FR-E800	A generic term for Mitsubishi Electric general-purpose inverter FR-A800 series, FR-A800 Plus series, and FR-E800 series
FX5 CPU module	A generic term for FX5S CPU module, FX5UJ CPU module, FX5U CPU module, and FX5UC CPU module
Pr.	Parameter number (Number assigned to function of inverter)

1 OVERVIEW

The function blocks in this reference manual mean the FB libraries for controlling stacker cranes used for conveyance in automated warehouses by connecting a MELSEC iQ-F series programmable controller and FR-A800/FR-E800 series inverters via CC-Link IE Field Network Basic.

1.1 Features

This section describes the features of this function.

Positioning control via CC-Link IE Field Network Basic communications

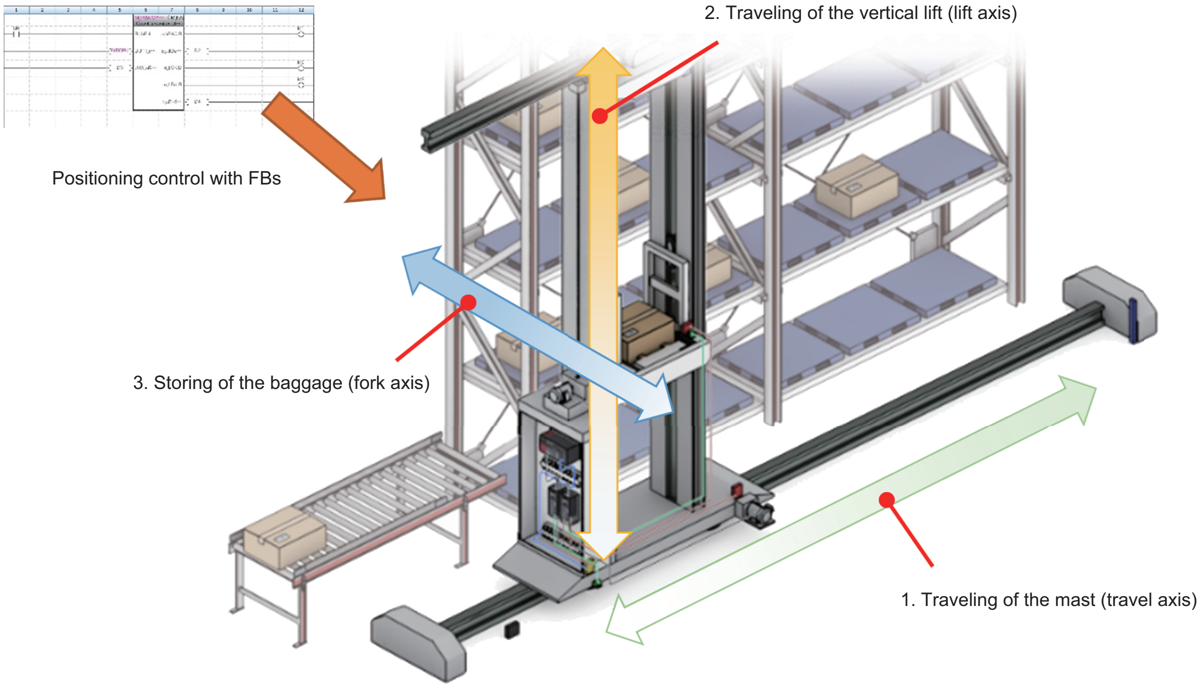
This function calculates the speed command from a deviation between the positioning control position command (target position) and the distance meter feedback position (current position) to perform the full-close positioning control that uses inverters and CC-Link IE Field Network Basic communications.

Flexible system design

The flexible system design can be realized by combining the (charge-free) FB libraries optimized for logistics conveyance and users' own programs (such as saving the operation history).

Application example

The following figure shows an application example of this system to stacker crane equipment. The system uses three motors and performs positioning control with FBs.


2. Traveling of the vertical lift (lift axis)
Positioning control with FBs
3. Storing of the baggage (fork axis)
1. Traveling of the mast (travel axis)

1.2 List of FB Libraries

The following table lists the FB libraries in this reference manual.

Point

To use these FB libraries, set the parameters using the engineering tool. (☞ Page 21 Parameter Settings)

○: Required, —: Not required

Name	Description	Parameter setting
M+AWH_PosVelGen_F (positioning operation command generation)	Generates speed and position commands for controlling positioning to the target position.	○
M+AWH_PIDControl_F (PID control)	Performs position deviation correction during positioning control.	○
M+AWH_VelConv_F (frequency conversion)	Converts the speed command (m/s) to the set frequency (Hz).	○
M+AWH_MotorSwitch_F (motor switching control)	Switches commands to the inverter when one inverter operates two motors by selecting and switching a motor to be operated.	○
M+AWH_AntiSwayControl_F (anti-sway control)	Applies the notch filter to the position command to suppress swinging at positioning stop.	○
M+AWH_FREQROL_CCLinkIEFBasic_F (inverter communication)	Controls and monitors the inverters connected to CC-Link IE Field Network Basic.	○
M+AWH_ScaleIF_SerialComm_F (distance measurement: serial)	Performs serial communication with distance meters and gives feedback about distance measurement values.	○
M+AWH_ScaleIF_EN_F (distance measurement: Ethernet)	Performs Ethernet communication with distance meters and gives feedback about distance measurement values.	○
M+AWH_DecDistance_F (deceleration distance calculation)	Calculates a distance required for deceleration stop during positioning control.	—

For these FB libraries, please consult your local Mitsubishi representative.

For the FB library registration method, refer to the following.

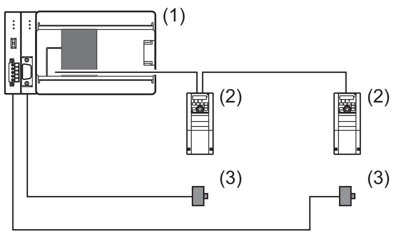
📖 GX Works3 Operating Manual

1.3 System Configuration

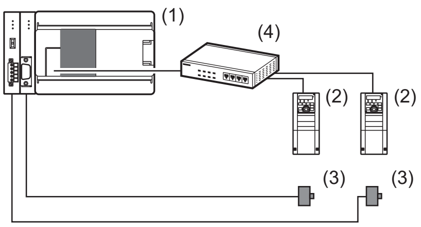
The following figures show examples of system configuration for using the FB libraries in this reference manual.

When a serial communication compatible distance meter is used

- Line topology



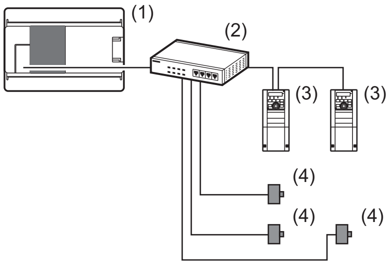
- Star topology



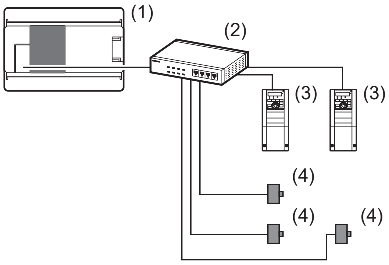
No.	Device		Description
(1)	FX5 CPU module	Built-in Ethernet port	Used for connection with an inverter. Communication method: CC-Link IE Field Network Basic
		Built-in RS-485 port	Used for connection with a distance meter. Communication method: Serial communication through the predefined protocol support function (two channels maximum)
		FX5-485-BD	
		FX5-485ADP	
(2)	Inverter	FR-E800 series	CC-Link IE Field Network Basic communication compatible model Star topology and line topology are available.
		FR-A800 series	CC-Link IE Field Network Basic communication compatible model Star topology is available.
		FR-A8AP / FR-A8AP E kit	Vector control compatible option for FR-A800 and FR-E800
(3)	Distance meter	DL100 Pro (SICK AG) Distance meters other than above	Serial communication (RS-485 or RS-422) compatible models For the procedure of using general-purpose distance meters, refer to the following. ☞ Page 100 Operation Examples of General-Purpose Distance Meters
(4)	Switching hub	—	Used for connection with an inverter (for star topology). Communication method: CC-Link IE Field Network Basic

When an Ethernet communication compatible distance meter is used

- Line topology



- Star topology



No.	Device		Description
(1)	FX5 CPU module	Built-in Ethernet port	Used for connection with a switching hub.
(2)	Switching hub	—	Used for connection with an inverter. Communication method: CC-Link IE Field Network Basic
			Used for connection with a distance meter. Communication method: Ethernet (predefined protocol: UDP)
(3)	Inverter	FR-E800 series	CC-Link IE Field Network Basic communication compatible model Star topology and line topology are available.
		FR-A800 series	CC-Link IE Field Network Basic communication compatible model Star topology is available.
		FR-A8AP / FR-A8AP E kit	Vector control compatible option for FR-A800 and FR-E800
(4)	Distance meter	AMS308i (Leuze) Distance meters other than above	Ethernet communication compatible model For the procedure of using general-purpose distance meters, refer to the following. ☞ Page 100 Operation Examples of General-Purpose Distance Meters

2 SPECIFICATIONS

This chapter describes the common specifications of the FB libraries in this reference manual.

2.1 FB Library Specifications

The following table shows specifications of the FB libraries in this reference manual.

Item	Description	
Ethernet-equipped module	FX5 CPU module (Use the built-in Ethernet port.)	
Inverter	FR-A800, FR-E800 (CC-Link IE Field Network Basic compatible device)	
Communication type	CC-Link IE Field Network Basic Predefined protocol support function (serial/Ethernet)	
Topology	Star topology or line topology (supported by only FR-E800)	
Maximum number of connected inverters	2	
Maximum number of connected distance meters	DL100 Pro (SICK AG)	2
	AMS308i (Leuze)	3
Number of registered protocols (in the predefined protocol support function)	DL100 Pro (SICK AG)	8 (64 maximum)
	AMS308i (Leuze)	6 (64 maximum)
Number of steps in a project	13.56K steps	
Label capacity of a project	1.44K points [Word]	
Latch label capacity of a project	0K points [Word]	

Project performance values

The following tables list the performance values in the project data of the FB libraries.

Positioning operation with distance meters (serial communication) (2-axis)

Project performance value[1][2][3]	Minimum scan time (ms)	1.161
	Maximum scan time (ms)	2.86
	Maximum link scan time (ms)	69.522

[1] These values are performance values for the program described below.
☞ Page 84 Positioning Operation with Distance Meters (Serial Communication)

[2] When the program capacity is set to 128K steps, the processing speed may become slow.

[3] The standard area is used for labels.

Positioning operation with distance meters (Ethernet communication) (3-axis)

Project performance value[1][2][3]	Minimum scan time (ms)	0.951
	Maximum scan time (ms)	3.015
	Maximum link scan time (ms)	92.977

[1] These values are performance values for the program described below.
☞ Page 93 Positioning Operation with Distance Meters (Ethernet Communication)

[2] When the program capacity is set to 128K steps, the processing speed may become slow.

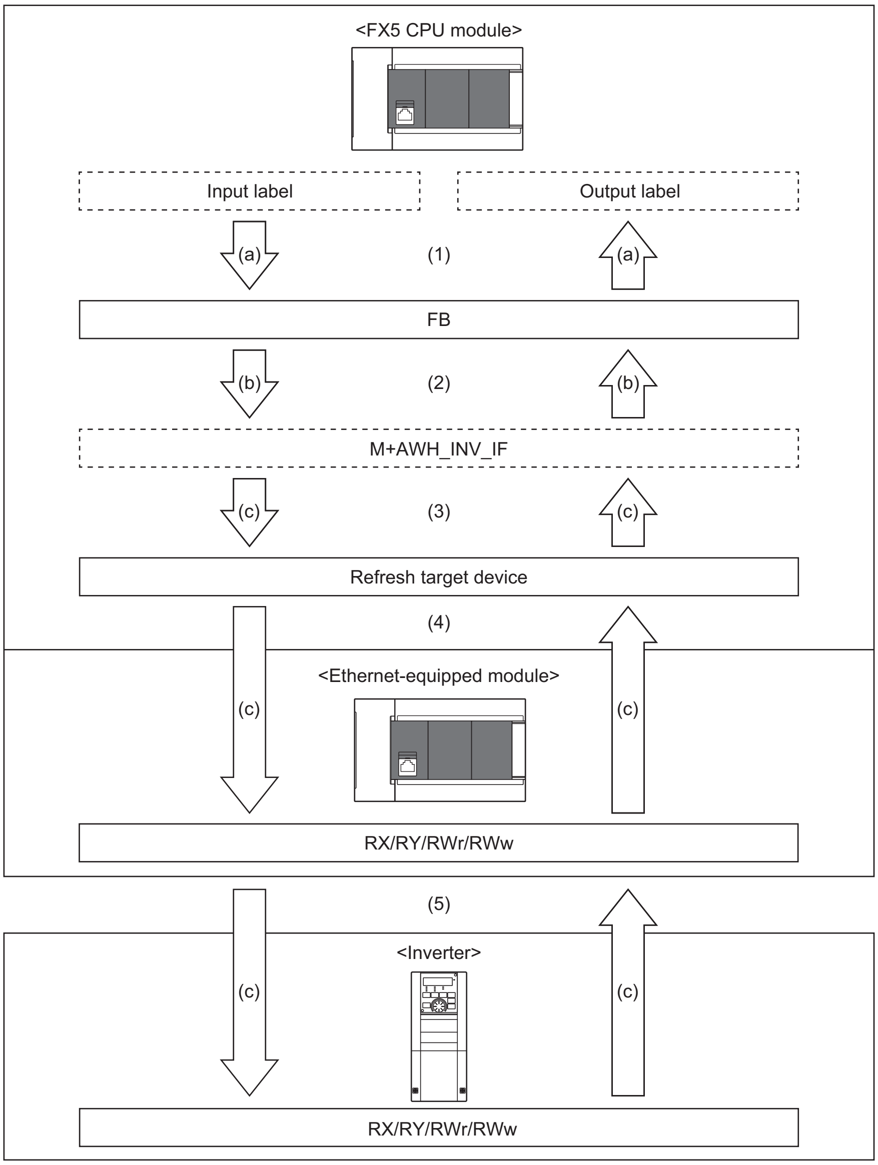
[3] The standard area is used for labels.

2.2 FB Library Correlations

The FB libraries process data between the FX5 CPU module and an inverter and between the FX5 CPU module and a distance meter.

The following figure shows the correlations of the FB libraries.

Between the FX5 CPU module and an inverter


<FX5 CPU module>
Input label
Output label
(a)
(1)
(a)
FB
(b)
(2)
(b)
M+AWH_INV_IF
(c)
(3)
(c)
Refresh target device
(4)
<Ethernet-equipped module>
(c)
(c)
RX/RY/RWr/RWw
(5)
<Inverter>
(c)
(c)
RX/RY/RWr/RWw

(1) User-created program processing
(2) FB processing
(3) Global label definition (device assignment)[*1]
(4) Link refresh[*2]
(5) CC-Link IE Field Network Basic

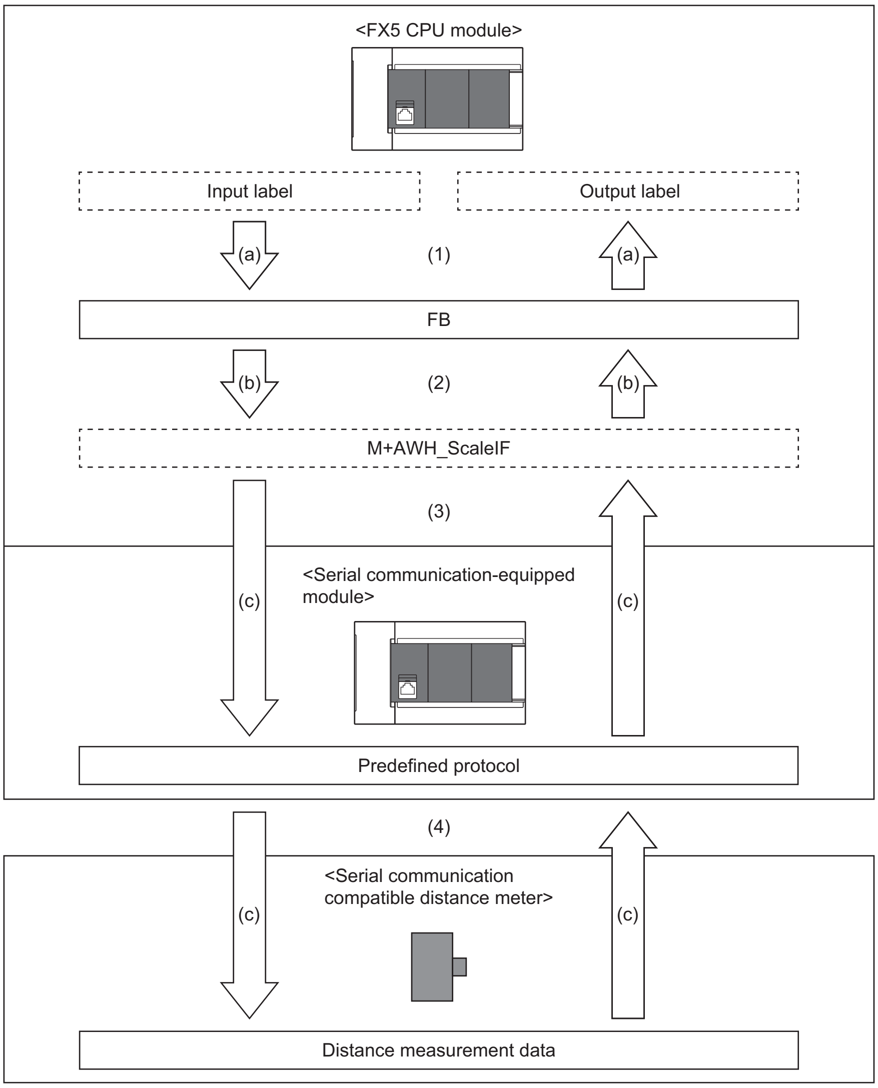
(a) Data processing by user
(b) Data processing by FB
(c) Data processing performed by other than users and FB

[*1] For details on the setting method, refer to the following.
☞ Page 23 Global label settings

[*2] For details on the setting method, refer to the following.
☞ Page 23 Refresh parameter settings

Between the FX5 CPU module and a distance meter

■Serial communication compatible distance meter

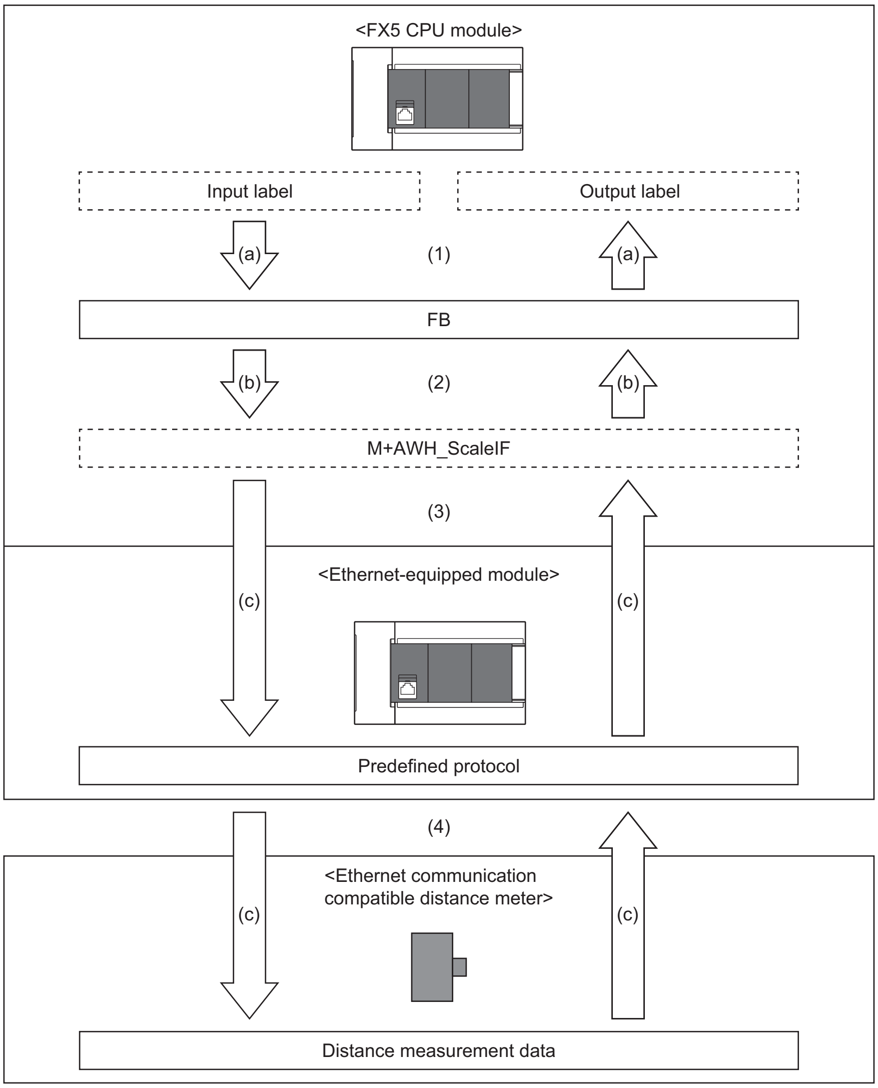

<FX5 CPU module>
Input label
Output label
(a)
(1)
(a)
FB
(b)
(2)
(b)
M+AWH_ScaleIF
(3)
(c)
<Serial communication-equipped module>
(c)
Predefined protocol
(4)
(c)
<Serial communication compatible distance meter>
(c)
Distance measurement data

(1) User-created program processing	(a) Data processing by user
(2) FB processing	(b) Data processing by FB
(3) Global label definition (device assignment)*1	(c) Data processing performed by other than users and FB
(4) Serial communication (predefined protocol support function)*2	

*1 For details on the setting method, refer to the following.
☞Page 23 Global label settings

*2 For details on the setting method, refer to the following.
☞Page 24 Serial communication (built-in RS-485 port)
☞Page 25 Serial communication (FX5-485-BD or FX5-485ADP)

■Ethernet communication compatible distance meter


<FX5 CPU module>
Input label
Output label
(a)
(1)
(a)
FB
(b)
(2)
(b)
M+AWH_ScaleIF
(3)
<Ethernet-equipped module>
(c)
(c)
Predefined protocol
(4)
<Ethernet communication compatible distance meter>
(c)
(c)
Distance measurement data

(1) User-created program processing
(2) FB processing
(3) Global label definition (device assignment)*1
(4) Ethernet communication (predefined protocol support function)*2

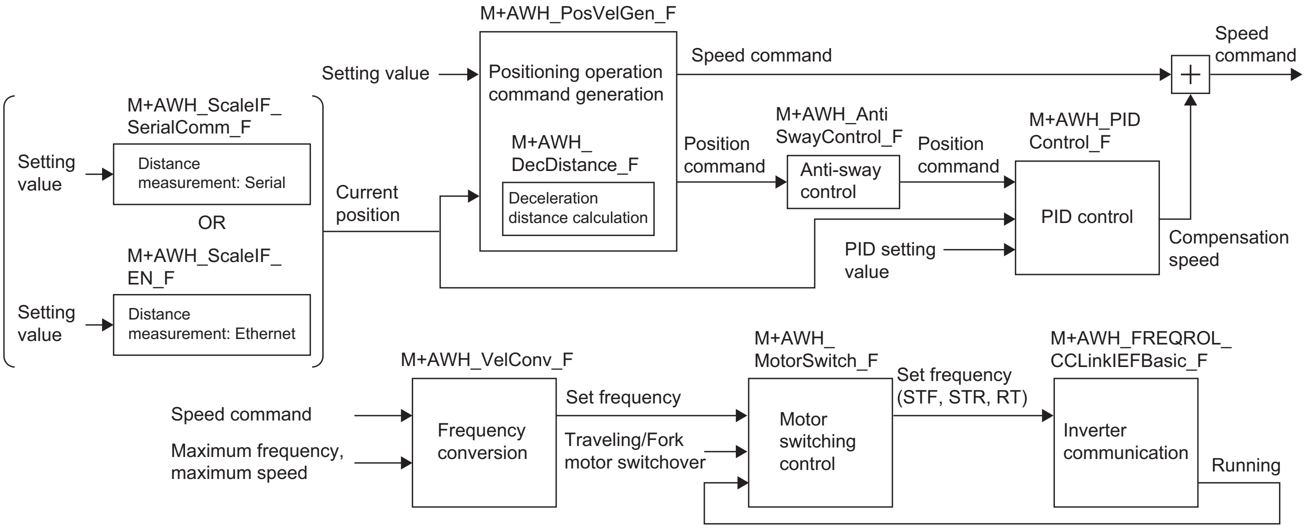
(a) Data processing by user
(b) Data processing by FB
(c) Data processing performed by other than users and FB

*1 For details on the setting method, refer to the following.
☞ Page 23 Global label settings

*2 For details on the setting method, refer to the following.
☞ Page 26 Ethernet communication

2.3 FB Library Configuration Example

The following figure shows an FB configuration example of using the FB libraries to control the stacker cranes.


M+AWH_PosVelGen_F
Setting value
Positioning operation command generation
M+AWH_DecDistance_F
Deceleration distance calculation
Speed command
Speed command
M+AWH_ScaleIF_SerialComm_F
Setting value
Distance measurement: Serial
OR
M+AWH_ScaleIF_EN_F
Setting value
Distance measurement: Ethernet
Current position
Position command
M+AWH_AntiSwayControl_F
Anti-sway control
Position command
M+AWH_PIDControl_F
PID control
PID setting value
Compensation speed
M+AWH_VelConv_F
Speed command
Maximum frequency, maximum speed
Frequency conversion
Set frequency
Traveling/Fork motor switchover
M+AWH_MotorSwitch_F
Motor switching control
Set frequency (STF, STR, RT)
M+AWH_FREQROL_CCLinkIEFBasic_F
Inverter communication
Running

Point

- Use M+AWH_AntiSwayControl_F (anti-sway control) and M+AWH_MotorSwitch_F (motor switching control) according to the user's system and the expected operation.
- A different FB is used depending on the distance meter's communication type.

Serial communication: M+AWH_ScaleIF_SerialComm_F (distance measurement: serial)

Ethernet communication: M+AWH_ScaleIF_EN_F (distance measurement: Ethernet)

- The position command that is created by M+AWH_PosVelGen_F (positioning operation command generation) is used for speed command correction.

2.4 List of Global Labels

The following table lists the global labels used for the FB libraries.

Name	Description
M+AWH_INV_IF	Used for storing link device information transferred through communication with inverters.
M+AWH_ScaleIF	Used for storing current position information received through communication with distance meters.

M+AWH_INV_IF

Label name	Name	Data type	Class	Description
G_bRX[1]	Remote input (RX)	Bit	VAR_GLOBAL	Stores a remote input (RX) value.
G_bRY[1]	Remote output (RY)	Bit	VAR_GLOBAL	Stores a remote output (RY) value.
G_wRWr[1]	Remote register (RWr)	Word [signed]	VAR_GLOBAL	Stores a remote register (RWr) value.
G_wRWw[1]	Remote register (RWw)	Word [signed]	VAR_GLOBAL	Stores a remote register (RWw) value.

[1] This global label adds an index register to assignments. For details, refer to the following.
☞ Page 21 Parameter Settings

M+AWH_ScaleIF

Label name	Name	Data type	Class	Description
G_d3CurrentPos[1]	Current position	Double word [signed] (0..2)	VAR_GLOBAL	Stores the current position [m] measured by the distance meter. G_d3CurrentPos[0]: Travel axis G_d3CurrentPos[1]: Lift axis G_d3CurrentPos[2]: Fork axis[2]
G_w3SensorStatus[1]	Distance meter status	Word [signed] (0..2)	VAR_GLOBAL	Stores the distance meter status (error information). G_w3SensorStatus[0]: Travel axis G_w3SensorStatus[1]: Lift axis G_w3SensorStatus[2]: Fork axis[2]

[1] This global label adds an index register to assignments. For details, refer to the following.
☞ Page 21 Parameter Settings

[2] Used for M+AWH_ScaleIF_EN_F (distance measurement: Ethernet).

2.5 List of Structures

The following table lists the structures used for the FB libraries.

Name	Description
PID_PR	Set proportional gain, integral time, and others for PID control.

PID_PR (PID setting)

Label name	Name	Data type	Setting range	Description
eKp	Proportional gain	Single-precision real number	• 0.000000 • 2^{-126} (1.175494E-38) to 150.000000	Set the proportional gain [sec^{-1}].
eTi	Integral time	Single-precision real number	• 0.000000 • 2^{-126} (1.175494E-38) to 10.000000	Set the integral time [s]. When the integral control enabled is on, set a value larger than 0.
eTd	Differential time	Single-precision real number	• 0.000000 • 2^{-126} (1.175494E-38) to 10.000000	Set the differential time [s].
eDeadBand	Dead band setting	Single-precision real number	• 0.000000 • 2^{-126} (1.175494E-38) to 300.000000	Set the dead band [m].
eHighLimit	Output upper limit	Single-precision real number	• 0.000000 • 2^{-126} (1.175494E-38) to 10.000000	Set the compensation speed output upper limit [m/s].
eLowLimit	Output lower limit	Single-precision real number	• -10.000000 to -2^{-126} (-1.175494E-38) • 0.000000	Set the compensation speed output lower limit [m/s].
eDeviationOver	Excessive error level	Single-precision real number	• 0.000000 • 2^{-126} (1.175494E-38) to 300.000000	Set the allowable range of the position deviation [m] for excessive error detection.
bPrelease	Proportional control enabled	Bit	On, Off	Set whether to enable the proportional control. • On: Enabled • Off: Disabled
bIrelease	Integral control enabled	Bit	On, Off	Set whether to enable the integral control. • On: Enabled • Off: Disabled
bDrelease	Differential control enabled	Bit	On, Off	Set whether to enable the differential control. • On: Enabled • Off: Disabled
bIntInit	Integral initialization	Bit	On, Off	Set whether to reset the integral control manipulated amount. • On: Reset • Off: Do not reset
bIntFreeze	Integral held	Bit	On, Off	Set whether to hold the integral control manipulated amount. • On: Hold • Off: Do not hold

2.6 Link Devices

The following tables list the link devices accessed using the FB libraries.

The letter "n" in a device number represents a value determined by the station number.

Point

The tables show the link devices for using the FR-E800 series.

When using the FR-A800 series, refer to the following.

☞ Page 109 When the FR-A800 Series Is Used

RYn/RXn mapping

○: Can be changed, ×: Cannot be changed

Master station to Inverter (RYn)			Inverter to Master station (RXn)		
Device No.	**Device name**	**Mapping**	**Device No.**	**Device name**	**Mapping**
RYn0	Forward rotation command	×	RXn0	Forward running	×
RYn1	Reverse rotation command	×	RXn1	Reverse running	×
RYn2	High-speed operation command (terminal RH function)	○	RXn2	Running (terminal RUN function)	×
RYn3	Middle-speed operation command (terminal RM function)	○	RXn3	Up to frequency	×
RYn4	Low-speed operation command (terminal RL function)	○	RXn4	Overload warning	×
RYn5	JOG operation selection 2	×	RXn5	Pr.193 assignment function (NET Y1)	○
RYn6	Second function selection	×	RXn6	Frequency detection (terminal FU function)	×
RYn7	Current input selection	×	RXn7	Fault (terminal ABC function)	×
RYn8	Pr.185 assignment function (NET X1)	○	RXn8	Pr.194 assignment function (NET Y2)	○
RYn9	Output stop (terminal MRS function)	×	RXn9	Pr.313 assignment function (DO0)	○
RYnA	Pr.186 assignment function (NET X2)	○	RXnA	Pr.314 assignment function (DO1)	○
RYnB	Pr.184 assignment function (RES)	○	RXnB	Pr.315 assignment function (DO2)	○
RYnC	Monitor command	×	RXnC	Monitoring	×
RYnD	Frequency setting command (RAM)	×	RXnD	Frequency setting completion (RAM)	×
RYnE	Frequency setting command (RAM, E2PROM)	×	RXnE	Frequency setting completion (RAM, E2PROM)	×
RYnF	Instruction code execution request	×	RXnF	Instruction code execution completion	×
RY(n+1)0 to RY(n+1)7	Reserved	×	RX(n+1)0 to RX(n+1)5	Reserved	×
			RX(n+1)6	Pr.195 assignment function (NET Y3)	○
			RX(n+1)7	Pr.196 assignment function (NET Y4)	○
RY(n+1)8	Not used (initial data process completion flag)	×	RX(n+1)8	Not used (initial data process completion flag)	×
RY(n+1)9			RX(n+1)9		
RY(n+1)A	Error reset request flag	×	RX(n+1)A	Error status flag	×
RY(n+1)B	Pr.187 assignment function (NET X3)	○	RX(n+1)B	Remote station ready	×
RY(n+1)C	Pr.188 assignment function (NET X4)	○	RX(n+1)C	Positioning completed	×
RY(n+1)D	Pr.189 assignment function (NET X5)	○	RX(n+1)D	During position command operation	×
RY(n+1)E	Reserved	×	RX(n+1)E	Home position return completed	×
RY(n+1)F	Reserved	×	RX(n+1)F	Home position return failure	×

RWw/RWr mapping

○: Can be changed, ×: Cannot be changed

Master station to Inverter (RWwn)[1]				Inverter to Master station (RWrn)[1]		
Device No.	Device name		Mapping	Device No.	Device name	Mapping
	Upper 8 bits	Lower 8 bits				
RWwn0	Monitor code 2	Monitor code 1	×	RWrn0	First monitor value	×
RWwn1	Set frequency (0.01 Hz increments)/Torque command		×	RWrn1	Second monitor value	×
RWwn2	H00	Instruction code	○	RWrn2	Reply code	○
RWwn3	Data to be written		○	RWrn3	Data to be read	○

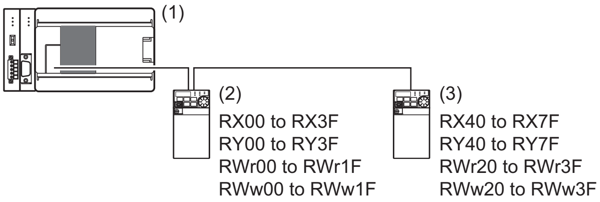
[1] The list shows the devices when Pr.544 is set to "0" (compatible with CC-Link Ver.1). For link devices when Pr.544 is not set to "0", refer to the manuals for the inverters used.

2.7 Parameter Settings

The following describes the parameter settings for using these FB libraries.

CC-Link IE Field Network Basic settings

Use GX Works3 to configure settings to connect the FX5 CPU module and inverters via CC-Link IE Field Network Basic. The following example shows a system configuration where the FX5U CPU module and two FR-E800-E inverters (station No.1 and station No.2) are connected.



(1) Serial communication adapter + FX5U CPU module (station number 0, master station)
(2) FR-E800-E (station number 1, axis 1 (travel axis))
(3) FR-E800-E (station number 2, axis 2 (lift axis))

- Link device and global label (M+AWH_INV_IF) assignment examples

Station No.	Link device (RX)	Refresh target device (X)	Global label (bRX)
1	RX0 to RX3F	X1000 to X1077	G_bRX[0] to G_bRX[63]
2	RX40 to RX7F	X1100 to X1177	G_bRX[64] to G_bRX[127]

Station No.	Link device (RY)	Refresh target device (Y)	Global label (bRY)
1	RY0 to RY3F	Y1000 to Y1077	G_bRY[0] to G_bRY[63]
2	RY40 to RY7F	Y1100 to Y1177	G_bRY[64] to G_bRY[127]

Station No.	Link device (RWr)	Refresh target device (W)	Global label (wRWr)
1	RWr0 to RWr1F	W0 to W1F	G_wRWr[0] to G_wRWr[31]
2	RWr20 to RWr3F	W20 to W3F	G_wRWr[32] to G_wRWr[63]

Station No.	Link device (RWw)	Refresh target device (W)	Global label (wRWw)
1	RWw00 to RWw1F	W40 to W5F	G_wRWw[0] to G_wRWw[31]
2	RWw20 to RWw3F	W60 to W7F	G_wRWw[32] to G_wRWw[63]

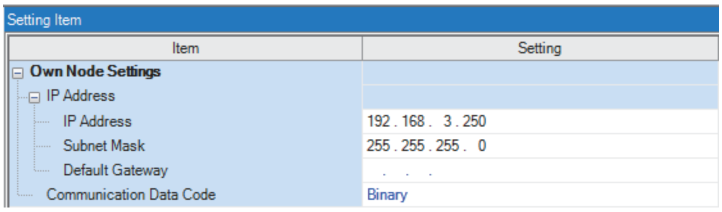
Network configuration settings

1. Open the Ethernet port setting window.

[Navigation window] ⇨ [Parameter] ⇨ CPU module ⇨ [Module Parameter] ⇨ [Ethernet port]

2. Set the IP address and subnet mask of the programmable controller.

[Basic Setting] ⇨ [Own Node Settings] ⇨ [IP Address]

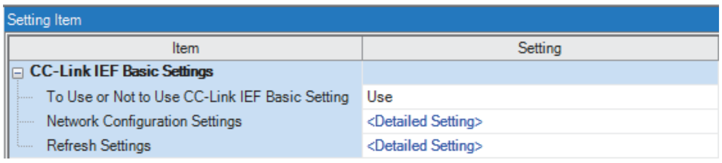


Setting Item

Item	Setting
Own Node Settings	
IP Address	
IP Address	192 . 168 . 3 . 250
Subnet Mask	255 . 255 . 255 . 0
Default Gateway	. . .
Communication Data Code	Binary

3. Set [To Use or Not to Use CC-Link IEF Basic Setting] to "Enable".

[Basic Settings] ⇨ [CC-Link IEF Basic Setting] ⇨ [To Use or Not to Use CC-Link IEF Basic Setting]



Setting Item

Item	Setting
CC-Link IEF Basic Settings	
To Use or Not to Use CC-Link IEF Basic Setting	Use
Network Configuration Settings	<Detailed Setting>
Refresh Settings	<Detailed Setting>

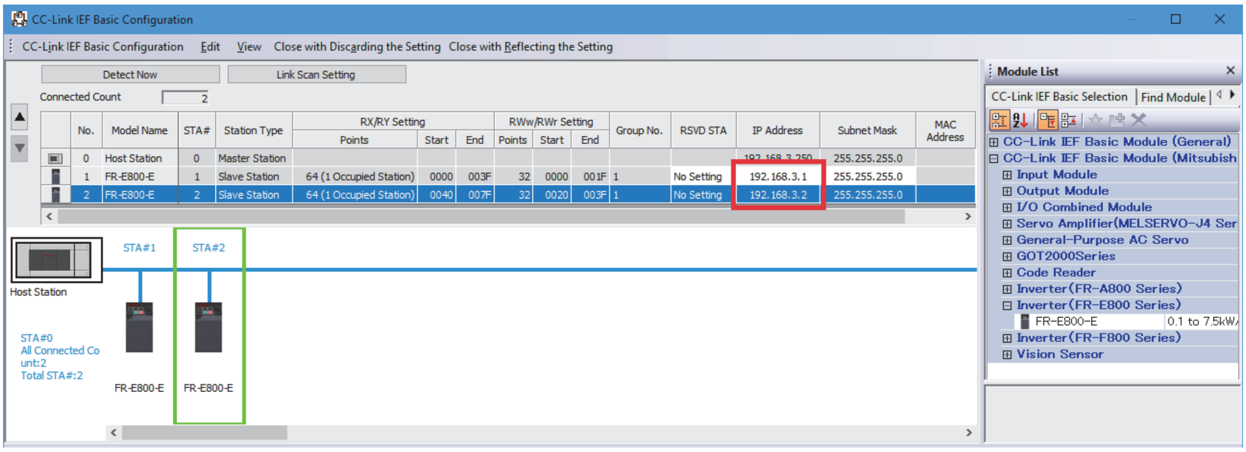
4. Open the network configuration window.

[CC-Link IEF Basic Setting] ⇨ [Network Configuration Settings] ⇨ <Detailed Settings>

5. Add FR-E800-E inverters.

Select FR-E800-E inverters in "Module List", and drag and drop them to the network map or the list of stations.

6. Set the IP address of each station.



CC-Link IEF Basic Configuration

Connected Count: 2

No.	Model Name	STA#	Station Type	RX/RY Setting Points	RX/RY Setting Start	RX/RY Setting End	RWw/RWr Setting Points	RWw/RWr Setting Start	RWw/RWr Setting End	Group No.	RSVD STA	IP Address	Subnet Mask	MAC Address
0	Host Station	0	Master Station									192.168.3.250	255.255.255.0	
1	FR-E800-E	1	Slave Station	64 (1 Occupied Station)	0000	003F	32	0000	001F	1	No Setting	192.168.3.1	255.255.255.0	
2	FR-E800-E	2	Slave Station	64 (1 Occupied Station)	0040	007F	32	0020	003F	1	No Setting	192.168.3.2	255.255.255.0	

CC-Link IEF Basic Configuration
Edit
View
Close with Discarding the Setting
Close with Reflecting the Setting
Detect Now
Link Scan Setting
Host Station
STA#1
STA#2
STA#0
All Connected Count:2
Total STA#:2
FR-E800-E
FR-E800-E
Module List
CC-Link IEF Basic Selection
Find Module
CC-Link IEF Basic Module (General)
CC-Link IEF Basic Module (Mitsubish
Input Module
Output Module
I/O Combined Module
Servo Amplifier(MELSERVO-J4 Ser
General-Purpose AC Servo
GOT2000Series
Code Reader
Inverter(FR-A800 Series)
Inverter(FR-E800 Series)
FR-E800-E
0.1 to 7.5kW
Inverter(FR-F800 Series)
Vision Sensor

Restriction

Set the target stations (inverters) to be controlled by this FB library left-aligned. If the target stations are set with another station put in between, FB cannot access link devices correctly and fails to operate correctly.

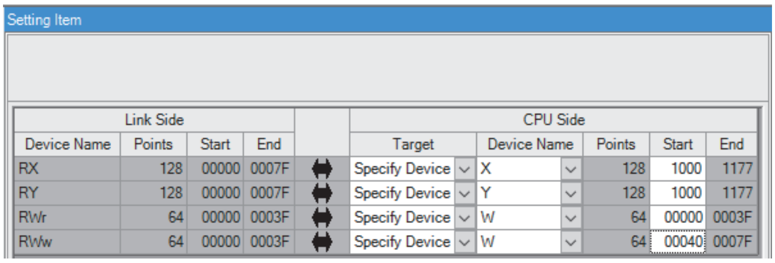
Refresh parameter settings

1. Open the Ethernet port setting window.

[Navigation window] ⇨ [Parameter] ⇨ CPU module ⇨ [Module Parameter] ⇨ [Ethernet port]

2. Open the refresh setting window.

[Basic Settings] ⇨ [CC-Link IEF Basic Setting] ⇨ [Refresh Settings] ⇨ <Detailed Settings>



Link Side					CPU Side				
Device Name	Points	Start	End		Target	Device Name	Points	Start	End
RX	128	00000	0007F	⇔	Specify Device	X	128	1000	1177
RY	128	00000	0007F	⇔	Specify Device	Y	128	1000	1177
RWr	64	00000	0003F	⇔	Specify Device	W	64	00000	0003F
RWw	64	00000	0003F	⇔	Specify Device	W	64	00040	0007F

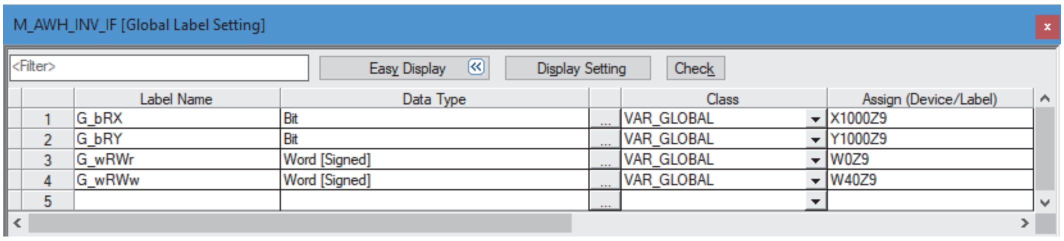
3. Specify the devices to be assigned to RX/RY and RWw/RWr. The following shows a setting example.

Remote station 1	Remote station 2
• RX0 to RX3F ⇔ X1000 to X1077 (128 points) • RY0 to RY3F ⇔ Y1000 to Y1077 (128 points) • RWr0 to RWr1F ⇔ W0 to W1F (64 points) • RWw0 to RWw1F ⇔ W40 to W5F (64 points)	• RX0 to RX3F ⇔ X1100 to X1177 (128 points) • RY0 to RY3F ⇔ Y1100 to Y1177 (128 points) • RWr0 to RWr1F ⇔ W20 to W3F (64 points) • RWw0 to RWw1F ⇔ W60 to W7F (64 points)

Global label settings

To enable the FB of M+AWH_FREQROL_CCLinkIEFBasic_F, add the index register Z9 to devices assigned in the refresh settings and set the devices to the global labels (M+AWH_INV_IF).

- Setting example: (G_bRX: X1000Z9, G_bRY: Y1000Z9, G_wRWr: W0Z9, G_wRWw: W40Z9)



	Label Name	Data Type	Class	Assign (Device/Label)
1	G_bRX	Bit	VAR_GLOBAL	X1000Z9
2	G_bRY	Bit	VAR_GLOBAL	Y1000Z9
3	G_wRWr	Word [Signed]	VAR_GLOBAL	W0Z9
4	G_wRWw	Word [Signed]	VAR_GLOBAL	W40Z9
5				

Point

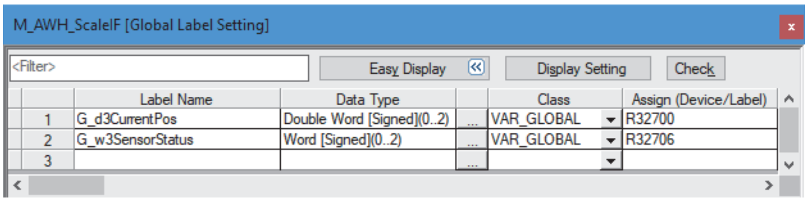
- To change the assignment (devices/labels) with the global labels, users need to copy them and change them. (☞ Page 101 FB library registration and duplication)
- To input data by users, the users need to enter the label name, data type, class, and assignment (device/label) for each item. (☞ Page 17 List of Global Labels)

Setting for communication with distance meters

Use GX Works3 to configure settings for the FX5 CPU module to communicate with distance meters.
Separately, set the distance meters according to the configuration.

