



Engineering Software MELSOFT GX Works2 FB Quick Start Guide



Symbol	Description	Example
Point	This symbol explains information you need to know.	Select [View] \rightarrow [Comment] (\boxed{Ctrl} key + $\boxed{F4}$ key). The comment display/hide setting can be switched.
	This symbol describes content that must be noted in operation.	When dismounting the module, the power must be turned off.
	Buttons on the screen	OK button
[]	Menu names on the menu bar ([] \rightarrow [] shows drop-down menus.)	Select [Project] \rightarrow [New].
	Keys on the keyboard	F4 key
()	Another procedure corresponding to a drop-down menu (icons and keys on the keyboard)	Select [Compile] \rightarrow [Rebuild All]. ()

The following shows the symbols used in this Quick start guide with descriptions and examples.

Terms

The following explains the terms and abbreviations, such as FB, used in this Quick start guide.

Term or abbreviation	Description
FB	Abbreviation of Function Block.
FB library	A collection of FB parts that are usable in GX Works2 (Simple Project). Sequence programs to use MELSEC-Q/L series modules and partner products can be easily created.
GX Works2	A programming tool for the programmable controller. Programming using FB libraries is possible. Generic product name for SWnDND-GXW2-E and SWnDNC-GXW2-E. (n = version)
GX Developer	A programming tool for the programmable controller. Product name for SWnD5C-GPPW-E. (n = version)

Related manuals

This Quick start guide explains the basic procedures to introduce FB.

Refer to the manuals in the following table as required.

Manual name	Manual number (Model code)
GX Works2 Version 1 Operating Manual (Common) Explains the system configuration of GX Works2 and the functions common to Simple project and Structured project such as parameter setting, operation method for the online function.	SH-080779ENG (13JU63)
(Sold separately.)	
GX Works2 Version 1 Operating Manual (Simple Project) Explains methods for such as creating and monitoring programs in Simple project of GX Works2. (Sold separately.)	SH-080780ENG (13JU64)
GX Works2 Version 1 Operating Manual (Simple Project, Function Block) Explains methods for such as creating function blocks, pasting function blocks to sequence programs, and operating FB library in Simple project of GX Works2. (Sold separately.)	SH-080984ENG (13JU72)

Introduction

This Quick start guide explains the basic procedures for first-time FB (Function Block) users. This guide will help with understanding how to use FBs.



This Quick start guide explains how to use FB libraries and how to create FBs using simple examples.

When designing/operating systems, read the manuals of the CPU module that is to be used, that in use, and use them safely.

FBs

FB is an abbreviation for a Function Block that is designed to convert a ladder block, which is used repeatedly in a sequence program, into a component (FB) to be utilized in a sequence program. This not only increases the efficiency of program development but also reduces programming mistakes to improve program quality.

Sequence program



Converting into Components

What does it mean when a sequence program is converted into a component? The following section explains the process to convert a simple program into a component.

Example) A program in which the output signal (Y12) is turned ON when the input signal (X1) is turned ON 12 times.



Advantages of Using FBs

This section introduces advantages of creating programs by using FBs.

Easy programming

A sequence program can be created simply by pasting in an FB. This significantly reduces the program development man-hours. (Programming is made easier using FB libraries provided by Mitsubishi Electric Corporation.)



Easy reading

Using an FB creates a simple program with only a 'box' (FB), an input, and an output to create an easy-to-read sequence program.



Reusing

Converting a standard program into a component allows the program to be reused any number of times.

As a result, operations such as copying a sequence program and modifying a device, which had often been required in the past, will be unnecessary.



Improving quality

Converting a standard program into a component as an FB to reuse the program allows development of programs of consistent quality, without relying on the technological skill of the program developers.

When developers A and B are developing sequence programs for different devices, using the same FB for the common processing enables to create consistent quality of sequence programs.



Protecting assets

By setting up a block password, the created FB can be protected so that it cannot be viewed.