Global label settings (common to Ethernet communication and serial communication)

Set the following global labels and assign the file register to enable the FBs of M+AWH_ScaleIF_SerialComm_F and M+AWH_ScaleIF_EN_F.



	Label Name	Data Type		Class	Assign (Device/Label)
1	G_d3CurrentPos	Double Word [Signed](0..2)	...	VAR_GLOBAL	R32700
2	G_w3SensorStatus	Word [Signed](0..2)	...	VAR_GLOBAL	R32706
3			...		

Point

- To change the assignment (devices/labels) with the global labels, users need to copy them and change them. (☞ Page 101 FB library registration and duplication)
- To input data by users, the users need to enter the label name, data type, class, and assignment (device/label) for each item. (☞ Page 17 List of Global Labels)

Serial communication (built-in RS-485 port)

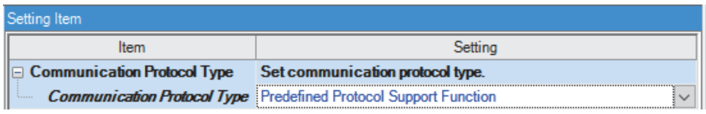
CPU module: FX5U/FX5UC CPU module

1. Open the 485 serial port settings.

[Navigation window] ⇨ [Parameter] ⇨ CPU module ⇨ [Module Parameter] ⇨ [485 Serial Port]

2. Set "Communication Protocol Type" to "Predefined Protocol Support Function".

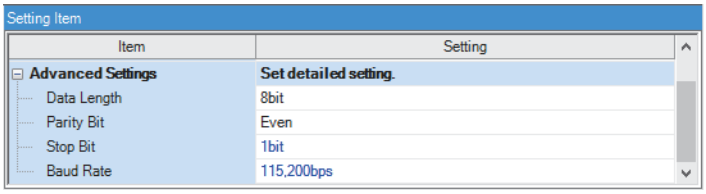
[Basic Setting] ⇨ [Communication Protocol Type]



Item	Setting
Communication Protocol Type	**Set communication protocol type.**
Communication Protocol Type	Predefined Protocol Support Function

3. Set Data Length, Parity, Stop Bit, and Baud Rate according to the distance meter to be used. The following shows a setting example.

[Basic Setting] ⇨ [Detailed Setting]



Item	Setting
Advanced Settings	**Set detailed setting.**
Data Length	8bit
Parity Bit	Even
Stop Bit	1bit
Baud Rate	115,200bps

Serial communication (FX5-485-BD or FX5-485ADP)

CPU module: FX5S/FX5UJ/FX5U/FX5UC CPU module[*1]

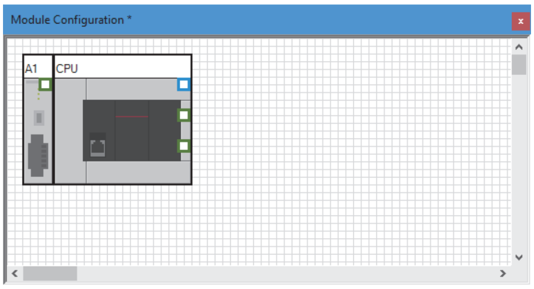
[*1] The FX5UC CPU module does not support FX5-485-BD.

1. Open the "Module Configuration" window.

[Navigation window] ⇨ [Module Configuration]

2. Mount the communication adapter on the CPU module. (Drag and drop the communication adapter to be used to the side of the CPU module.)

[Element Selection window] ⇨ [Communication Adapter]



3. Set the parameters.

[Edit] ⇨ [Parameter] ⇨ [Fix]

4. Check the parameters.

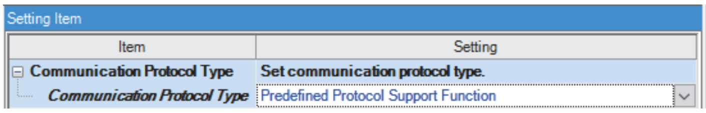
[Tool] ⇨ [Check Parameter]

5. Open the module parameter setting window of the added module.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ [FX5-485ADP]

6. Set "Communication Protocol Type" to "Predefined Protocol Support Function".

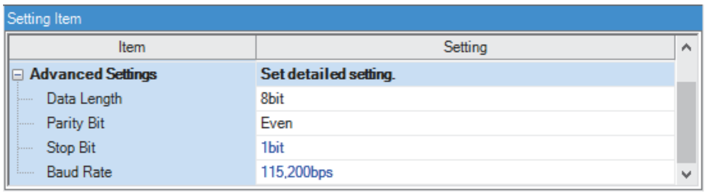
[Basic Setting] ⇨ [Communication Protocol Type]



Item	Setting
Communication Protocol Type	**Set communication protocol type.**
Communication Protocol Type	Predefined Protocol Support Function

7. Set Data Length, Parity, Stop Bit, and Baud Rate according to the distance meter to be used. The following shows a setting example.

[Basic Setting] ⇨ [Detailed Setting]



Item	Setting
Advanced Settings	**Set detailed setting.**
Data Length	8bit
Parity Bit	Even
Stop Bit	1bit
Baud Rate	115,200bps

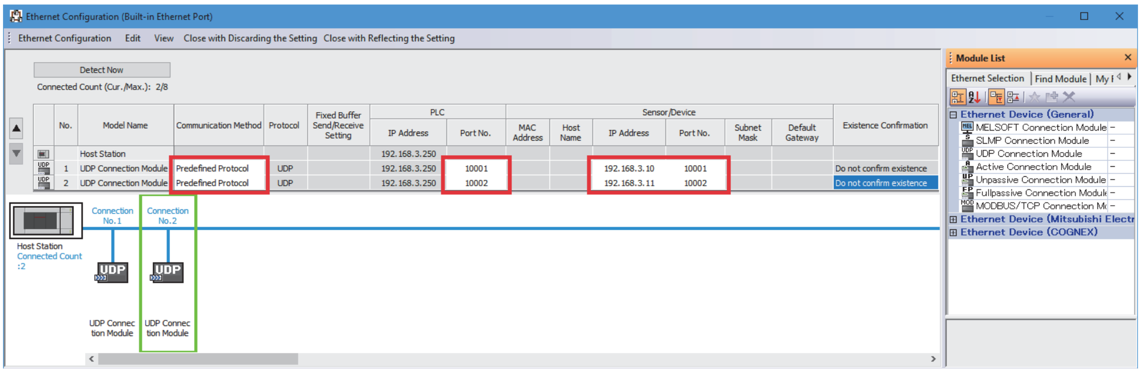
Ethernet communication

1. Open the External Device Configuration of the Ethernet port.

[Navigation window] ⇨ [Parameter] ⇨ CPU module ⇨ [Module Parameter] ⇨ [Ethernet Port] ⇨ [Basic Settings] ⇨ [External Device Configuration] ⇨ <Detailed Setting>

2. Select the external device in "Module List", and drag and drop it to the network map or the list of connected devices to add the distance meter.

3. Set "Communication Method" to "Predefined Protocol" and set the IP address and port number according to the distance meter to be used. The following shows a setting example.


Ethernet Configuration (Built-in Ethernet Port)
Ethernet Configuration
Edit
View
Close with Discarding the Setting
Close with Reflecting the Setting
Detect Now
Connection No.1
Connection No.2
Host Station
Connected Count :2
UDP
UDP
UDP Connection Module
UDP Connection Module
Module List
Ethernet Selection
Find Module
Ethernet Device (General)
MELSOFT Connection Module
SLMP Connection Module
UDP Connection Module
Active Connection Module
Unpassive Connection Module
Fullpassive Connection Module
MODBUS/TCP Connection Module
Ethernet Device (Mitsubishi Electr
Ethernet Device (COGNEX)

Connected Count (Cur./Max.): 2/8

No.	Model Name	Communication Method	Protocol	Fixed Buffer Send/Receive Setting	PLC		Sensor/Device							Existence Confirmation
					IP Address	Port No.	MAC Address	Host Name	IP Address	Port No.	Subnet Mask	Default Gateway	
	Host Station				192.168.3.250									
1	UDP Connection Module	Predefined Protocol	UDP		192.168.3.250	10001			192.168.3.10	10001			Do not confirm existence
2	UDP Connection Module	Predefined Protocol	UDP		192.168.3.250	10002			192.168.3.11	10002			Do not confirm existence

Point

Port numbers 1 to 1023 are typically reserved port numbers (WELL KNOWN PORT NUMBERS) and 61440 to 65534 are used by other communication functions, so it is recommended to use 1024 to 5548 or 5570 to 61439 for the own station port numbers.

Predefined protocol support function setting

Use GX Works3 to set predefined protocols to establish communication with distance meters.

For details on the setting method, refer to any of the following according to the distance meter communication method.

📖 MELSEC iQ-F FX5 User's Manual (Serial Communication)

📖 MELSEC iQ-F FX5 User's Manual (Ethernet Communication)

The following section describes how to use the protocol setting data provided with the FB libraries and their precautions.

Serial communication

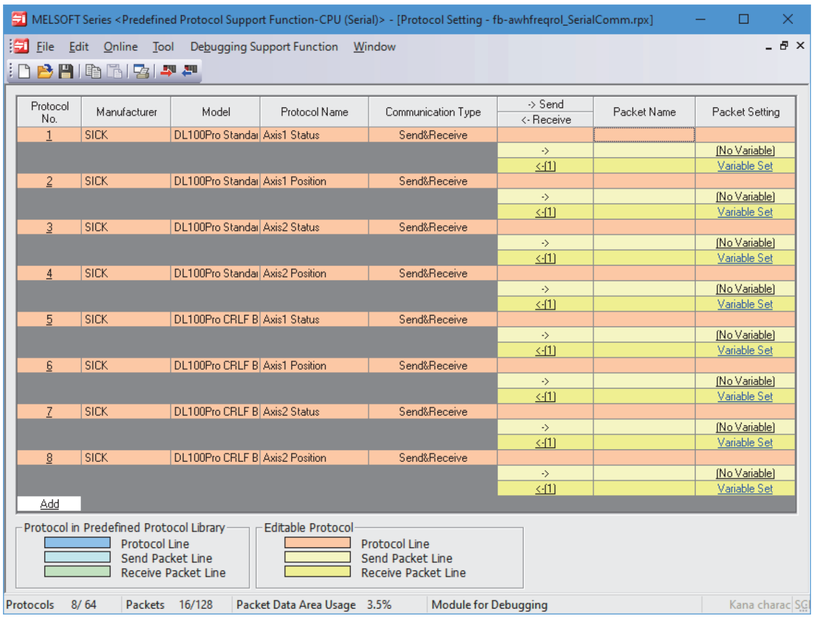
Use the protocol setting data "fb-awhfreqrol_SerialComm.rpx". This protocol setting data enables serial communication with DL100 Pro (SICK AG) distance meters.

1. Register the protocol setting data "fb-awhfreqrol_SerialComm.rpx" to the CPU module.

For details on the protocol setting data registration method, refer to the following.

📖 MELSEC iQ-F FX5 User's Manual (Serial Communication)

2. The protocol setting data is registered.


MELSOFT Series <Predefined Protocol Support Function-CPU (Serial)> - [Protocol Setting - fb-awhfreqrol_SerialComm.rpx]
File
Edit
Online
Tool
Debugging Support Function
Window
Add
Protocol in Predefined Protocol Library
Protocol Line
Send Packet Line
Receive Packet Line
Editable Protocol
Protocol Line
Send Packet Line
Receive Packet Line

Protocol No.	Manufacturer	Model	Protocol Name	Communication Type	-> Send <- Receive	Packet Name	Packet Setting
1	SICK	DL100Pro Standa	Axis1 Status	Send&Receive			
					->		(No Variable)
					<-(1)		Variable Set
2	SICK	DL100Pro Standa	Axis1 Position	Send&Receive			
					->		(No Variable)
					<-(1)		Variable Set
3	SICK	DL100Pro Standa	Axis2 Status	Send&Receive			
					->		(No Variable)
					<-(1)		Variable Set
4	SICK	DL100Pro Standa	Axis2 Position	Send&Receive			
					->		(No Variable)
					<-(1)		Variable Set
5	SICK	DL100Pro CRLF B	Axis1 Status	Send&Receive			
					->		(No Variable)
					<-(1)		Variable Set
6	SICK	DL100Pro CRLF B	Axis1 Position	Send&Receive			
					->		(No Variable)
					<-(1)		Variable Set
7	SICK	DL100Pro CRLF B	Axis2 Status	Send&Receive			
					->		(No Variable)
					<-(1)		Variable Set
8	SICK	DL100Pro CRLF B	Axis2 Position	Send&Receive			
					->		(No Variable)
					<-(1)		Variable Set

Protocols 8/ 64 | Packets 16/128 | Packet Data Area Usage 3.5% | Module for Debugging | Kana charac | SGI

Point

- If an additional protocol for communications with another device needs to be registered with this protocol setting data, add the protocol to the top or bottom of the existing protocol settings. (For protocol settings that are configured with existing protocol numbers 1 to 8, ensure that their protocol numbers appear consecutively.)
- This protocol setting data uses file register areas R32700 to R32708 to enable various communications with distance meters through the predefined protocol support function.

Ethernet communication

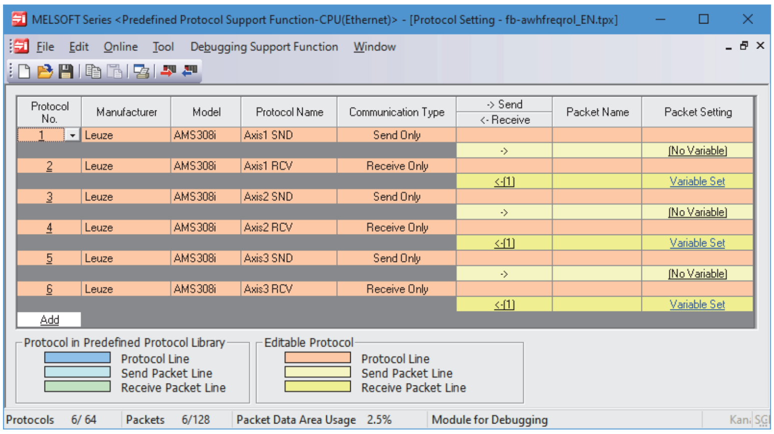
Use the protocol setting data "fb-awhfreqrol_EN.tpx". This protocol setting data enables Ethernet communication with AMS308i (Leuze) distance meters.

1. Register the protocol setting data "fb-awhfreqrol_EN.tpx" to the CPU module.

For details on the protocol setting data registration method, refer to the following.

📖 MELSEC iQ-F FX5 User's Manual (Ethernet Communication)

2. The protocol setting data is registered.


MELSOFT Series <Predefined Protocol Support Function-CPU(Ethernet)> - [Protocol Setting - fb-awhfreqrol_EN.tpx]
File
Edit
Online
Tool
Debugging Support Function
Window
Add

Protocol No.	Manufacturer	Model	Protocol Name	Communication Type	-> Send <- Receive	Packet Name	Packet Setting
1	Leuze	AMS308i	Axis1 SND	Send Only			
					->		[No Variable]
2	Leuze	AMS308i	Axis1 RCV	Receive Only			
					<-(1)		Variable Set
3	Leuze	AMS308i	Axis2 SND	Send Only			
					->		[No Variable]
4	Leuze	AMS308i	Axis2 RCV	Receive Only			
					<-(1)		Variable Set
5	Leuze	AMS308i	Axis3 SND	Send Only			
					->		[No Variable]
6	Leuze	AMS308i	Axis3 RCV	Receive Only			
					<-(1)		Variable Set

Protocol in Predefined Protocol Library
- Protocol Line
- Send Packet Line
- Receive Packet Line

Editable Protocol
- Protocol Line
- Send Packet Line
- Receive Packet Line

Protocols 6/ 64 | Packets 6/128 | Packet Data Area Usage 2.5% | Module for Debugging

Point

- If an additional protocol for communications with another device needs to be registered with this protocol setting data, add the protocol to the top or bottom of the existing protocol settings. (For protocol settings that are configured with existing protocol numbers 1 to 6, ensure that their protocol numbers appear consecutively.)
- This protocol setting data uses file register areas R32700 to R32708 to enable various communications with distance meters through the predefined protocol support function.

Inverter parameter setting

Use FR Configurator2 to set the inverter parameters (FR-E800 series).
For the parameter settings for the FR-A800 series, refer to the following.
☞ Page 109 When the FR-A800 Series Is Used
The setting value is an example for use with a sample program.

Point

For details on parameters, refer to the manuals for the inverters used.
For details on how to use FR Configurator2, refer to the following.
📖FR Configurator2 Instruction Manual

Inverter parameter				**Description**
No.	**Name**	**Initial value**	**Setting value**	
7	Acceleration time[*1]	5	0	As the operation pattern is generated using an FB, set the acceleration/deceleration time to 0 for the inverter.
8	Deceleration time[*1]	5	0	
9	Electronic thermal O/L relay	Inverter rated current	2.55	Set the rated motor current. Set the parameter in accordance with specifications of the motor used.
13	Starting frequency[*1]	0.5	0	As the operation pattern is generated using an FB, set the starting frequency to 0 for the inverter.
18	High speed maximum frequency[*1]	120	200	Set the maximum output frequency to 200 Hz.
45	Second deceleration time	9999	1	Used for motor switching for the travel/fork axis by "M+AWH_MotorSwitch_F". Set the parameters in accordance with specifications of the motor used.
46	Second torque boost	9999	1	
47	Second V/F (base frequency)	9999	60	
48	Second stall prevention operation level	9999	150	
51	Second electronic thermal O/L relay / Rated second motor current	9999	0.68	
71	Applied motor	0	23	Set the parameters to change the control method to Vector control. Set the parameters in accordance with specifications of the motor used.
80	Motor capacity	9999	0.4	
81	Number of motor poles	9999	4	
83	Rated motor voltage	200/400/575	200	
84	Rated motor frequency	9999	60	
96	Auto tuning setting/status	0	1	Set the parameter to perform offline auto tuning.
183	MRS terminal function selection[*1]	24	24	Assign the MRS (Output stop) signal to terminal MRS.
190	RUN terminal function selection[*1]	0	0	Assign the RUN (Inverter running) signal to terminal RUN in positive logic.
191	FU terminal function selection[*1]	4	4	Assign the FU (Output frequency detection) signal to terminal FU in positive logic.
192	ABC terminal function selection[*1]	99	199	Assign the ALM (Fault) signal to terminals A, B, and C in negative logic.
359	Encoder rotation direction	1	1	Set the parameters in accordance with specifications of the encoder used under Vector control.
369	Number of encoder pulses	1024	1000	
451	Second motor control method selection[*1]	9999	40	Set the parameter to perform V/F control for the fork axis motor.
502	Stop mode selection at communication error	0	0	When Ethernet communication is used, the operation at a communication error can be selected. The operation at a communication error can be selected when Pr.1431 is "3" or Pr.1432 is not "9999". Set the parameter in accordance with specifications of the system used.
541	Frequency command sign selection[*1]	0	1	The start command (forward/reverse rotation) can be inverted when a minus sign is added to the value of the frequency command.
800	Control method selection[*1]	40	0	Change the control method to Vector control.
1429	Ethernet function selection 3[*1]	45238	61450	Set the parameter to use CC-Link IE Field Network Basic.

Inverter parameter				Description
No.	**Name**	**Initial value**	**Setting value**	
1431	Ethernet signal loss detection function selection	3	3	Set the availability of the signal loss detection and select the action when Ethernet communication is interrupted by physical factors such as cable disconnection. Set the parameter in accordance with specifications of the system used.
1432	Ethernet communication check time interval	1.5	1.5	A signal loss detection is performed between the inverter and all the devices with IP addresses in the range for Ethernet command source selection (Pr.1449 to Pr.1454). If a signal loss is detected (a communication stops), a communication error (E.EHR) occurs and the inverter output will be shut off. Set the parameter in accordance with specifications of the system used.
1434	IP address 1 (Ethernet)	192	192	Enter the IP address of the inverter to be connected to Ethernet.
1435	IP address 2 (Ethernet)	168	168	
1436	IP address 3 (Ethernet)	50	3	
1437	IP address 4 (Ethernet)	1	1	
1438	Subnet mask 1	255	255	Enter the subnet mask of the network to which the inverter belongs.
1439	Subnet mask 2	255	255	
1440	Subnet mask 3	255	255	
1441	Subnet mask 4	0	0	
1449	Ethernet command source selection IP address 1	0	192	To limit the network devices that send the operation or speed command through the Ethernet network, set the range of IP addresses of the devices. When Pr.1449 to Pr.1452 are "0 (initial value)", no IP address is specified for command source via Ethernet. In this case, operation commands cannot be sent via Ethernet. The range for command source depends on the settings in Pr.1451 and Pr.1453, and Pr.1452 and Pr.1454. When the setting values on the left are set for Pr.1449 to Pr.1454, the range becomes as follows. • IP address range: 192.168.xxx (3 to 255).xxx (0 to 255)
1450	Ethernet command source selection IP address 2	0	168	
1451	Ethernet command source selection IP address 3	0	3	
1452	Ethernet command source selection IP address 4	0	0	
1453	Ethernet command source selection IP address 3 range specification	9999	255	
1454	Ethernet command source selection IP address 4 range specification	9999	255	

*1 For this parameter, set the setting value shown in the list.

Point

The project files of FR Configurator2 included in the FB libraries contain parameter setting examples. For parameter setting examples, refer to the project files corresponding to the inverter used.

- Project file for the FR-E800: fb-awhfreqrol_E800.frc2
- Project file for the FR-A800: fb-awhfreqrol_A800.frc2

Distance meter setting

Set distance meters as described in the following setting examples according to the CPU module setting. The examples show the settings that can work with the sample program.

For details on the setting method, refer to the manuals for the distance meters to be used.

AMS308i

Setting item			Setting value
Ethernet interface	Address		Set the IP address of AMS308i.
	Gateway		Set an IP address in the same network as AMS308i.
	Net mask		Set the subnet mask of AMS308i. Example: 255.255.255.0
HOST communication	UDP	Activation	UDP: On[*1]
		IP address	Set the IP address of the CPU module. Example: 192.168.3.250
		Port number	10001 (first axis), 10002 (second axis)
Position resolution			0.1 mm[*1]
Output cycle			5

[*1] The setting value must be set as specified.

DL100 Pro (Standard mode)

Setting item		Setting value
RS-422	CntMode	Off Requirement[*1]
	Protoc	Standard mode
	Baud	115.2kBd
	Format	8, e, 1[*1]
	ResDst	0.1 mm[*1]

[*1] The setting value must be set as specified.

DL100 Pro (CRLF code)

Setting item		Setting value
RS-422	CntMode	Off Requirement[*1]
	Protoc	CRLF mode
	Baud	115.2kBd
	Format	8, e, 1[*1]
	ResDst	0.1 mm[*1]

[*1] The setting value must be set as specified.

2.8 Precautions

Before using the FB libraries in this reference manual, check the following precautions.

For precautions specific to each FB, refer to "Precautions" in DETAILS of FB LIBRARIES.

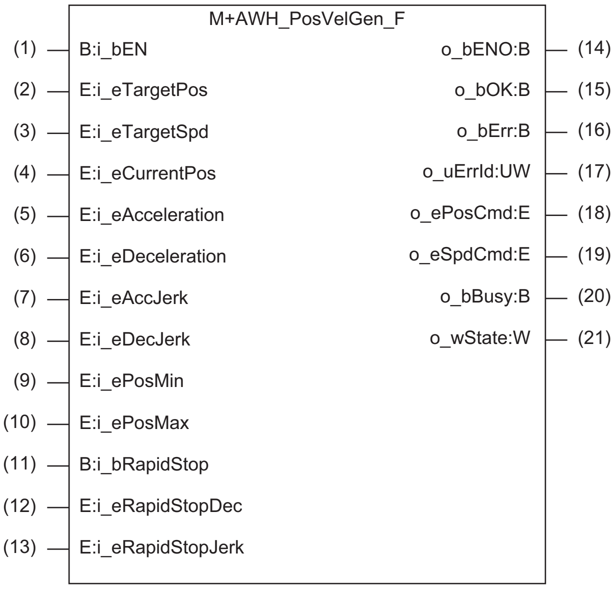
Description
The FBs in this reference manual do not include the error recovery processing. Prepare the error recovery processing separately to suit the user's system and the expected operation. Note that an error that occurs during FB operation will be cleared when recovery from the error is completed.
The FBs in this reference manual do not detect an alarm or fault output that occurs in inverters. Separately create the alarm and fault output monitoring processing for the inverters used. For alarms and fault output that occurred in the inverters, refer to the manuals for the inverters used.
The FBs cannot be used in an interrupt program.
Do not use the FBs in programs that are executed only once, such as a subroutine program or FOR-NEXT loop, because i_bEN (execution command) cannot be turned off and the normal operation cannot be acquired. Always use the FBs in programs that can turn off the execution command.
The FBs require the configuration of a ladder block for every input label.
To use more than one FB, care must be taken to avoid duplication of the target axis to prevent more than one program for the target axis from starting at the same time.
If an FB terminates with an error, turn off the execution condition of the FB that terminated with an error before executing a new FB. If the execution condition of the FB that terminated with an error remains on, the termination processing will not be performed and the newly executed FB will not operate normally.
While an FB is being executed, do not perform the online change.
The FB libraries use file register (R) areas R32700 to R32708.
Commands to the inverter depend on the scan time.

3 DETAILS of FB LIBRARIES

3.1 M+AWH_PosVelGen_F (Positioning Operation Command Generation)

Overview

This FB generates speed and position commands for positioning to the target position.


M+AWH_PosVelGen_F
(1) B:i_bEN
(2) E:i_eTargetPos
(3) E:i_eTargetSpd
(4) E:i_eCurrentPos
(5) E:i_eAcceleration
(6) E:i_eDeceleration
(7) E:i_eAccJerk
(8) E:i_eDecJerk
(9) E:i_ePosMin
(10) E:i_ePosMax
(11) B:i_bRapidStop
(12) E:i_eRapidStopDec
(13) E:i_eRapidStopJerk
o_bENO:B (14)
o_bOK:B (15)
o_bErr:B (16)
o_uErrId:UW (17)
o_ePosCmd:E (18)
o_eSpdCmd:E (19)
o_bBusy:B (20)
o_wState:W (21)

Labels

Input labels

No.	Label	Name	Data type	Input reception	Setting range	Description
(1)	i_bEN	Execution command	Bit	Always	On, Off	Rising: Parameter initialization[*1] While being on: Positioning execution[*1] Falling: Positioning interruption[*1]
(2)	i_eTargetPos	Target position	Single-precision real number	Always	• 0.000000 • 2^{-126} (1.175494E-38) to 300.000000	Specify the target position [m]. Set a value between i_ePosMin (minimum position value) and i_ePosMax (maximum position value).
(3)	i_eTargetSpd	Target speed	Single-precision real number	Always	0.010000 to 10.000000	Specify the target speed [m/s].
(4)	i_eCurrentPos	Current position	Single-precision real number	Always	• 0.000000 • 2^{-126} (1.175494E-38) to 300.000000	Specify the current position [m] fed back from the distance meter. Set a value between i_ePosMin (minimum position value) and i_ePosMax (maximum position value).
(5)	i_eAcceleration	Acceleration rate	Single-precision real number	At start	0.010000 to 1000.000000	Specify the target acceleration [m/s^2].
(6)	i_eDeceleration	Deceleration rate	Single-precision real number	At start	0.010000 to 1000.000000	Specify the target deceleration [m/s^2].
(7)	i_eAccJerk	Acceleration jerk	Single-precision real number	At start	0.010000 to 10000.000000	Specify the jerk [m/s^3] at acceleration.
(8)	i_eDecJerk	Deceleration jerk	Single-precision real number	At start	0.010000 to 10000.000000	Specify the jerk [m/s^3] at deceleration.
(9)	i_ePosMin	Minimum position value	Single-precision real number	At start	• 0.000000 • 2^{-126} (1.175494E-38) to 300.000000	Specify the minimum position value [m]. Set a value less than or equal to i_ePosMax (maximum position value).

No.	Label	Name	Data type	Input reception	Setting range	Description
(10)	i_ePosMax	Maximum position value	Single-precision real number	At start	• 0.000000 • 2^{-126} (1.175494E-38) to 300.000000	Specify the maximum position value [m]. Set a value more than or equal to i_ePosMin (minimum position value).
(11)	i_bRapidStop	Sudden stop	Bit	Always	On, Off	Specify whether to execute deceleration stop at the deceleration rate set in i_eRapidStopDec (deceleration rate for sudden stop). On: Execute. Off: Do not execute.
(12)	i_eRapidStopDec	Deceleration rate for sudden stop	Single-precision real number	At start	• 0.000000 • 0.010000 to 1000.000000	Specify the target deceleration [m/s^2] when executing i_eRapidStop (deceleration rate for sudden stop). Set a value equal to or greater than i_eDeceleration (deceleration rate). Example: When 500 is input, the deceleration is 500 [m/s^2].
(13)	i_eRapidStopJerk	Deceleration jerk for sudden stop	Single-precision real number	At start	• 0.000000 • 0.010000 to 10000.000000	Specify the deceleration jerk [m/s^3] for sudden stop.

*1 The processing varies depending on o_wState (status output). For details, refer to the following.
☞ Page 35 Function details

Output labels

No.	Label	Name	Data type	Default value	Description
(14)	o_bENO	Execution status	Bit	Off	On: The execution command is on. Off: The execution command is off.
(15)	o_bOK	Normal completion	Bit	Off	The on state indicates that positioning has been completed normally.
(16)	o_bErr	Error completion	Bit	Off	The on state indicates that an error has occurred in the FB.
(17)	o_uErrId	Error code	Word [unsigned]/bit string [16 bits]	0	Stores the error code of an error that occurred in the FB.
(18)	o_ePosCmd	Position command	Single-precision real number	0.000000	Stores the position command [m] for each control cycle.
(19)	o_eSpdCmd	Speed command	Single-precision real number	0.000000	Stores the speed command value [m/s] for each control cycle. A negative value indicates positioning in the reverse run direction.
(20)	o_bBusy	Positioning executing	Bit	Off	The on state indicates that positioning is being executed.
(21)	o_wState	Status output	Word [signed]	0	Stores the control status: 0: Stop (initial status) 1: During acceleration/deceleration 2: During constant speed (target speed) 3: During deceleration for positioning completion 4: Positioning completed 5: During deceleration for positioning interruption 6: During deceleration for sudden stop

Function details

Applicable hardware and software

■FB for control of the inverter for automated warehouse

Module	Firmware version	Engineering tool
FX5S CPU module	1.000 or later	GX Works3 Version 1.086Q or later
FX5UJ CPU module	1.030 or later	GX Works3 Version 1.086Q or later
FX5U CPU module	1.270 or later	GX Works3 Version 1.086Q or later
FX5UC CPU module	1.270 or later	GX Works3 Version 1.086Q or later

Basic specifications

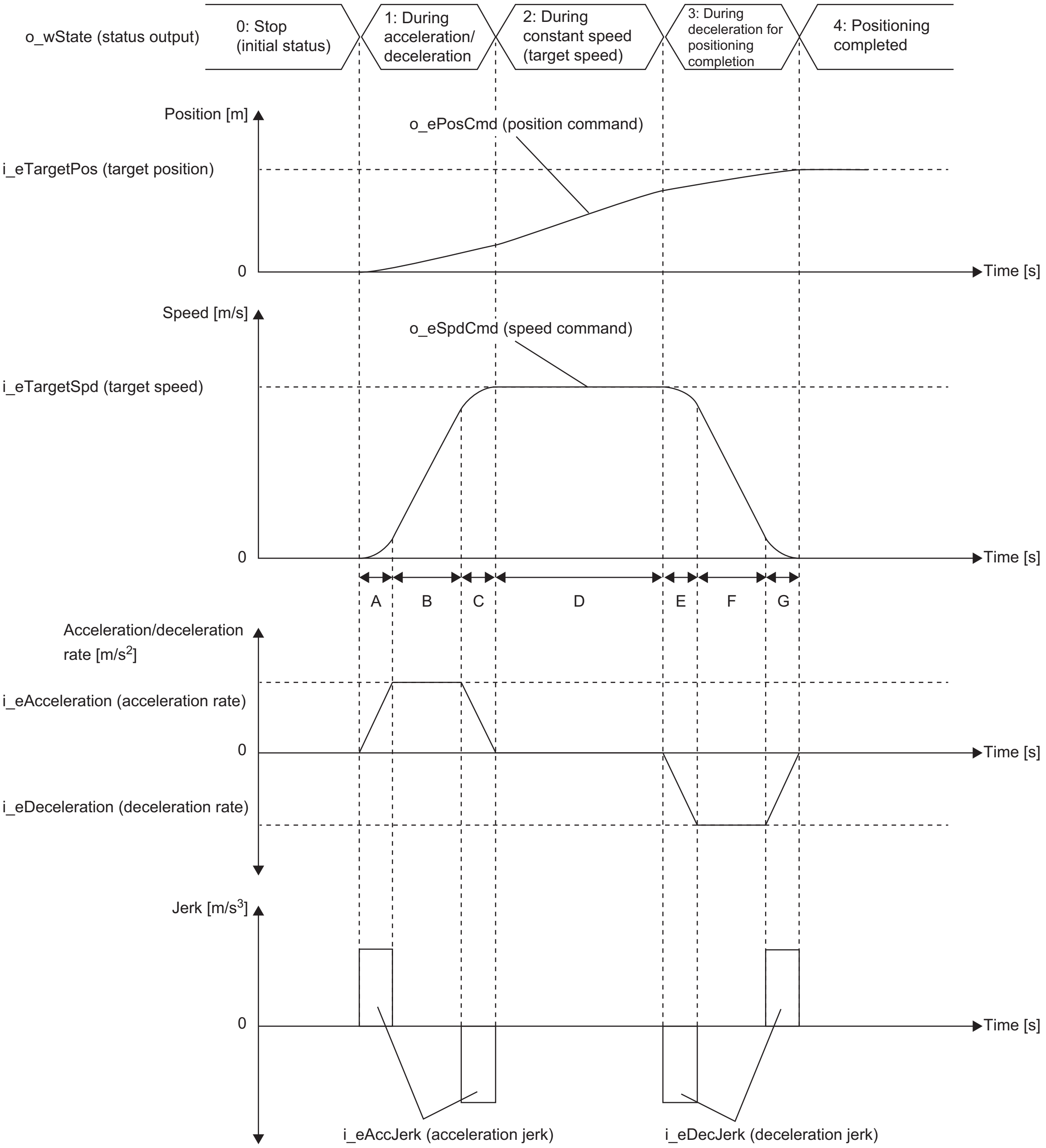
Item	Description
Language to use	Structured text language
Number of steps	Target value: 5035 steps The number of steps of the FB embedded in a program depends on the CPU module used, the input/output definitions, and the option setting of GX Works3. For the option setting of GX Works3, refer to the following. 📖 GX Works3 Operating Manual
Points of labels used	• Label: 0.19K points (Word) • Latch Label: 0K points (Word) The points of labels embedded in a program depend on the CPU module used, the devices specified for arguments, and the option setting of GX Works3. For the option setting of GX Works3, refer to the following. 📖 GX Works3 Operating Manual
Points of index register used	• Index register: 0 points • Long index register: 0 points
Points of file register used	File register: 0 points
FB dependency	M+AWH_PosVelGen_F └ M+AWH_DecDistance_F
FB compilation method	Subroutine type
FB operation	Always executed

Function description

- When i_bEN (execution command) is rising and o_wState (status output) is 0: Stop (initial status), this FB outputs speed and position commands for positioning to the target position in the direction of i_eTargetPos (target position), starting from i_eCurrentPos (current position).
- Positioning is executed while i_bEN (execution command) is on. While positioning is being executed, o_bBusy (positioning executing) is on.

- For position and speed commands, the current scan time is obtained for each control cycle, and the results calculated from the maximum speed, acceleration rate, deceleration rate, acceleration jerk, and deceleration jerk values and the elapsed time are output. The speed shows an S-shaped waveform.

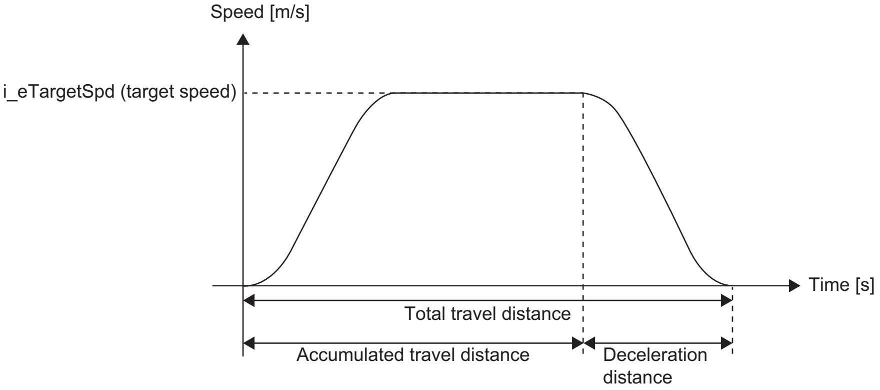
The acceleration and deceleration processing (positive direction) based on the acceleration/deceleration rate and jerk settings in this FB is shown below.



Area		Processing
A	Acceleration area 1	The acceleration rate is changed (increased) by the specified acceleration jerk from the start of acceleration to the target acceleration rate.
B	Maximum acceleration area	Acceleration is performed at the target acceleration rate.
C	Acceleration area 2	At the end of acceleration, acceleration is performed by changing (decreasing) the acceleration rate by the specified acceleration jerk from the target acceleration rate to acceleration rate 0.
D	During constant speed (target speed)	Control is performed at the target speed. (Acceleration and deceleration rates = 0.0)
E	Deceleration area 1	Deceleration is performed by changing (increasing) the deceleration rate by the specified deceleration jerk from the start of deceleration to the target deceleration rate.
F	Maximum deceleration area	Deceleration is performed at the target deceleration rate.
G	Deceleration area 2	At the end of deceleration, deceleration is performed by changing (decreasing) the deceleration rate by the specified deceleration jerk from the target deceleration rate to deceleration rate 0.

- To stop a control target at the specified target position, this FB starts deceleration when the following condition is met, and o_wState (status output) transitions to 3: During deceleration for positioning completion.

Deceleration distance + Accumulated travel distance ≥ Total travel distance



To calculate the deceleration distance, call M+AWH_DecDistance_F (deceleration distance calculation) from this FB.

- i_eTargetPos (target position) can be changed while the FB is operating. Changes can be made when o_wState (status output) is 1: During acceleration/deceleration or 2: During constant speed (target speed), and there is a distance required for deceleration stop. However, it is not allowed to change to the target position in the reverse run direction with respect to i_eCurrentPos (current position).
- i_eTargetSpd (target speed) can be changed while the FB is operating. Changes can be made when o_wState (status output) is 2: During constant speed (target speed).
- If o_wState (status output) is 1: During acceleration/deceleration or 2: During constant speed (target speed), positioning is interrupted at the falling edge of i_bEN (execution command). During positioning interruption, o_wState (status output) is set to 5: During deceleration for positioning interruption, and deceleration stop is performed at the values set for i_eDeceleration (deceleration rate) and i_eDecJerk (deceleration jerk). After the interruption processing has been completed, the output value of o_ePosCmd (position command) is held, and the output other than o_ePosCmd (position command) becomes off or 0.
- If i_bEN (execution command) is on and o_wState (status output) is 1: During acceleration/deceleration or 2: During constant speed (target speed), positioning is interrupted when i_bRapidStop (sudden stop) becomes on. During positioning interruption, o_wState (status output) is set to 6: During deceleration for sudden stop, and deceleration stop is performed at the values set for i_eRapidStopDec (deceleration rate for sudden stop) and i_eRapidStopJerk (deceleration jerk for sudden stop).

However, if i_eRapidStopDec (deceleration rate for sudden stop) or i_eRapidStopJerk (deceleration jerk for sudden stop) is set to 0, deceleration stop is performed at the values set for i_eDeceleration (deceleration rate) and i_eDecJerk (deceleration jerk).

After the interruption processing has been completed, o_bBusy (positioning executing) becomes off.

- When i_bEN (execution command) changes from off to on, and o_wState (status output) is 3: During deceleration for positioning completion, 5: During deceleration for positioning interruption, or 6: During deceleration for sudden stop, the on state of the execution command is not accepted because the previous deceleration is being processed. Change i_bEN (execution command) from off to on when o_wState (status output) is 0: Stop (initial status).
- If the input labels listed in the table below are out of range while i_bEN (execution command) is rising, o_bErr (error completion) turns on and processing of the FB does not start. In addition, a corresponding error code is stored in o_uErrId (error code). (☞ Page 44 Error code)

Input label	Error code
i_eTargetPos (target position)	110H
i_eTargetSpd (target speed)	111H
i_eCurrentPos (current position)	112H
i_eAcceleration (acceleration rate), i_eDeceleration (deceleration rate)	113H
i_eAccJerk (acceleration jerk), i_eDecJerk (deceleration jerk)	114H
i_ePosMin (minimum position value)	115H
i_ePosMax (maximum position value)	116H
i_eRapidStopDec (deceleration rate for sudden stop)	117H

Input label	Error code
i_eRapidStopJerk (deceleration jerk for sudden stop)	118H

- If the input labels listed in the table below are changed to out of range while the FB is operating, o_bErr (error completion) will turn on. (The FB will continue to operate.) In addition, a corresponding error code is stored in o_uErrId (error code). (☞ Page 44 Error code)

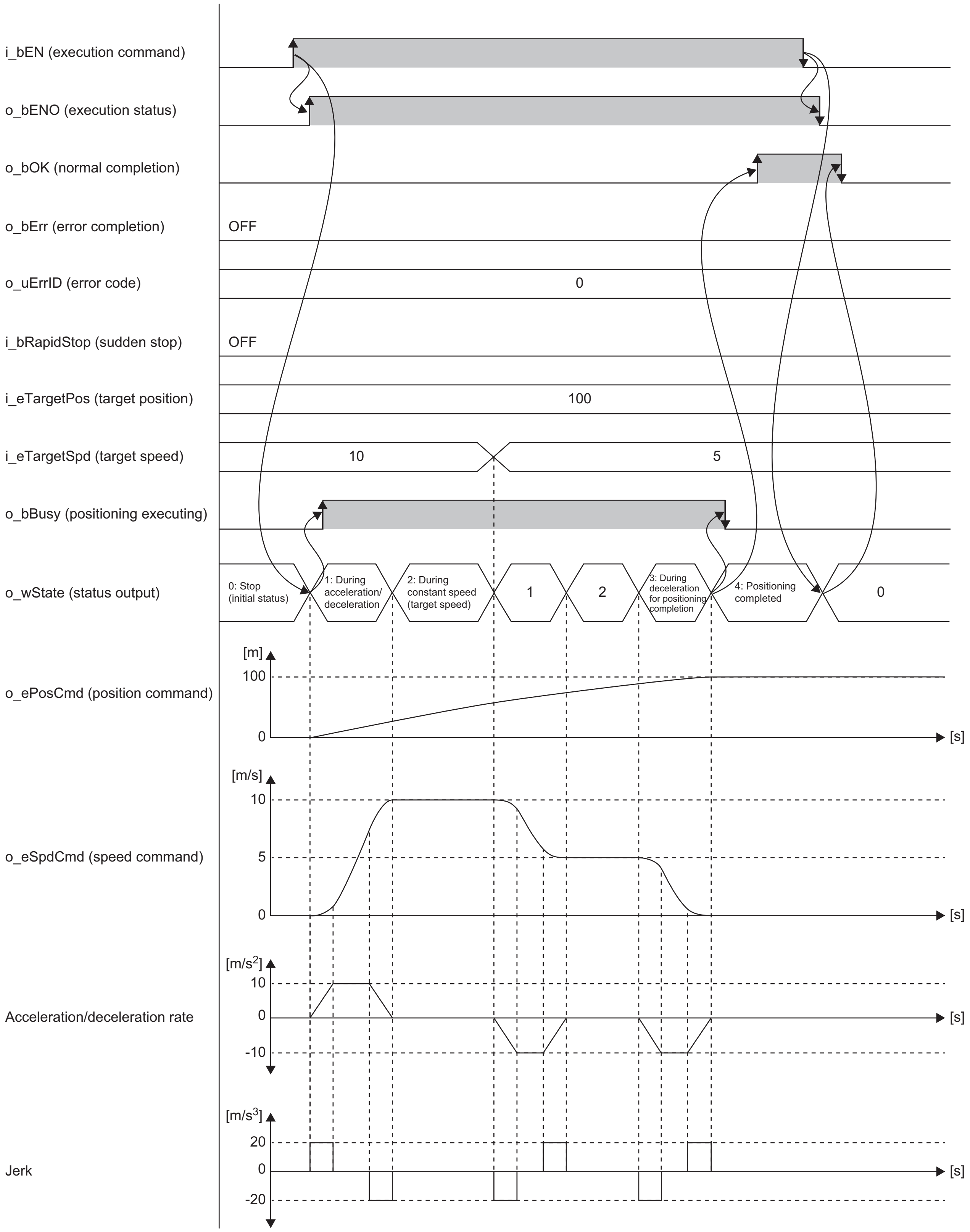
Input label	Error code	FB operation
i_eTargetPos (target position)	11AH	The operation continues with the setting value of i_eTargetPos (target position) before the error occurred.
i_eTargetSpd (target speed)	11BH	The operation continues with the setting value of i_eTargetSpd (target speed) before the error occurred.
i_eCurrentPos (current position)	11CH	The operation continues.[*1]

[*1] i_eCurrentPos (current position) is used when changing i_eTargetPos (target position). If the current position is an abnormal value, i_eTargetPos (target position) cannot be changed.

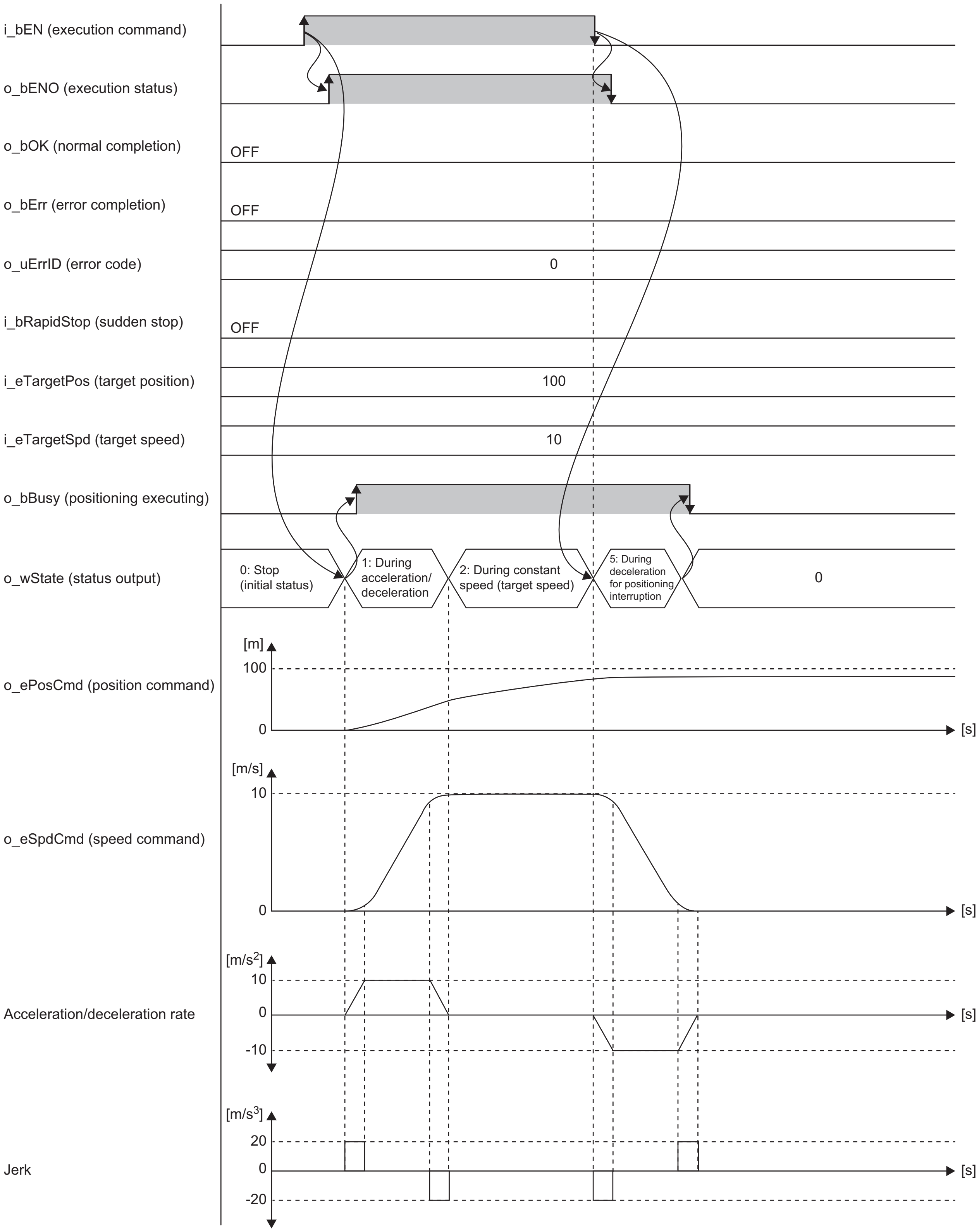
Timing chart of I/O signals

■Completed successfully

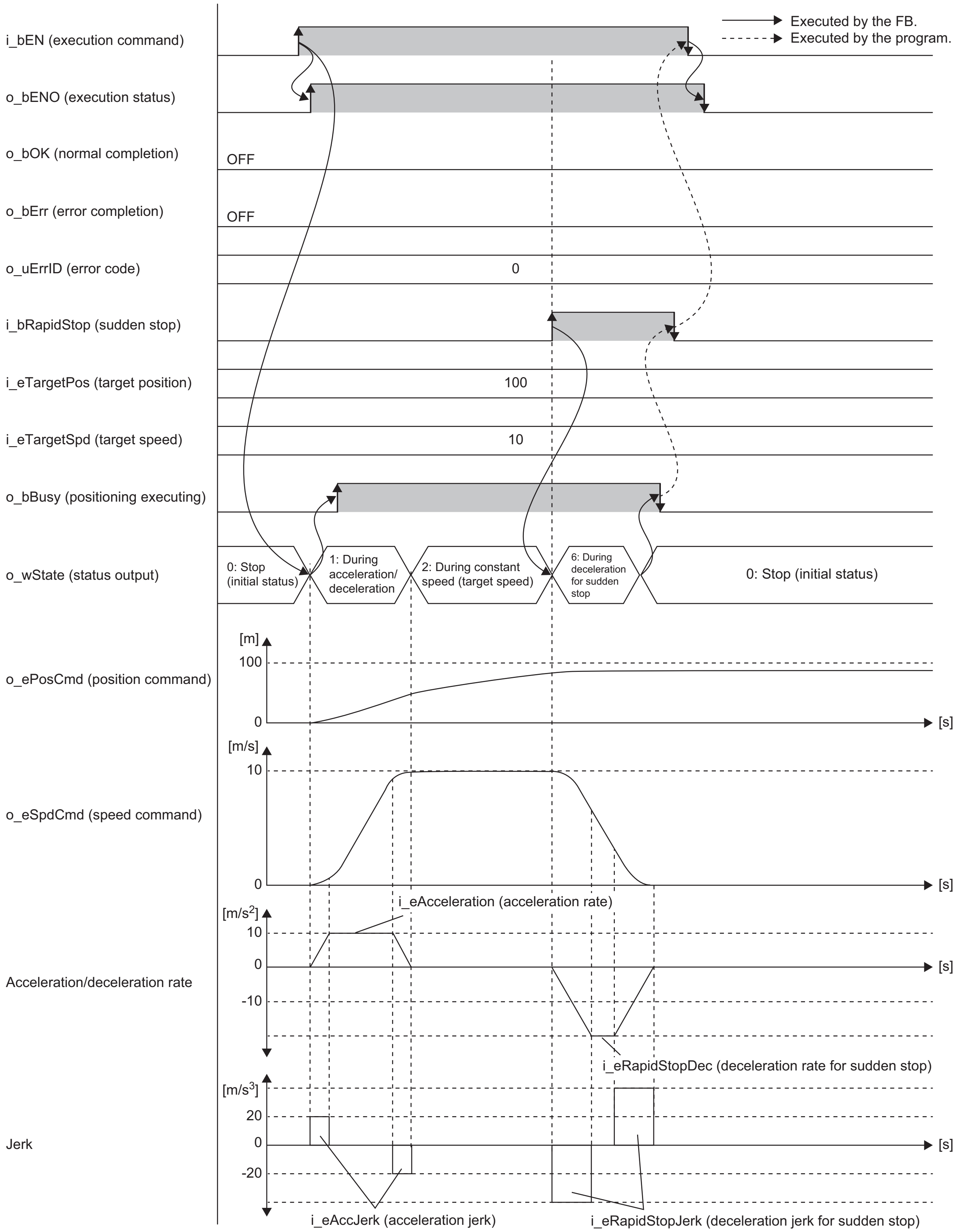
Positioning completed


i_bEN (execution command)
o_bENO (execution status)
o_bOK (normal completion)
o_bErr (error completion)
OFF
o_uErrID (error code)
0
i_bRapidStop (sudden stop)
OFF
i_eTargetPos (target position)
100
i_eTargetSpd (target speed)
10
5
o_bBusy (positioning executing)
o_wState (status output)
0: Stop (initial status)
1: During acceleration/ deceleration
2: During constant speed (target speed)
1
2
3: During deceleration for positioning completion
4: Positioning completed
0
o_ePosCmd (position command)
[m]
100
0
[s]
o_eSpdCmd (speed command)
[m/s]
10
5
0
[s]
Acceleration/deceleration rate
[m/s^2]
10
0
-10
[s]
Jerk
[m/s^3]
20
0
-20
[s]

Positioning interruption (i_bEN (execution command) changes from on to off.)

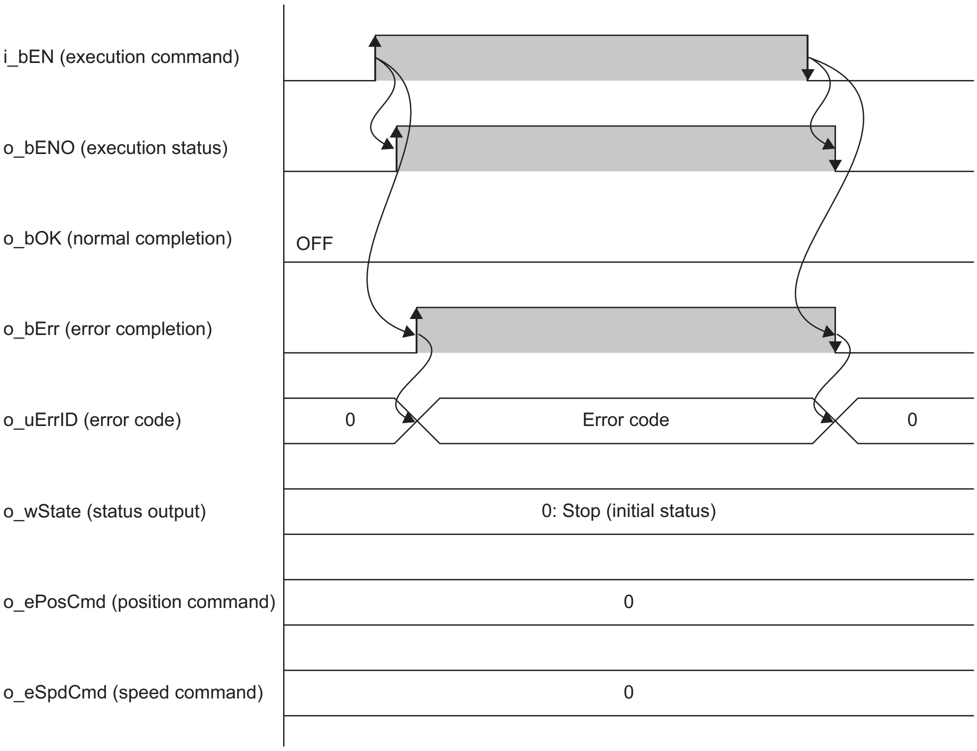


Positioning interruption (i_bRapidStop (sudden stop) turns on while i_bEN (execution command) is on.)

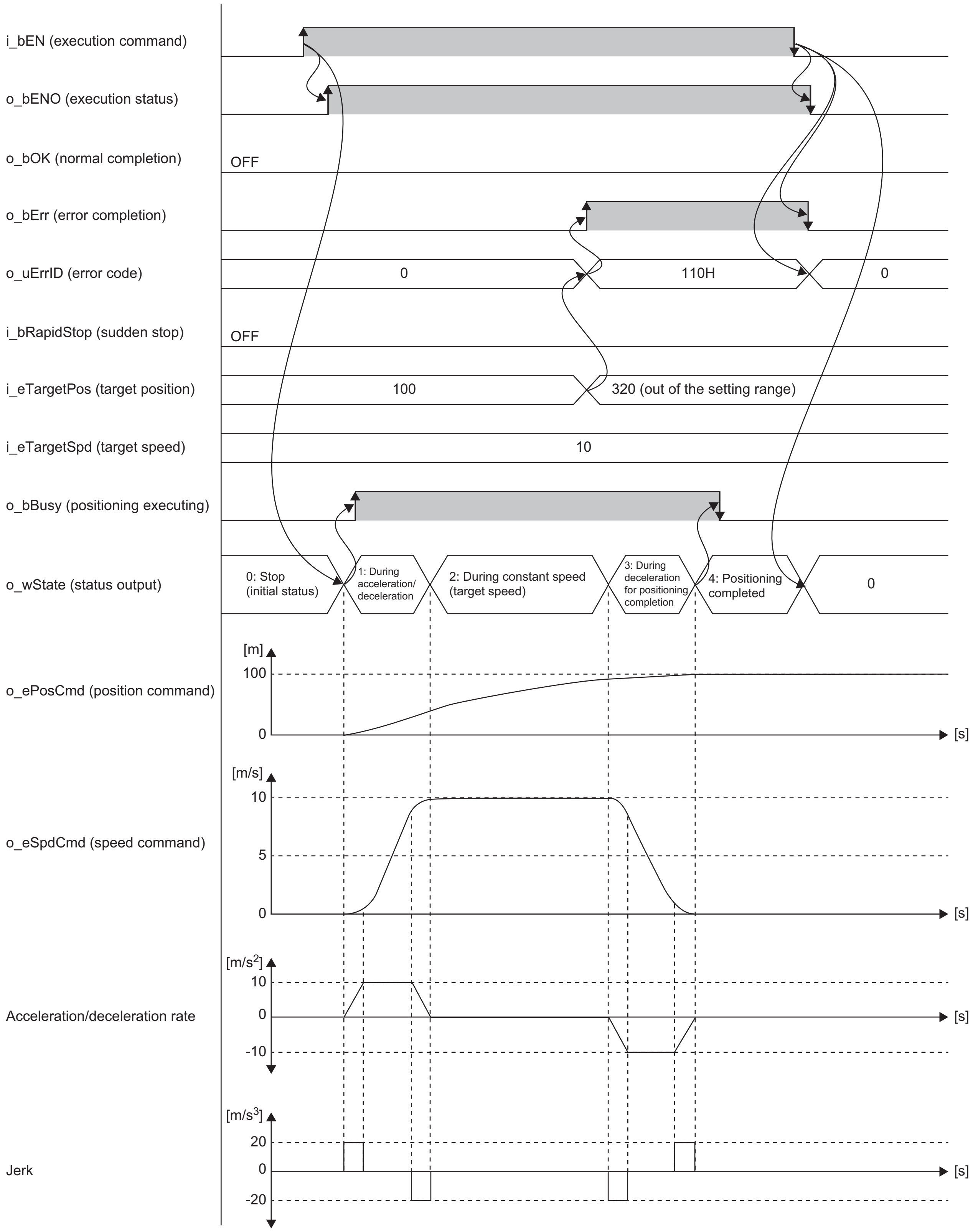

Executed by the FB.
Executed by the program.
i_bEN (execution command)
o_bENO (execution status)
o_bOK (normal completion)
OFF
o_bErr (error completion)
OFF
o_uErrID (error code)
0
i_bRapidStop (sudden stop)
i_eTargetPos (target position)
100
i_eTargetSpd (target speed)
10
o_bBusy (positioning executing)
o_wState (status output)
0: Stop (initial status)
1: During acceleration/ deceleration
2: During constant speed (target speed)
6: During deceleration for sudden stop
0: Stop (initial status)
o_ePosCmd (position command)
[m]
100
0
[s]
o_eSpdCmd (speed command)
[m/s]
10
0
[s]
i_eAcceleration (acceleration rate)
Acceleration/deceleration rate
[m/s²]
10
0
-10
[s]
i_eRapidStopDec (deceleration rate for sudden stop)
Jerk
[m/s³]
20
0
-20
[s]
i_eAccJerk (acceleration jerk)
i_eRapidStopJerk (deceleration jerk for sudden stop)

■Error completion

When an error occurs at start of the FB


i_bEN (execution command)
o_bENO (execution status)
o_bOK (normal completion)
OFF
o_bErr (error completion)
o_uErrID (error code)
0
Error code
0
o_wState (status output)
0: Stop (initial status)
o_ePosCmd (position command)
0
o_eSpdCmd (speed command)
0

When an error occurs while the FB is operating (when the target position is out of range)



Precautions

o_eSpdCmd (speed command) is calculated with single-precision real numbers, so a rounding error may occur.

Parameter settings

There are no parameter settings specific to this FB. For details on the common parameter settings, refer to the following.

☞ Page 21 Parameter Settings

Performance values

The performance values of this FB are as follows. These performance values show the performance combined with M+AWH_DecDistance_F (deceleration distance calculation).

FX5 CPU module	**Measurement condition**							**Processing time**	**Maximum scan time**	**Number of scans**
	Input label									
	i_eTargetPos (Target position)	**i_eTargetSpd (Target speed)**	**i_eCurrentPos (Current position)**	**i_eAcceleration (Acceleration rate)**	**i_eDeceleration (Deceleration rate)**	**i_eAccJerk (Acceleration jerk)**	**i_eDecJerk (Deceleration jerk)**			
FX5S CPU module	100	1	0	1	1	2	2	101520 ms	1.818 ms	147118 scans
FX5UJ CPU module	100	1	0	1	1	2	2	101550 ms	1.501 ms	166252 scans
FX5U/FX5UC CPU module*1*2	100	1	0	1	1	2	2	101550 ms	1.307 ms	192948 scans

*1 When the program capacity is set to 128K steps, the processing speed may become slow.

*2 The standard area is used for labels.

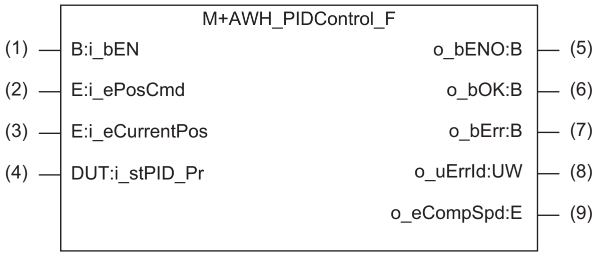
Error code

Error code	Description	Action
110H	The setting value of i_eTargetPos (target position) is out of range.	Check and correct the setting, then execute the FB again.
111H	The setting value of i_eTargetSpd (target speed) is out of range.	Check and correct the setting, then execute the FB again.
112H	The setting value of i_eCurrentPos (current position) is out of range.	Check and correct the setting, then execute the FB again.
113H	The setting value of i_eAcceleration (acceleration rate) or i_eDeceleration (deceleration rate) is out of range.	Check and correct the setting, then execute the FB again.
114H	The setting value of i_eAccJerk (acceleration jerk) or i_eDecJerk (deceleration jerk) is out of range.	Check and correct the setting, then execute the FB again.
115H	The setting value of i_ePosMin (minimum position value) is out of range.	Check and correct the setting, then execute the FB again.
116H	The setting value of i_ePosMax (maximum position value) is out of range.	Check and correct the setting, then execute the FB again.
117H	The setting value of i_eRapidStopDec (deceleration rate for sudden stop) is out of range.	Check and correct the setting, then execute the FB again.
118H	The setting value of i_eRapidStopJerk (deceleration jerk for sudden stop) is out of range.	Check and correct the setting, then execute the FB again.
11AH	The setting value of i_eTargetPos (target position) is out of range. i_eTargetPos (target position) is held at the value before the error occurred.	Check and correct the setting.
11BH	The setting value of i_eTargetSpd (target speed) is out of range. i_eTargetSpd (target speed) is held at the value before the error occurred.	Check and correct the setting.
11CH	The setting value of i_eCurrentPos (current position) is out of range.	Check and correct the setting.

3.2 M+AWH_PIDControl_F (PID Control)

Overview

This FB performs position deviation correction (PID control) during positioning control.



Labels

Input labels

No.	Label	Name	Data type	Input reception	Setting range	Description
(1)	i_bEN	Execution command	Bit	Always	On, Off	On: Start FB. Off: Do not start FB.
(2)	i_ePosCmd	Position command	Single-precision real number	Always	• 0.000000 • 2^{-126} (1.175494E-38) to 300.000000	Specify the position command [m] for each control cycle.
(3)	i_eCurrentPos	Current position	Single-precision real number	Always	• 0.000000 • 2^{-126} (1.175494E-38) to 300.000000	Specify the current position [m] fed back from the distance meter.
(4)	i_stPID_Pr	PID setting	PID_PR	Always	—	Specify the PID setting information. For the structure, refer to the following. ☞ Page 18 List of Structures

Output labels

No.	Label	Name	Data type	Default value	Description
(5)	o_bENO	Execution status	Bit	Off	On: The execution command is on. Off: The execution command is off.
(6)	o_bOK	Normal completion	Bit	Off	The on state indicates that PID calculation has started normally.
(7)	o_bErr	Error completion	Bit	Off	The on state indicates that an error has occurred in the FB.
(8)	o_uErrId	Error code	Word [unsigned]/bit string [16 bits]	0	Stores the error code of an error that occurred in the FB.
(9)	o_eCompSpd	Compensation speed	Single-precision real number	0.000000	Stores the speed [m/s] after position deviation correction by PID control.

Function details

Applicable hardware and software

■FB for control of the inverter for automated warehouse

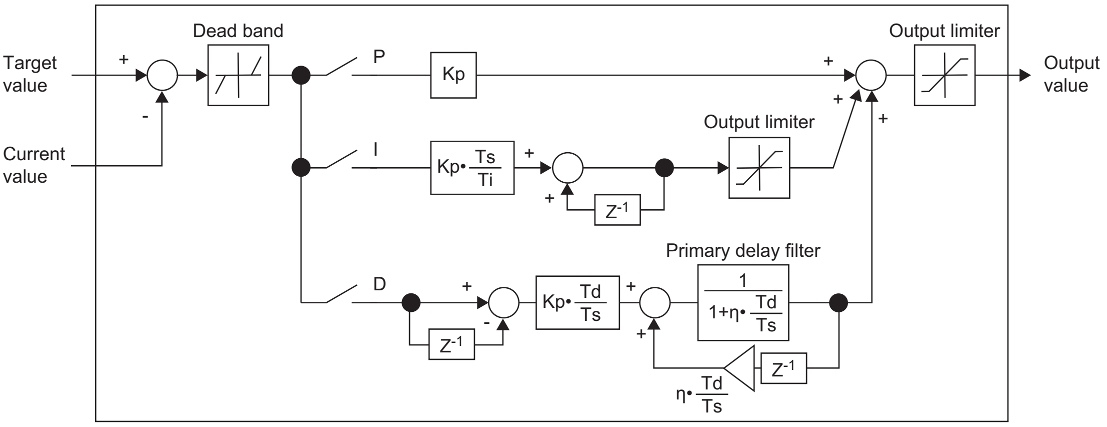
Module	Firmware version	Engineering tool
FX5S CPU module	1.000 or later	GX Works3 Version 1.086Q or later
FX5UJ CPU module	1.030 or later	GX Works3 Version 1.086Q or later
FX5U CPU module	1.270 or later	GX Works3 Version 1.086Q or later
FX5UC CPU module	1.270 or later	GX Works3 Version 1.086Q or later

Basic specifications

Item	Description
Language to use	Structured text language
Number of steps	Target value: 1419 steps The number of steps of the FB embedded in a program depends on the CPU module used, the input/output definitions, and the option setting of GX Works3. For the option setting of GX Works3, refer to the following. 🕮 GX Works3 Operating Manual
Points of labels used	• Label: 0.05K points (Word) • Latch Label: 0K points (Word) The points of labels embedded in a program depend on the CPU module used, the devices specified for arguments, and the option setting of GX Works3. For the option setting of GX Works3, refer to the following. 🕮 GX Works3 Operating Manual
Points of index register used	• Index register: 0 points • Long index register: 0 points
Points of file register used	File register: 0 points
FB dependency	No dependency
FB compilation method	Subroutine type
FB operation	Always executed

Function description

- Turning on i_bEN (execution command) performs position deviation correction (PID control) during positioning control.
- Position deviation correction is performed by PID control as shown in the block diagram below.



P: Proportional operation, I: Integral operation, D: Differential operation

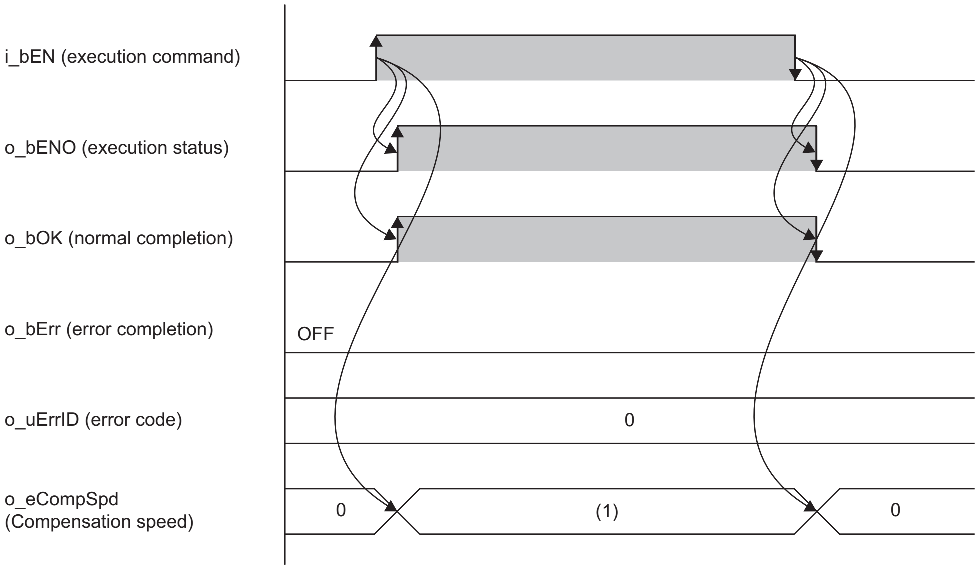
Kp: Proportional gain, Ts: Sampling time, Ti: Integral time, Td: Differential time, Z^{-1}: Previous value, n: Derivative gain coefficient (0.2 fixed)

- When i_bEN (execution command) is off, all outputs become off or 0.
- If i_ePosCmd (position command) is out of range, o_bErr (error completion) turns on and the processing of this FB is interrupted. In addition, the error code 130H is stored, and the output value of o_eCompSpd (compensation speed) is 0. (☞ Page 48 Error code)

- If i_eCurrentPos (current position) is out of range, o_bErr (error completion) turns on and the processing of this FB is interrupted. In addition, the error code 131H is stored, and the output value of o_eCompSpd (compensation speed) is 0. (☞ Page 48 Error code)
- If i_stPID_Pr (PID setting) is out of range, o_bErr (error completion) turns on and the processing of this FB is interrupted. In addition, the error code 132H is stored, and the output value of o_eCompSpd (compensation speed) is 0. (☞ Page 48 Error code)
- If the absolute value of the position deviation (i_ePosCmd (position command) - i_eCurrentPos (current position)) exceeds the setting value of i_stPID_Pr.eDeviationOver (excessive error level of PID setting), o_bErr (error completion) turns on and the processing of this FB is interrupted. In addition, the error code 230H is stored in o_uErrId (error code), and the output value of o_eCompSpd (compensation speed) is 0. (☞ Page 48 Error code)
- If i_stPID_Pr.eDeviationOver (excessive error level of PID setting) is 0, no judgment is made.

Timing chart of I/O signals

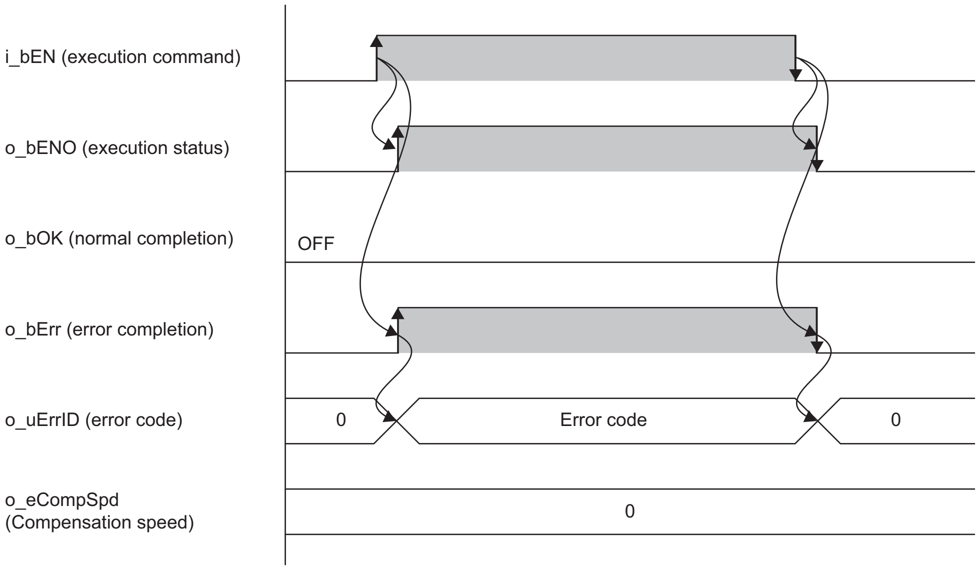
■Completed successfully


i_bEN (execution command)
o_bENO (execution status)
o_bOK (normal completion)
o_bErr (error completion)
OFF
o_uErrID (error code)
0
o_eCompSpd
(Compensation speed)
0
(1)
0

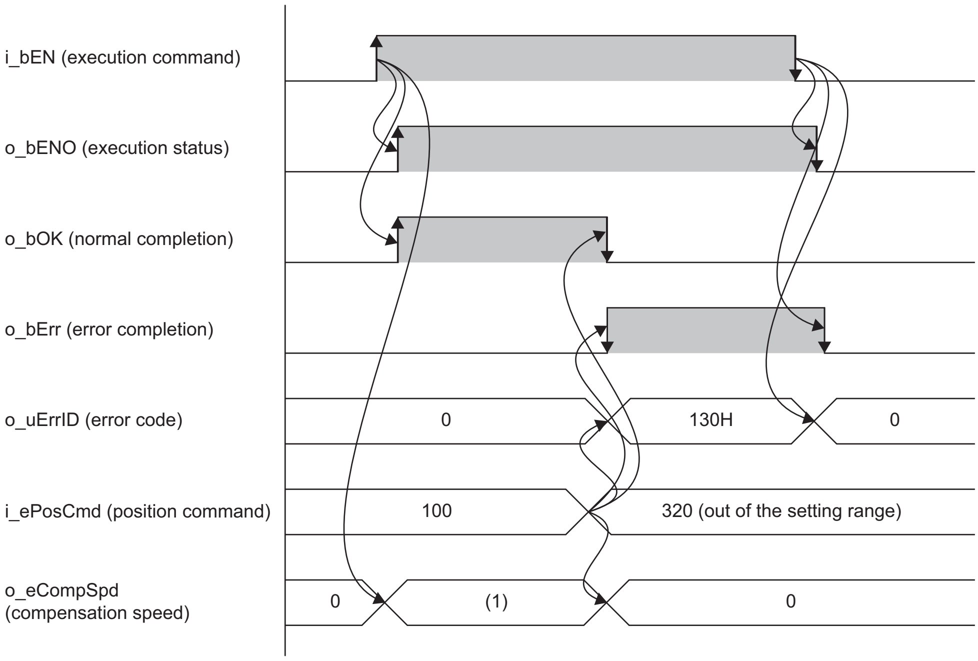
(1) Compensation speed [m/s]: While the FB is being executed, a calculated value is output every scan.

■Error completion

When an error occurs at start of the FB


i_bEN (execution command)
o_bENO (execution status)
o_bOK (normal completion)
OFF
o_bErr (error completion)
o_uErrID (error code)
0
Error code
0
o_eCompSpd
(Compensation speed)
0

When an error occurs while the FB is operating (when the position command is out of range)


i_bEN (execution command)
o_bENO (execution status)
o_bOK (normal completion)
o_bErr (error completion)
o_uErrID (error code)
0
130H
0
i_ePosCmd (position command)
100
320 (out of the setting range)
o_eCompSpd
(compensation speed)
0
(1)
0

(1) Compensation speed [m/s]: While the FB is being executed, a calculated value is output every scan.

Parameter settings

There are no parameter settings specific to this FB. For details on the common parameter settings, refer to the following.

☞ Page 21 Parameter Settings

Performance values

FX5 CPU module	Measurement condition	Processing time	Maximum scan time	Number of scans
FX5S CPU module	Proportional control enabled: On Integral control enabled: On Differential control enabled: On	0.361 ms	1.104 ms	1 scan
FX5UJ CPU module	Proportional control enabled: On Integral control enabled: On Differential control enabled: On	0.342 ms	0.786 ms	1 scan
FX5U/FX5UC CPU module[*1][*2]	Proportional control enabled: On Integral control enabled: On Differential control enabled: On	0.245 ms	0.593 ms	1 scan

*1 When the program capacity is set to 128K steps, the processing speed may become slow.

*2 The standard area is used for labels.

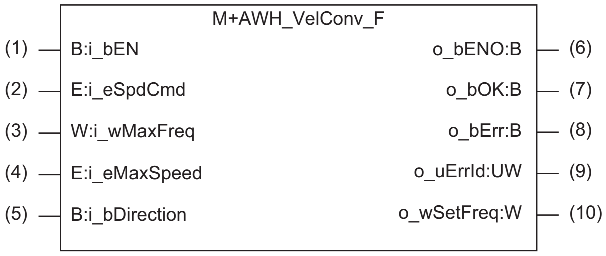
Error code

Error code	Description	Action
130H	The setting value of i_ePosCmd (position command) is out of range.	Check and correct the setting.
131H	The setting value of i_eCurrentPos (current position) is out of range.	Check and correct the setting.
132H	The setting value of i_stPID_Pr (PID setting) is out of range.	Check and correct the setting.
230H	The position deviation exceeds the setting value of eDeviationOver (excessive error level).	Check if current position feedback from the distance meter is performed correctly. Check and correct the eDeviationOver (excessive error level) setting.

3.3 M+AWH_VelConv_F (Frequency Conversion)

Overview

This FB converts the speed command [m/s] to the set frequency [Hz].



Labels

Input labels

No.	Label	Name	Data type	Input reception	Setting range	Description
(1)	i_bEN	Execution command	Bit	Always	On, Off	On: Start FB. Off: Do not start FB.
(2)	i_eSpdCmd	Speed command	Single-precision real number	Always	• -10.000000 to -2^{-126} (-1.175494E-38) • 0.000000 • 2^{-126} (1.175494E-38) to 10.000000	Specify the speed command [m/s]. Set a value less than or equal to i_eMaxSpeed (maximum speed).
(3)	i_wMaxFreq	Maximum frequency	Word [signed]	At start	0 to 20000	Specify the maximum value of the set frequency [0.01 Hz increments] of the inverter according to the equipment. The maximum value is 200 Hz. Example: When 6000 is input, the maximum frequency is 60.00 [Hz].
(4)	i_eMaxSpeed	Maximum speed	Single-precision real number	At start	0.010000 to 10.000000	Specify the maximum value [m/s] of the speed command as an absolute value according to the equipment. Example: When 10 is input, the maximum speed is as follows. • Speed in the positive direction: 10 [m/s] • Speed in the negative direction: -10 [m/s]
(5)	i_bDirection	Rotation direction	Bit	Always	On, Off	Specify the rotation direction. On: Speed command (positive direction) → Set frequency (negative direction) Off: Speed command (positive direction) → Set frequency (positive direction)

Output labels

No.	Label	Name	Data type	Default value	Description
(6)	o_bENO	Execution status	Bit	Off	On: The execution command is on. Off: The execution command is off.
(7)	o_bOK	Normal completion	Bit	Off	The on state indicates that conversion from the speed command to the set frequency was performed normally.
(8)	o_bErr	Error completion	Bit	Off	The on state indicates that an error has occurred in the FB.
(9)	o_uErrId	Error code	Word [unsigned]/ bit string [16 bits]	0	Stores the error code of an error that occurred in the FB.
(10)	o_wSetFreq	Set frequency	Word [signed]	0	Stores the set frequency [0.01 Hz increments] to be given to the inverter.

Function details

Applicable hardware and software

■FB for control of the inverter for automated warehouse

Module	Firmware version	Engineering tool
FX5S CPU module	1.000 or later	GX Works3 Version 1.086Q or later
FX5UJ CPU module	1.030 or later	GX Works3 Version 1.086Q or later
FX5U CPU module	1.270 or later	GX Works3 Version 1.086Q or later
FX5UC CPU module	1.270 or later	GX Works3 Version 1.086Q or later

Basic specifications

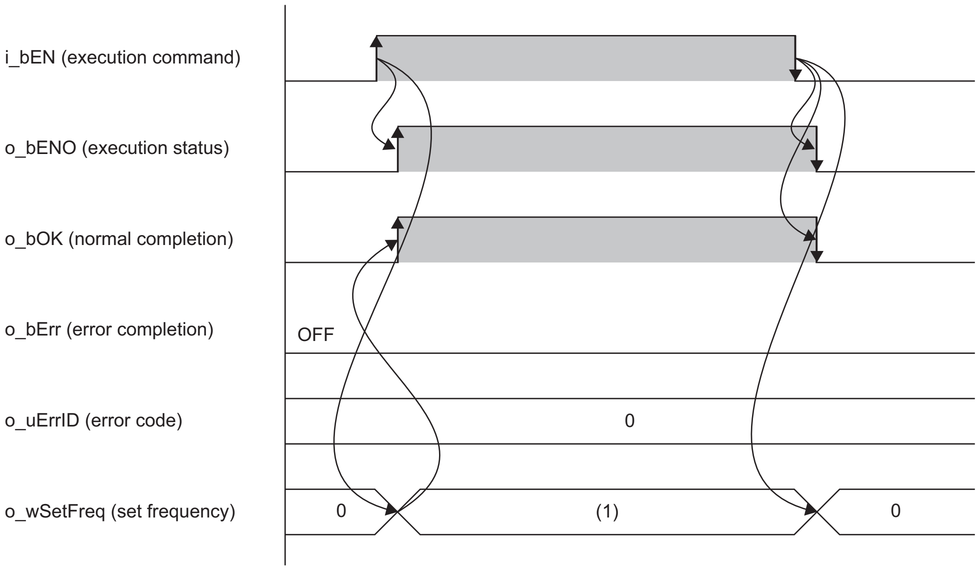
Item	Description
Language to use	Structured text language
Number of steps	Target value: 777 steps The number of steps of the FB embedded in a program depends on the CPU module used, the input/output definitions, and the option setting of GX Works3. For the option setting of GX Works3, refer to the following. 📖 GX Works3 Operating Manual
Points of labels used	• Label: 0.01K points (Word) • Latch Label: 0K points (Word) The points of labels embedded in a program depend on the CPU module used, the devices specified for arguments, and the option setting of GX Works3. For the option setting of GX Works3, refer to the following. 📖 GX Works3 Operating Manual
Points of index register used	• Index register: 0 points • Long index register: 0 points
Points of file register used	File register: 0 points
FB dependency	No dependency
FB compilation method	Subroutine type
FB operation	Always executed

Function description

- Turning on i_bEN (execution command) converts the speed command [m/s] to the set frequency [Hz] according to the machine specifications (maximum frequency and maximum speed) and outputs it.
- When i_bEN (execution command) is off, all outputs become off or 0.
- If i_wMaxFreq (maximum frequency) is out of range while i_bEN (execution command) is rising, o_bErr (error completion) turns on and processing of the FB does not start. In addition, the error code 140H is stored in o_uErrId (error code). (☞ Page 52 Error code)
- If i_eMaxSpeed (maximum speed) is out of range while i_bEN (execution command) is rising, o_bErr (error completion) turns on and processing of the FB does not start. In addition, the error code 141H is stored in o_uErrId (error code). (☞ Page 52 Error code)
- If the absolute value of i_eSpdCmd (speed command) exceeds i_eMaxSpeed (maximum speed) while the FB is operating, o_bErr (error completion) will turn on. (The FB will continue to operate.) In addition, the error code 142H is stored, and o_wSetFreq (set frequency) is held at the setting value of i_wMaxFreq (maximum frequency). (☞ Page 52 Error code)

Timing chart of I/O signals

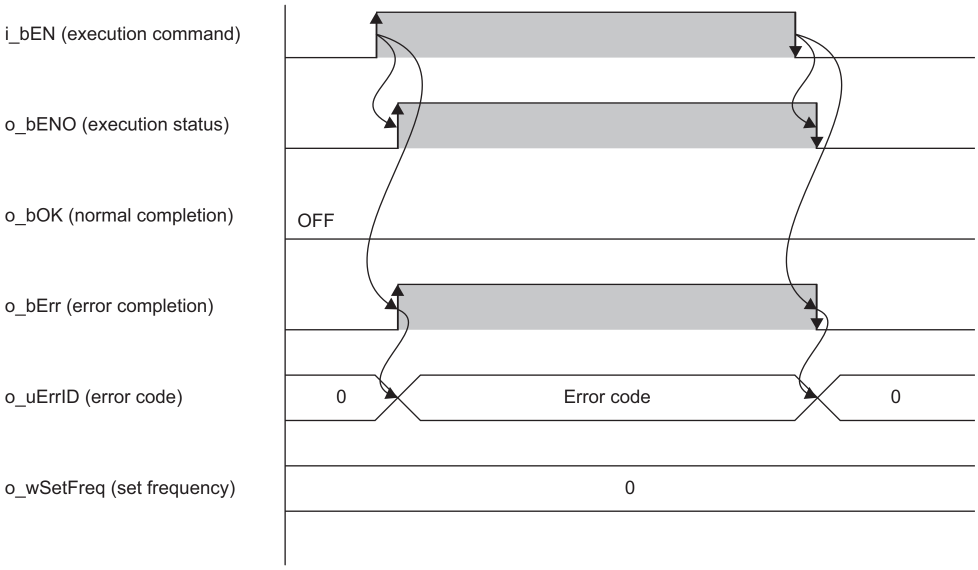
■Completed successfully


i_bEN (execution command)
o_bENO (execution status)
o_bOK (normal completion)
o_bErr (error completion)
OFF
o_uErrID (error code)
0
o_wSetFreq (set frequency)
0
(1)
0

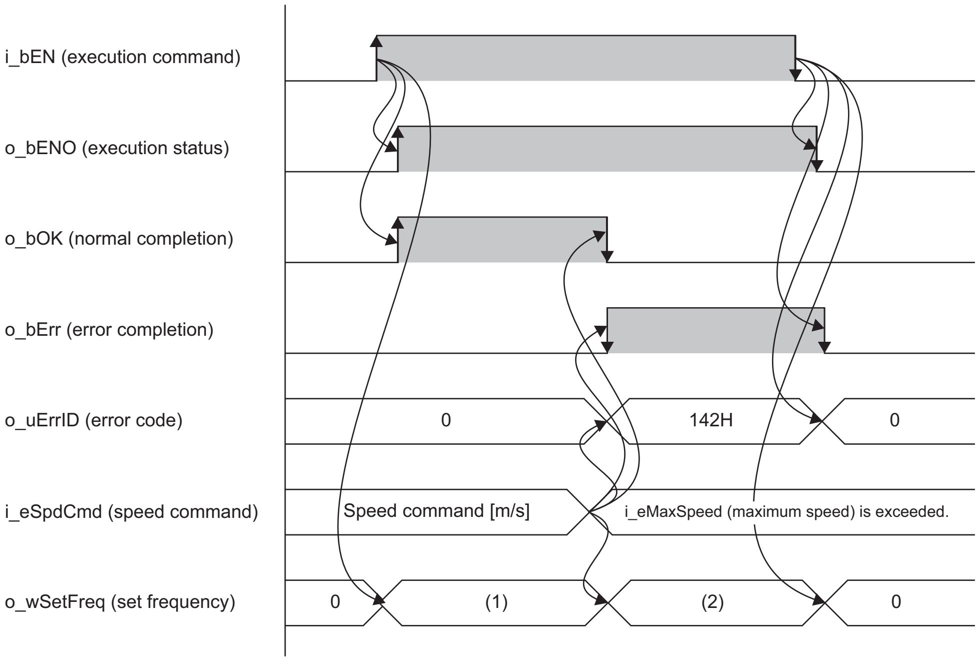
(1) Set frequency [0.01 Hz increments]: While the FB is being executed, a calculated value is output every scan.

■Error completion

When an error occurs at start of the FB


i_bEN (execution command)
o_bENO (execution status)
o_bOK (normal completion)
OFF
o_bErr (error completion)
o_uErrID (error code)
0
Error code
0
o_wSetFreq (set frequency)
0

When an error occurs while the FB is operating (when the absolute value of the speed command exceeds the maximum speed)


i_bEN (execution command)
o_bENO (execution status)
o_bOK (normal completion)
o_bErr (error completion)
o_uErrID (error code)
0
142H
0
i_eSpdCmd (speed command)
Speed command [m/s]
i_eMaxSpeed (maximum speed) is exceeded.
o_wSetFreq (set frequency)
0
(1)
(2)
0

(1) Set frequency [0.01 Hz increments]: While the FB is being executed, a calculated value is output every scan.
(2) Maximum frequency [0.01 Hz increments]: o_wSetFreq (set frequency) is held at the setting value of i_wMaxFreq (maximum frequency).

Precautions

In a program using this FB library, turning off the execution command of this FB while the inverter is running may cause sudden stop as the output frequency to the inverter becomes 0. Turn off the execution command in a program that can safely stop the inverter.

Parameter settings

There are no parameter settings specific to this FB. For details on the common parameter settings, refer to the following.

☞ Page 21 Parameter Settings

Performance values

FX5 CPU module	Measurement condition	Processing time	Maximum scan time	Number of scans
FX5S CPU module	—	0.1 ms	0.727 ms	1 scan
FX5UJ CPU module	—	0.645 ms	0.482 ms	1 scan
FX5U/FX5UC CPU module[*1][*2]	—	0.067 ms	0.407 ms	1 scan

[*1] When the program capacity is set to 128K steps, the processing speed may become slow.
[*2] The standard area is used for labels.

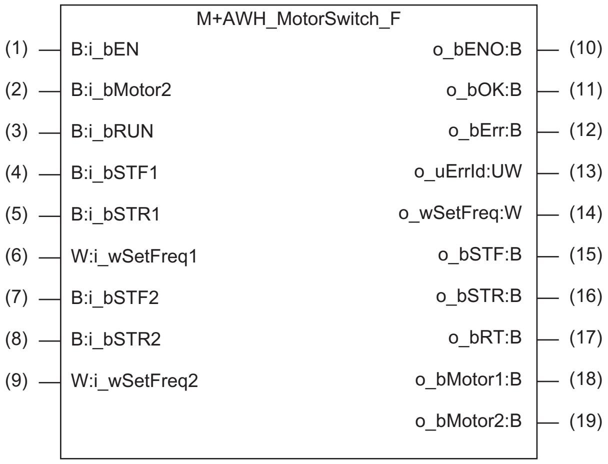
Error code

Error code	Description	Action
140H	The setting value of i_wMaxFreq (maximum frequency) is out of range.	Check and correct the setting, then execute the FB again.
141H	The setting value of i_wMaxSpd (maximum speed) is out of range.	Check and correct the setting, then execute the FB again.
142H	i_eSpdCmd (speed command) exceeds the setting value of i_eMaxSpd (maximum speed). When the FB is operating, o_wSetFreq (set frequency) is held at the setting value of i_wMaxFreq (maximum frequency).	Check and correct the setting.