Once the block password has been set, the following operations are restricted:

- Displaying and editing of FB program
- Editing of FB local label
- Copying to other project





FB Libraries

An FB library is a collection of FB parts that are usable in GX Works2 (Simple project). Using an FB library enables easy setting and operation of MELSEC-Q/L modules and partner products.

<Example of MELSEC-Q/L module>



<Example of partner product>



■ FB Library Lineup

In FB libraries, there are 'FBs for MELSEC-Q/L modules' and 'FBs for partner products'.

FBs for MELSEC-Q/L modules	F
-CPU	
-Analog input/output module	
-Counter module	
-Positioning module	
:	

FBs for partner products -Vision sensor

FB libraries supporting various functions are expected to be released sequentially.

How to Obtain FB Libraries

Please contact your local Mitsubishi Electric sales office or representative to obtain the FB Library.

Development Tool

The following development tool is required to develop sequence programs using FBs.

Tool name	Version
GX Works2 (Simple project)	1.12N or later



Depending on the FB library, supporting versions of GX Works2 may differ.

FB Specifications and Precautions

The following specifications and precautions must be understood prior to using FBs.

- 1. An FB cannot be used in another FB.
- 2. Because an FB specific process is added when an FB is arranged, the number of steps increases when compared to a ladder created without using an FB.
- 3. FBs cannot be used in an interruption program.
- 4. FBs whose execution does not complete within 1 scan cannot be used in the FOR to NEXT instruction loops and subroutine programs.

Using FB Libraries

This chapter explains the procedure to create a program by using an FB library.



Before using FB libraries, read and agree to the terms of use indicated when obtaining an FB library.

Programs to be Created

This section explains how to use an FB library with an example of importing an analog value from an analog input module.

Example) Reading an analog value to D10 from the analog input module (Q64AD) when the switch (X10) is turned ON.



Program can easily be created by using an FB library as follows.



Create this program in the following section.

Preparations Prior to Use of FB Libraries

Before using an FB library, contact your distributor to obtain it.

(FB libraries will not be installed when installing GX Works2.)

The following explains operation procedures using the FB library for Q64AD as an example.

Operating procedure

1. As the file obtained from your distributor is a zip format file, unzip "fb-q64ad_v102c.zip" and start installation.



2. The installation screen is displayed.

The screen for installation is displayed.

Follow the instructions and perform installation.



3. The following dialog is displayed when the installation is complete.

MELSOFT Library Q64AD -	InstallShield Wizard
	InstallShield Wizard Complete
	The InstallShield Wizard has successfully installed MELSOFT Library Q64AD. Click Finish to exit the wizard.
	<back cancel<="" finish="" td=""></back>

This completes the preparation prior to use of FB libraries.



1 Creating New Projects

This section explains how to create a new project by starting GX Works2.

Operating procedure

- *1.* Select [MELSOFT] \rightarrow [GX Works2]^{*1} \rightarrow [GX Works2] from Windows[®] Start^{*2}.
 - *1 : Does not appear in Windows $^{\textcircled{R}}$ 8 or later.
 - *2 : Select [All apps] on the Start screen or [Start] \rightarrow [All Programs]/[All apps].
- 2. After starting, the GX Works2 main screen is displayed.



To the next page

3. Select [Project] \rightarrow [New].



4. The "New Project" dialog is displayed.



5. A project tree and the ladder screen are displayed.



	n window is no	t displayed, use the following	g procedure to display it.
View Online Debug D Toolbar Statusbar Color and Sont	iagnostics <u>T</u> ool <u>W</u> indov		①Select [Docking Window]
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View Qnline Debug D Joolbar Statusbar Color and Font		w is not displayed, use the f	ollowing procedure to display it. — ①Select [Docking Window].

2 Importing FB Library to Projects

This section explains how to import an FB library for analog input module (Q64AD) to be pasted to the program into a project.