3.4 M+AWH_MotorSwitch_F (Motor Switching Control)

Overview

This FB switches commands to the inverter when one inverter operates two motors by selecting and switching a motor to be operated.


M+AWH_MotorSwitch_F
(1) B:i_bEN
(2) B:i_bMotor2
(3) B:i_bRUN
(4) B:i_bSTF1
(5) B:i_bSTR1
(6) W:i_wSetFreq1
(7) B:i_bSTF2
(8) B:i_bSTR2
(9) W:i_wSetFreq2
o_bENO:B (10)
o_bOK:B (11)
o_bErr:B (12)
o_uErrId:UW (13)
o_wSetFreq:W (14)
o_bSTF:B (15)
o_bSTR:B (16)
o_bRT:B (17)
o_bMotor1:B (18)
o_bMotor2:B (19)

Labels

Input labels

No.	Label	Name	Data type	Input reception	Setting range	Description
(1)	i_bEN	Execution command	Bit	Always	On, Off	On: Start FB. Off: Do not start FB.
(2)	i_bMotor2	Second motor selection	Bit	Always	On, Off	Specify the motor. On: Specify the second motor. Off: Specify the first motor.
(3)	i_bRUN	Inverter running	Bit	Always	On, Off	Specify the inverter running status by inputting the Inverter running (RUN) signal. On: Running Off: Stopped
(4)	i_bSTF1	First motor forward rotation	Bit	Always	On, Off	Specify the status of the forward rotation command of the first motor.[*1] On: Forward rotation command Off: Stop command
(5)	i_bSTR1	First motor reverse rotation	Bit	Always	On, Off	Specify the status of the reverse rotation command of the first motor.[*1] On: Reverse rotation command Off: Stop command
(6)	i_wSetFreq1	First motor set frequency	Word [signed]	Always	-20000 to 20000	Specify the set frequency of the first motor [0.01 Hz increments].[*1] Example) When 6000 is input, the set frequency and maximum value are as follows. • Set frequency: 60.00 [Hz] • Maximum value: ±200 Hz
(7)	i_bSTF2	Second motor forward rotation	Bit	Always	On, Off	Specify the status of the forward rotation command of the second motor.[*2] On: Forward rotation command Off: Stop command
(8)	i_bSTR2	Second motor reverse rotation	Bit	Always	On, Off	Specify the status of the reverse rotation command of the second motor.[*2] On: Reverse rotation command Off: Stop command

No.	Label	Name	Data type	Input reception	Setting range	Description
(9)	i_wSetFreq2	Second motor set frequency	Word [signed]	Always	-20000 to 20000	Specify the set frequency of the second motor [0.01 Hz increments].[*2] Example) When 6000 is input, the set frequency and maximum value are as follows. • Set frequency: 60.00 [Hz] • Maximum value: ±200 Hz

*1 This is valid when i_bMotor2 (second motor selection) is off.

*2 This is valid when i_bMotor2 (second motor selection) is on.

Output labels

No.	Label	Name	Data type	Default value	Description
(10)	o_bENO	Execution status	Bit	Off	On: The execution command is on. Off: The execution command is off.
(11)	o_bOK	Normal completion	Bit	Off	The on state indicates that execution of the motor switching control has started normally.
(12)	o_bErr	Error completion	Bit	Off	The on state indicates that an error has occurred in the FB.
(13)	o_uErrId	Error code	Word [unsigned]/ bit string [16 bits]	0	The error code of an error that occurred in the FB is stored.
(14)	o_wSetFreq	Set frequency	Word [signed]	0	The set frequency to be given to the inverter [0.01 Hz increments] is stored.
(15)	o_bSTF	Forward rotation command	Bit	Off	The status of the forward rotation command to be given to the inverter is stored. On: Forward rotation command Off: Stop command
(16)	o_bSTR	Reverse rotation command	Bit	Off	The status of the reverse rotation command to be given to the inverter is stored. On: Reverse rotation command Off: Stop command
(17)	o_bRT	Second function selection	Bit	Off	The status of the second function selection signal to be given to the inverter is stored. On: Execute the second motor control. Off: Execute the first motor control.
(18)	o_bMotor1	First motor enabled	Bit	Off	The on state indicates that the first motor is selected.
(19)	o_bMotor2	Second motor enabled	Bit	Off	The on state indicates that the second motor is selected.

Function details

Applicable hardware and software

■FB for control of the inverter for automated warehouse

Module	Firmware version	Engineering tool
FX5S CPU module	1.000 or later	GX Works3 Version 1.086Q or later
FX5UJ CPU module	1.030 or later	GX Works3 Version 1.086Q or later
FX5U CPU module	1.270 or later	GX Works3 Version 1.086Q or later
FX5UC CPU module	1.270 or later	GX Works3 Version 1.086Q or later

Basic specifications

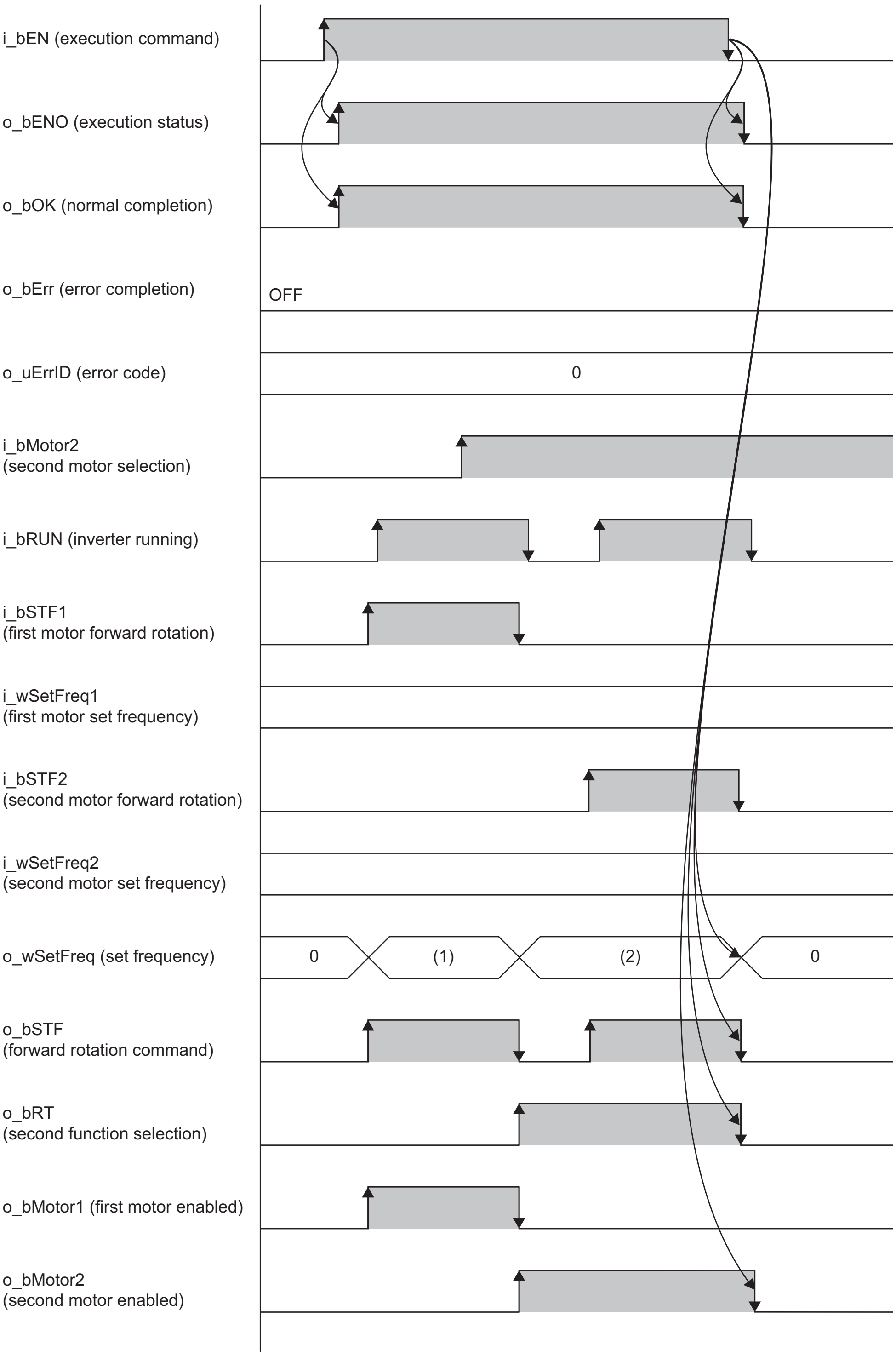
Item	Description
Language to use	Structured text language
Number of steps	Target value: 831 steps The number of steps of the FB embedded in a program depends on the CPU module used, the input/output definitions, and the option setting of GX Works3. For the option setting of GX Works3, refer to the following. 🕮 GX Works3 Operating Manual
Points of labels used	• Label: 0.01K points (Word) • Latch Label: 0K points (Word) The points of labels embedded in a program depend on the CPU module used, the devices specified for arguments, and the option setting of GX Works3. For the option setting of GX Works3, refer to the following. 🕮 GX Works3 Operating Manual
Points of index register used	• Index register: 0 points • Long index register: 0 points
Points of file register used	File register: 0 points
FB dependency	No dependency
FB compilation method	Subroutine type
FB operation	Always executed

Function description

- Turning on i_bEN (execution command) outputs commands for the first motor when the second motor selection (i_bMotor2) is off, or commands for the second motor when i_bMotor2 is on.
- Motor switching is enabled when the inverter running (i_bRUN) is off.
- When i_bEN (execution command) is off, all outputs become off or 0.
- If i_wSetFreq1 (first motor set frequency) is out of range, o_bErr (error completion) will turn on. (The FB will continue to operate.) In addition, the error code 150H is stored in o_uErrId (error code). (☞ Page 58 Error code) If the first motor is controlled and the setting value of i_wSetFreq1 (first motor set frequency) exceeds ±200 Hz, the frequency is limited to ±200 Hz. However, if i_wSetFreq1 (first motor set frequency) is out of range while i_bEN (execution command) is rising, processing of the FB does not start.
- If i_wSetFreq2 (second motor set frequency) is out of range, o_bErr (error completion) will turn on. (The FB will continue to operate.) In addition, the error code 151H is stored in o_uErrId (error code). (☞ Page 58 Error code) If the second motor is controlled and the setting value of i_wSetFreq2 (second motor set frequency) exceeds ±200 Hz, the frequency is limited to ±200 Hz. However, if i_wSetFreq2 (second motor set frequency) is out of range while i_bEN (execution command) is rising, processing of the FB does not start.

Timing chart of I/O signals

■Completed successfully

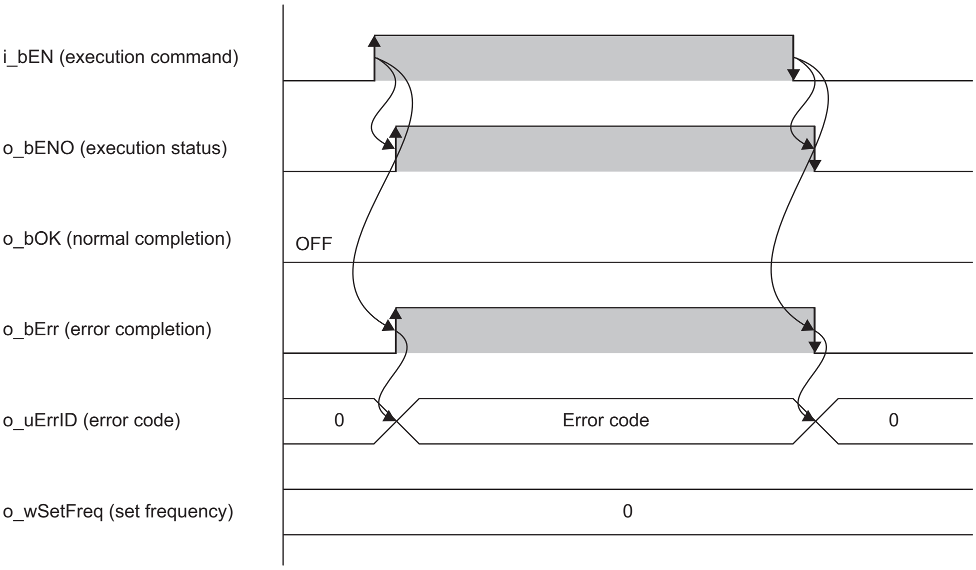

i_bEN (execution command)
o_bENO (execution status)
o_bOK (normal completion)
o_bErr (error completion)
OFF
o_uErrID (error code)
0
i_bMotor2 (second motor selection)
i_bRUN (inverter running)
i_bSTF1 (first motor forward rotation)
i_wSetFreq1 (first motor set frequency)
i_bSTF2 (second motor forward rotation)
i_wSetFreq2 (second motor set frequency)
o_wSetFreq (set frequency)
0
(1)
(2)
0
o_bSTF (forward rotation command)
o_bRT (second function selection)
o_bMotor1 (first motor enabled)
o_bMotor2 (second motor enabled)

(1) First motor set frequency: While the FB is being executed, the calculated value is output every scan.

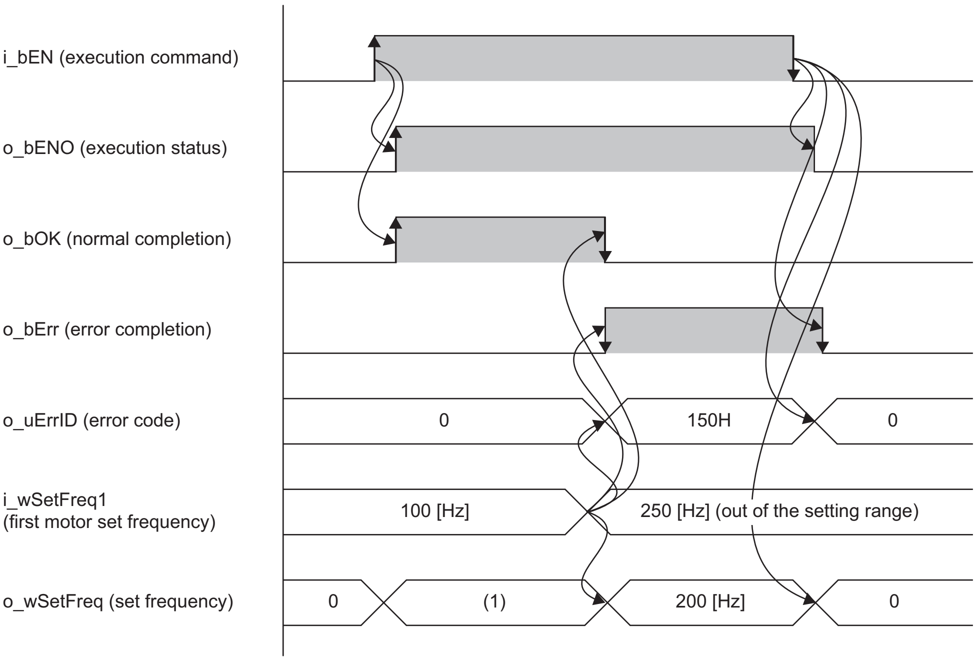
(2) Second motor set frequency: While the FB is being executed, the calculated value is output every scan.

■Error completion

When an error occurs at start of the FB


i_bEN (execution command)
o_bENO (execution status)
o_bOK (normal completion)
OFF
o_bErr (error completion)
o_uErrID (error code)
0
Error code
0
o_wSetFreq (set frequency)
0

When an error occurs while the FB is operating (when the first motor is controlled and the setting value of the first motor set frequency is out of the setting range)


i_bEN (execution command)
o_bENO (execution status)
o_bOK (normal completion)
o_bErr (error completion)
o_uErrID (error code)
0
150H
0
i_wSetFreq1
(first motor set frequency)
100 [Hz]
250 [Hz] (out of the setting range)
o_wSetFreq (set frequency)
0
(1)
200 [Hz]
0

(1) First motor set frequency: While the FB is being executed, the calculated value is output every scan.

Precautions

In a program using this FB library, turning off the execution command of this FB while the inverter is running may cause sudden stop as the output frequency to the inverter becomes 0. Turn off the execution command in a program that can safely stop the inverter.

Parameter settings

There are no parameter settings specific to this FB. For details on the common parameter settings, refer to the following.

☞ Page 21 Parameter Settings

Performance values

FX5 CPU module	Measurement condition	Processing time	Maximum scan time	Number of scans
FX5S CPU module	First motor	0.087 ms	0.711 ms	1 scan
FX5UJ CPU module	First motor	0.073 ms	0.471 ms	1 scan
FX5U/FX5UC CPU module[*1][*2]	First motor	0.059 ms	0.402 ms	1 scan

*1 When the program capacity is set to 128K steps, the processing speed may become slow.

*2 The standard area is used for labels.

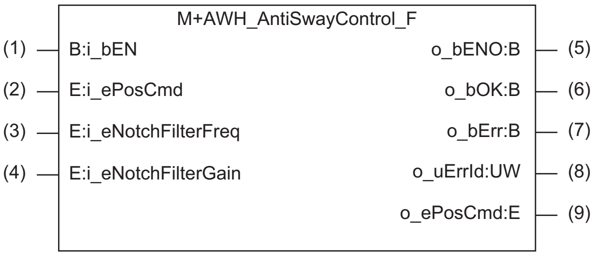
Error code

Error code	Description	Action
150H	The setting value of i_wSetFreq1 (first motor set frequency) is out of range. When the FB is operating, o_wSetFreq (set frequency) is limited to ±200 Hz.	Check and correct the setting.
151H	The setting value of i_wSetFreq2 (second motor set frequency) is out of range. When the FB is operating, o_wSetFreq (set frequency) is limited to ±200 Hz.	Check and correct the setting.

3.5 M+AWH_AntiSwayControl_F (Anti-sway Control)

Overview

This FB applies the notch filter to the position command to suppress swinging at positioning stop.



Labels

Input labels

No.	Label	Name	Data type	Input reception	Setting range	Description
(1)	i_bEN	Execution command	Bit	Always	On, Off	On: Start FB. Off: Do not start FB.
(2)	i_ePosCmd	Position command	Single-precision real number	Always	• 0.000000 • 2^{-126} (1.175494E-38) to 300.000000	Specify the position command [m] for each control cycle.
(3)	i_eNotchFilterFreq	Notch filter frequency	Single-precision real number	At start	10.000000 to 1000.000000	Specify the frequency [0.01 Hz increments] at which the notch filter is activated to suppress swinging. Example) When 1000 is input, notch filter frequency is 10.00 [Hz].
(4)	i_eNotchFilterGain	Notch filter gain	Single-precision real number	At start	0.100000 to 500.000000	Specify the notch filter gain [%].

Output labels

No.	Label	Name	Data type	Default value	Description
(5)	o_bENO	Execution status	Bit	Off	On: The execution command is on. Off: The execution command is off.
(6)	o_bOK	Normal completion	Bit	Off	The on state indicates that application of the notch filter to the position command has started normally.
(7)	o_bErr	Error completion	Bit	Off	The on state indicates that an error has occurred in the FB.
(8)	o_uErrId	Error code	Word [unsigned]/ bit string [16 bits]	0	The error code of an error that occurred in the FB is stored.
(9)	o_ePosCmd	Position command	Single-precision real number	0.000000	The position command [m] after the notch filter is applied is stored.

Function details

Applicable hardware and software

■FB for control of the inverter for automated warehouse

Module	Firmware version	Engineering tool
FX5S CPU module	1.000 or later	GX Works3 Version 1.086Q or later
FX5UJ CPU module	1.030 or later	GX Works3 Version 1.086Q or later
FX5U CPU module	1.270 or later	GX Works3 Version 1.086Q or later
FX5UC CPU module	1.270 or later	GX Works3 Version 1.086Q or later

Basic specifications

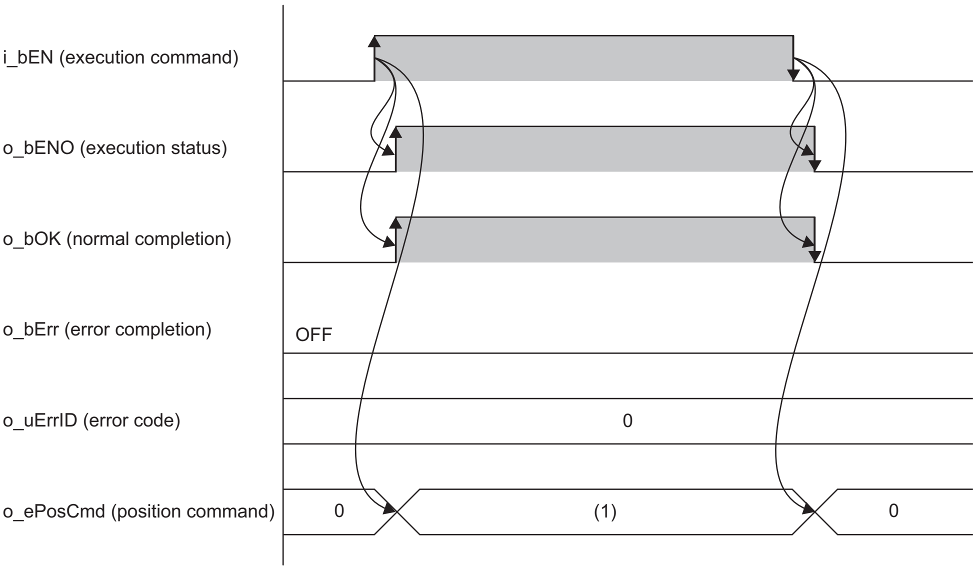
Item	Description
Language to use	Structured text language
Number of steps	Target value: 1075 steps The number of steps of the FB embedded in a program depends on the CPU module used, the input/output definitions, and the option setting of GX Works3. For the option setting of GX Works3, refer to the following. 📖 GX Works3 Operating Manual
Points of labels used	• Label: 0.05K points (Word) • Latch Label: 0K points (Word) The points of labels embedded in a program depend on the CPU module used, the devices specified for arguments, and the option setting of GX Works3. For the option setting of GX Works3, refer to the following. 📖 GX Works3 Operating Manual
Points of index register used	• Index register: 0 points • Long index register: 0 points
Points of file register used	File register: 0 points
FB dependency	No dependency
FB compilation method	Subroutine type
FB operation	Always executed

Function description

- When i_bEN (execution command) is turned on, the notch filter is activated according to the input label settings, and the position command during positioning control is compensated.
- When i_bEN (execution command) is off, all outputs become off or 0.
- If i_ePosCmd (position command) is out of range, o_bErr (error completion) turns on and the processing of this FB is interrupted. In addition, the error code 130H is stored in o_uErrId (error code). The output value of o_ePosCmd (position command) becomes the same as the value of i_ePosCmd (position command). (☞ Page 62 Error code)
- If i_eNotchFilterFreq (notch filter frequency) is out of range while i_bEN (execution command) is rising, o_bErr (error completion) turns on and processing of the FB does not start. In addition, the error code 160H is stored in o_uErrId (error code). The output value of o_ePosCmd (position command) becomes the same as the value of i_ePosCmd (position command). (☞ Page 62 Error code)
- If i_eNotchFilterGain (notch filter gain) is out of range while i_bEN (execution command) is rising, o_bErr (error completion) turns on and processing of the FB does not start. In addition, the error code 161H is stored in o_uErrId (error code). The output value of o_ePosCmd (position command) becomes the same as the value of i_ePosCmd (position command). (☞ Page 62 Error code)

Timing chart of I/O signals

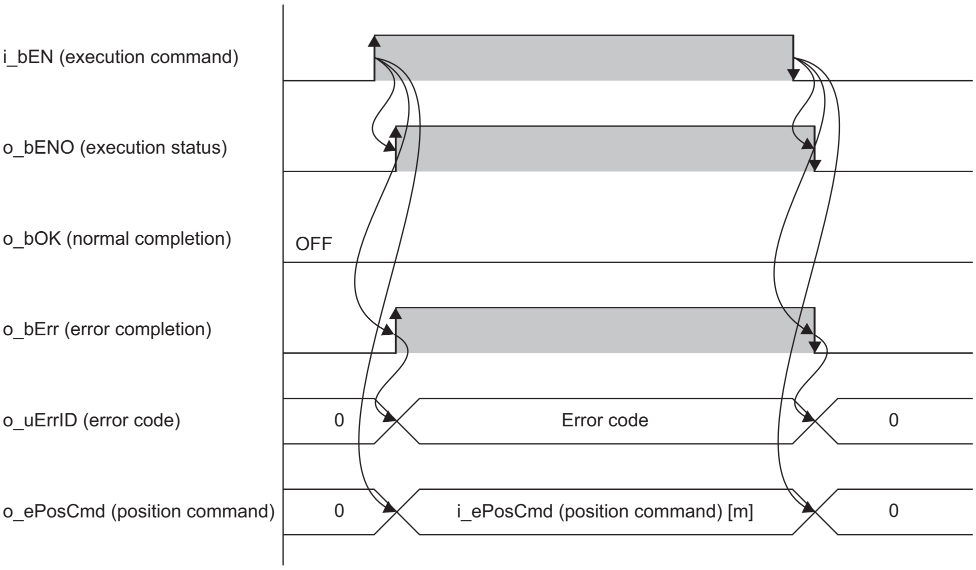
■Completed successfully


i_bEN (execution command)
o_bENO (execution status)
o_bOK (normal completion)
o_bErr (error completion)
OFF
o_uErrID (error code)
0
o_ePosCmd (position command)
0
(1)
0

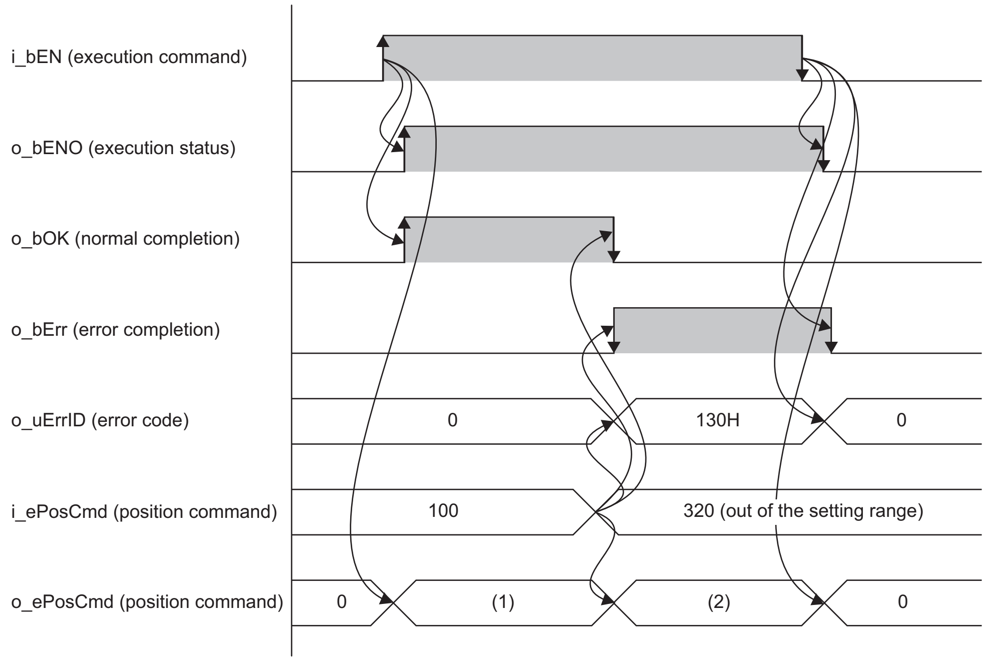
(1) Position command [m] after anti-sway control calculation: While the FB is being executed, the calculated value is output every scan.

■Error completion

When an error occurs at start of the FB


i_bEN (execution command)
o_bENO (execution status)
o_bOK (normal completion)
OFF
o_bErr (error completion)
o_uErrID (error code)
0
Error code
0
o_ePosCmd (position command)
0
i_ePosCmd (position command) [m]
0

When an error occurs while the FB is operating (when the position command is out of range)


i_bEN (execution command)
o_bENO (execution status)
o_bOK (normal completion)
o_bErr (error completion)
o_uErrID (error code)
0
130H
0
i_ePosCmd (position command)
100
320 (out of the setting range)
o_ePosCmd (position command)
0
(1)
(2)
0

(1) Position command [m] after anti-sway control calculation: While the FB is being executed, the calculated value is output every scan.
(2) i_ePosCmd (position command) [m]

Parameter settings

There are no parameter settings specific to this FB. For details on the common parameter settings, refer to the following.

☞ Page 21 Parameter Settings

Performance values

FX5 CPU module	Measurement condition	Processing time	Maximum scan time	Number of scans
FX5S CPU module	—	0.226 ms	0.882 ms	1 scan
FX5UJ CPU module	—	0.189 ms	0.641 ms	1 scan
FX5U/FX5UC CPU module[*1][*2]	—	0.16 ms	0.498 ms	1 scan

[*1] When the program capacity is set to 128K steps, the processing speed may become slow.
[*2] The standard area is used for labels.

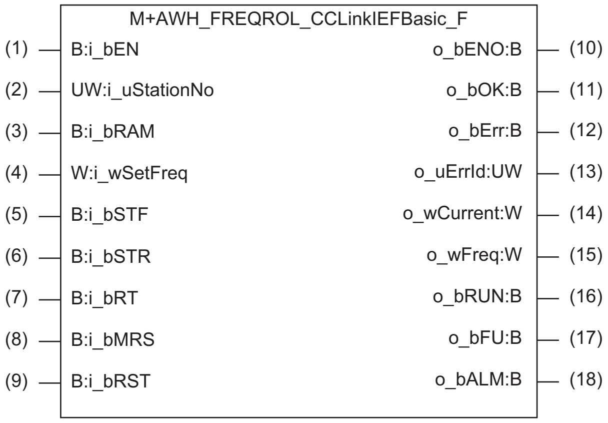
Error code

Error code	Description	Action
130H	The setting value of i_ePosCmd (position command) is out of range.	Check and correct the setting.
160H	The setting value of i_eNotchFilterFreq (notch filter frequency) is out of range.	Check and correct the setting, then execute the FB again.
161H	The setting value of i_eNotchFilterGain (notch filter gain) is out of range.	Check and correct the setting, then execute the FB again.

3.6 M+AWH_FREQROL_CCLinkIEFBasic_F (Inverter Communication)

Overview

This FB controls and monitors the inverters connected to CC-Link IE Field Network Basic.



Labels

Input labels

No.	Label	Name	Data type	Input reception	Setting range	Description
(1)	i_bEN	Execution command	Bit	Always	On, Off	On: Start FB. Off: Do not start FB.
(2)	i_uStationNo	Target station number	Word [unsigned]/bit string [16 bits]	At start	The setting range varies depending on the target modules.	Specify the station number of the inverter to be connected. ■FX5S/FX5UJ CPU module 1 to 8 ■FX5U/FX5UC CPU module 1 to 16
(3)	i_bRAM	Frequency setting command	Bit	Always	On, Off	Specify the frequency setting command (RAM) of the inverter. Turning on this label writes the set frequency (i_wSetFreq) to the RAM of the inverter.
(4)	i_wSetFreq	Set frequency	Word [signed]	Always	-20000 to 20000	Specify the set frequency [0.01 Hz increments] of the inverter. Example) When 6000 is input, the set frequency is 60.00 [Hz].
(5)	i_bSTF	Forward rotation command	Bit	Always	On, Off	Specify the status of the forward rotation command of the inverter. On: Forward rotation start Off: Stop command
(6)	i_bSTR	Reverse rotation command	Bit	Always	On, Off	Specify the status of the reverse rotation command of the inverter. On: Reverse rotation start Off: Stop command
(7)	i_bRT	Second function selection	Bit	Always	On, Off	Specify the status of the second function selection signal of the inverter. On: Execute the second motor control. Off: Execute the first motor control.
(8)	i_bMRS	Output stop	Bit	Always	On, Off	Specify the status of the output stop signal of the inverter. Turning on this label shuts off the inverter output.
(9)	i_bRST	Error reset	Bit	Specified	On, Off	Specify the status of the error reset request flag of the inverter. At the rising edge of i_bRST (error reset) during an inverter fault (o_bALM (Fault) is off): An error reset request is output to the inverter.

Output labels

No.	Label	Name	Data type	Default value	Description
(10)	o_bENO	Execution status	Bit	Off	On: The execution command is on. Off: The execution command is off.
(11)	o_bOK	Normal completion	Bit	Off	The on state indicates that execution of control and monitoring of the inverter has started normally.
(12)	o_bErr	Error completion	Bit	Off	The on state indicates that an error has occurred in the FB.
(13)	o_uErrId	Error code	Word [unsigned]/ bit string [16 bits]	0	The error code of an error that occurred in the FB is stored.
(14)	o_wCurrent	Output current	Word [signed]	0	The first monitor value of the inverter is stored. In this FB, the output current value [0.01 A/0.1 A increments][1] is stored.
(15)	o_wFreq	Output frequency	Word [signed]	0	The second monitor value of the inverter is stored. In this FB, the output frequency value [0.01 Hz increments] is stored.
(16)	o_bRUN	Running	Bit	Off	The inverter running signal is stored. The on state indicates that the inverter is operating at an output frequency equal to or higher than the setting value of [Pr.13 Starting frequency][2].
(17)	o_bFU	Frequency detection	Bit	Off	The frequency detection signal of the inverter is stored. The on state indicates that the inverter output frequency is equal to or higher than the setting value of [Pr.42 Output frequency detection][2] or [Pr.43 Output frequency detection for reverse rotation][2].
(18)	o_bALM	Fault	Bit	On	The fault signal of the inverter is stored. The off state indicates that the inverter's protective function is activated (fault occurs) to stop the output.

[1] The unit of the output current differs depending on the inverter model used. For details, refer to the manuals for the inverters used.

[2] For details on Pr, which is parameter numbers (numbers assigned to functions of the inverter), refer to the manuals for the inverters used.

Global labels

Refer to the following.

☞ Page 17 List of Global Labels

Function details

Applicable hardware and software

■FB for control of the inverter for automated warehouse

Module		Firmware version	Engineering tool
FX5S CPU module		1.000 or later	GX Works3 Version 1.086Q or later
FX5UJ CPU module		1.030 or later	GX Works3 Version 1.086Q or later
FX5U CPU module		1.270 or later	GX Works3 Version 1.086Q or later
FX5UC CPU module		1.270 or later	GX Works3 Version 1.086Q or later
Inverter	FR-E800 series	— (CC-Link IE Field Network Basic communication compatible model)	FR Configurator2 Version 1.28E or later
	FR-A800 series		

Basic specifications

Item	Description
Language to use	Structured text language
Number of steps	Target value: 1099 steps The number of steps of the FB embedded in a program depends on the CPU module used, the input/output definitions, and the option setting of GX Works3. For the option setting of GX Works3, refer to the following. 📖 GX Works3 Operating Manual
Points of labels used	• Label: 0.02K points (Word) • Latch Label: 0K points (Word) The points of labels embedded in a program depend on the CPU module used, the devices specified for arguments, and the option setting of GX Works3. For the option setting of GX Works3, refer to the following. 📖 GX Works3 Operating Manual
Points of index register used	• Index register: 1 point (Device number used: Z9) • Long index register: 0 points
Points of file register used	File register: 0 points
FB dependency	No dependency
FB compilation method	Subroutine type
FB operation	Always executed

Function description

- When i_bEN (execution command) is turned on, input commands are sent to the inverter connected to CC-Link IE Field Network Basic communication, and the monitor values from the inverter are received and output.
- If both i_bSTF (forward rotation command) and i_bSTR (reverse rotation command) are on, the inverter will receive the commands as the stop command.
- During an inverter fault (o_bALM (Fault) is off), turning on i_bRST (error reset) outputs an error reset request to the inverter.
- When i_bEN (execution command) is off, all outputs become off or 0, and the stop command is output to the inverter. However, if the Ethernet cable is disconnected, the stop command will not be output to the inverter.
- If i_uStationNo (target station number) is out of range while i_bEN (execution command) is rising, o_bErr (error completion) turns on and processing of the FB does not start. In addition, the error code 170H is stored in o_uErrId (error code). When a value out of the setting range is specified for the FX5UJ CPU module and the FX5S CPU module, the error code 270H is stored. (☞ Page 69 Error code)

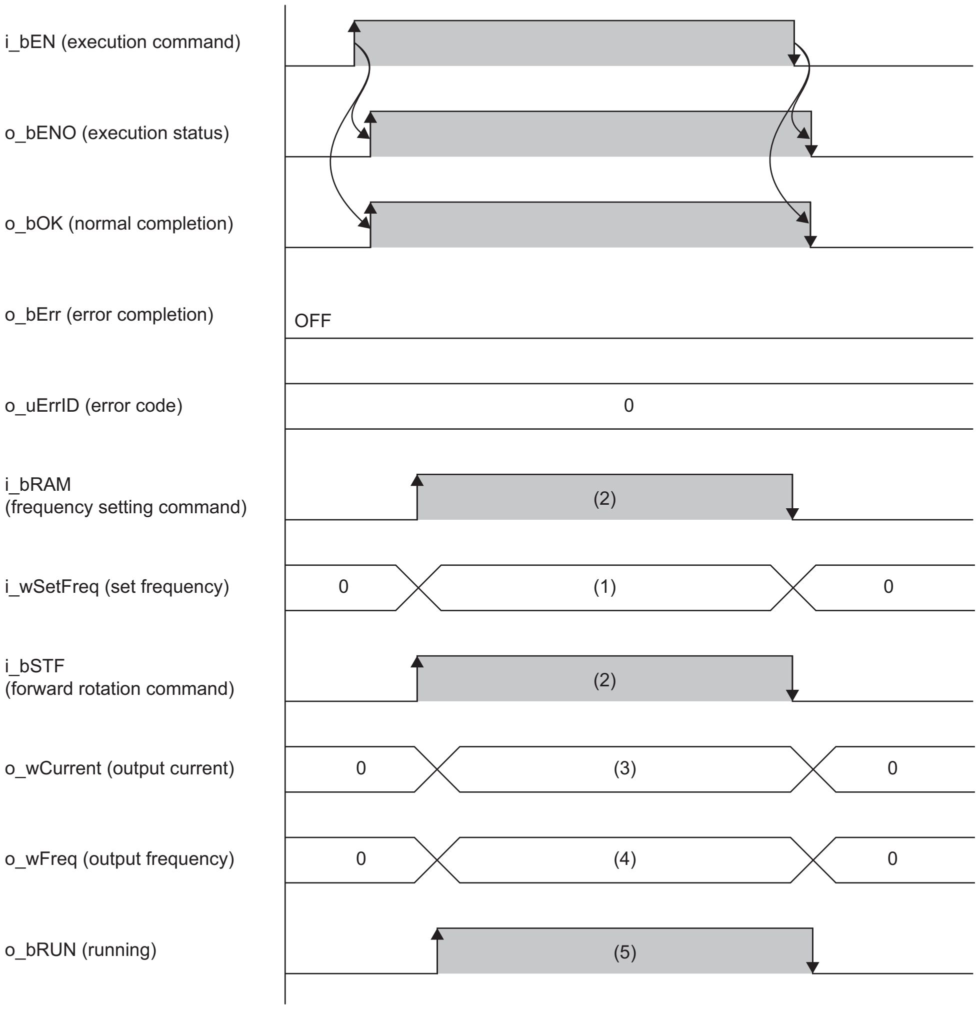
The following table shows the setting values for i_uStationNo (target station number) and the corresponding error codes for each CPU module.

Module	**Error code**			
	i_uStationNo = 0	**i_uStationNo = 1 to 8**	**i_uStationNo = 9 to 16**	**i_uStationNo = 17 or more**
FX5S/FX5UJ CPU module	Error code: 170H	—	Error code: 270H	Error code: 170H
FX5U/FX5UC CPU module	Error code: 170H	—	—	Error code: 170H

- If i_wSetFreq (set frequency) is out of range, o_bErr (error completion) will turn on. (The FB will continue to operate.) In addition, the error code 171H is stored in o_uErrId (error code). (☞ Page 69 Error code) If the setting value of i_wSetFreq (set frequency) exceeds ±200 Hz, the frequency is limited to ±200 Hz. However, if i_wSetFreq (set frequency) is out of range while i_bEN (execution command) is rising, processing of the FB does not start.
- This FB uses SD1536 to check the cyclic transmission status of the station number specified in i_uStationNo (target station number). If the bit of the target station number is not on (cyclic transmission is not performed), o_bErr (error completion) will turn on. (The FB will continue to operate.) In addition, the error code 270H is stored in o_uErrId (error code). (☞ Page 69 Error code)

Timing chart of I/O signals

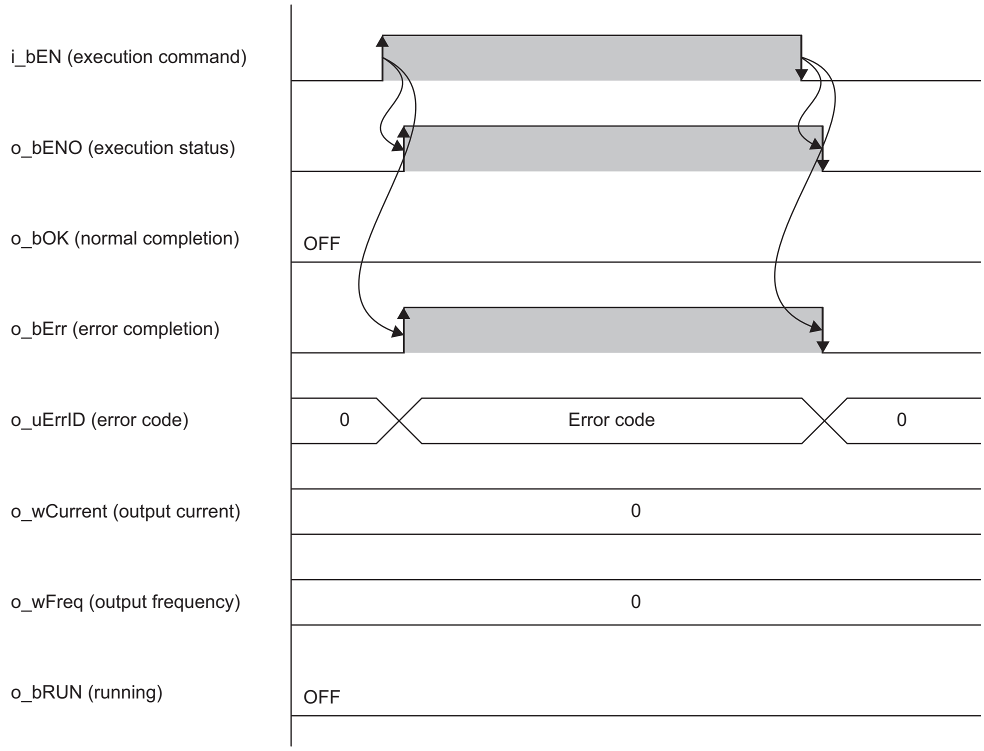
■Completed successfully


i_bEN (execution command)
o_bENO (execution status)
o_bOK (normal completion)
o_bErr (error completion)
OFF
o_uErrID (error code)
0
i_bRAM
(frequency setting command)
(2)
i_wSetFreq (set frequency)
0
(1)
0
i_bSTF
(forward rotation command)
(2)
o_wCurrent (output current)
0
(3)
0
o_wFreq (output frequency)
0
(4)
0
o_bRUN (running)
(5)

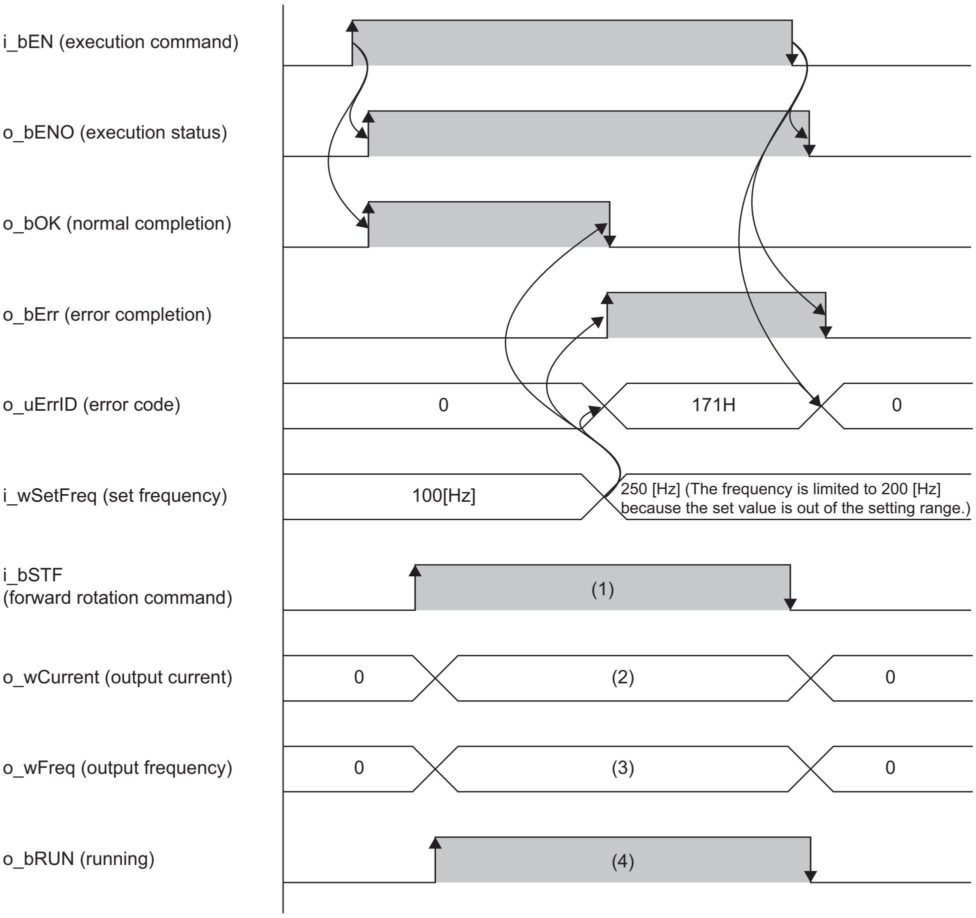
(1) Set frequency [0.01 Hz increments]: While the FB is being executed, the value is written to the inverter every scan.
(2) While the FB is being executed, the value is written from the inverter every scan.
(3) Output current [0.01 A/0.1 A increments]: While the FB is being executed, the value is read from the inverter every scan.
(4) Output frequency [0.01 Hz increments]: While the FB is being executed, the value is read from the inverter every scan.
(5) While the FB is being executed, the value is read from the inverter every scan.

■Error completion

When an error occurs at start of the FB


i_bEN (execution command)
o_bENO (execution status)
o_bOK (normal completion)
OFF
o_bErr (error completion)
o_uErrID (error code)
0
Error code
0
o_wCurrent (output current)
0
o_wFreq (output frequency)
0
o_bRUN (running)
OFF

When an error occurs while the FB is operating (when the setting value of the set frequency is out of the setting range)


i_bEN (execution command)
o_bENO (execution status)
o_bOK (normal completion)
o_bErr (error completion)
o_uErrID (error code)
0
171H
0
i_wSetFreq (set frequency)
100[Hz]
250 [Hz] (The frequency is limited to 200 [Hz] because the set value is out of the setting range.)
i_bSTF (forward rotation command)
(1)
o_wCurrent (output current)
0
(2)
0
o_wFreq (output frequency)
0
(3)
0
o_bRUN (running)
(4)

(1) While the FB is being executed, the value is written to the inverter every scan.
(2) Output current [0.01 A/0.1 A increments]: While the FB is being executed, the value is read from the inverter every scan.
(3) Output frequency [0.01 Hz increments]: While the FB is being executed, the value is read from the inverter every scan.
(4) While the FB is being executed, the value is read from the inverter every scan.

Precautions

- This FB uses the index register Z9. When using an interrupt program, do not use this index register.
- Although a double coil warning may occur during compilation, it does not cause any problem when using the FB.
- In a program using this FB library, turning off the execution command of this FB while the inverter is running may cause sudden stop as the stop command is output to the inverter. Turn off the execution command in a program that can safely stop the inverter.
- If the Ethernet cable is disconnected while the inverter is running, this FB cannot control the inverter. Consider the system configuration where a failsafe is enabled. (☞ Page 21 Parameter Settings)
- For this FB, the setting values for function assignment to some I/O terminals of the inverter are fixed. (☞ Page 21 Parameter Settings)

Parameter settings

To execute this FB, configure the CC-Link IE Field Network Basic settings. For details on the parameter setting method, refer to the following.

☞ Page 21 Parameter Settings

Performance values

FX5 CPU module	Measurement condition	Processing time	Maximum scan time	Number of scans	Maximum link scan time
FX5S CPU module	Target inverter: FR-E800	0.099 ms	0.886 ms	1 scan	6 ms
FX5UJ CPU module	Target inverter: FR-E800	0.1 ms	0.564 ms	1 scan	7.065 ms
FX5U/FX5UC CPU module[1][2]	Target inverter: FR-E800	0.093 ms	0.47 ms	1 scan	7.698 ms

[1] When the program capacity is set to 128K steps, the processing speed may become slow.

[2] The standard area is used for labels.

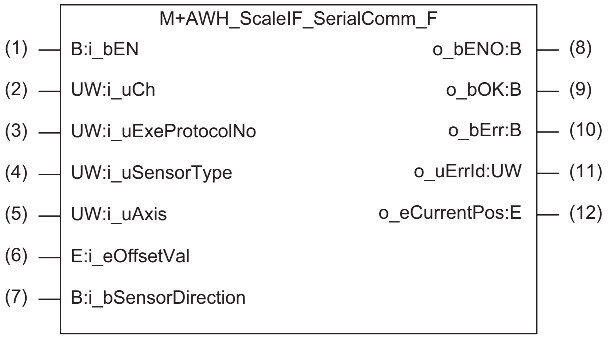
Error code

Error code	Description	Action
170H	The setting value of i_uStationNo (target station number) is out of range.	Check and correct the setting, then execute the FB again.
171H	The setting value of i_wSetFreq (set frequency) is out of range. i_wSetFreq (set frequency) is limited to ±200 Hz.	Check and correct the setting.
270H	An error occurred in communication processing with the inverter (CC-Link IEF Basic).	Check the connection with the inverter and the CC-Link IEF Basic setting.

3.7 M+AWH_ScaleIF_SerialComm_F (Distance Measurement: Serial)

Overview

This FB performs serial communication with distance meters and gives feedback about distance measurement values.



Labels

Input labels

No.	Label	Name	Data type	Input reception	Setting range	Description
(1)	i_bEN	Execution command	Bit	Always	On, Off	On: Start FB. Off: Do not start FB.
(2)	i_uCh	Target channel	Word [unsigned]/ bit string [16 bits]	At start	■FX5S/FX5UJ CPU module 2 to 4 (Channel 1 is not available.) ■FX5U CPU module 1 to 4 ■FX5UC CPU module 1, 3, 4 (Channel 2 is not available.)	Specify the channel number. 1: Built-in RS-485 port 2: FX5-485-BD 3, 4: FX5-485ADP
(3)	i_uExeProtocolNo	Execution protocol number specification	Word [unsigned]/ bit string [16 bits]	At start	1 to 63	Specify the protocol number used by the predefined protocol support function. Refer to "Model" corresponding to the model name set in i_uSensorType (distance meter model name) and "Protocol Name" corresponding to the number set in i_uAxis (target axis), and specify the protocol number with which "Axis□ Status"[*1] is registered.[*2] For details on the settings, refer to the following. ☞ Page 27 Predefined protocol support function setting
(4)	i_uSensorType	Distance meter model name	Word [unsigned]/ bit string [16 bits]	At start	1, 9	Specify the distance meter to be used. 1: DL100 Pro (SICK AG) 9: Distance meter other than the above that supports serial communication (RS-485 or RS-422)
(5)	i_uAxis	Target axis	Word [unsigned]/ bit string [16 bits]	At start	1, 2	Specify the number of the axis to be used by the distance meter. 1: Travel axis 2: Lift axis
(6)	i_eOffsetVal	Distance offset value	Single-precision real number	Always	• -300.000000 to -2^{-126} (-1.175494E-38) • 0.000000 • 2^{-126} (1.175494E-38) to 300.000000	Specify the value [m] to offset the measurement value of the distance meter.

No.	Label	Name	Data type	Input reception	Setting range	Description
(7)	i_bSensorDirection	Distance measurement value direction	Bit	Always	On, Off	Specify the increase direction of the measurement value of the distance meter. Off: The measurement value increases for positioning in the positive direction. On: The measurement value increases for positioning in the negative direction.

*1 The symbol ☐ indicates the number of the target axis.

*2 A protocol with a protocol name of "Axis☐ Position" is executed at the same time as the "Axis☐ Status" protocol, so there is no need to specify the protocol number.

Output labels

No.	Label	Name	Data type	Default value	Description
(8)	o_bENO	Execution status	Bit	Off	On: The execution command is on. Off: The execution command is off.
(9)	o_bOK	Normal completion	Bit	Off	The on state indicates that the distance measurement value was fed back normally.
(10)	o_bErr	Error completion	Bit	Off	The on state indicates that an error has occurred in the FB.
(11)	o_uErrId	Error code	Word [unsigned]/ bit string [16 bits]	0	Stores the error code of an error that occurred in the FB.
(12)	o_eCurrentPos	Current position	Single-precision real number	0.000000	Stores the current position [m] measured by the distance meter for each control cycle. (The value is held when the FB is stopped.)

Global labels

Refer to the following.

☞ Page 17 List of Global Labels

Function details

Applicable hardware and software

■FB for control of the inverter for automated warehouse

Module	Firmware version	Engineering tool
FX5S CPU module	1.000 or later	GX Works3 Version 1.086Q or later
FX5UJ CPU module	1.030 or later	GX Works3 Version 1.086Q or later
FX5U CPU module	1.270 or later	GX Works3 Version 1.086Q or later
FX5UC CPU module	1.270 or later	GX Works3 Version 1.086Q or later

Device whose operation is verified

■Distance meter

Model name	Manufacturer	Distance measurement method	Communication method	Software version	Hardware version
DL100 Pro	SICK AG	Laser	RS-422 communication	v001.004.002	22180379

Basic specifications

Item	Description
Language to use	Structured text language
Number of steps	Target value: 1.035 steps The number of steps of the FB embedded in a program depends on the CPU module used, the input/output definitions, and the option setting of GX Works3. For the option setting of GX Works3, refer to the following. 📖 GX Works3 Operating Manual
Points of labels used	• Label: 0.04K points (Word) • Latch Label: 0K points (Word) The points of labels embedded in a program depend on the CPU module used, the devices specified for arguments, and the option setting of GX Works3. For the option setting of GX Works3, refer to the following. 📖 GX Works3 Operating Manual
Points of index register used	• Index register: 0 points • Long index register: 0 points
Points of file register used	File register: 9 points (Word) (R32700 to R32708)
FB dependency	No dependency
FB compilation method	Subroutine type
FB operation	Always executed

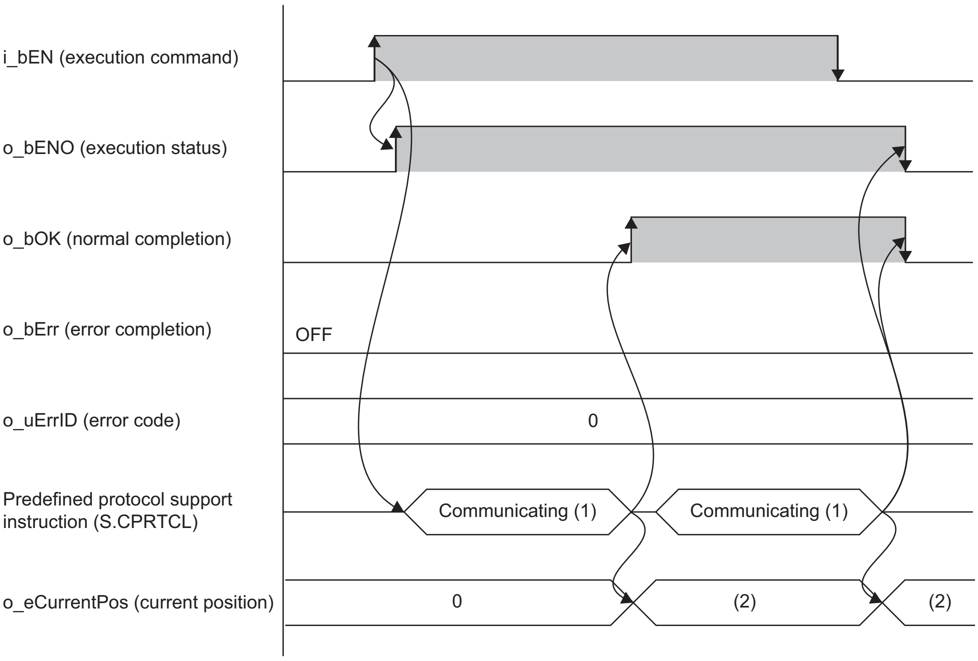
Function description

- Turning on i_bEN (execution command) causes the predefined protocol support instruction (S.CPRTCL) to execute the protocol registered with the predefined protocol support function of GX Works3. After execution of the protocol specified by i_uExeProtocolNo (execution protocol number specification), o_bOK (normal completion) turns on.
- The execution of the protocol enables communication with a distance meter capable of serial communication (RS-485 or RS-422) to feed back the current position.
- When i_bEN (execution command) is off, the output value of o_eCurrentPos (current position) is held, and the output of other than o_eCurrentPos (current position) becomes off or 0. However, during communication by the predefined protocol support instruction (S.CPRTCL), the operation continues until the communication is completed.
- If i_uCh (target channel) is out of range while i_bEN (execution command) is rising, o_bErr (error completion) turns on and processing of the FB does not start. In addition, the error code 180H is stored in o_uErrId (error code). (☞ Page 76 Error code)
- If i_uExeProtocolNo (execution protocol number specification) is out of range while i_bEN (execution command) is rising, o_bErr (error completion) turns on and processing of the FB does not start. In addition, the error code 181H is stored in o_uErrId (error code). (☞ Page 76 Error code)
- If i_uSensorType (distance meter model name) is out of range while i_bEN (execution command) is rising, o_bErr (error completion) turns on and processing of the FB does not start. In addition, the error code 182H is stored in o_uErrId (error code). (☞ Page 76 Error code)
- If i_uAxis (target axis) is out of range while i_bEN (execution command) is rising, o_bErr (error completion) turns on and processing of the FB does not start. In addition, the error code 183H is stored in o_uErrId (error code). (☞ Page 76 Error code)
- This FB uses SD9102 to check whether the predefined protocol is prepared normally. If the check result is abnormal, o_bErr (error completion) turns on and processing of the FB does not start. In addition, the error code 184H is stored in o_uErrId (error code). (☞ Page 76 Error code)
- If an error occurs in the distance meter (serial communication), o_bErr (error completion) turns on. (The FB will continue to operate.) In addition, the error code 280H is stored in o_uErrId (error code), and o_eCurrentPos (current position) is held at the value before the error occurred. (☞ Page 76 Error code)
- If a distance measurement value error occurs due to blocking of light from the distance meter (serial communication), o_bErr (error completion) turns on. (The FB will continue to operate.) In addition, the error code 281H is stored in o_uErrId (error code), and o_eCurrentPos (current position) is held at the value before the error occurred. (☞ Page 76 Error code)
- If an error occurs during the predefined protocol's send/receive operation, o_bErr (error completion) turns on. (The FB will continue to operate.) In addition, an error code is stored in o_uErrId (error code). For error code details, refer to the following.

📖 MELSEC iQ-F FX5 User's Manual (Serial Communication)

Timing chart of I/O signals

■Completed successfully

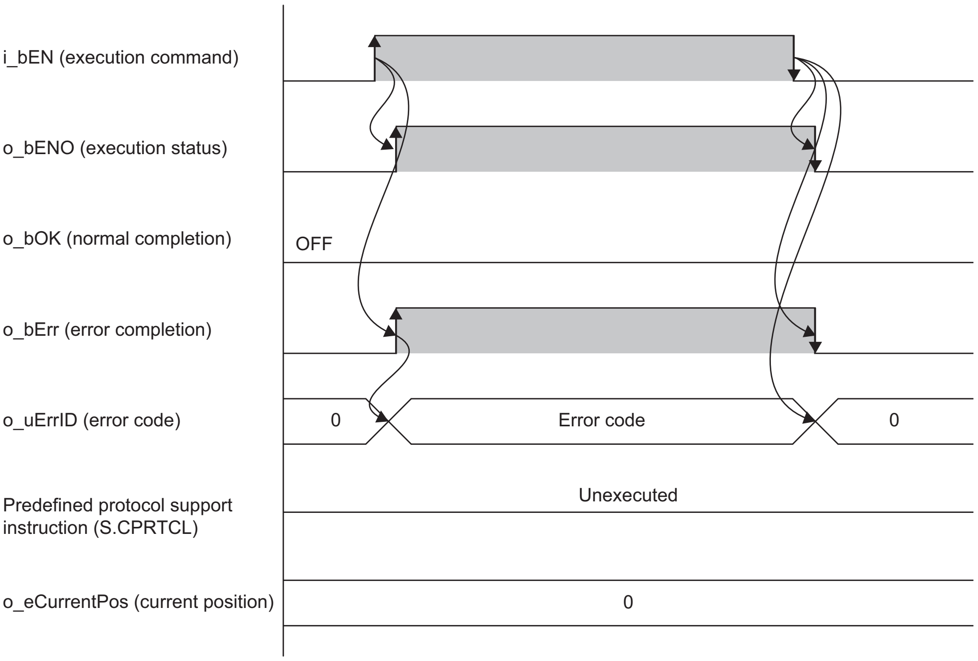

i_bEN (execution command)
o_bENO (execution status)
o_bOK (normal completion)
o_bErr (error completion)
OFF
o_uErrID (error code)
0
Predefined protocol support instruction (S.CPRTCL)
Communicating (1)
Communicating (1)
o_eCurrentPos (current position)
0
(2)
(2)

(1) While the FB is being executed, the predefined protocol support instruction (S.CPRTCL) is executed at any time.

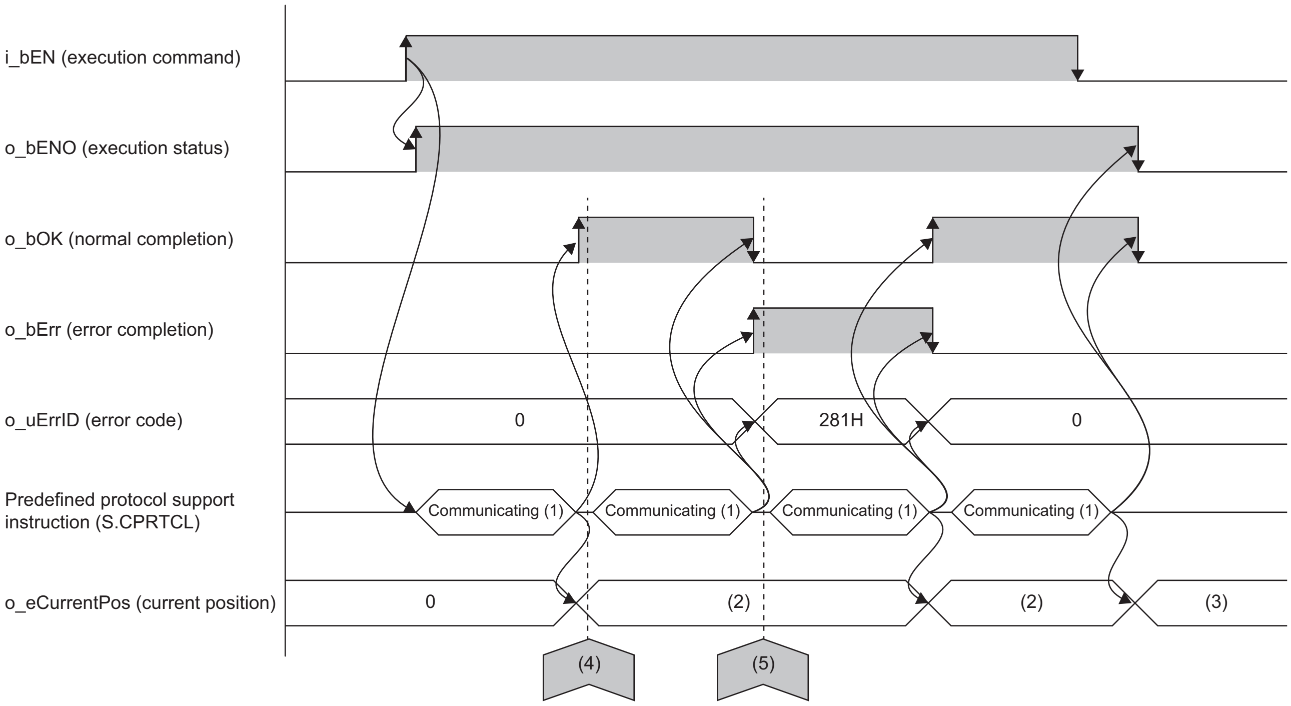
(2) A value obtained from a distance meter

■Error completion

When an error occurs at start of the FB


i_bEN (execution command)
o_bENO (execution status)
o_bOK (normal completion)
OFF
o_bErr (error completion)
o_uErrID (error code)
0
Error code
0
Predefined protocol support instruction (S.CPRTCL)
Unexecuted
o_eCurrentPos (current position)
0

When an error occurs while the FB is operating (when a distance measurement value error occurs due to light blocking)


i_bEN (execution command)
o_bENO (execution status)
o_bOK (normal completion)
o_bErr (error completion)
o_uErrID (error code)
0
281H
0
Predefined protocol support instruction (S.CPRTCL)
Communicating (1)
Communicating (1)
Communicating (1)
Communicating (1)
o_eCurrentPos (current position)
0
(2)
(2)
(3)
(4)
(5)

(1) While the FB is being executed, the predefined protocol support instruction (S.CPRTCL) is executed at any time.
(2) A value obtained from a distance meter
(3) Measurement value
(4) The light from the distance meter is blocked.
(5) A cause of blocking of light from the distance meter is removed.

Precautions

- Use in combination with the protocol setting data "fb-awhfreqrol_SerialComm.rpx" included with the sample program.
- In a configuration using this FB library, if the execution command of this FB is turned off while the inverter is running, the current position cannot be updated, and speed correction cannot be performed normally.
- Set 100 μm (0.1 mm) as the measurement position unit in the distance meter. (☞ Page 21 Parameter Settings)
- Since the number of channels that can be set in the predefined protocol support function (serial communication) is two channels, distance meters for up to two axes can be used.
- This FB uses the predefined protocol support instruction (S.CPRTCL). For details, refer to the following.

📖 MELSEC iQ-F FX5 User's Manual (Serial Communication)

Parameter settings

From GX Works3, set the parameters for serial connection and the predefined protocol support function settings. For the steps to set the parameters, refer to the following.

☞ Page 21 Parameter Settings

Performance values

FX5 CPU module	Measurement condition	Processing time	Maximum scan time	Number of scans
FX5S CPU module	Target distance meter: DL100 Pro (SICK AG)	9.511 ms	1.309 ms	15 scans
FX5UJ CPU module	Target distance meter: DL100 Pro (SICK AG)	8.993 ms	1.507 ms	21 scans
FX5U/FX5UC CPU module[*1][*2]	Target distance meter: DL100 Pro (SICK AG)	7.841 ms	0.978 ms	24 scans

[*1] When the program capacity is set to 128K steps, the processing speed may become slow.

[*2] The standard area is used for labels.

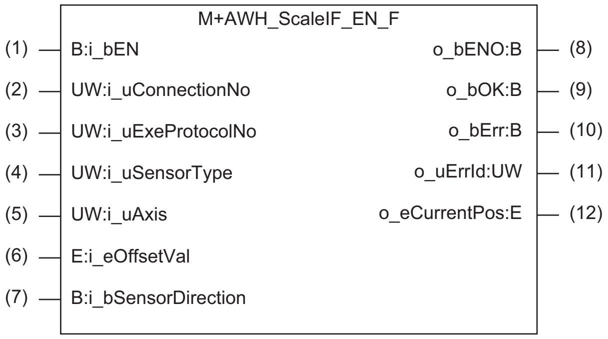
Error code

Error code	Description	Action
180H	The setting value of i_uCh (channel number) is out of range.	Check and correct the setting, then execute the FB again. When an error occurs in the CPU module, check and correct the setting, then clear the error.
181H	The setting value of i_uExeProtocolNo (execution protocol number specification) is out of range.	Check and correct the setting, then execute the FB again.
182H	The setting value of i_uSensorType (distance meter model name) is out of range.	Check and correct the setting, then execute the FB again.
183H	The setting value of i_uAxis (target axis) is out of range.	Check and correct the setting, then execute the FB again.
184H	The protocol setting file for the predefined protocol support function is not registered.	Register the protocol setting file for the used distance meter and then execute the FB again.
280H	An error occurred in the distance meter (serial communication).	Check if the distance meter is working correctly.
281H	A distance measurement value error occurred due to blocking of light from the distance meter (serial communication). The current position is not updated by the distance meter while this error is on.	Remove the cause of light blocking.
Module error code	The error code generated by the module is returned. (Error code during serial communication)	📖 MELSEC iQ-F FX5 User's Manual (Serial Communication)

3.8 M+AWH_ScaleIF_EN_F (Distance Measurement: Ethernet)

Overview

This FB performs Ethernet communication with distance meters and gives feedback about distance measurement values.



Labels

Input labels

No.	Label	Name	Data type	Input reception	Setting range	Description
(1)	i_bEN	Execution command	Bit	Always	On, Off	On: Start FB. Off: Do not start FB.
(2)	i_uConnectionNo	Connection number	Word [unsigned]/ bit string [16 bits]	At start	1 to 8	Specify the connection number. Specify the connection number of the distance meter registered in "External Device Configuration".
(3)	i_uExeProtocolNo	Execution protocol number specification	Word [unsigned]/ bit string [16 bits]	At start	1 to 63	Specify the protocol number used by the predefined protocol support function. Refer to "Model" corresponding to the model name set in i_uSensorType (distance meter model name) and "Protocol Name" corresponding to the number set in i_uAxis (target axis), and specify the protocol number with which "Axis□ SND"[*1] is registered.[*2] For details on the settings, refer to the following. ☞ Page 27 Predefined protocol support function setting
(4)	i_uSensorType	Distance meter model name	Word [unsigned]/ bit string [16 bits]	At start	1, 9	Specify the distance meter to be used. 1: AMS308i (Leuze) 9: Ethernet communication compatible distance meter other than the above
(5)	i_uAxis	Target axis	Word [unsigned]/ bit string [16 bits]	At start	1 to 3	Specify the number of the axis to be used by the distance meter. 1: Travel axis 2: Lift axis 3: Fork axis
(6)	i_eOffsetVal	Distance offset value	Single-precision real number	Always	• -300.000000 to -2^{-126} (-1.175494E-38) • 0.000000 • 2^{-126} (1.175494E-38) to 300.000000	Specify the value [m] to offset the measurement value of the distance meter.
(7)	i_bSensorDirection	Distance measurement value direction	Bit	Always	On, Off	Specify the increase direction of the measurement value of the distance meter. Off: The measurement value increases for positioning in the positive direction. On: The measurement value increases for positioning in the negative direction.

*1 The symbol □ indicates the number of the target axis.

*2 A protocol with a protocol name of "Axis□ RCV" is executed at the same time as the "Axis□ SND" protocol, so there is no need to specify the protocol number.

Output labels

No.	Label	Name	Data type	Default value	Description
(8)	o_bENO	Execution status	Bit	Off	On: The execution command is on. Off: The execution command is off.
(9)	o_bOK	Normal completion	Bit	Off	The on state indicates that the distance measurement value was fed back normally.
(10)	o_bErr	Error completion	Bit	Off	The on state indicates that an error has occurred in the FB.
(11)	o_uErrId	Error code	Word [unsigned]/ bit string [16 bits]	0	Stores the error code of an error that occurred in the FB.
(12)	o_eCurrentPos	Current position	Single-precision real number	0.000000	Stores the current position [m] measured by the distance meter for each control cycle. (The value is held when the FB is stopped.)

Global labels

Refer to the following.

☞ Page 17 List of Global Labels

Function details

Applicable hardware and software

■FB for control of the inverter for automated warehouse

Module	Firmware version	Engineering tool
FX5S CPU module	1.000 or later	GX Works3 Version 1.086Q or later
FX5UJ CPU module	1.030 or later	GX Works3 Version 1.086Q or later
FX5U CPU module	1.270 or later	GX Works3 Version 1.086Q or later
FX5UC CPU module	1.270 or later	GX Works3 Version 1.086Q or later

■Distance meter

Model name	Manufacturer	Distance measurement method	Communication method	Software version	Hardware version
AMS308i	Leuze electronic	Laser	Ethernet communication	v1.0.20	1

Basic specifications

Item	Description
Language to use	Structured text language
Number of steps	Target value: 1254 steps The number of steps of the FB embedded in a program depends on the CPU module used, the input/output definitions, and the option setting of GX Works3. For the option setting of GX Works3, refer to the following. 📖 GX Works3 Operating Manual
Points of labels used	• Label: 0.04K points (Word) • Latch Label: 0K points (Word) The points of labels embedded in a program depend on the CPU module used, the devices specified for arguments, and the option setting of GX Works3. For the option setting of GX Works3, refer to the following. 📖 GX Works3 Operating Manual
Points of index register used	• Index register: 0 points • Long index register: 0 points
Points of file register used	File register: 9 points (Word) (R32700 to R32708)
FB dependency	No dependency
FB compilation method	Subroutine type
FB operation	Always executed

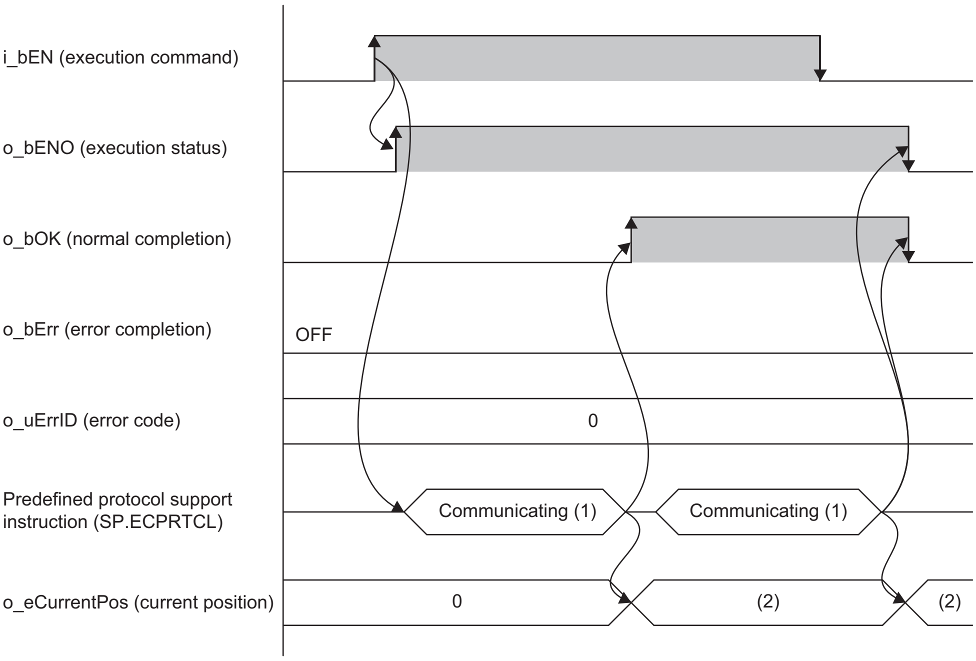
Function description

- Turning on i_bEN (execution command) causes the predefined protocol support instruction (SP.ECPRTCL) to execute the protocol registered with the predefined protocol support function of GX Works3. After execution of the protocol specified by i_uExeProtocolNo (execution protocol number specification), o_bOK (normal completion) turns on.
- The execution of the protocol enables UDP-based communication with a distance meter that supports Ethernet connection to feed back the current position.
- When i_bEN (execution command) is off, the output value of o_eCurrentPos (current position) is held, and the output other than o_eCurrentPos (current position) becomes off or 0. However, during communication by the predefined protocol support instruction (SP.ECPRTCL), the operation continues until the communication is completed.
- If i_uConnectionNo (connection No.) is out of range while i_bEN (execution command) is rising, o_bErr (error completion) turns on and processing of the FB does not start. In addition, the error code 190H is stored in o_uErrId (error code). (☞ Page 82 Error code)
- If i_uExeProtocolNo (execution protocol number specification) is out of range while i_bEN (execution command) is rising, o_bErr (error completion) turns on and processing of the FB does not start. In addition, the error code 181H is stored in o_uErrId (error code). (☞ Page 82 Error code)
- If i_uSensorType (distance meter model name) is out of range while i_bEN (execution command) is rising, o_bErr (error completion) turns on and processing of the FB does not start. In addition, the error code 182H is stored in o_uErrId (error code). (☞ Page 82 Error code)
- If i_uAxis (target axis) is out of range while i_bEN (execution command) is rising, o_bErr (error completion) turns on and processing of the FB does not start. In addition, the error code 183H is stored in o_uErrId (error code). (☞ Page 82 Error code)
- This FB uses SD10692 to check whether the predefined protocol is prepared normally. If the check result is abnormal, o_bErr (error completion) turns on and processing of the FB does not start. In addition, the error code 184H is stored in o_uErrId (error code). (☞ Page 82 Error code)
- If an error occurs in the distance meter (Ethernet communication), o_bErr (error completion) turns on. (The FB will continue to operate.) In addition, the error code 290H is stored in o_uErrId (error code). (☞ Page 82 Error code)
- If a distance measurement value error occurs due to blocking of light from the distance meter (Ethernet communication), o_bErr (error completion) turns on. (The FB will continue to operate.) In addition, the error code 291H is stored in o_uErrId (error code). (☞ Page 82 Error code)
- If an error occurs during the predefined protocol's send/receive operation, o_bErr (error completion) turns on. (The FB will continue to operate.) In addition, an error code is stored in o_uErrId (error code). For error code details, refer to the following.

📖 MELSEC iQ-F FX5 User's Manual (Ethernet Communication)

Timing chart of I/O signals

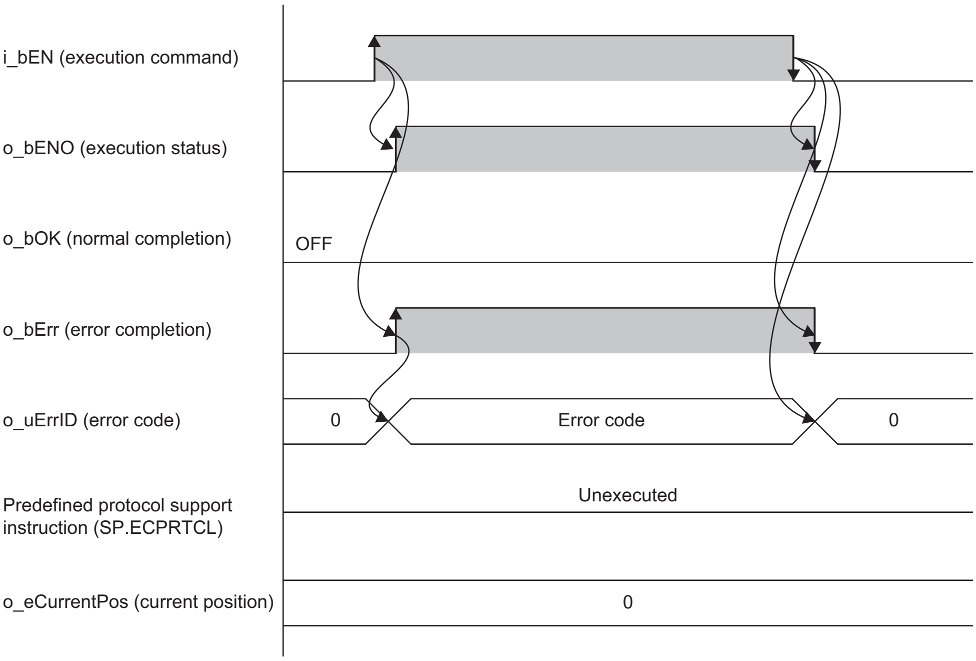
■Completed successfully


i_bEN (execution command)
o_bENO (execution status)
o_bOK (normal completion)
o_bErr (error completion)
OFF
o_uErrID (error code)
0
Predefined protocol support instruction (SP.ECPRTCL)
Communicating (1)
Communicating (1)
o_eCurrentPos (current position)
0
(2)
(2)

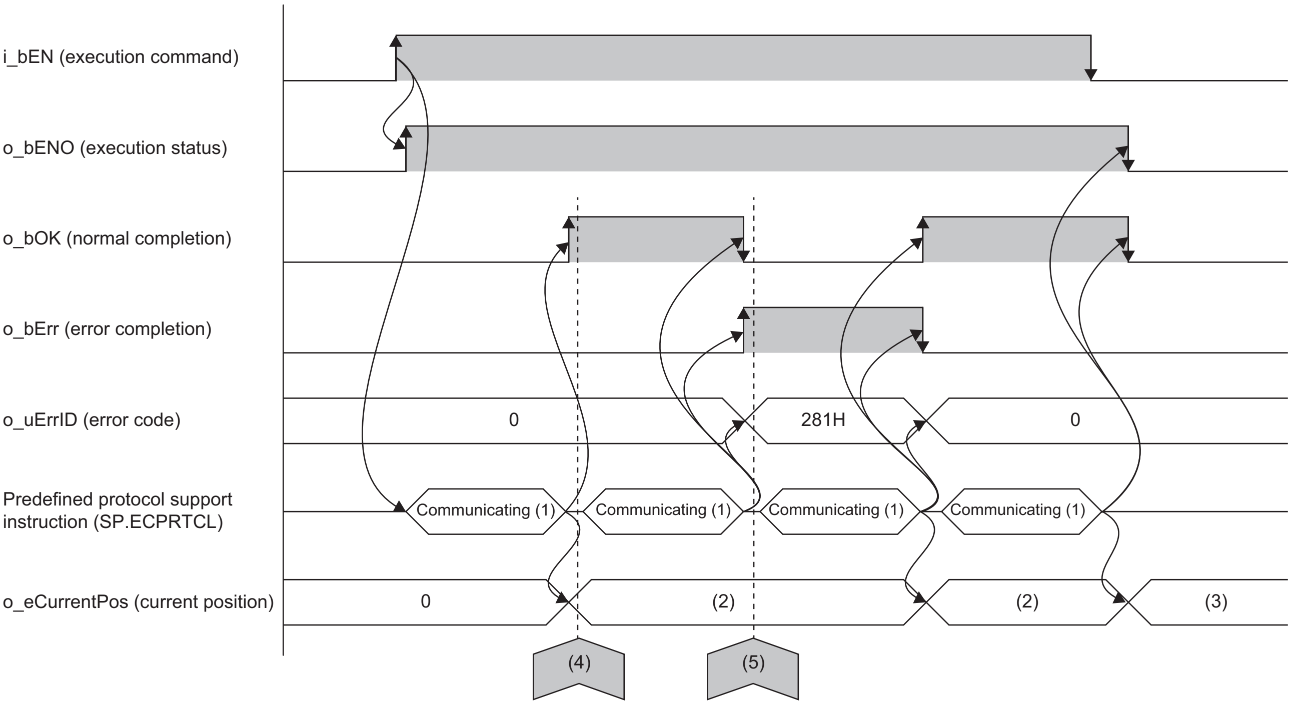
(1) While the FB is being executed, the predefined protocol support instruction (SP.ECPRTCL) is executed at any time.
(2) A value obtained from a distance meter

■Error completion

When an error occurs at start of the FB


i_bEN (execution command)
o_bENO (execution status)
o_bOK (normal completion)
OFF
o_bErr (error completion)
o_uErrID (error code)
0
Error code
0
Predefined protocol support instruction (SP.ECPRTCL)
Unexecuted
o_eCurrentPos (current position)
0

When an error occurs while the FB is operating (when a distance measurement value error occurs due to light blocking)


i_bEN (execution command)
o_bENO (execution status)
o_bOK (normal completion)
o_bErr (error completion)
o_uErrID (error code)
0
281H
0
Predefined protocol support instruction (SP.ECPRTCL)
Communicating (1)
Communicating (1)
Communicating (1)
Communicating (1)
o_eCurrentPos (current position)
0
(2)
(2)
(3)
(4)
(5)

(1) While the FB is being executed, the predefined protocol support instruction (SP.ECPRTCL) is executed at any time.
(2) A value obtained from a distance meter
(3) Measurement value
(4) The light from the distance meter is blocked.
(5) A cause of blocking of light from the distance meter is removed.

Precautions

- Use in combination with the protocol setting data "fb-awhfreqrol_EN.tpx" included with the sample program.
- In a configuration using this FB library, if the execution command of this FB is turned off while the inverter is running, the current position cannot be updated, and speed correction cannot be performed normally.
- Set 100 μm (0.1 mm) as the measurement position unit in the distance meter. (☞ Page 21 Parameter Settings)
- This FB uses the predefined protocol support instruction (SP.ECPRTCL). For details, refer to the following.

📖 MELSEC iQ-F FX5 User's Manual (Ethernet Communication)

Parameter settings

From GX Works3, set the parameters for the settings of Ethernet connection configuration with external devices and the predefined protocol support function. For the steps to set the parameters, refer to the following.

☞ Page 21 Parameter Settings

Performance values

FX5 CPU module	Measurement condition	Processing time	Maximum scan time	Number of scans
FX5S CPU module	Target distance meter: AMS308i (Leuze)	16.321 ms	1.167 ms	19 scans
FX5UJ CPU module	Target distance meter: AMS308i (Leuze)	17.718 ms	0.753 ms	24 scans
FX5U/FX5UC CPU module[*1][*2]	Target distance meter: AMS308i (Leuze)	18.167 ms	0.544 ms	28 scans

[*1] When the program capacity is set to 128K steps, the processing speed may become slow.

[*2] The standard area is used for labels.

Error code

Error code	Description	Action
181H	The setting value of i_uExeProtocolNo (execution protocol number specification) is out of range.	Check and correct the setting, then execute the FB again.
182H	The setting value of i_uSensorType (distance meter model name) is out of range.	Check and correct the setting, then execute the FB again.
183H	The setting value of i_uAxis (target axis) is out of range.	Check and correct the setting, then execute the FB again.
184H	The protocol setting file for the predefined protocol support function is not registered.	Register the protocol setting file for the used distance meter and then execute the FB again.
190H	The setting value of i_uConnectionNo (connection No.) is out of range.	Check and correct the setting, then execute the FB again.
290H	An error occurred in the distance meter (Ethernet communication).	Check if the distance meter is working correctly.
291H	A distance measurement value error occurred due to blocking of light from the distance meter (Ethernet communication). The current position is not updated by the distance meter while this error is on.	Remove the cause of light blocking.
Module error code	The error code generated by the module is returned. (Error code during Ethernet communication)	📖 MELSEC iQ-F FX5 User's Manual (Ethernet Communication)

3.9 M+AWH_DecDistance_F (Deceleration Distance Calculation)

Overview

This FB calculates a required distance for deceleration stop during positioning control.

Function details

Basic specifications

Item	Description
FB compilation method	Subroutine type
FB operation	Always executed

Function description

This FB is called from M+AWH_PosVelGen_F (positioning operation command generation) and calculates a required distance for deceleration stop during positioning control.

Precautions

Do not use this FB in user-created programs because it is used in other FBs.

4 OPERATION EXAMPLES

4.1 Positioning Operation with Distance Meters (Serial Communication)

The following describes the usage procedure to perform the following operations: communicate with distance meters capable of serial communication; give feedback about current position information; execute the positioning operation for the two axes (travel axis and lift axis) of the stacker crane.

In this operation, the following FBs are used.

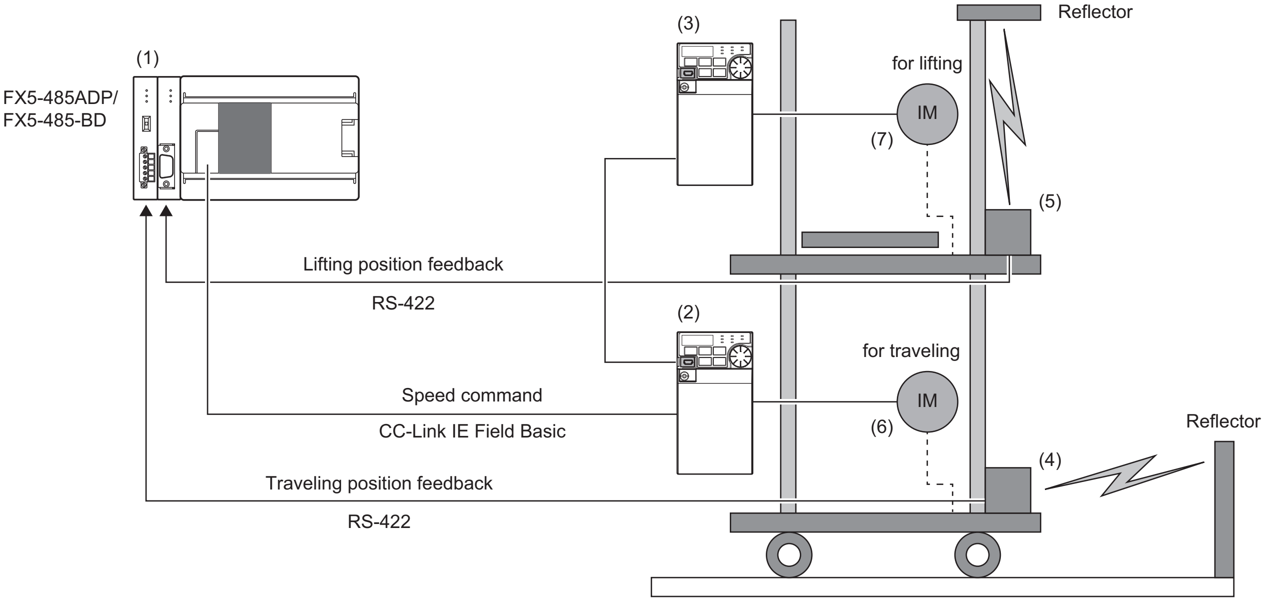
- M+AWH_PosVelGen_F (positioning operation command generation)
- M+AWH_PIDControl_F (PID control)
- M+AWH_VelConv_F (frequency conversion)
- M+AWH_AntiSwayControl_F (anti-sway control)
- M+AWH_FREQROL_CCLinkIEFBasic_F (inverter communication)
- M+AWH_ScaleIF_SerialComm_F (distance measurement: serial)
- M+AWH_DecDistance_F (deceleration distance calculation)

Overview

This operation enables communication with two inverters and performs positioning control for the travel axis (axis 1) and lift axis (axis 2) of the stacker crane.

Input the following positioning control settings in the global labels for the sample program. Then, operate the global labels for executing each FB to move the stacker crane to the target position.