Operating procedure

1. Select [Project] \rightarrow [Library] \rightarrow [Install].



To the next page.

2. The "Import Library to Project" dialog is displayed.



3. The imported FBs are displayed in the Project view and the Element Selection window.



The FB library for Q64AD is now usable in GX Works2. Next, create a program using the imported FB library.

③ Pasting FBs

This section explains how to drag and drop the FB to be pasted to the program window from the Element Selection window or Project view. (Drag and drop from the Project view is possible from GX Works2 1.24A or later.)

Operating procedure

1. Paste "M+Q64AD_ReadADVal" to the program window.



2. The "Input FB Instance Name" dialog is displayed.

Input FB Instance Name Local Label(MAIN) CK ReadADVal_1 Exit		[EN0
Input FB Instance Name Local Label(MAIN) CK ReadAOVal Exit		
Input FB Instance Name Image: Constant of the second sec		
Input FB Instance Name Local Label(MAIN) Image: Cock and the cock		
Input FB Instance Name Local Label(MAIN) Image: Constraint of the state of		
Local Label(MAIN)	Input FB Instance Name	
ReadADVal_1	Local Label(MAIN)	
	ReadADVal_1 Exit	

For details of settings, refer to section '(4) Setting Names of the Pasted FBs' in the following page.

④ Setting Names of the Pasted FBs

When an FB library is pasted to the program window, a dialog to input a name of the pasted FB (FB instance name^{*}) is displayed.

* Instance name is to distinguish the FB.

A temporary name is automatically set to the instance name. To use the name as it is, close the dialog by clicking . Make sure that the same name does not exist in the same program when changing the name.

Keep as the default in this procedure.

Operating procedure

1. Input the FB instance name.



2. The FB is pasted to the program window.

		Rea	adAD\	/al_1		
			B:FB_EN	ReadADVal_1	FB_ENO:B	
			W:i_Start_IO_No)	FB_OK:B	
			W:i_CH		FB_ERROR:B	
					ERROR_ID:W	
				c	_AD_Value:W	
0)						[END]

0

Point

- When inputting an instance name, be careful of the following points.
- Case-sensitive
- Single-byte number cannot be selected for the first letter.
- The maximum number of characters for an instance name is 16 in single-byte.

An error occurs when clicking $\boxed{}$ with the following setting.

(When the first letter is a single-byte number).

			MELSOF	i Series GX Worksz
Inp	it FB Instance Name		(1)	A received word is used in FB instance name
Loca	Label(MAIN)	>	\checkmark	A reserved word is used in the instance mane.
1-10	Exit			ОК

5 Creating Input and Output Ladders

Create the input ladder section and the output ladder section of the pasted FB, and complete the program.

Refer to the following drawing and input the information.



Input ladder section

Number Description (1) FB execution instruction (2) Module mounting XY address: 0 (3) Channel number: 1 (4) FB is running: ON (5) Normal end: ON (6) Error end: ON (7) Stores the error code. (8) Stores the analog value.

Output ladder section

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6 Performing Conversion/Compilation

Conversion/compilation is required to execute the completed program.

The following explains how to convert/compile all programs.

Operating procedure

1. Select [Compile] \rightarrow [Rebuild All].

🗰 MELSOFT Series GX Works2 (Unset Project) - [[PRG] MAIN]							
Eroject Edit Find/Replace	⊆on	npile	⊻iew	<u>O</u> nline	De <u>b</u> ug	Diagno	
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Navigation	<mark>a</mark>	<u>R</u> eb	uild All		Shift+Alt	+F4	

2. The following message is displayed.



3. All programs are converted/compiled and the result is displayed in the Output window.

Output				
lebuild All				
No. Result	Data Name	Class	Content	Error Code
1 Information			Word device (VAR range) 5 points used (Range D12283 - D12287)	F1301
2 Information			Bit device (VAR range) 3 points used (Range M8189 - M8191)	F1305
3 Information	-		Pointer (VAR range) 0 point used	F1310
4 Information	-	-	Timer (VAR range) 0 point used	F1312
5 Information	-		Counter (VAR range) 0 point used	F1324
	Rebui	ld All Complet	ed.Error: 0, Warning: 0, CheckWarning: 0	

This completes the program creation.