System configuration


(1)
FX5-485ADP/
FX5-485-BD
(3)
Reflector
for lifting
IM
(7)
(5)
Lifting position feedback
RS-422
(2)
for traveling
IM
Speed command
CC-Link IE Field Basic
(6)
Reflector
(4)
Traveling position feedback
RS-422

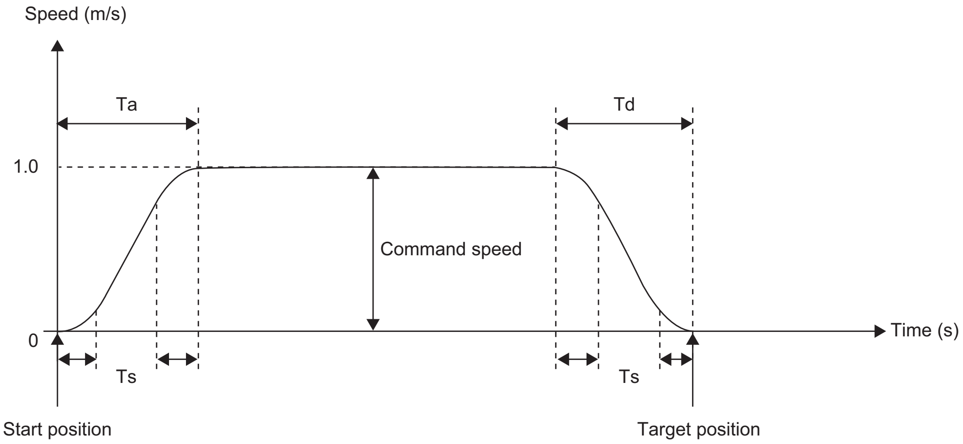
No.	Device	Description	Station No.
(1)	FX5U CPU module	Programmable controller	Master station
(2)	FR-E800 + FR-A8AP E kit (axis 1 (travel axis))	Inverter for travel axis control (with Vector control compatible option)	1
(3)	FR-E800 + FR-A8AP E kit (axis 2 (lift axis))	Inverter for lift axis control (with Vector control compatible option)	2
(4)	DL100 Pro (axis 1 (travel axis))	Distance meter for positioning for travel axis (serial communication)	—
(5)	DL100 Pro (axis 2 (lift axis))	Distance meter for positioning for lift axis (serial communication)	—
(6)	Motor (axis 1 (travel axis)) + PLG	Motor for driving stacker crane's travel axis and PLG	—
(7)	Motor (axis 2 (lift axis)) + PLG	Motor for driving stacker crane's lift axis and PLG	—

Positioning control setting example

Item	Setting value	
	Travel axis (axis 1)	**Lift axis (axis 2)**
Target position	100.0 [m]	30.0 [m]
Command speed	1.0 [m/s]	0.5 [m/s]
Acceleration/deceleration reference speed	1.0 [m/s]	0.5 [m/s]
S-curve time	0.5 [s]	0.5 [s]
Acceleration/Deceleration time	1.0 [s]	1.0 [s]
Acceleration/Deceleration rate	1.0 [m/s^2]	1.0 [m/s^2]

Positioning operation details

As shown in the following figure, move the stacker crane from the operation start position to the target position set in the global label.



The acceleration rate and deceleration rate and the acceleration jerk and deceleration jerk can be calculated from the acceleration/deceleration reference speed, the acceleration time and deceleration time, and the S-curve time.

Item	Abbreviation	Description	Calculation formula
Acceleration/deceleration reference speed	V	Command speed [m/s] that is the basis of the acceleration/deceleration section	—
Acceleration time[*1]	Ta	Period of time [s] for which acceleration is enabled	—
Deceleration time[*1]	Td	Period of time [s] for which deceleration is enabled	—
S-curve time[*2]	Ts	Period of time [s] for which S-curve acceleration/deceleration is enabled	—
Acceleration rate	A	—	V ÷ Ta
Deceleration rate	D	—	V ÷ Td
Acceleration jerk	Ja	—	A ÷ Ts
Deceleration jerk	Jd	—	D ÷ Ts

[*1] The acceleration/deceleration time in the actual equipment may be different.

[*2] Set the S-curve time value to be shorter than the acceleration time value.

Process flow

The following describes a process flow from the wiring and parameter settings of the FX5 CPU module, inverters, and distance meters to the use of the FB library for control of inverters for automated warehouse.

1. FB library registration

Register the FB library. For the operating procedure, refer to the following.
📖 GX Works3 Operating Manual

2. Wiring

For the wiring method, refer to the manual of each distance meter.

3. CPU module setting

- Use GX Works3 to set CC-Link IEF Basic and the global labels. (☞ Page 21 Parameter Settings)
- Use GX Works3 to set predefined protocols to establish communication with distance meters. (☞ Page 27 Predefined protocol support function setting)

4. Inverter setting

Use FR Configurator2 to set the inverters. (☞ Page 29 Inverter parameter setting)

5. Distance meter setting

Set distance meters according to the CPU module setting. (☞ Page 31 Distance meter setting)

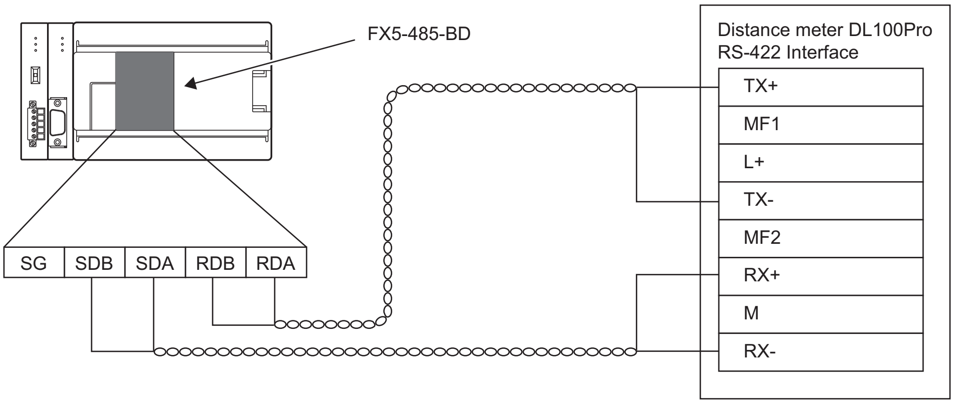
6. Programming

Create programs. (☞ Page 88 Programming)

Wiring

The following figure shows an example of wiring between the distance meter DL100 Pro and the MELSEC iQ-F series FX5-485-BD.

For details on wiring, refer to the manual of each distance meter.



Programming

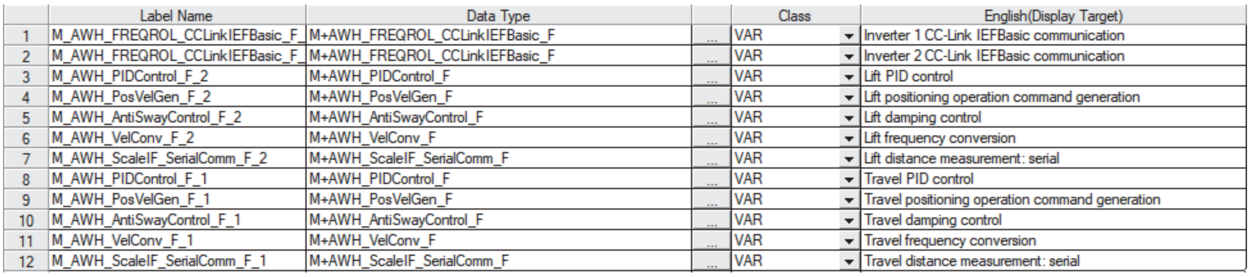
This section describes programs used in the application example.

In these programs, only the circuits required to operate each function are described, and such a circuit as an interlock for safety is not included. Add such a circuit as an interlock according to your device.

Data name in sample programs	Execution type	Description
awhfreqrol_sample1_main	Scan	Executes the positioning control main processing.
awhfreqrol_sample2_main	Scan	This item is not used in this example. Delete the item.
awhfreqrol_sample_initial	Initial	Sets initial values in labels that require input for positioning control.

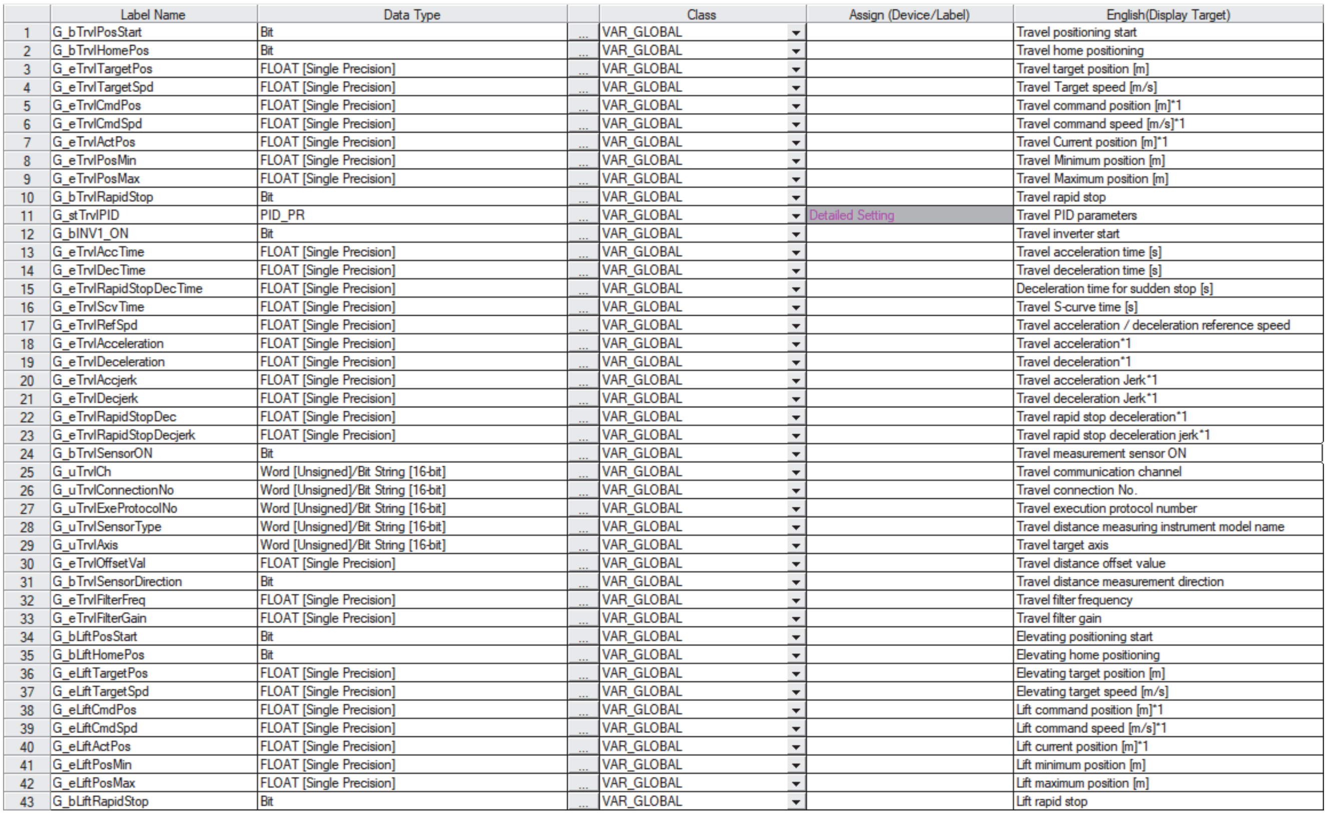
Label list

■Local labels

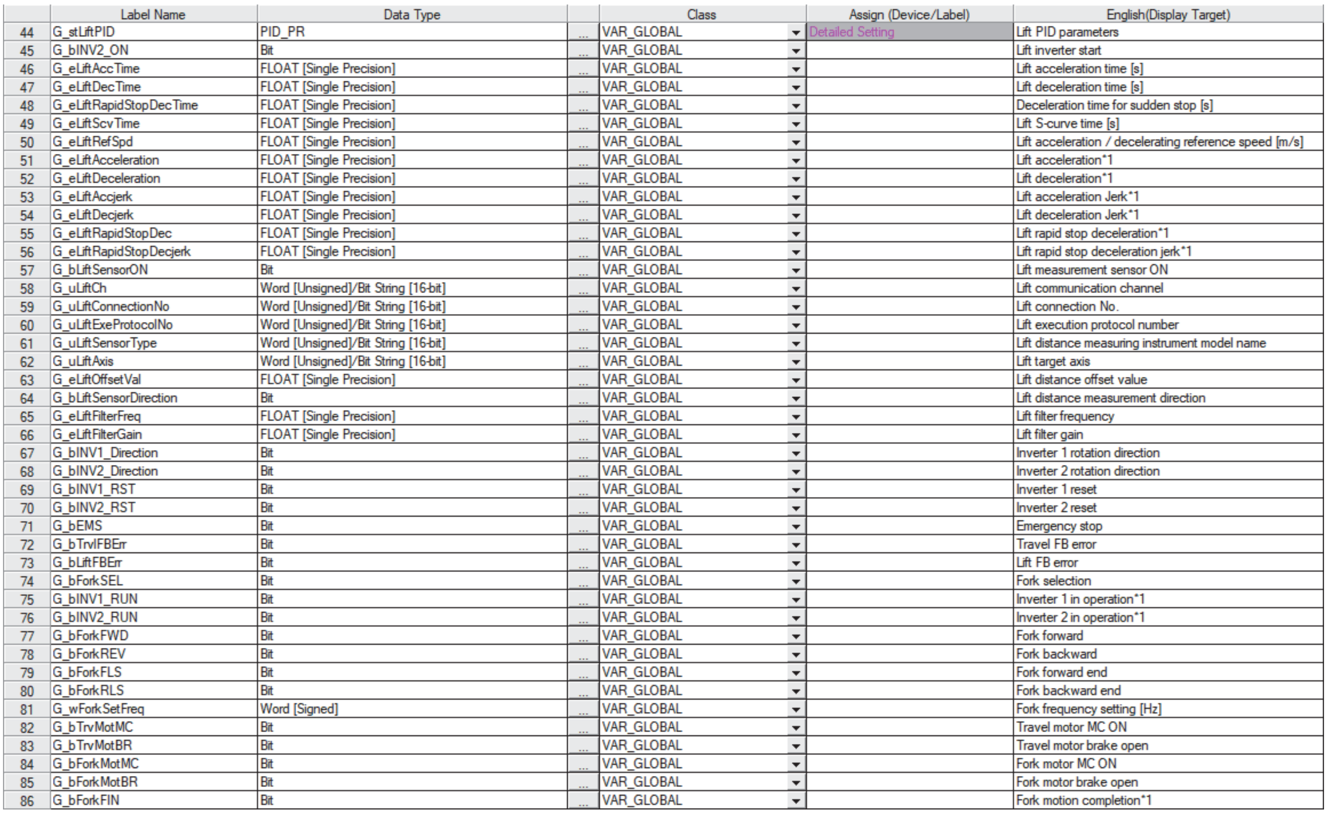


	Label Name	Data Type		Class	English(Display Target)
1	M_AWH_FREQROL_CCLinkIEFBasic_F_	M+AWH_FREQROL_CCLinkIEFBasic_F	...	VAR	Inverter 1 CC-Link IEFBasic communication
2	M_AWH_FREQROL_CCLinkIEFBasic_F_	M+AWH_FREQROL_CCLinkIEFBasic_F	...	VAR	Inverter 2 CC-Link IEFBasic communication
3	M_AWH_PIDControl_F_2	M+AWH_PIDControl_F	...	VAR	Lift PID control
4	M_AWH_PosVelGen_F_2	M+AWH_PosVelGen_F	...	VAR	Lift positioning operation command generation
5	M_AWH_AntiSwayControl_F_2	M+AWH_AntiSwayControl_F	...	VAR	Lift damping control
6	M_AWH_VelConv_F_2	M+AWH_VelConv_F	...	VAR	Lift frequency conversion
7	M_AWH_ScaleIF_SerialComm_F_2	M+AWH_ScaleIF_SerialComm_F	...	VAR	Lift distance measurement: serial
8	M_AWH_PIDControl_F_1	M+AWH_PIDControl_F	...	VAR	Travel PID control
9	M_AWH_PosVelGen_F_1	M+AWH_PosVelGen_F	...	VAR	Travel positioning operation command generation
10	M_AWH_AntiSwayControl_F_1	M+AWH_AntiSwayControl_F	...	VAR	Travel damping control
11	M_AWH_VelConv_F_1	M+AWH_VelConv_F	...	VAR	Travel frequency conversion
12	M_AWH_ScaleIF_SerialComm_F_1	M+AWH_ScaleIF_SerialComm_F	...	VAR	Travel distance measurement: serial

■Global labels



	Label Name	Data Type		Class	Assign (Device/Label)	English(Display Target)
1	G_bTrvlPosStart	Bit	...	VAR_GLOBAL		Travel positioning start
2	G_bTrvlHomePos	Bit	...	VAR_GLOBAL		Travel home positioning
3	G_eTrvlTargetPos	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel target position [m]
4	G_eTrvlTargetSpd	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel Target speed [m/s]
5	G_eTrvlCmdPos	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel command position [m]*1
6	G_eTrvlCmdSpd	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel command speed [m/s]*1
7	G_eTrvlActPos	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel Current position [m]*1
8	G_eTrvlPosMin	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel Minimum position [m]
9	G_eTrvlPosMax	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel Maximum position [m]
10	G_bTrvlRapidStop	Bit	...	VAR_GLOBAL		Travel rapid stop
11	G_stTrvlPID	PID_PR	...	VAR_GLOBAL	Detailed Setting	Travel PID parameters
12	G_bINV1_ON	Bit	...	VAR_GLOBAL		Travel inverter start
13	G_eTrvlAccTime	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel acceleration time [s]
14	G_eTrvlDecTime	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel deceleration time [s]
15	G_eTrvlRapidStopDecTime	FLOAT [Single Precision]	...	VAR_GLOBAL		Deceleration time for sudden stop [s]
16	G_eTrvlScvTime	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel S-curve time [s]
17	G_eTrvlRefSpd	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel acceleration / deceleration reference speed
18	G_eTrvlAcceleration	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel acceleration*1
19	G_eTrvlDeceleration	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel deceleration*1
20	G_eTrvlAccjerk	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel acceleration Jerk*1
21	G_eTrvlDecjerk	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel deceleration Jerk*1
22	G_eTrvlRapidStopDec	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel rapid stop deceleration*1
23	G_eTrvlRapidStopDecjerk	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel rapid stop deceleration jerk*1
24	G_bTrvlSensorON	Bit	...	VAR_GLOBAL		Travel measurement sensor ON
25	G_uTrvlCh	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL		Travel communication channel
26	G_uTrvlConnectionNo	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL		Travel connection No.
27	G_uTrvlExeProtocolNo	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL		Travel execution protocol number
28	G_uTrvlSensorType	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL		Travel distance measuring instrument model name
29	G_uTrvlAxis	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL		Travel target axis
30	G_eTrvlOffsetVal	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel distance offset value
31	G_bTrvlSensorDirection	Bit	...	VAR_GLOBAL		Travel distance measurement direction
32	G_eTrvlFilterFreq	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel filter frequency
33	G_eTrvlFilterGain	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel filter gain
34	G_bLiftPosStart	Bit	...	VAR_GLOBAL		Elevating positioning start
35	G_bLiftHomePos	Bit	...	VAR_GLOBAL		Elevating home positioning
36	G_eLiftTargetPos	FLOAT [Single Precision]	...	VAR_GLOBAL		Elevating target position [m]
37	G_eLiftTargetSpd	FLOAT [Single Precision]	...	VAR_GLOBAL		Elevating target speed [m/s]
38	G_eLiftCmdPos	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift command position [m]*1
39	G_eLiftCmdSpd	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift command speed [m/s]*1
40	G_eLiftActPos	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift current position [m]*1
41	G_eLiftPosMin	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift minimum position [m]
42	G_eLiftPosMax	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift maximum position [m]
43	G_bLiftRapidStop	Bit	...	VAR_GLOBAL		Lift rapid stop



	Label Name	Data Type		Class	Assign (Device/Label)	English(Display Target)
44	G_stLiftPID	PID_PR	...	VAR_GLOBAL	Detailed Setting	Lift PID parameters
45	G_bINV2_ON	Bit	...	VAR_GLOBAL		Lift inverter start
46	G_eLiftAccTime	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift acceleration time [s]
47	G_eLiftDecTime	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift deceleration time [s]
48	G_eLiftRapidStopDecTime	FLOAT [Single Precision]	...	VAR_GLOBAL		Deceleration time for sudden stop [s]
49	G_eLiftScvTime	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift S-curve time [s]
50	G_eLiftRefSpd	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift acceleration / decelerating reference speed [m/s]
51	G_eLiftAcceleration	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift acceleration*1
52	G_eLiftDeceleration	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift deceleration*1
53	G_eLiftAccjerk	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift acceleration Jerk*1
54	G_eLiftDecjerk	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift deceleration Jerk*1
55	G_eLiftRapidStopDec	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift rapid stop deceleration*1
56	G_eLiftRapidStopDecjerk	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift rapid stop deceleration jerk*1
57	G_bLiftSensorON	Bit	...	VAR_GLOBAL		Lift measurement sensor ON
58	G_uLiftCh	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL		Lift communication channel
59	G_uLiftConnectionNo	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL		Lift connection No.
60	G_uLiftExeProtocolNo	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL		Lift execution protocol number
61	G_uLiftSensorType	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL		Lift distance measuring instrument model name
62	G_uLiftAxis	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL		Lift target axis
63	G_eLiftOffsetVal	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift distance offset value
64	G_bLiftSensorDirection	Bit	...	VAR_GLOBAL		Lift distance measurement direction
65	G_eLiftFilterFreq	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift filter frequency
66	G_eLiftFilterGain	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift filter gain
67	G_bINV1_Direction	Bit	...	VAR_GLOBAL		Inverter 1 rotation direction
68	G_bINV2_Direction	Bit	...	VAR_GLOBAL		Inverter 2 rotation direction
69	G_bINV1_RST	Bit	...	VAR_GLOBAL		Inverter 1 reset
70	G_bINV2_RST	Bit	...	VAR_GLOBAL		Inverter 2 reset
71	G_bEMS	Bit	...	VAR_GLOBAL		Emergency stop
72	G_bTrvlFBErr	Bit	...	VAR_GLOBAL		Travel FB error
73	G_bLiftFBErr	Bit	...	VAR_GLOBAL		Lift FB error
74	G_bForkSEL	Bit	...	VAR_GLOBAL		Fork selection
75	G_bINV1_RUN	Bit	...	VAR_GLOBAL		Inverter 1 in operation*1
76	G_bINV2_RUN	Bit	...	VAR_GLOBAL		Inverter 2 in operation*1
77	G_bForkFWD	Bit	...	VAR_GLOBAL		Fork forward
78	G_bForkREV	Bit	...	VAR_GLOBAL		Fork backward
79	G_bForkFLS	Bit	...	VAR_GLOBAL		Fork forward end
80	G_bForkRLS	Bit	...	VAR_GLOBAL		Fork backward end
81	G_wForkSetFreq	Word [Signed]	...	VAR_GLOBAL		Fork frequency setting [Hz]
82	G_bTrvMotMC	Bit	...	VAR_GLOBAL		Travel motor MC ON
83	G_bTrvMotBR	Bit	...	VAR_GLOBAL		Travel motor brake open
84	G_bForkMotMC	Bit	...	VAR_GLOBAL		Fork motor MC ON
85	G_bForkMotBR	Bit	...	VAR_GLOBAL		Fork motor brake open
86	G_bForkFIN	Bit	...	VAR_GLOBAL		Fork motion completion*1

[1] This is a global label used for calculations in the sample programs. Do not change it.

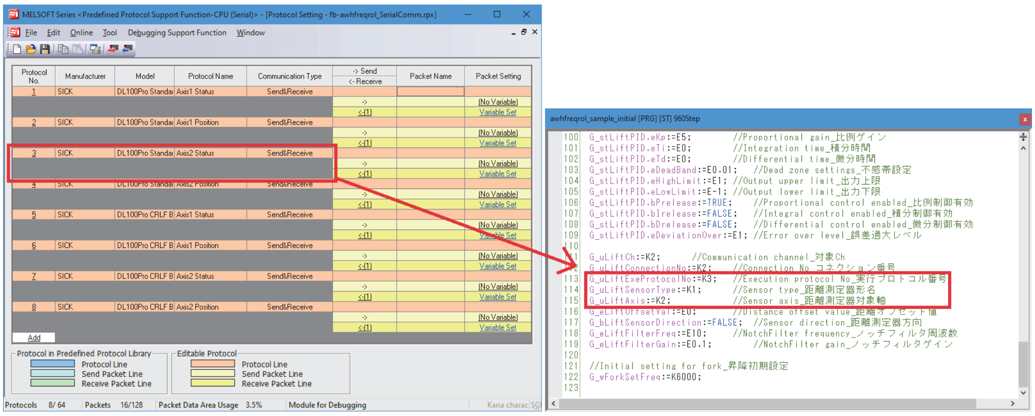
Predefined protocol setting

Use the predefined protocol support function to enable serial communication with distance meters.

Ex.

Enabling serial communication with the distance meter (DL100 Pro, Standard Binary code) on the lift axis

In the initial execution program "awhfreqrol_sample_initial", set "G_uLiftAxis = 2 (lift axis)" and "G_uLiftExeProtocolNo = 3 (specify Axis2 Position)".


MELSOFT Series <Predefined Protocol Support Function-CPU (Serial)> - [Protocol Setting - fb-awhfreqrol_SerialComm.rpx]
File
Edit
Online
Tool
Debugging Support Function
Window
Add
Protocol in Predefined Protocol Library
Protocol Line
Send Packet Line
Receive Packet Line
Editable Protocol
Protocol Line
Send Packet Line
Receive Packet Line
awhfreqrol_sample_initial [PRG] [ST] 960Step

Protocol No.	Manufacturer	Model	Protocol Name	Communication Type	-> Send <- Receive	Packet Name	Packet Setting
1	SICK	DL100Pro Standa	Axis1 Status	Send&Receive			
					->		(No Variable)
					<-(1)		Variable Set
2	SICK	DL100Pro Standa	Axis1 Position	Send&Receive			
					->		(No Variable)
					<-(1)		Variable Set
3	SICK	DL100Pro Standa	Axis2 Status	Send&Receive			
					->		(No Variable)
					<-(1)		Variable Set
4	SICK	DL100Pro Standa	Axis2 Position	Send&Receive			
					->		(No Variable)
					<-(1)		Variable Set
5	SICK	DL100Pro CRLF B	Axis1 Status	Send&Receive			
					->		(No Variable)
					<-(1)		Variable Set
6	SICK	DL100Pro CRLF B	Axis1 Position	Send&Receive			
					->		(No Variable)
					<-(1)		Variable Set
7	SICK	DL100Pro CRLF B	Axis2 Status	Send&Receive			
					->		(No Variable)
					<-(1)		Variable Set
8	SICK	DL100Pro CRLF B	Axis2 Position	Send&Receive			
					->		(No Variable)
					<-(1)		Variable Set

Protocols 8/ 64 Packets 16/128 Packet Data Area Usage 3.5% Module for Debugging Kana charac SG

```
G_stLiftPID.eKp:=E5;        //Proportional gain_比例ゲイン
G_stLiftPID.eTi:=E0;        //Integration time_積分時間
G_stLiftPID.eTd:=E0;        //Differential time_微分時間
G_stLiftPID.eDeadBand:=E0.01;   //Dead zone settings_不感帯設定
G_stLiftPID.eHighLimit:=E1; //Output upper limit_出力上限
G_stLiftPID.eLowLimit:=E-1; //Output lower limit_出力下限
G_stLiftPID.bPrelease:=TRUE;    //Proportional control enabled_比例制御有効
G_stLiftPID.bIrelease:=FALSE;   //Integral control enabled_積分制御有効
G_stLiftPID.bDrelease:=FALSE;   //Differential control enabled_微分制御有効
G_stLiftPID.eDeviationOver:=E1; //Error over level_誤差過大レベル

G_uLiftCh:=K2;      //Communication channel_対象Ch
G_uLiftConnectionNo:=K2;    //Connection No_コネクション番号
G_uLiftExeProtocolNo:=K3;   //Execution protocol No_実行プロトコル番号
G_uLiftSensorType:=K1;      //Sensor type_距離測定器形名
G_uLiftAxis:=K2;            //Sensor axis_距離測定器対象軸
G_eLiftOffsetVal:=E0;       //Distance offset value_距離オフセット値
G_bLiftSensorDirection:=FALSE;  //Sensor direction_距離測定器方向
G_eLiftFilterFreq:=E10;     //NotchFilter frequency_ノッチフィルタ周波数
G_eLiftFilterGain:=E0.1;        //NotchFilter gain_ノッチフィルタゲイン

//Initial setting for fork_昇降初期設定
G_wForkSetFreq:=K6000;

```

Program example

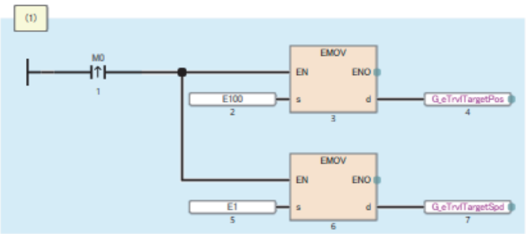
■Positioning target value input and control program

This program manipulates input bits to execute the following operations:

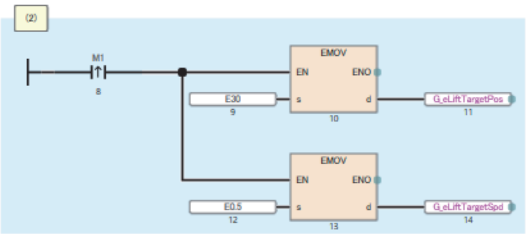
- Input the target positions and target speeds for positioning the travel axis (axis 1) and lift axis (axis 2).
- Input execution commands to FBs.
- Initialize input bits and target positions.

Input bit	Corresponding operation	Operation description
M0	(1): Target value input (travel axis)	Inputs the target position (100 [m]) and target speed (1.0 [m/s]) for positioning the travel axis.
M1	(2): Target value input (lift axis)	Inputs the target position (30 [m]) and target speed (0.5 [m/s]) for positioning the lift axis.
M10	(3): Start of the inverter control and distance measurement	Starts the current position feedback from the distance meter. Execution commands are input to the following FBs: • M_AWH_ScaleIF_SerialComm_F_1 (travel distance measurement: serial) • M_AWH_ScaleIF_SerialComm_F_2 (lift distance measurement: serial)
M11		Starts the command output to the inverters. Execution commands are input to the following FBs: • M_AWH_VelConv_F_1 (travel frequency conversion) • M_AWH_FREQROL_CCLinkIEFBasic_F_1 (CC-Link IE Field Network Basic communication with inverter 1) • M_AWH_VelConv_F_2 (lift frequency conversion) • M_AWH_FREQROL_CCLinkIEFBasic_F_2 (CC-Link IE Field Network Basic communication with inverter 2)
M12	(4): Start of positioning (6): Initialization after execution	Generates positioning operation commands in the order of the travel axis and lift axis and executes the positioning. Execution commands are input to the following FBs: • M_AWH_PosVelGen_F_1 (travel axis positioning operation command generation) • M_AWH_PosVelGen_F_2 (lift axis positioning operation command generation) After completion of the positioning, initializes the input bits and target positions.
M13	(5): Start of positioning (for homing) (6): Initialization after execution	Generates positioning operation commands in the order of the lift axis and travel axis and executes the positioning (for homing). Execution commands are input to the following FBs: • M_AWH_PosVelGen_F_1 (travel axis positioning operation command generation) • M_AWH_PosVelGen_F_2 (lift axis positioning operation command generation) After completion of the positioning, initializes the input bits and target positions.

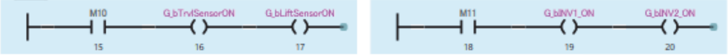
(1)


M0
1
EMOV
EN
ENO
E100
2
s
d
3
G_eTrvlTargetPos
4
EMOV
EN
ENO
E1
5
s
d
6
G_eTrvlTargetSpd
7

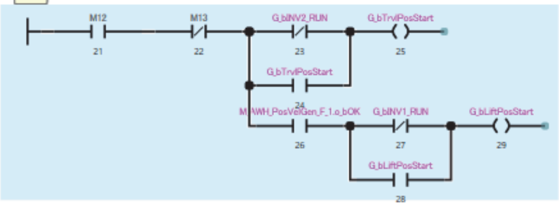
(2)


M1
8
EMOV
EN
ENO
E30
9
s
d
10
G_eLiftTargetPos
11
EMOV
EN
ENO
E0.5
12
s
d
13
G_eLiftTargetSpd
14

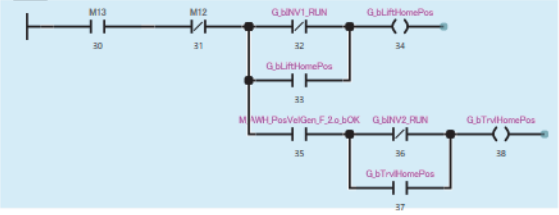
(3)


M10
15
G_bTrvlSensorON
16
G_bLiftSensorON
17
M11
18
G_bINV1_ON
19
G_bINV2_ON
20

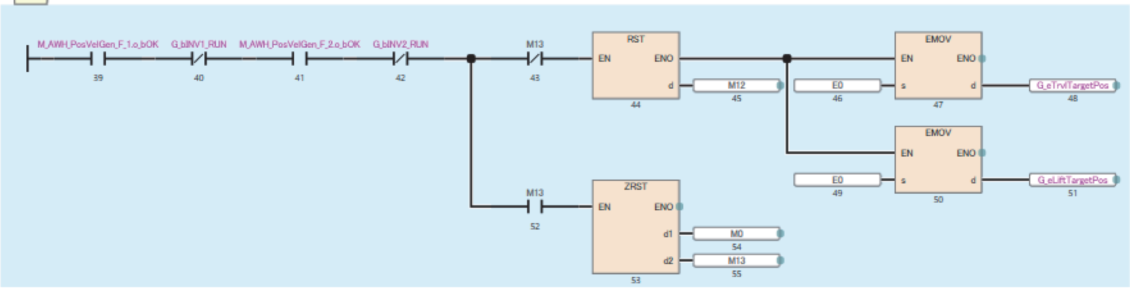
(4)


M12
21
M13
22
G_bINV2_RUN
23
G_bTrvlPosStart
25
G_bTrvlPosStart
24
M_AWH_PosVelGen_F_1.o_bOK
26
G_bINV1_RUN
27
G_bLiftPosStart
29
G_bLiftPosStart
28

(5)

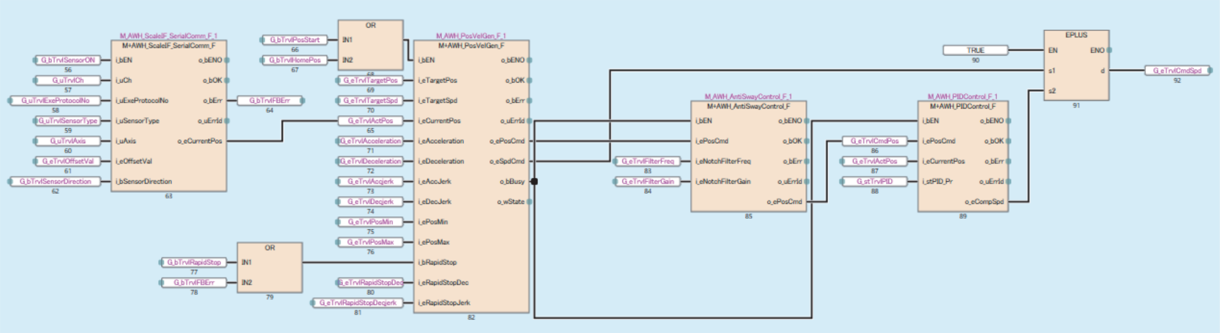

M13
30
M12
31
G_bINV1_RUN
32
G_bLiftHomePos
34
G_bLiftHomePos
33
M_AWH_PosVelGen_F_2.o_bOK
35
G_bINV2_RUN
36
G_bTrvlHomePos
38
G_bTrvlHomePos
37

(6)

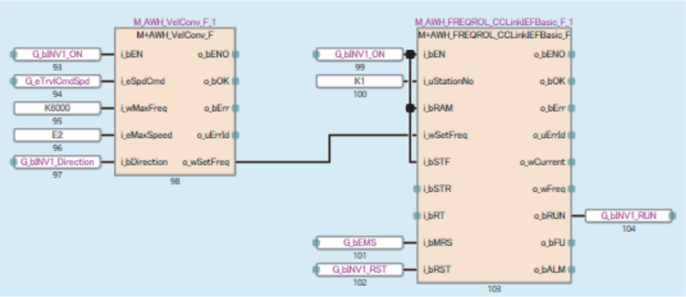

M_AWH_PosVelGen_F_1.o_bOK
39
G_bINV1_RUN
40
M_AWH_PosVelGen_F_2.o_bOK
41
G_bINV2_RUN
42
M13
43
RST
EN
ENO
d
44
M12
45
E0
46
EMOV
EN
ENO
s
d
47
G_eTrvlTargetPos
48
EMOV
EN
ENO
E0
49
s
d
50
G_eLiftTargetPos
51
M13
52
ZRST
EN
ENO
d1
d2
53
M0
54
M13
55

■Travel axis positioning control

(1) Distance measurement value feedback to speed/position commands generation

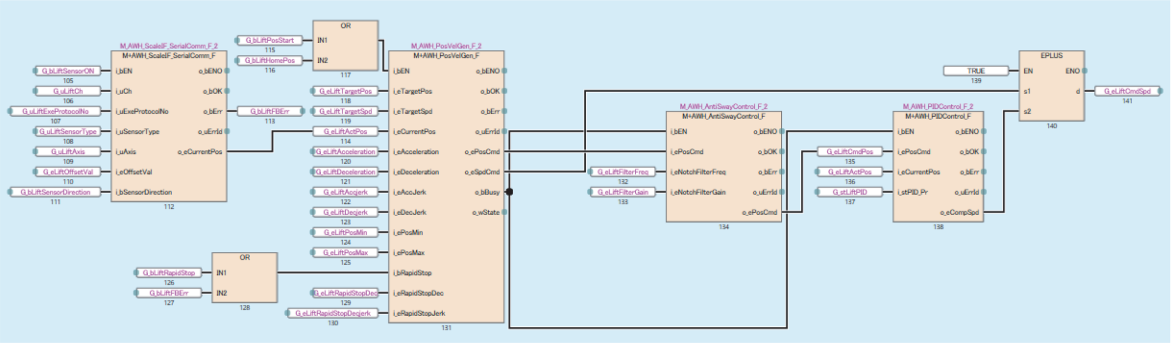

M_AWH_ScaleIF_SerialComm_F_1
M+AWH_ScaleIF_SerialComm_F
G_bTrvlSensorON
56
i_bEN
o_bENO
G_uTrvlCh
57
i_uCh
o_bOK
G_uTrvlExeProtocolNo
58
i_uExeProtocolNo
o_bErr
G_bTrvlFBErr
64
G_uTrvlSensorType
59
i_uSensorType
o_uErrId
G_uTrvlAxis
60
i_uAxis
o_eCurrentPos
G_eTrvlOffsetVal
61
i_eOffsetVal
G_bTrvlSensorDirection
62
i_bSensorDirection
63
OR
G_bTrvlPosStart
66
IN1
G_bTrvlHomePos
67
IN2
68
M_AWH_PosVelGen_F_1
M+AWH_PosVelGen_F
i_bEN
o_bENO
G_eTrvlTargetPos
69
i_eTargetPos
o_bOK
G_eTrvlTargetSpd
70
i_eTargetSpd
o_bErr
G_eTrvlActPos
65
i_eCurrentPos
o_uErrId
G_eTrvlAcceleration
71
i_eAcceleration
o_ePosCmd
G_eTrvlDeceleration
72
i_eDeceleration
o_eSpdCmd
G_eTrvlAccjerk
73
i_eAccJerk
o_bBusy
G_eTrvlDecjerk
74
i_eDecJerk
o_wState
G_eTrvlPosMin
75
i_ePosMin
G_eTrvlPosMax
76
i_ePosMax
OR
G_bTrvlRapidStop
77
IN1
G_bTrvlFBErr
78
IN2
79
i_bRapidStop
G_eTrvlRapidStopDec
80
i_eRapidStopDec
G_eTrvlRapidStopDecjerk
81
i_eRapidStopJerk
82
M_AWH_AntiSwayControl_F_1
M+AWH_AntiSwayControl_F
i_bEN
o_bENO
i_ePosCmd
o_bOK
G_eTrvlFilterFreq
83
i_eNotchFilterFreq
o_bErr
G_eTrvlFilterGain
84
i_eNotchFilterGain
o_uErrId
o_ePosCmd
85
M_AWH_PIDControl_F_1
M+AWH_PIDControl_F
i_bEN
o_bENO
G_eTrvlCmdPos
86
i_ePosCmd
o_bOK
G_eTrvlActPos
87
i_eCurrentPos
o_bErr
G_stTrvlPID
88
i_stPID_Pr
o_uErrId
o_eCompSpd
89
EPLUS
TRUE
90
EN
ENO
s1
d
s2
91
G_eTrvlCmdSpd
92

(2) Speed command → Frequency conversion to inverter communication

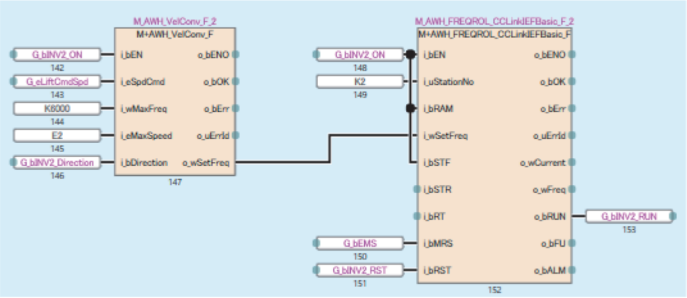

M_AWH_VelConv_F_1
M+AWH_VelConv_F
G_bINV1_ON
93
i_bEN
o_bENO
G_eTrvlCmdSpd
94
i_eSpdCmd
o_bOK
K6000
95
i_wMaxFreq
o_bErr
E2
96
i_eMaxSpeed
o_uErrId
G_bINV1_Direction
97
i_bDirection
o_wSetFreq
98
M_AWH_FREQROL_CCLinkIEFBasic_F_1
M+AWH_FREQROL_CCLinkIEFBasic_F
G_bINV1_ON
99
i_bEN
o_bENO
K1
100
i_uStationNo
o_bOK
i_bRAM
o_bErr
i_wSetFreq
o_uErrId
i_bSTF
o_wCurrent
i_bSTR
o_wFreq
i_bRT
o_bRUN
G_bINV1_RUN
104
G_bEMS
101
i_bMRS
o_bFU
G_bINV1_RST
102
i_bRST
o_bALM
103

■Lift axis positioning control

(1) Distance measurement value feedback to speed/position commands generation


M_AWH_ScaleIF_SerialComm_F_2
M+AWH_ScaleIF_SerialComm_F
G_bLiftSensorON
105
i_bEN
o_bENO
G_uLiftCh
106
i_uCh
o_bOK
G_uLiftExeProtocolNo
107
i_uExeProtocolNo
o_bErr
G_bLiftFBErr
113
G_uLiftSensorType
108
i_uSensorType
o_uErrId
G_uLiftAxis
109
i_uAxis
o_eCurrentPos
G_eLiftOffsetVal
110
i_eOffsetVal
G_bLiftSensorDirection
111
i_bSensorDirection
112
OR
G_bLiftPosStart
115
IN1
G_bLiftHomePos
116
IN2
117
M_AWH_PosVelGen_F_2
M+AWH_PosVelGen_F
i_bEN
o_bENO
G_eLiftTargetPos
118
i_eTargetPos
o_bOK
G_eLiftTargetSpd
119
i_eTargetSpd
o_bErr
G_eLiftActPos
114
i_eCurrentPos
o_uErrId
G_eLiftAcceleration
120
i_eAcceleration
o_ePosCmd
G_eLiftDeceleration
121
i_eDeceleration
o_eSpdCmd
G_eLiftAccjerk
122
i_eAccJerk
o_bBusy
G_eLiftDecjerk
123
i_eDecJerk
o_wState
G_eLiftPosMin
124
i_ePosMin
G_eLiftPosMax
125
i_ePosMax
OR
G_bLiftRapidStop
126
IN1
G_bLiftFBErr
127
IN2
128
i_bRapidStop
G_eLiftRapidStopDec
129
i_eRapidStopDec
G_eLiftRapidStopDecjerk
130
i_eRapidStopJerk
131
M_AWH_AntiSwayControl_F_2
M+AWH_AntiSwayControl_F
i_bEN
o_bENO
i_ePosCmd
o_bOK
G_eLiftFilterFreq
132
i_eNotchFilterFreq
o_bErr
G_eLiftFilterGain
133
i_eNotchFilterGain
o_uErrId
o_ePosCmd
134
M_AWH_PIDControl_F_2
M+AWH_PIDControl_F
i_bEN
o_bENO
G_eLiftCmdPos
135
i_ePosCmd
o_bOK
G_eLiftActPos
136
i_eCurrentPos
o_bErr
G_stLiftPID
137
i_stPID_Pr
o_uErrId
o_eCompSpd
138
EPLUS
TRUE
139
EN
ENO
s1
d
s2
140
G_eLiftCmdSpd
141

(2) Speed command → Frequency conversion to inverter communication


M_AWH_VelConv_F_2
M+AWH_VelConv_F
G_bINV2_ON
142
i_bEN
o_bENO
G_eLiftCmdSpd
143
i_eSpdCmd
o_bOK
K6000
144
i_wMaxFreq
o_bErr
E2
145
i_eMaxSpeed
o_uErrId
G_bINV2_Direction
146
i_bDirection
o_wSetFreq
147
M_AWH_FREQROL_CCLinkIEFBasic_F_2
M+AWH_FREQROL_CCLinkIEFBasic_F
G_bINV2_ON
148
i_bEN
o_bENO
K2
149
i_uStationNo
o_bOK
i_bRAM
o_bErr
i_wSetFreq
o_uErrId
i_bSTF
o_wCurrent
i_bSTR
o_wFreq
i_bRT
o_bRUN
G_bINV2_RUN
153
G_bEMS
150
i_bMRS
o_bFU
G_bINV2_RST
151
i_bRST
o_bALM
152

4.2 Positioning Operation with Distance Meters (Ethernet Communication)

The following describes the usage procedure to perform the following operations: communicate with distance meters capable of Ethernet communication; give feedback about current position information; perform the positioning operation for the two axes (travel axis and lift axis) of the stacker crane; operate one inverter to switch the motor between the travel axis and fork axis.

In this operation, the following FBs are used.

- M+AWH_PosVelGen_F (positioning operation command generation)
- M+AWH_PIDControl_F (PID control)
- M+AWH_VelConv_F (frequency conversion)
- M+AWH_MotorSwitch_F (motor switching control)
- M+AWH_AntiSwayControl_F (anti-sway control)
- M+AWH_FREQROL_CCLinkIEFBasic_F (inverter communication)
- M+AWH_ScaleIF_EN_F (distance measurement: Ethernet)
- M+AWH_DecDistance_F (deceleration distance calculation)

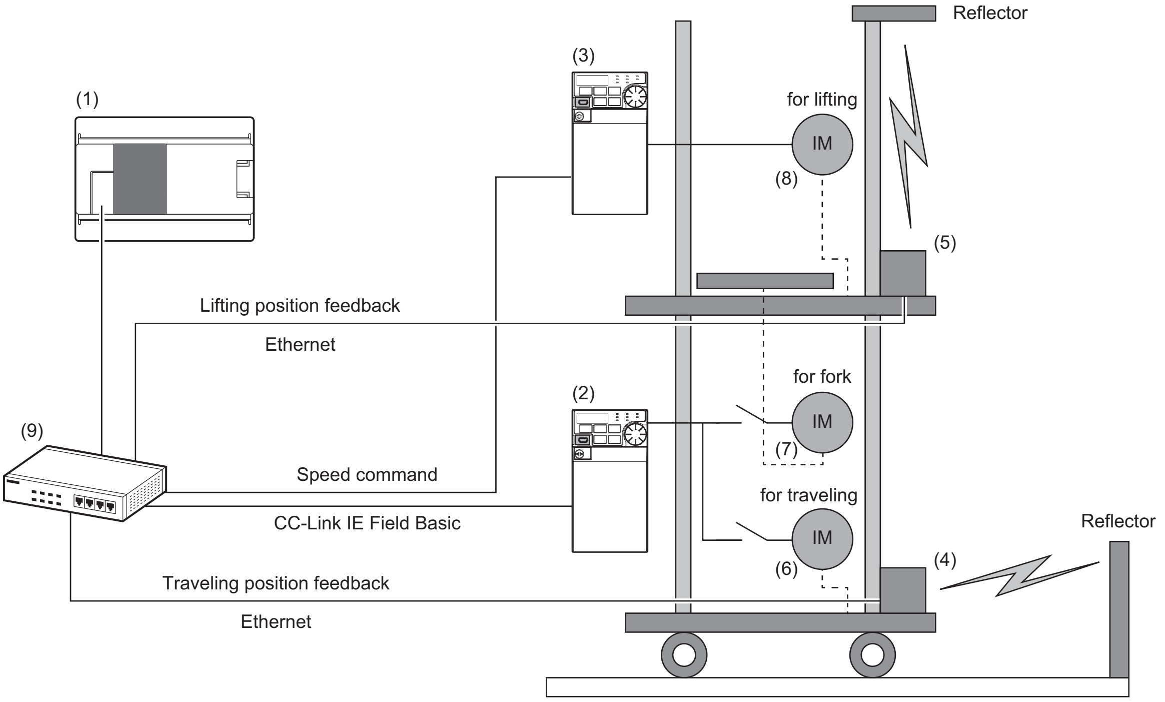
Overview

This operation enables communication with two inverters and performs positioning control for the travel axis (axis 1) and lift axis (axis 2) of the stacker crane.

Input the following positioning control settings in the global labels for the sample program. Then, operate the global labels for executing each FB to move the stacker crane to the target position.

Also, two motors of the travel axis (axis 1) and fork axis (axis 3) can be controlled by switching them with one inverter. (For the fork axis (axis 3), only the V/F control can be performed.)

System configuration



No.	Device	Description	Station No.
(1)	FX5U CPU module	Programmable controller	Master station
(2)	FR-E800 + FR-A8AP E kit (axis 1 (travel axis))	Inverter for travel axis control (with Vector control compatible option)	1
(3)	FR-E800 + FR-A8AP E kit (axis 2 (lift axis))	Inverter for lift axis control (with Vector control compatible option)	2

No.	Device	Description	Station No.
(4)	AMS308i (axis 1 (travel axis))	Distance meter for positioning for travel axis (Ethernet communication)	—
(5)	AMS308i (axis 2 (lift axis))	Distance meter for positioning for lift axis (Ethernet communication)	—
(6)	Motor (axis 1 (travel axis)) + PLG	Motor for driving stacker crane's travel axis and PLG	—
(7)	Motor (axis 2 (lift axis)) + PLG	Motor for driving stacker crane's lift axis and PLG	—
(8)	Motor (axis 3 (fork axis))	Motor for driving stacker crane's fork axis	—
(9)	Switching hub	Used for connection with various devices.	—

Positioning control setting example

Item	Setting value		
	Travel axis (axis 1)	Lift axis (axis 2)	Fork axis (axis 3)
Target position	100.0 [m]	30.0 [m]	—
Command speed	1.0 [m/s]	0.5 [m/s]	—
Acceleration/deceleration reference speed	1.0 [m/s]	0.5 [m/s]	—
S-curve time	0.5 [s]	0.5 [s]	—
Acceleration/Deceleration time	1.0 [s]	1.0 [s]	—
Acceleration/Deceleration rate	1.0 [m/s^2]	1.0 [m/s^2]	—
Running frequency (axis 3)	—	—	60 [Hz]

Positioning operation details

Refer to the following.

☞ Page 84 Positioning Operation with Distance Meters (Serial Communication)

Process flow

The following describes a process flow from the wiring and parameter settings of the FX5 CPU module, inverters, and distance meters to the use of the FB library for control of inverters for automated warehouse.

1. FB library registration

Register the FB library. For the operating procedure, refer to the following.

📖 GX Works3 Operating Manual

2. Wiring

For the wiring method, refer to the manual of each distance meter.

3. CPU module setting

- Use GX Works3 to set CC-Link IEF Basic and the global labels. (☞ Page 21 Parameter Settings)
- Use GX Works3 to set predefined protocols to establish communication with distance meters. (☞ Page 27 Predefined protocol support function setting)

4. Inverter setting

Use FR Configurator2 to set the inverters. (☞ Page 29 Inverter parameter setting)

5. Distance meter setting

Set distance meters according to the CPU module setting. (☞ Page 31 Distance meter setting)

6. Programming

Create programs. (☞ Page 95 Programming)

Programming

This section describes programs used in the application example.

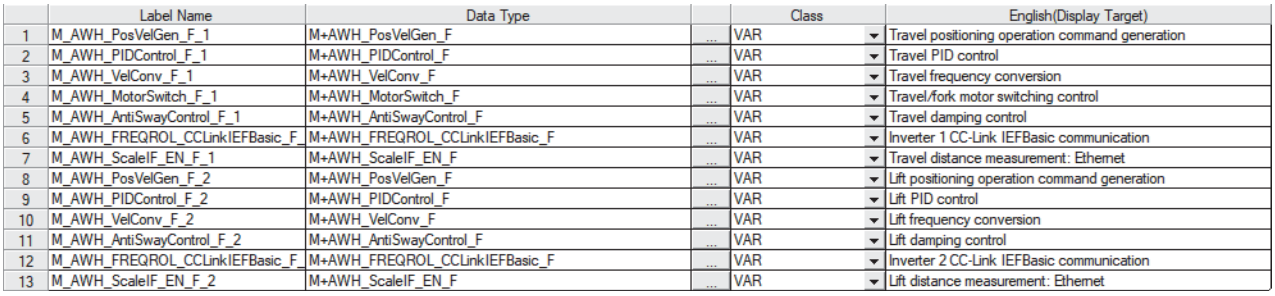
In these programs, only the circuits required to operate each function are described, and such a circuit as an interlock for safety is not included. Add such a circuit as an interlock according to your device.

Data name in sample programs	Execution type	Description
awhfreqrol_sample1_main	Scan	This item is not used in this example. Delete the item.
awhfreqrol_sample2_main	Scan	Executes the positioning control main processing.
awhfreqrol_sample_initial	Initial	Sets initial values in labels that require input for positioning control.

Label list

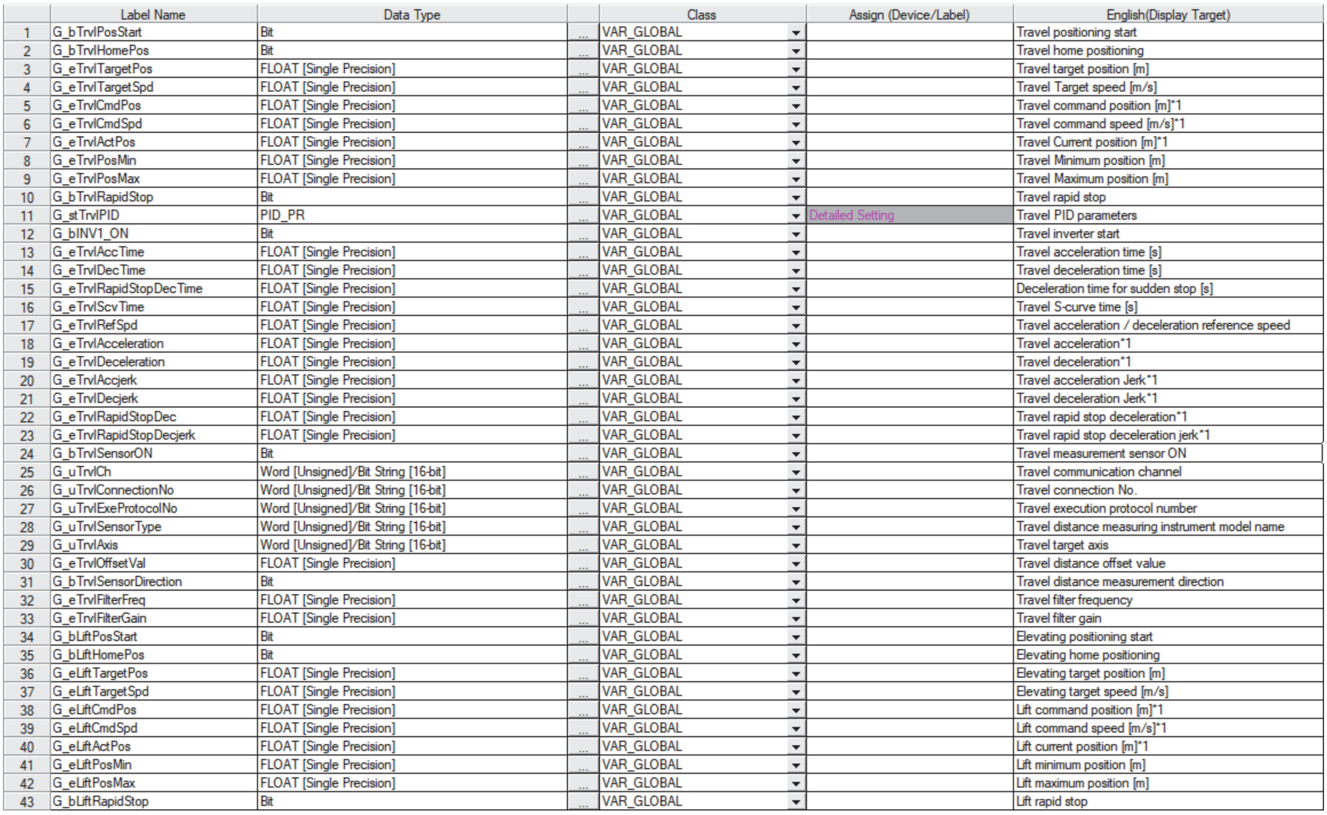
The following labels are used in these programs.

■Local labels

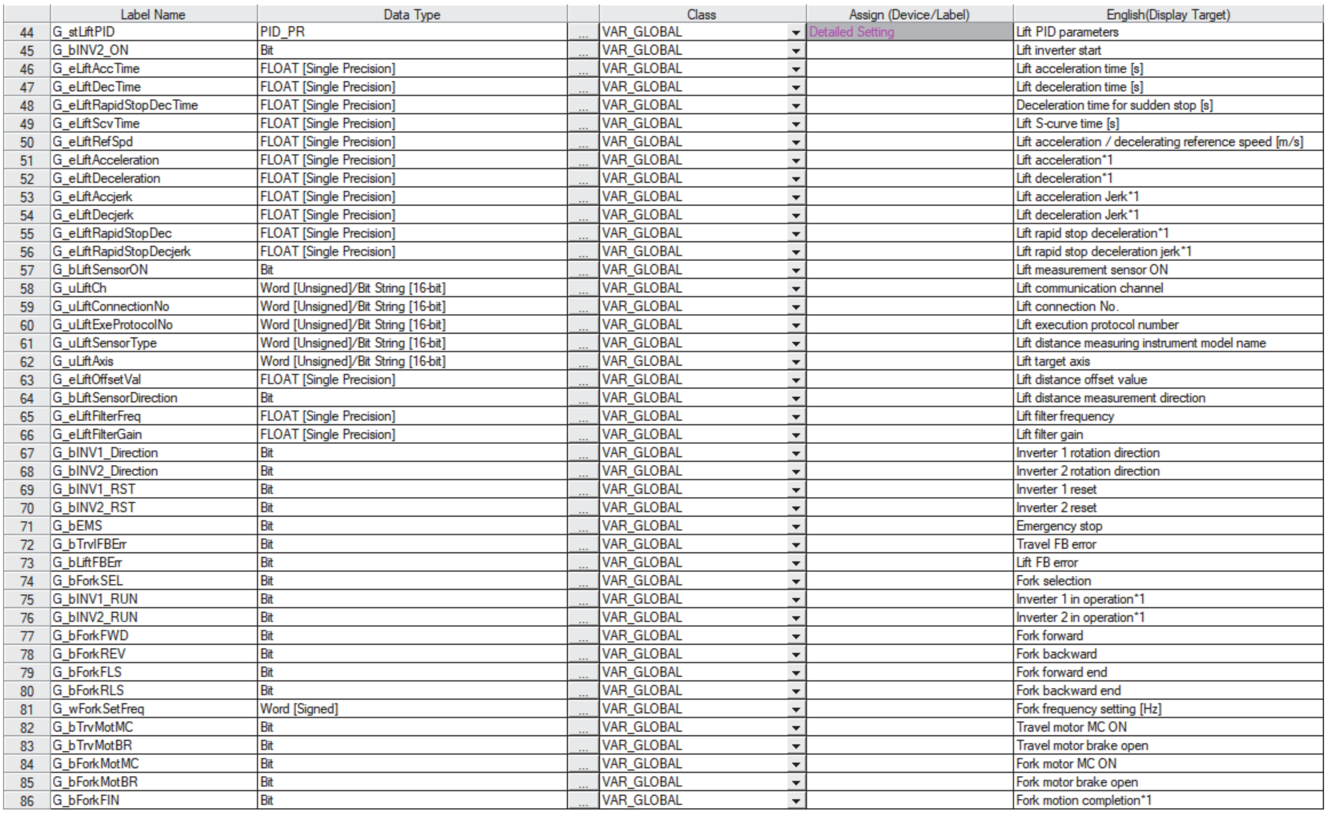


	Label Name	Data Type		Class	English(Display Target)
1	M_AWH_PosVelGen_F_1	M+AWH_PosVelGen_F	...	VAR	Travel positioning operation command generation
2	M_AWH_PIDControl_F_1	M+AWH_PIDControl_F	...	VAR	Travel PID control
3	M_AWH_VelConv_F_1	M+AWH_VelConv_F	...	VAR	Travel frequency conversion
4	M_AWH_MotorSwitch_F_1	M+AWH_MotorSwitch_F	...	VAR	Travel/fork motor switching control
5	M_AWH_AntiSwayControl_F_1	M+AWH_AntiSwayControl_F	...	VAR	Travel damping control
6	M_AWH_FREQROL_CCLinkIEFBasic_F_	M+AWH_FREQROL_CCLinkIEFBasic_F	...	VAR	Inverter 1 CC-Link IEFBasic communication
7	M_AWH_ScaleIF_EN_F_1	M+AWH_ScaleIF_EN_F	...	VAR	Travel distance measurement: Ethernet
8	M_AWH_PosVelGen_F_2	M+AWH_PosVelGen_F	...	VAR	Lift positioning operation command generation
9	M_AWH_PIDControl_F_2	M+AWH_PIDControl_F	...	VAR	Lift PID control
10	M_AWH_VelConv_F_2	M+AWH_VelConv_F	...	VAR	Lift frequency conversion
11	M_AWH_AntiSwayControl_F_2	M+AWH_AntiSwayControl_F	...	VAR	Lift damping control
12	M_AWH_FREQROL_CCLinkIEFBasic_F_	M+AWH_FREQROL_CCLinkIEFBasic_F	...	VAR	Inverter 2 CC-Link IEFBasic communication
13	M_AWH_ScaleIF_EN_F_2	M+AWH_ScaleIF_EN_F	...	VAR	Lift distance measurement: Ethernet

■Global labels



	Label Name	Data Type		Class	Assign (Device/Label)	English(Display Target)
1	G_bTrvlPosStart	Bit	...	VAR_GLOBAL		Travel positioning start
2	G_bTrvlHomePos	Bit	...	VAR_GLOBAL		Travel home positioning
3	G_eTrvlTargetPos	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel target position [m]
4	G_eTrvlTargetSpd	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel Target speed [m/s]
5	G_eTrvlCmdPos	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel command position [m]*1
6	G_eTrvlCmdSpd	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel command speed [m/s]*1
7	G_eTrvlActPos	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel Current position [m]*1
8	G_eTrvlPosMin	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel Minimum position [m]
9	G_eTrvlPosMax	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel Maximum position [m]
10	G_bTrvlRapidStop	Bit	...	VAR_GLOBAL		Travel rapid stop
11	G_stTrvlPID	PID_PR	...	VAR_GLOBAL	Detailed Setting	Travel PID parameters
12	G_bINV1_ON	Bit	...	VAR_GLOBAL		Travel inverter start
13	G_eTrvlAccTime	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel acceleration time [s]
14	G_eTrvlDecTime	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel deceleration time [s]
15	G_eTrvlRapidStopDecTime	FLOAT [Single Precision]	...	VAR_GLOBAL		Deceleration time for sudden stop [s]
16	G_eTrvlScvTime	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel S-curve time [s]
17	G_eTrvlRefSpd	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel acceleration / deceleration reference speed
18	G_eTrvlAcceleration	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel acceleration*1
19	G_eTrvlDeceleration	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel deceleration*1
20	G_eTrvlAccjerk	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel acceleration Jerk*1
21	G_eTrvlDecjerk	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel deceleration Jerk*1
22	G_eTrvlRapidStopDec	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel rapid stop deceleration*1
23	G_eTrvlRapidStopDecjerk	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel rapid stop deceleration jerk*1
24	G_bTrvlSensorON	Bit	...	VAR_GLOBAL		Travel measurement sensor ON
25	G_uTrvlCh	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL		Travel communication channel
26	G_uTrvlConnectionNo	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL		Travel connection No.
27	G_uTrvlExeProtocolNo	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL		Travel execution protocol number
28	G_uTrvlSensorType	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL		Travel distance measuring instrument model name
29	G_uTrvlAxis	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL		Travel target axis
30	G_eTrvlOffsetVal	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel distance offset value
31	G_bTrvlSensorDirection	Bit	...	VAR_GLOBAL		Travel distance measurement direction
32	G_eTrvlFilterFreq	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel filter frequency
33	G_eTrvlFilterGain	FLOAT [Single Precision]	...	VAR_GLOBAL		Travel filter gain
34	G_bLiftPosStart	Bit	...	VAR_GLOBAL		Elevating positioning start
35	G_bLiftHomePos	Bit	...	VAR_GLOBAL		Elevating home positioning
36	G_eLiftTargetPos	FLOAT [Single Precision]	...	VAR_GLOBAL		Elevating target position [m]
37	G_eLiftTargetSpd	FLOAT [Single Precision]	...	VAR_GLOBAL		Elevating target speed [m/s]
38	G_eLiftCmdPos	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift command position [m]*1
39	G_eLiftCmdSpd	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift command speed [m/s]*1
40	G_eLiftActPos	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift current position [m]*1
41	G_eLiftPosMin	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift minimum position [m]
42	G_eLiftPosMax	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift maximum position [m]
43	G_bLiftRapidStop	Bit	...	VAR_GLOBAL		Lift rapid stop



	Label Name	Data Type		Class	Assign (Device/Label)	English(Display Target)
44	G_stLiftPID	PID_PR	...	VAR_GLOBAL	Detailed Setting	Lift PID parameters
45	G_bINV2_ON	Bit	...	VAR_GLOBAL		Lift inverter start
46	G_eLiftAccTime	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift acceleration time [s]
47	G_eLiftDecTime	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift deceleration time [s]
48	G_eLiftRapidStopDecTime	FLOAT [Single Precision]	...	VAR_GLOBAL		Deceleration time for sudden stop [s]
49	G_eLiftScvTime	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift S-curve time [s]
50	G_eLiftRefSpd	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift acceleration / decelerating reference speed [m/s]
51	G_eLiftAcceleration	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift acceleration*1
52	G_eLiftDeceleration	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift deceleration*1
53	G_eLiftAccjerk	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift acceleration Jerk*1
54	G_eLiftDecjerk	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift deceleration Jerk*1
55	G_eLiftRapidStopDec	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift rapid stop deceleration*1
56	G_eLiftRapidStopDecjerk	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift rapid stop deceleration jerk*1
57	G_bLiftSensorON	Bit	...	VAR_GLOBAL		Lift measurement sensor ON
58	G_uLiftCh	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL		Lift communication channel
59	G_uLiftConnectionNo	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL		Lift connection No.
60	G_uLiftExeProtocolNo	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL		Lift execution protocol number
61	G_uLiftSensorType	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL		Lift distance measuring instrument model name
62	G_uLiftAxis	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL		Lift target axis
63	G_eLiftOffsetVal	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift distance offset value
64	G_bLiftSensorDirection	Bit	...	VAR_GLOBAL		Lift distance measurement direction
65	G_eLiftFilterFreq	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift filter frequency
66	G_eLiftFilterGain	FLOAT [Single Precision]	...	VAR_GLOBAL		Lift filter gain
67	G_bINV1_Direction	Bit	...	VAR_GLOBAL		Inverter 1 rotation direction
68	G_bINV2_Direction	Bit	...	VAR_GLOBAL		Inverter 2 rotation direction
69	G_bINV1_RST	Bit	...	VAR_GLOBAL		Inverter 1 reset
70	G_bINV2_RST	Bit	...	VAR_GLOBAL		Inverter 2 reset
71	G_bEMS	Bit	...	VAR_GLOBAL		Emergency stop
72	G_bTrvlFBErr	Bit	...	VAR_GLOBAL		Travel FB error
73	G_bLiftFBErr	Bit	...	VAR_GLOBAL		Lift FB error
74	G_bForkSEL	Bit	...	VAR_GLOBAL		Fork selection
75	G_bINV1_RUN	Bit	...	VAR_GLOBAL		Inverter 1 in operation*1
76	G_bINV2_RUN	Bit	...	VAR_GLOBAL		Inverter 2 in operation*1
77	G_bForkFWD	Bit	...	VAR_GLOBAL		Fork forward
78	G_bForkREV	Bit	...	VAR_GLOBAL		Fork backward
79	G_bForkFLS	Bit	...	VAR_GLOBAL		Fork forward end
80	G_bForkRLS	Bit	...	VAR_GLOBAL		Fork backward end
81	G_wForkSetFreq	Word [Signed]	...	VAR_GLOBAL		Fork frequency setting [Hz]
82	G_bTrvMotMC	Bit	...	VAR_GLOBAL		Travel motor MC ON
83	G_bTrvMotBR	Bit	...	VAR_GLOBAL		Travel motor brake open
84	G_bForkMotMC	Bit	...	VAR_GLOBAL		Fork motor MC ON
85	G_bForkMotBR	Bit	...	VAR_GLOBAL		Fork motor brake open
86	G_bForkFIN	Bit	...	VAR_GLOBAL		Fork motion completion*1

*1 This is a global label used for calculations in the sample programs. Do not change it.

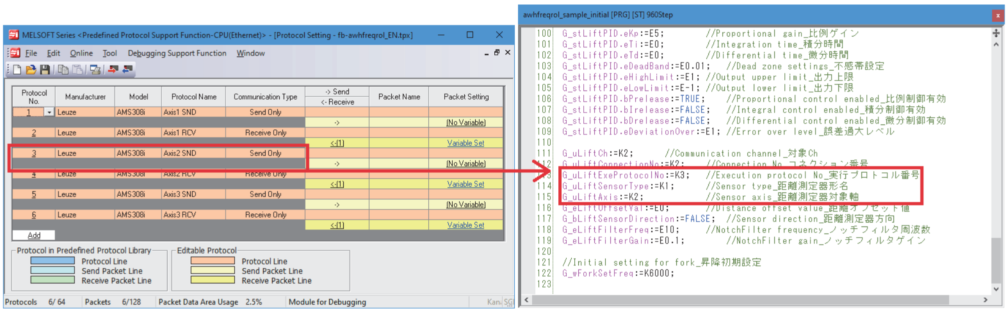
Predefined protocol setting

Use the predefined protocol support function to enable Ethernet communication with distance meters.

Ex.

Enabling Ethernet communication with the distance meter (AMS308i) on the lift axis

In the initial execution program "awhfreqrol_sample_initial", set "G_uLiftAxis = 2 (lift axis)" and "G_uLiftExeProtocolNo = 3 (specify Axis2 SND)".


MELSOFT Series <Predefined Protocol Support Function-CPU(Ethernet)> - [Protocol Setting - fb-awhfreqrol_EN.tpx]
File Edit Online Tool Debugging Support Function Window
Add
Protocol in Predefined Protocol Library
Protocol Line
Send Packet Line
Receive Packet Line
Editable Protocol
Protocol Line
Send Packet Line
Receive Packet Line
awhfreqrol_sample_initial [PRG] [ST] 960Step

Protocol No.	Manufacturer	Model	Protocol Name	Communication Type	-> Send <- Receive	Packet Name	Packet Setting
1	Leuze	AMS308i	Axis1 SND	Send Only			
					->		(No Variable)
2	Leuze	AMS308i	Axis1 RCV	Receive Only			
					<-(1)		Variable Set
3	Leuze	AMS308i	Axis2 SND	Send Only			
					->		(No Variable)
4	Leuze	AMS308i	Axis2 RCV	Receive Only			
					<-(1)		Variable Set
5	Leuze	AMS308i	Axis3 SND	Send Only			
					->		(No Variable)
6	Leuze	AMS308i	Axis3 RCV	Receive Only			
					<-(1)		Variable Set

Protocols 6/ 64 Packets 6/128 Packet Data Area Usage 2.5% Module for Debugging

```
G_stLiftPID.eKp:=E5;          //Proportional gain_比例ゲイン
G_stLiftPID.eTi:=E0;          //Integration time_積分時間
G_stLiftPID.eTd:=E0;          //Differential time_微分時間
G_stLiftPID.eDeadBand:=E0.01;   //Dead zone settings_不感帯設定
G_stLiftPID.eHighLimit:=E1; //Output upper limit_出力上限
G_stLiftPID.eLowLimit:=E-1; //Output lower limit_出力下限
G_stLiftPID.bPrelease:=TRUE;    //Proportional control enabled_比例制御有効
G_stLiftPID.bIrelease:=FALSE;   //Integral control enabled_積分制御有効
G_stLiftPID.bDrelease:=FALSE;   //Differential control enabled_微分制御有効
G_stLiftPID.eDeviationOver:=E1; //Error over level_誤差過大レベル

G_uLiftCh:=K2;      //Communication channel_対象Ch
G_uLiftConnectionNo:=K2;    //Connection No_コネクション番号
G_uLiftExeProtocolNo:=K3;   //Execution protocol No_実行プロトコル番号
G_uLiftSensorType:=K1;      //Sensor type_距離測定器形名
G_uLiftAxis:=K2;            //Sensor axis_距離測定器対象軸
G_eLiftOffsetVal:=E0;       //Distance offset value_距離オフセット値
G_bLiftSensorDirection:=FALSE;  //Sensor direction_距離測定器方向
G_eLiftFilterFreq:=E10;     //NotchFilter frequency_ノッチフィルタ周波数
G_eLiftFilterGain:=E0.1;        //NotchFilter gain_ノッチフィルタゲイン

//Initial setting for fork_昇降初期設定
G_wForkSetFreq:=K6000;
```

Program example

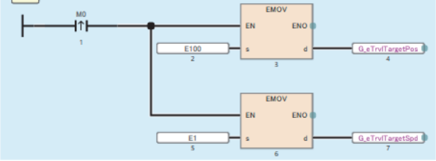
■Positioning target value input and control program

This program manipulates input bits to execute the following operations:

- Input the target positions and target speeds for positioning the travel axis (axis 1) and lift axis (axis 2) and input the running frequency for the fork axis (axis 3).
- Input execution commands to FBs.
- Initialize input bits and target positions.

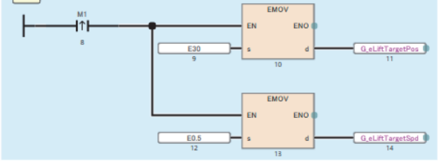
Input bit	Corresponding operation	Operation description
M0	(1): Target value input (travel axis)	Inputs the target position (100 [m]) and target speed (1.0 [m/s]) for positioning the travel axis.
M1	(2): Target value input (lift axis)	Inputs the target position (30 [m]) and target speed (0.5 [m/s]) for positioning the lift axis.
M2	(3): Target value input (fork axis)	Inputs the frequency setting (60 [Hz]) for operating the fork axis.
M10	(4): Start of the inverter control and distance measurement	Starts the current position feedback from the distance meter. Execution commands are input to the following FBs: • M_AWH_ScaleIF_EN_1 (travel distance measurement: Ethernet) • M_AWH_ScaleIF_EN_2 (lift distance measurement: Ethernet)
M11		Starts the command output to the inverters. Execution commands are input to the following FBs: • M_AWH_VelConv_F_1 (travel frequency conversion) • M_AWH_FREQROL_CCLinkIEFBasic_F_1 (CC-Link IE Field Network Basic communication with inverter 1) • M_AWH_MotorSwitch_F_1 (motor switching between the travel axis and fork axis) • M_AWH_VelConv_F_2 (lift frequency conversion) • M_AWH_FREQROL_CCLinkIEFBasic_F_2 (CC-Link IE Field Network Basic communication with inverter 2)
M12	(5): Start of positioning (6): Fork axis operation (8): Initialization after execution	Generates positioning operation commands in the order of the travel axis and lift axis and executes the positioning. Execution commands are input to the following FBs: • M_AWH_PosVelGen_F_1 (travel axis positioning operation command generation) • M_AWH_PosVelGen_F_2 (lift axis positioning operation command generation) After completion of the lift axis positioning, switches the motor between the travel axis and fork axis and performs the fork axis operation. The input labels are operated for the following FB: • M_AWH_MotorSwitch_F_1 (motor switching between the travel axis and fork axis) After completion of the positioning and fork axis operation, initializes the input bits and target positions.
M13	(7): Start of positioning (for homing) (8): Initialization after execution	Generates positioning operation commands in the order of the lift axis and travel axis and executes the positioning (for homing). Execution commands are input to the following FBs: • M_AWH_PosVelGen_F_1 (travel axis positioning operation command generation) • M_AWH_PosVelGen_F_2 (lift axis positioning operation command generation) After completion of the positioning, initializes the input bits and target positions.

(1)



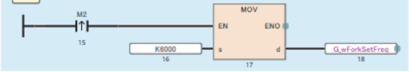
M0
1
E100
2
EMOV
EN
ENO
s
d
3
G_eTrvlTargetPos
4
E1
5
EMOV
6
G_eTrvlTargetSpd
7

(2)



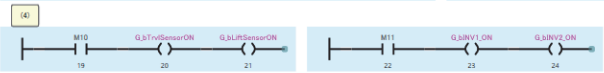
M1
8
E30
9
EMOV
10
G_eLiftTargetPos
11
E0.5
12
EMOV
13
G_eLiftTargetSpd
14

(3)



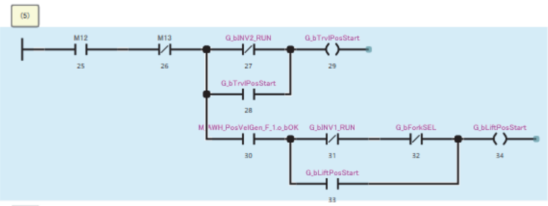
M2
15
K6000
16
MOV
17
G_wForkSetFreq
18

(4)



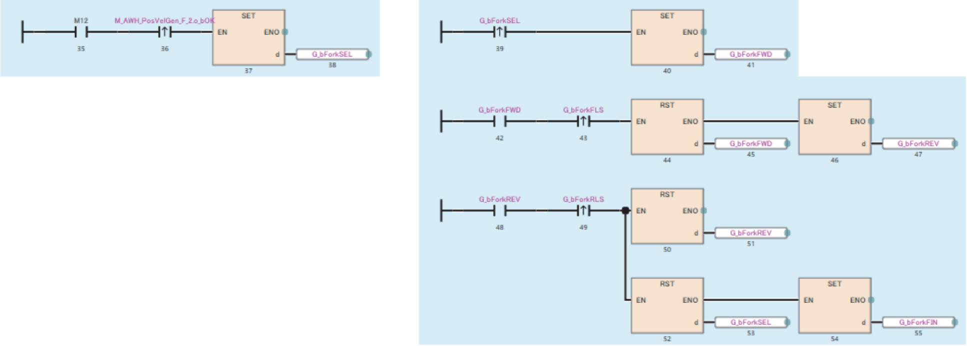
M10
19
G_bTrvlSensorON
20
G_bLiftSensorON
21
M11
22
G_bINV1_ON
23
G_bINV2_ON
24

(5)



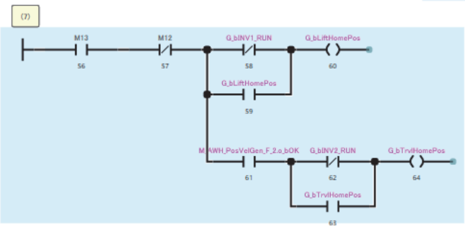
M12
25
M13
26
G_bINV2_RUN
27
G_bTrvlPosStart
28
G_bTrvlPosStart
29
M_AWH_PosVelGen_F_1.o_bOK
30
G_bINV1_RUN
31
G_bForkSEL
32
G_bLiftPosStart
33
G_bLiftPosStart
34

(6)



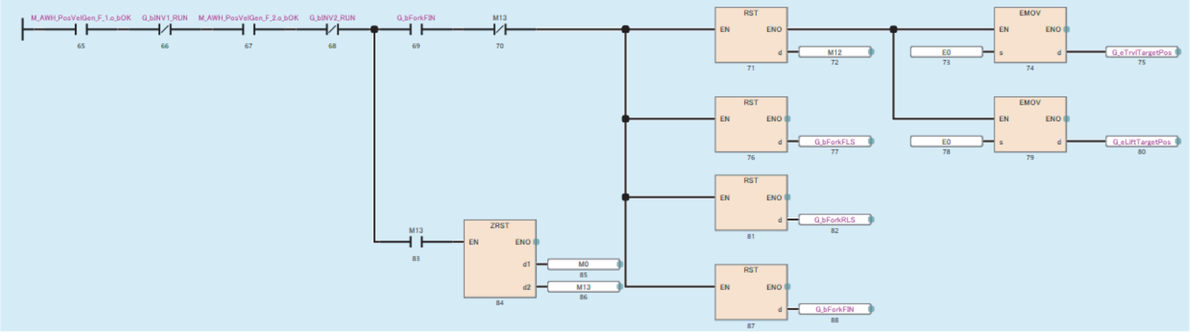
M12
35
M_AWH_PosVelGen_F_2.o_bOK
36
SET
37
G_bForkSEL
38
G_bForkSEL
39
SET
40
G_bForkFWD
41
G_bForkFWD
42
G_bForkFLS
43
RST
44
G_bForkFWD
45
SET
46
G_bForkREV
47
G_bForkREV
48
G_bForkRLS
49
RST
50
G_bForkREV
51
RST
52
G_bForkSEL
53
SET
54
G_bForkFIN
55

(7)



M13
56
M12
57
G_bINV1_RUN
58
G_bLiftHomePos
59
G_bLiftHomePos
60
M_AWH_PosVelGen_F_2.o_bOK
61
G_bINV2_RUN
62
G_bTrvlHomePos
63
G_bTrvlHomePos
64

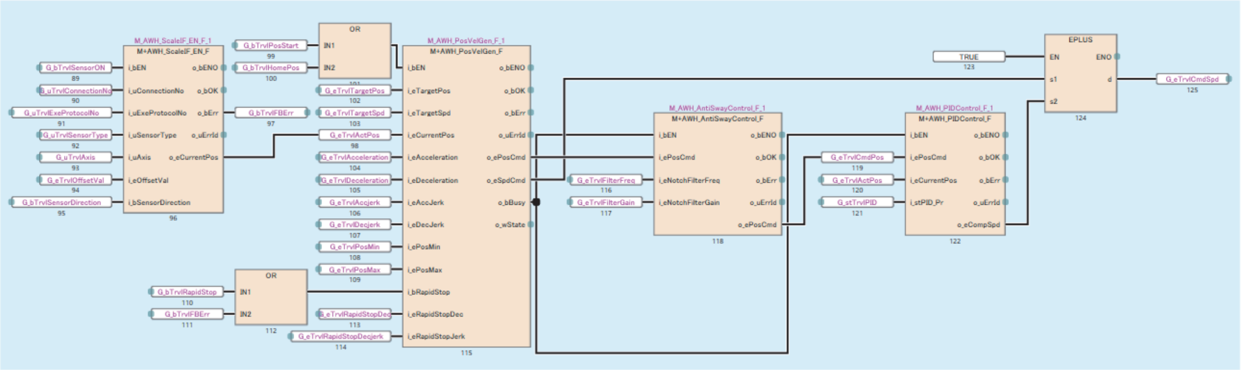
(8)



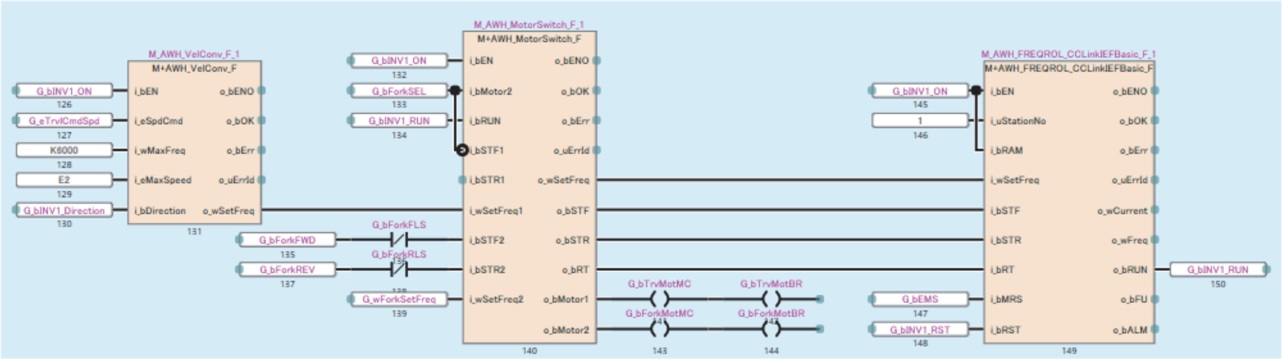
M_AWH_PosVelGen_F_1.o_bOK
65
G_bINV1_RUN
66
M_AWH_PosVelGen_F_2.o_bOK
67
G_bINV2_RUN
68
G_bForkFIN
69
M13
70
RST
71
M12
72
E0
73
EMOV
74
G_eTrvlTargetPos
75
RST
76
G_bForkFLS
77
E0
78
EMOV
79
G_eLiftTargetPos
80
RST
81
G_bForkRLS
82
M13
83
ZRST
d1
d2
84
M0
85
M13
86
RST
87
G_bForkFIN
88

■Travel axis positioning control

(1) Distance measurement value feedback to speed/position commands generation

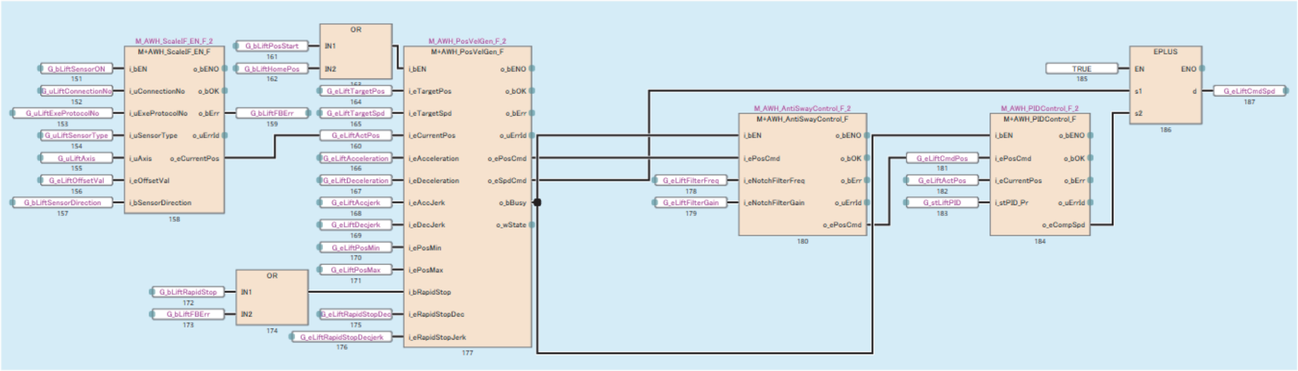

M_AWH_ScaleIF_EN_F_1
M+AWH_ScaleIF_EN_F
G_bTrvlSensorON
G_uTrvlConnectionNo
G_uTrvlExeProtocolNo
G_uTrvlSensorType
G_uTrvlAxis
G_eTrvlOffsetVal
G_bTrvlSensorDirection
i_bEN
i_uConnectionNo
i_uExeProtocolNo
i_uSensorType
i_uAxis
i_eOffsetVal
i_bSensorDirection
o_bENO
o_bOK
o_bErr
o_uErrId
o_eCurrentPos
OR
IN1
IN2
G_bTrvlPosStart
G_bTrvlHomePos
G_bTrvlFBErr
M_AWH_PosVelGen_F_1
M+AWH_PosVelGen_F
G_eTrvlTargetPos
G_eTrvlTargetSpd
G_eTrvlActPos
G_eTrvlAcceleration
G_eTrvlDeceleration
G_eTrvlAccJerk
G_eTrvlDecJerk
G_eTrvlPosMin
G_eTrvlPosMax
G_bTrvlRapidStop
G_eTrvlRapidStopDec
G_eTrvlRapidStopDecJerk
i_bEN
i_eTargetPos
i_eTargetSpd
i_eCurrentPos
i_eAcceleration
i_eDeceleration
i_eAccJerk
i_eDecJerk
i_ePosMin
i_ePosMax
i_bRapidStop
i_eRapidStopDec
i_eRapidStopJerk
o_bENO
o_bOK
o_bErr
o_uErrId
o_ePosCmd
o_eSpdCmd
o_bBusy
o_wState
M_AWH_AntiSwayControl_F_1
M+AWH_AntiSwayControl_F
G_eTrvlFilterFreq
G_eTrvlFilterGain
i_bEN
i_ePosCmd
i_eNotchFilterFreq
i_eNotchFilterGain
o_bENO
o_bOK
o_bErr
o_uErrId
o_ePosCmd
M_AWH_PIDControl_F_1
M+AWH_PIDControl_F
G_eTrvlCmdPos
G_eTrvlActPos
G_stTrvlPID
i_bEN
i_ePosCmd
i_eCurrentPos
i_stPID_Pr
o_bENO
o_bOK
o_bErr
o_uErrId
o_eCompSpd
TRUE
EPLUS
EN
ENO
s1
s2
d
G_eTrvlCmdSpd

(2) Speed command → Frequency conversion, travel/fork motor switching control, inverter communication

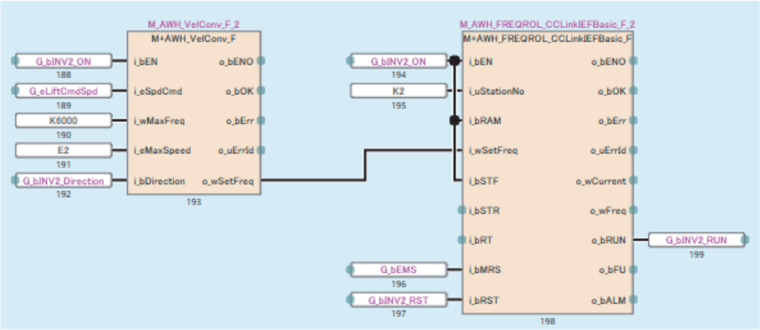

M_AWH_VelConv_F_1
M+AWH_VelConv_F
G_bINV1_ON
G_eTrvlCmdSpd
K6000
E2
G_bINV1_Direction
i_bEN
i_eSpdCmd
i_wMaxFreq
i_eMaxSpeed
i_bDirection
o_bENO
o_bOK
o_bErr
o_uErrId
o_wSetFreq
M_AWH_MotorSwitch_F_1
M+AWH_MotorSwitch_F
G_bINV1_ON
G_bForkSEL
G_bINV1_RUN
G_bForkFWD
G_bForkREV
G_bForkFLS
G_bForkRLS
G_wForkSetFreq
i_bEN
i_bMotor2
i_bRUN
i_bSTF1
i_bSTR1
i_wSetFreq1
i_bSTF2
i_bSTR2
i_wSetFreq2
o_bENO
o_bOK
o_bErr
o_uErrId
o_wSetFreq
o_bSTF
o_bSTR
o_bRT
o_bMotor1
o_bMotor2
G_bTrvMotMC
G_bTrvMotBR
G_bForkMotMC
G_bForkMotBR
M_AWH_FREQROL_CCLinkIEFBasic_F_1
M+AWH_FREQROL_CCLinkIEFBasic_F
G_bINV1_ON
1
G_bEMS
G_bINV1_RST
i_bEN
i_uStationNo
i_bRAM
i_wSetFreq
i_bSTF
i_bSTR
i_bRT
i_bMRS
i_bRST
o_bENO
o_bOK
o_bErr
o_uErrId
o_wCurrent
o_wFreq
o_bRUN
o_bFU
o_bALM
G_bINV1_RUN

■Lift axis positioning control

(1) Distance measurement value feedback to speed/position commands generation


M_AWH_ScaleIF_EN_F_2
M+AWH_ScaleIF_EN_F
G_bLiftSensorON
G_uLiftConnectionNo
G_uLiftExeProtocolNo
G_uLiftSensorType
G_uLiftAxis
G_eLiftOffsetVal
G_bLiftSensorDirection
i_bEN
i_uConnectionNo
i_uExeProtocolNo
i_uSensorType
i_uAxis
i_eOffsetVal
i_bSensorDirection
o_bENO
o_bOK
o_bErr
o_uErrId
o_eCurrentPos
OR
IN1
IN2
G_bLiftPosStart
G_bLiftHomePos
G_bLiftFBErr
M_AWH_PosVelGen_F_2
M+AWH_PosVelGen_F
G_eLiftTargetPos
G_eLiftTargetSpd
G_eLiftActPos
G_eLiftAcceleration
G_eLiftDeceleration
G_eLiftAccJerk
G_eLiftDecJerk
G_eLiftPosMin
G_eLiftPosMax
G_bLiftRapidStop
G_eLiftRapidStopDec
G_eLiftRapidStopDecJerk
i_bEN
i_eTargetPos
i_eTargetSpd
i_eCurrentPos
i_eAcceleration
i_eDeceleration
i_eAccJerk
i_eDecJerk
i_ePosMin
i_ePosMax
i_bRapidStop
i_eRapidStopDec
i_eRapidStopJerk
o_bENO
o_bOK
o_bErr
o_uErrId
o_ePosCmd
o_eSpdCmd
o_bBusy
o_wState
M_AWH_AntiSwayControl_F_2
M+AWH_AntiSwayControl_F
G_eLiftFilterFreq
G_eLiftFilterGain
i_bEN
i_ePosCmd
i_eNotchFilterFreq
i_eNotchFilterGain
o_bENO
o_bOK
o_bErr
o_uErrId
o_ePosCmd
M_AWH_PIDControl_F_2
M+AWH_PIDControl_F
G_eLiftCmdPos
G_eLiftActPos
G_stLiftPID
i_bEN
i_ePosCmd
i_eCurrentPos
i_stPID_Pr
o_bENO
o_bOK
o_bErr
o_uErrId
o_eCompSpd
TRUE
EPLUS
EN
ENO
s1
s2
d
G_eLiftCmdSpd

(2) Speed command → Frequency conversion to inverter communication


M_AWH_VelConv_F_2
M+AWH_VelConv_F
G_bINV2_ON
G_eLiftCmdSpd
K6000
E2
G_bINV2_Direction
i_bEN
i_eSpdCmd
i_wMaxFreq
i_eMaxSpeed
i_bDirection
o_bENO
o_bOK
o_bErr
o_uErrId
o_wSetFreq
M_AWH_FREQROL_CCLinkIEFBasic_F_2
M+AWH_FREQROL_CCLinkIEFBasic_F
G_bINV2_ON
K2
G_bEMS
G_bINV2_RST
i_bEN
i_uStationNo
i_bRAM
i_wSetFreq
i_bSTF
i_bSTR
i_bRT
i_bMRS
i_bRST
o_bENO
o_bOK
o_bErr
o_uErrId
o_wCurrent
o_wFreq
o_bRUN
o_bFU
o_bALM
G_bINV2_RUN

4.3 Operation Examples of General-Purpose Distance Meters

This section describes the usage procedure for communications with distance meters other than distance meters (DL100 Pro (SICK AG) and AMS308i (Leuze)) whose operation is verified in these FB libraries.
In the usage procedure, users are required to edit programs by using the following FBs.
Users are also required to create and add predefined protocols to be used for the predefined protocol support function according to the distance meter to be used.

- M+AWH_ScaleIF_SerialComm_F (distance measurement: serial)
- M+AWH_ScaleIF_EN_F (distance measurement: Ethernet)

Process flow

The following describes a process flow from the wiring and parameter settings of the FX5 CPU module and distance meters to the use of the FB library for control of inverters for automated warehouse.

1. FB library registration and duplication

Register and duplicate the FB library. (☞ Page 101 FB library registration and duplication)

2. Wiring

For the wiring method, refer to the manual of each distance meter.

3. Distance meter setting

Set distance meters according to the CPU module setting. For the setting method, refer to the manuals for the distance meters to be used.

4. Predefined protocol support function setting

Add protocol settings to create predefined protocols. (☞ Page 102 Predefined protocol support function setting)

5. Programming

Create programs. (☞ Page 104 Programming)

FB library registration and duplication

The programs in FBs that are registered from the FB library are not editable. To edit the programs, users need to duplicate (copy) the FBs.

The following describes how to register the FB library, duplicate program elements (FBs) in the library to reuse, and edit the programs.

Registering the FB library

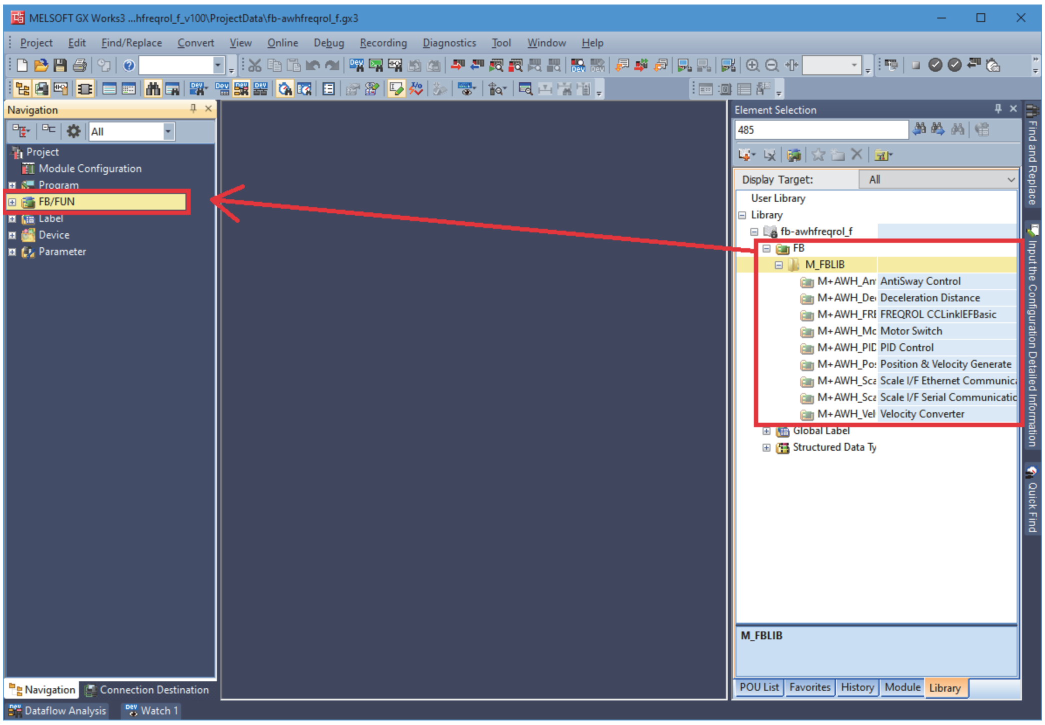
Register the FB library. For the operating procedure, refer to the following.

📖 GX Works3 Operating Manual

Pasting elements to the Navigation window

1. Select a program element on the [Library] tab in the Element Selection window. (Multiple elements can be selected.)

2. Drag and drop the program element to [FB/FUN] in the Navigation window.


MELSOFT GX Works3 ...hfreqrol_f_v100\ProjectData\fb-awhfreqrol_f.gx3
Project Edit Find/Replace Convert View Online Debug Recording Diagnostics Tool Window Help
Navigation
All
Project
Module Configuration
Program
FB/FUN
Label
Device
Parameter
Navigation
Connection Destination
Dataflow Analysis
Watch 1
Element Selection
485
Display Target:
All
User Library
Library
fb-awhfreqrol_f
FB
M_FBLIB
M+AWH_An AntiSway Control
M+AWH_De Deceleration Distance
M+AWH_FRI FREQROL CCLinkIEFBasic
M+AWH_Mc Motor Switch
M+AWH_PID PID Control
M+AWH_Po: Position & Velocity Generate
M+AWH_Sca Scale I/F Ethernet Communica
M+AWH_Sca Scale I/F Serial Communicatio
M+AWH_Vel Velocity Converter
Global Label
Structured Data Ty
M_FBLIB
POU List
Favorites
History
Module
Library
Find and Replace
Input the Configuration Detailed Information
Quick Find

Duplicating reused program elements (FBs)

1. Select and copy an FB to be duplicated in [FB/FUN] in the Navigation window.

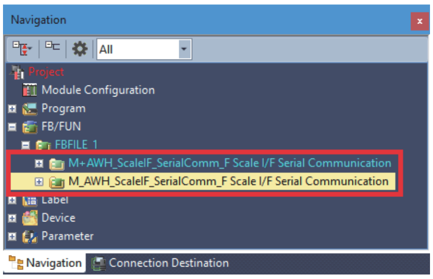
- When a serial communication compatible distance meter is used: Copy M+AWH_ScaleIF_SerialComm_F.
- When an Ethernet communication compatible distance meter is used: Copy M+AWH_ScaleIF_EN_F.

🖱 FB name ⇨ Right-click ⇨ [Copy Data]

2. Duplicate the copied FB into the FB file.

🖱 FB file name ⇨ Right-click ⇨ [Paste Data]

The plus sign (+) in the data name of the reused program element will be changed to the underscore (_) after duplication.


Navigation
All
Project
Module Configuration
Program
FB/FUN
FBFILE 1
M+AWH_ScaleIF_SerialComm_F Scale I/F Serial Communication
M_AWH_ScaleIF_SerialComm_F Scale I/F Serial Communication
Label
Device
Parameter
Navigation
Connection Destination

Distance meter setting

For details on various distance meter settings and the setting method, refer to the manuals for the distance meters to be used.
For the required setting items in the distance measurement value setting, refer to the following.
○: Setting is required, —: Setting is not required

Setting item	Setting value	Serial communication compatible	Ethernet communication compatible
Unit of distance measurement value	0.1 mm	○	○
Data length	8 bits	○	—
Parity	Even number	○	—
Stop Bit	1 bit	○	—
IP address	Set the IP address of the distance meter to be used.	—	○
Gateway	Set an IP address in the same network as the distance meter to be used.	—	○
Subnet mask	Set the subnet mask of the distance meter to be used.	—	○
Protocol to be used	UDP	—	○
Destination IP address	Set the IP address of the CPU module. Example: 192.168.3.250	—	○

Predefined protocol support function setting

This section describes the settings required for communications with general-purpose distance meters other than distance meters (DL100 Pro (SICK AG) and AMS308i (Leuze)) whose operation is verified.

Adding protocol settings

To communicate with a general-purpose distance meter, add a predefined protocol for the used distance meter to the protocol setting data. Register the protocol setting from GX Works3.
For the detailed method, refer to any of the following according to the distance meter communication method (serial communication or Ethernet communication).
📖 MELSEC iQ-F FX5 User's Manual (Serial Communication)
📖 MELSEC iQ-F FX5 User's Manual (Ethernet Communication)

Point

If an additional protocol for communication with another device needs to be registered with the protocol setting data provided with the FB library, add the protocol to the top or bottom of the existing protocol settings. (For protocol settings that are configured with existing protocol numbers, ensure that their protocol numbers appear consecutively.)

Creating predefined protocols

Create predefined protocols to enable communication with distance meters.

Create a predefined protocol and add the protocol setting according to the specifications of the distance meter to be used.

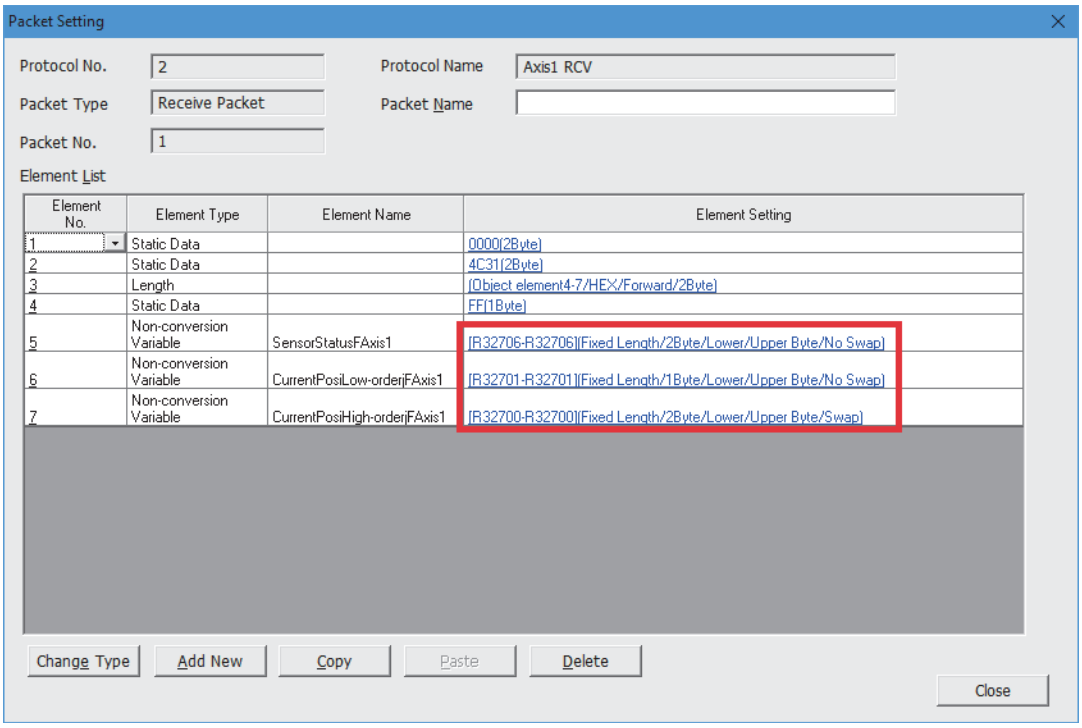
For the specifications of the predefined protocols, refer to the manuals for the distance meters to be used.

When creating predefined protocols, for storage locations for the received data of current position and status (error information), refer to the following memory maps.

Predefined protocol support function memory maps (file register)

R32700	R32701	R32702	R32703	R32704	R32705	R32706	R32707	R32708
Current position						Status (error information)		
(First axis)		(Second axis)		(Third axis)		(First axis)	(Second axis)	(Third axis)
G_d3CurrentPos[0]		G_d3CurrentPos[1]		G_d3CurrentPos[2]		G_w3SensorStatus[0]	G_w3SensorStatus[1]	G_w3SensorStatus[2]

Set the protocol so that its components (received data items) can be stored in the specified file register.



Packet Setting

Protocol No. 2

Protocol Name Axis1 RCV

Packet Type Receive Packet

Packet Name

Packet No. 1

Element List

Element No.	Element Type	Element Name	Element Setting
1	Static Data		0000(2Byte)
2	Static Data		4C31(2Byte)
3	Length		(Object element4-7/HEX/Forward/2Byte)
4	Static Data		FF(1Byte)
5	Non-conversion Variable	SensorStatusFAxis1	[R32706-R32706](Fixed Length/2Byte/Lower/Upper Byte/No Swap)
6	Non-conversion Variable	CurrentPosiLow-orderjFAxis1	[R32701-R32701](Fixed Length/1Byte/Lower/Upper Byte/No Swap)
7	Non-conversion Variable	CurrentPosiHigh-orderjFAxis1	[R32700-R32700](Fixed Length/2Byte/Lower/Upper Byte/Swap)

Programming

The following describes programming required for communication with general-purpose distance meters.

Editing programs in FBs (for serial communication compatible distance meters)

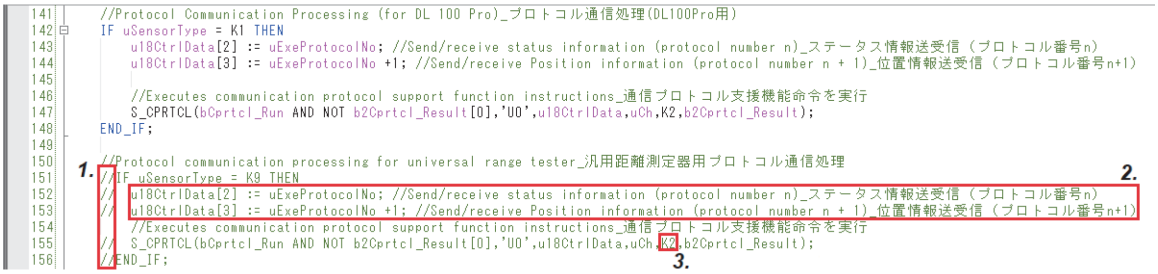
Edit programs in the copy of M+AWH_ScaleIF_SerialComm_F (distance measurement: serial) according to the following instructions.

Restriction

If the programs are not changed according to the following instructions, and the FB is executed with the input label "i_uSensorType (distance meter model name) = K9", the FB does not properly operate.

■Protocol communication processing

This processing is triggered by the predefined protocol support function instruction (S.CPRTCL) to execute the protocol communication according to the predefined protocol setting.



```
//Protocol Communication Processing (for DL 100 Pro)_プロトコル通信処理(DL100Pro用)
IF uSensorType = K1 THEN
    u18CtrlData[2] := uExeProtocolNo; //Send/receive status information (protocol number n)_ステータス情報送受信 (プロトコル番号n)
    u18CtrlData[3] := uExeProtocolNo +1; //Send/receive Position information (protocol number n + 1)_位置情報送受信 (プロトコル番号n+1)

    //Executes communication protocol support function instructions_通信プロトコル支援機能命令を実行
    S_CPRTCL(bCprtcl_Run AND NOT b2Cprtcl_Result[0],'U0',u18CtrlData,uCh,K2,b2Cprtcl_Result);
END_IF;

//Protocol communication processing for universal range tester_汎用距離測定器用プロトコル通信処理
//IF uSensorType = K9 THEN
//  u18CtrlData[2] := uExeProtocolNo; //Send/receive status information (protocol number n)_ステータス情報送受信 (プロトコル番号n)
//  u18CtrlData[3] := uExeProtocolNo +1; //Send/receive Position information (protocol number n + 1)_位置情報送受信 (プロトコル番号n+1)
    //Executes communication protocol support function instructions_通信プロトコル支援機能命令を実行
//  S_CPRTCL(bCprtcl_Run AND NOT b2Cprtcl_Result[0],'U0',u18CtrlData,uCh,K2,b2Cprtcl_Result);
//END_IF;
```

1. Uncomment the protocol communication ladder program for general-purpose distance meters.

2. Specify the protocol numbers to be executed in u18CtrlData (control data) according to the created predefined protocol setting. For details on the control data of the predefined protocol support function instruction (S.CPRTCL), refer to the following.

📖 MELSEC iQ-F FX5 User's Manual (Serial Communication)

Point

By default, two protocol numbers are specified. Add or delete the protocol numbers according to the number of protocols to be executed.

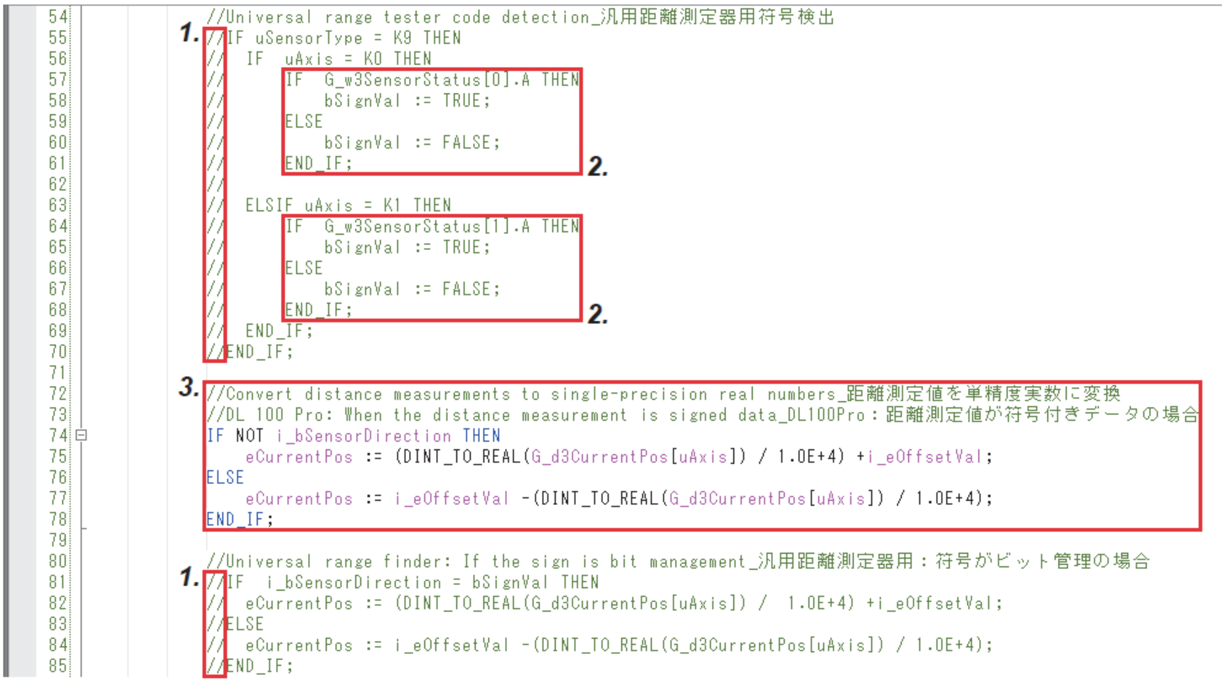
3. Specify the number of protocols to be executed in series according to the created predefined protocol setting (the number of protocols specified in step 2).

■Sign detection processing

The sign of a distance measurement value is detected based on the status of the G_w3SensorStatus (status (error information)) bit received from the distance meter.

Restriction

Do not perform the following procedure when the distance meter to be used outputs distance measurement values as signed values.

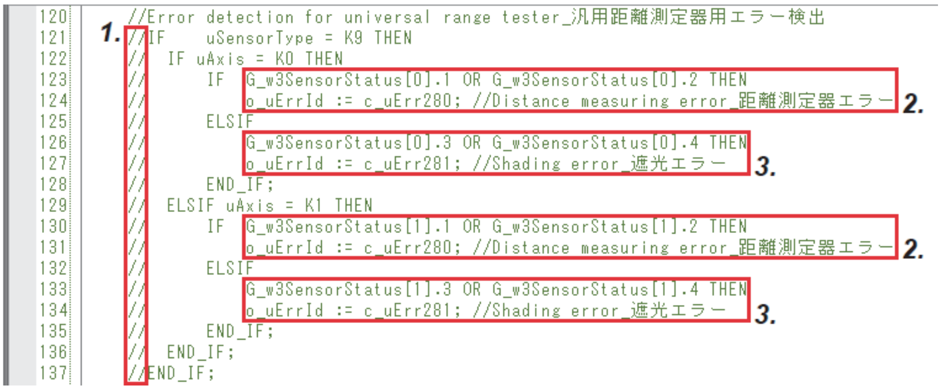


```
//Universal range tester code detection_汎用距離測定器用符号検出
//IF uSensorType = K9 THEN
//  IF  uAxis = K0 THEN
//      IF  G_w3SensorStatus[0].A THEN
//          bSignVal := TRUE;
//      ELSE
//          bSignVal := FALSE;
//      END_IF;
//
//  ELSIF uAxis = K1 THEN
//      IF  G_w3SensorStatus[1].A THEN
//          bSignVal := TRUE;
//      ELSE
//          bSignVal := FALSE;
//      END_IF;
//  END_IF;
//END_IF;

//Convert distance measurements to single-precision real numbers_距離測定値を単精度実数に変換
//DL 100 Pro: When the distance measurement is signed data_DL100Pro：距離測定値が符号付きデータの場合
IF NOT i_bSensorDirection THEN
    eCurrentPos := (DINT_TO_REAL(G_d3CurrentPos[uAxis]) / 1.0E+4) +i_eOffsetVal;
ELSE
    eCurrentPos := i_eOffsetVal -(DINT_TO_REAL(G_d3CurrentPos[uAxis]) / 1.0E+4);
END_IF;

//Universal range finder: If the sign is bit management_汎用距離測定器用：符号がビット管理の場合
//IF  i_bSensorDirection = bSignVal THEN
//  eCurrentPos := (DINT_TO_REAL(G_d3CurrentPos[uAxis]) /  1.0E+4) +i_eOffsetVal;
//ELSE
//  eCurrentPos := i_eOffsetVal -(DINT_TO_REAL(G_d3CurrentPos[uAxis]) / 1.0E+4);
//END_IF;
```

1. Uncomment the sign detection ladder program for general-purpose distance meters as well as the ladder program for single-precision real number conversion of a distance measurement value (when the sign is managed with a bit).
2. For the processing for detecting the sign of a distance measurement value, change the statements according to the G_w3SensorStatus bit to be referenced.
3. The default program (when DL100 Pro is used) includes statements to work with a case where a distance measurement value is output as a signed value. Therefore, delete the statements.

■Error detection processing

The error code is output based on the status of each G_w3SensorStatus (status (error information)) bit received from the distance meter.



```
//Error detection for universal range tester_汎用距離測定器用エラー検出
//IF    uSensorType = K9 THEN
//  IF uAxis = K0 THEN
//      IF  G_w3SensorStatus[0].1 OR G_w3SensorStatus[0].2 THEN
//          o_uErrId := c_uErr280; //Distance measuring error_距離測定器エラー
//      ELSIF
//          G_w3SensorStatus[0].3 OR G_w3SensorStatus[0].4 THEN
//          o_uErrId := c_uErr281; //Shading error_遮光エラー
//      END_IF;
//  ELSIF uAxis = K1 THEN
//      IF  G_w3SensorStatus[1].1 OR G_w3SensorStatus[1].2 THEN
//          o_uErrId := c_uErr280; //Distance measuring error_距離測定器エラー
//      ELSIF
//          G_w3SensorStatus[1].3 OR G_w3SensorStatus[1].4 THEN
//          o_uErrId := c_uErr281; //Shading error_遮光エラー
//      END_IF;
//  END_IF;
//END_IF;
```

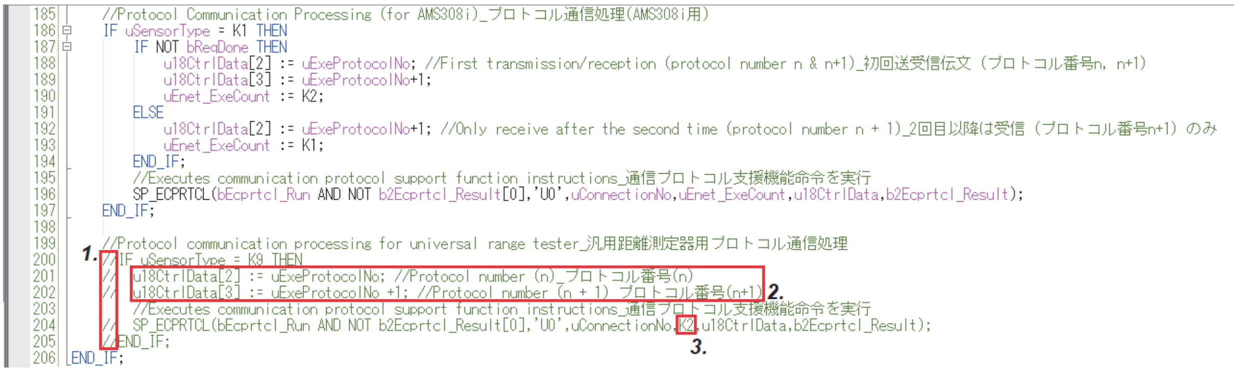
1. Uncomment the error detection ladder program for general-purpose distance meters.
2. For the processing for detecting distance meter errors, change the statements according to the G_w3SensorStatus bit to be referenced.
3. For the processing for detecting the distance measurement value errors due to light blocking, change the statements according to the G_w3SensorStatus bit to be referenced.

Editing programs in FBs (for Ethernet communication compatible distance meters)

Edit programs in the copy of M+AWH_ScaleIF_EN _F (distance measurement: Ethernet) according to the following instructions.

■Protocol communication processing

This processing is triggered by the predefined protocol support function instruction (SP.ECPRTCL) to execute the protocol communication according to the predefined protocol setting.



```
    //Protocol Communication Processing (for AMS308i)_プロトコル通信処理(AMS308i用)
    IF uSensorType = K1 THEN
        IF NOT bReqDone THEN
            u18CtrlData[2] := uExeProtocolNo; //First transmission/reception (protocol number n & n+1)_初回送受信伝文 (プロトコル番号n, n+1)
            u18CtrlData[3] := uExeProtocolNo+1;
            uEnet_ExeCount := K2;
        ELSE
            u18CtrlData[2] := uExeProtocolNo+1; //Only receive after the second time (protocol number n + 1)_2回目以降は受信 (プロトコル番号n+1) のみ
            uEnet_ExeCount := K1;
        END_IF;
        //Executes communication protocol support function instructions_通信プロトコル支援機能命令を実行
        SP_ECPRTCL(bEcprtcl_Run AND NOT b2Ecprtcl_Result[0],'U0',uConnectionNo,uEnet_ExeCount,u18CtrlData,b2Ecprtcl_Result);
    END_IF;

    //Protocol communication processing for universal range tester_汎用距離測定器用プロトコル通信処理
    //IF uSensorType = K9 THEN
    //  u18CtrlData[2] := uExeProtocolNo; //Protocol number (n)_プロトコル番号(n)
    //  u18CtrlData[3] := uExeProtocolNo +1; //Protocol number (n + 1) プロトコル番号(n+1)
        //Executes communication protocol support function instructions_通信プロトコル支援機能命令を実行
    //  SP_ECPRTCL(bEcprtcl_Run AND NOT b2Ecprtcl_Result[0],'U0',uConnectionNo,K2,u18CtrlData,b2Ecprtcl_Result);
    //END_IF;
END_IF;
```

1. Uncomment the protocol communication ladder program for general-purpose distance meters.
2. Specify the protocol numbers to be executed in u18CtrlData (control data) according to the created predefined protocol setting. For details on the control data of the predefined protocol support function instruction (SP.ECPRTCL), refer to the following.

📖 MELSEC iQ-F FX5 User's Manual (Ethernet Communication)

Point

By default, two protocol numbers are specified. Add or delete the protocol numbers according to the number of protocols to be executed.

3. Specify the number of protocols to be executed in series according to the created predefined protocol setting (the number of protocols specified in step 2).

Point

Depending on the distance meters to be used, protocol communications (send/receive) of position information may become limited to receive processing only on the second and subsequent data exchanges. For details, refer to the manuals for the distance meters to be used.

Limiting the protocol communications to receive processing only enables reduction of the takt time of communications for obtaining position information.

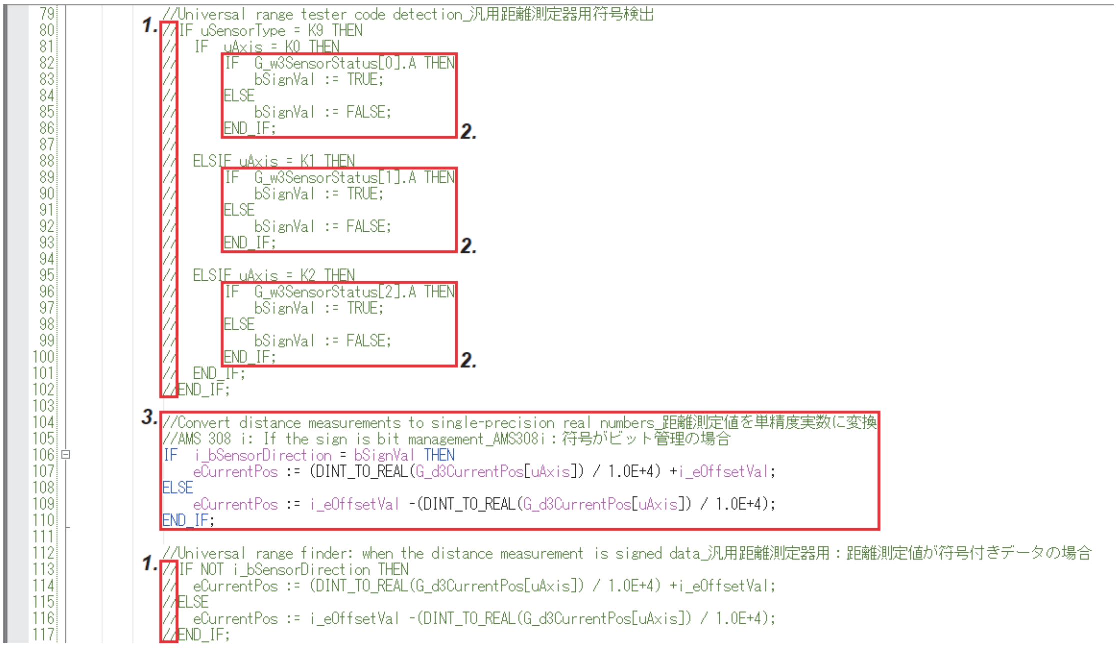
As a program example, bReqDone (first send completion) label used for AMS308i controls the predefined protocol to communicate data as follows: both sending and receiving data for the first time; only receiving data for the second and subsequent times.

■Sign detection processing

The sign of a distance measurement value is detected based on the status of the G_w3SensorStatus (status (error information)) bit received from the distance meter.

Point

- Perform only step 3 in the following procedure when the used distance meter outputs distance measurement values as signed values.
- Perform only steps 1 and 2 in the following procedure when the used distance meter uses a bit to manage the sign of a distance measurement value.

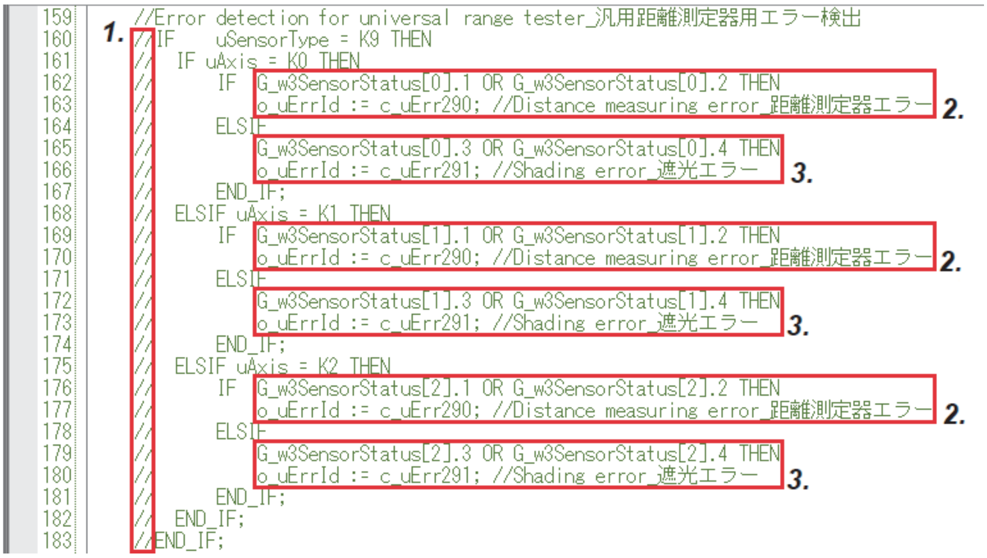


```
//Universal range tester code detection_汎用距離測定器用符号検出
//IF uSensorType = K9 THEN
//  IF  uAxis = K0 THEN
//      IF  G_w3SensorStatus[0].A THEN
//          bSignVal := TRUE;
//      ELSE
//          bSignVal := FALSE;
//      END_IF;
//
//  ELSIF uAxis = K1 THEN
//      IF  G_w3SensorStatus[1].A THEN
//          bSignVal := TRUE;
//      ELSE
//          bSignVal := FALSE;
//      END_IF;
//
//  ELSIF uAxis = K2 THEN
//      IF  G_w3SensorStatus[2].A THEN
//          bSignVal := TRUE;
//      ELSE
//          bSignVal := FALSE;
//      END_IF;
//  END_IF;
//END_IF;

//Convert distance measurements to single-precision real numbers_距離測定値を単精度実数に変換
//AMS 308 i: If the sign is bit management_AMS308i：符号がビット管理の場合
IF  i_bSensorDirection = bSignVal THEN
    eCurrentPos := (DINT_TO_REAL(G_d3CurrentPos[uAxis]) / 1.0E+4) +i_eOffsetVal;
ELSE
    eCurrentPos := i_eOffsetVal -(DINT_TO_REAL(G_d3CurrentPos[uAxis]) / 1.0E+4);
END_IF;

//Universal range finder: when the distance measurement is signed data_汎用距離測定器用：距離測定値が符号付きデータの場合
//IF NOT i_bSensorDirection THEN
//  eCurrentPos := (DINT_TO_REAL(G_d3CurrentPos[uAxis]) / 1.0E+4) +i_eOffsetVal;
//ELSE
//  eCurrentPos := i_eOffsetVal -(DINT_TO_REAL(G_d3CurrentPos[uAxis]) / 1.0E+4);
//END_IF;
```

1. Uncomment the sign detection ladder program for general-purpose distance meters as well as the ladder program for single-precision real number conversion of a distance measurement value (when a distance measurement value is a signed value).
2. For the processing for detecting the sign of a distance measurement value, change the statements according to the G_w3SensorStatus bit to be referenced.
3. The default program (when AMS308i is used) includes statements to work with a case where the sign of a distance measurement value is managed with a bit. Therefore, delete the statements.

■Error detection processing

The error code is output based on the status of each G_w3SensorStatus (status (error information)) bit received from the distance meter.



```
//Error detection for universal range tester_汎用距離測定器用エラー検出
//IF    uSensorType = K9 THEN
//  IF uAxis = K0 THEN
//      IF  G_w3SensorStatus[0].1 OR G_w3SensorStatus[0].2 THEN
//          o_uErrId := c_uErr290; //Distance measuring error_距離測定器エラー
//      ELSIF
//          G_w3SensorStatus[0].3 OR G_w3SensorStatus[0].4 THEN
//          o_uErrId := c_uErr291; //Shading error_遮光エラー
//      END_IF;
//  ELSIF uAxis = K1 THEN
//      IF  G_w3SensorStatus[1].1 OR G_w3SensorStatus[1].2 THEN
//          o_uErrId := c_uErr290; //Distance measuring error_距離測定器エラー
//      ELSIF
//          G_w3SensorStatus[1].3 OR G_w3SensorStatus[1].4 THEN
//          o_uErrId := c_uErr291; //Shading error_遮光エラー
//      END_IF;
//  ELSIF uAxis = K2 THEN
//      IF  G_w3SensorStatus[2].1 OR G_w3SensorStatus[2].2 THEN
//          o_uErrId := c_uErr290; //Distance measuring error_距離測定器エラー
//      ELSIF
//          G_w3SensorStatus[2].3 OR G_w3SensorStatus[2].4 THEN
//          o_uErrId := c_uErr291; //Shading error_遮光エラー
//      END_IF;
//  END_IF;
//END_IF;
```

1. Uncomment the error detection ladder program for general-purpose distance meters.
2. For the processing for detecting distance meter errors, change the statements according to the G_w3SensorStatus bit to be referenced.
3. For the processing for detecting the distance measurement value errors due to light blocking, change the statements according to the G_w3SensorStatus bit to be referenced.

APPENDIX

Appendix 1 When the FR-A800 Series Is Used

For the FR-A800 series, the link device assignment and some parameter contents are different from those of the FR-E800 series.

The following tables list the settings when the FR-A800 series is used.

Link devices

The letter "n" in a device number represents a value determined by the station number.

○: Can be changed, ×: Cannot be changed

Master station to Inverter (RYn)			**Inverter to Master station (RXn)**		
Device No.	**Device name**	**Mapping**	**Device No.**	**Device name**	**Mapping**
RYn0	Forward rotation command	×	RXn0	Forward running	×
RYn1	Reverse rotation command	×	RXn1	Reverse running	×
RYn2	High-speed operation command (terminal RH function)	○	RXn2	Running (terminal RUN function)	×
RYn3	Middle-speed operation command (terminal RM function)	○	RXn3	Up to frequency (terminal SU function)	○
RYn4	Low-speed operation command (terminal RL function)	○	RXn4	Overload warning (terminal OL function)	○
RYn5	JOG operation command (terminal JOG function)	○	RXn5	Instantaneous power failure (terminal IPF function)	○
RYn6	Second function selection (terminal RT function)	×	RXn6	Frequency detection (terminal FU function)	×
RYn7	Current input selection (terminal AU function)	○	RXn7	Fault (terminal ABC1 function)	×
RYn8	Selection of automatic restart after instantaneous power failure (terminal CS function)	○	RXn8	- (terminal ABC2 function)	○
RYn9	Output stop (terminal MRS function)	×	RXn9	Pr.313 assignment function (DO0)	○
RYnA	Start self-holding selection (terminal STOP function)	○	RXnA	Pr.314 assignment function (DO1)	○
RYnB	Reset (terminal RES function)	○	RXnB	Pr.315 assignment function (DO2)	○
RYnC	Monitor command	×	RXnC	Monitoring	×
RYnD	Frequency setting command (RAM)	×	RXnD	Frequency setting completion (RAM)	×
RYnE	Frequency setting command (RAM, E2PROM)	×	RXnE	Frequency setting completion (RAM, E2PROM)	×
RYnF	Instruction code execution request	×	RXnF	Instruction code execution completion	×
RY(n+1)0 to RY(n+1)7	Reserved	×	RX(n+1)0 to RX(n+1)7	Reserved	×
RY(n+1)8	Not used (initial data process completion flag)	×	RX(n+1)8	Not used (initial data process completion flag)	×
RY(n+1)9			RX(n+1)9		
RY(n+1)A	Error reset request flag	×	RX(n+1)A	Error status flag	×
RY(n+1)B to RY(n+1)F	Reserved	×	RX(n+1)B	Remote station ready	×
			RX(n+1)C to RX(n+1)F	Reserved	×

Inverter parameter

Use FR Configurator2 to set the inverter parameters.
The setting value is an example for use with a sample program.

Point

For details on parameters, refer to the manuals for the inverters used.
For details on how to use FR Configurator2, refer to the following.
📖FR Configurator2 Instruction Manual

No.	Name	Initial value	Setting value	Description
7	Acceleration time[*1]	5	0	As the operation pattern is generated using an FB, set the acceleration/deceleration time to 0 for the inverter.
8	Deceleration time[*1]	5	0	
9	Electronic thermal O/L relay	Inverter rated current	2.55	Set the rated motor current. Set the parameter in accordance with specifications of the motor used.
13	Starting frequency[*1]	0.5	0	As the operation pattern is generated using an FB, set the starting frequency to 0 for the inverter.
18	High speed maximum frequency[*1]	120	200	Set the maximum output frequency to 200 Hz.
45	Second deceleration time	9999	1	Used for motor switching for the travel/fork axis by "M+AWH_MotorSwitch_F". Set the parameters in accordance with specifications of the motor used.
46	Second torque boost	9999	1	
47	Second V/F (base frequency)	9999	60	
48	Second stall prevention operation level	150	150	
51	Second electronic thermal O/L relay / Rated second motor current	9999	0.68	
71	Applied motor	0	0	Set the parameters to change the control method to Vector control. Set the parameters in accordance with specifications of the motor used.
80	Motor capacity	9999	0.4	
81	Number of motor poles	9999	4	
83	Rated motor voltage	200/400/575	200	
84	Rated motor frequency	9999	60	
96	Auto tuning setting/status	0	1	Set the parameter to perform offline auto tuning.
183	RT terminal function selection[*1]	3	3	Assign the RT (Second function selection) signal to terminal RT.
187	MRS terminal function selection[*1]	24	24	Assign the MRS (Output stop) signal to terminal MRS.
190	RUN terminal function selection[*1]	0	0	Assign the RUN (Inverter running) signal to terminal RUN in positive logic.
194	FU terminal function selection[*1]	1	4	Assign the FU (Output frequency detection) signal to terminal FU in positive logic.
195	ABC1 terminal function selection[*1]	99	199	Assign the ALM (Fault) signal to terminals A1, B1, and C1 in negative logic.
359	Encoder rotation direction	1	1	Set the parameters in accordance with specifications of the encoder used under Vector control.
369	Number of encoder pulses	1024	1000	
451	Second motor control method selection[*1]	9999	20	Set the parameter to perform V/F control for the fork axis motor.
502	Stop mode selection at communication error	0	0	For communication via the Ethernet connector, the operation at a communication error can be selected. The operation at a communication error can be selected when Pr.1431 is "3" or Pr.1432 is not "9999". Set the parameter in accordance with specifications of the system used.
541	Frequency command sign selection[*1]	0	1	The start command (forward/reverse rotation) can be inverted when a minus sign is added to the value of the frequency command.
800	Control method selection[*1]	20	0	Change the control method to Vector control.
1429	Ethernet function selection 3[*1]	9999	61450	Set the parameter to use CC-Link IE Field Network Basic.
1431	Ethernet signal loss detection function selection	0	3	Set the availability of the signal loss detection and select the action when Ethernet communication is interrupted by physical factors such as cable disconnection. Set the parameter in accordance with specifications of the system used.

No.	Name	Initial value	Setting value	Description
1432	Ethernet communication check time interval	9999	1.5	A signal loss detection is performed between the inverter and all the devices with IP addresses in the range for Ethernet command source selection (Pr.1449 to Pr.1454). If a signal loss is detected (a communication stops), a communication error (E.EHR) occurs and the inverter output will be shut off. Set the parameter in accordance with specifications of the system used.
1434	IP address 1 (Ethernet)	192	192	Enter the IP address of the inverter to be connected to Ethernet.
1435	IP address 2 (Ethernet)	168	168	
1436	IP address 3 (Ethernet)	50	3	
1437	IP address 4 (Ethernet)	1	1	
1438	Subnet mask 1	255	255	Enter the subnet mask of the network to which the inverter belongs.
1439	Subnet mask 2	255	255	
1440	Subnet mask 3	255	255	
1441	Subnet mask 4	0	0	
1449	Ethernet command source selection IP address 1	0	192	To limit the network devices that send the operation or speed command through the Ethernet network, set the range of IP addresses of the devices. When Pr.1449 to Pr.1452 are "0 (initial value)", no IP address is specified for command source via Ethernet. In this case, operation commands cannot be sent via Ethernet. The range for command source depends on the settings in Pr.1451 and Pr.1453, and Pr.1452 and Pr.1454. When the setting values on the left are set, the IP address range for command source via Ethernet is "192.168.xxx (3 to 255).xxx (0 to 255)".
1450	Ethernet command source selection IP address 2	0	168	
1451	Ethernet command source selection IP address 3	0	3	
1452	Ethernet command source selection IP address 4	0	0	
1453	Ethernet command source selection IP address 3 range specification	9999	255	
1454	Ethernet command source selection IP address 4 range specification	9999	255	

*1 For this parameter, set the setting value shown in the list.

MEMO

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MEMO

REVISIONS

*The manual number is given on the bottom left of the back cover.

Revision date	Revision	Description
January 2023	A	First edition

Japanese manual number: SH-082574-A

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