6

Point

When pasting multiple FBs that describe the device output (such as OUT Y0Z9) by using index modification internally, duplicate coil warnings occur during compiling. However, this is not a usage problem.

Writing and Executing Sequence Programs

Write the created program to the CPU module and run the program.

Operating procedure

1. Select [Online] \rightarrow [Write to PLC].



2. The "Online Data Operation" dialog is displayed.



3. Data are written to the programmable controller CPU.



Preparation to run the created program is now completed.

Point

Writing symbolic information using the Write to PLC function enables restoring to FB when the program is read from the programmable controller.

In addition, for universal model QCPU and L series CPU modules, program memory for the programmable controller can be economized by changing the write destination of the symbolic information to the CPU module built-in standard ROM.

8 Confirming Operations

Confirm the created program's operations.

Operating procedure

- 1. Select [Online] \rightarrow [Monitor] \rightarrow [Start Monitoring]^{*1}.
 - *1: When the following option is checked, select [Online] → [Monitor] → [Monitor Mode] from the menu.

 $\label{eq:constraint} \begin{array}{l} [\text{Tool}] \rightarrow [\text{Options}] \rightarrow "\text{Program Editor"} \rightarrow "\text{Ladder"} \rightarrow "\text{Ladder Diagram"} \rightarrow "\text{Use the Switching Ladder Edit Mode (Read, Write, Monitor, Monitor (Write))"} \end{array}$



2. Monitoring status is displayed.



3. Turn the switch (X10) ON and confirm that the analog value is read.



Double-clicking the FB in the sequence program on the screen enables monitoring of the sequence program status in the FB.



This concludes the explanation of how to use FB libraries.

Creating FBs

This chapter explains the procedure to create a new FB.

Create an FB with the following procedures.



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FBs to be Created

This section explains the procedure to create an FB from a simple program.

Example) When input X1 is turned ON 12 times, output Y12 is turned ON.

[Sequence program]





Creating an FB for the above program and pasting it to the sequence program creates a simple program with only an FB, an input, and an output.

[Sequence program to which FB is pasted]



Create an FB in the following section.

1 Creating New Projects

This section explains how to create a new project by starting GX Works2.

Operating procedure

- *1.* Select [MELSOFT] \rightarrow [GX Works2]^{*1} \rightarrow [GX Works2] from Windows[®] Start^{*2}.
 - *1 : Does not appear in Windows $^{\textcircled{R}}$ 8 or later.
 - *2 : Select [All apps] on the Start screen or [Start] \rightarrow [All Programs]/[All apps].
- 2. After starting, the GX Works2 main screen is displayed.



3. Select [Project] \rightarrow [New].



4. The "New Project" dialog is displayed.



5. A project tree and the ladder screen are displayed.



2 Creating New Data

After a GX Works2 project is created, create a new data file ("Count_Num" is used as an FB name in this section).

Operating procedure

1. In the Navigation window, select "FB_Pool", and right-click and select [Add New Data] from the shortcut menu.



2. The "New Data" dialog is displayed.



3. The newly created FB (Count_Num) is added to the Navigation window and the Element Selection window.



③ Setting Labels

Because FBs are utilized by being converting into components, the actual devices are not used and input labels, output labels, and internal labels are used to create a program.

First, categorize the actual devices of the sequence program into, input device, output device, and internal device.

Next, set each label for the categorized actual devices.



The labels corresponding to the actual devices in the FB that is to be created are as shown in the following tables.

Device type	Device name		Label type (Class)	Label name	Data type
Input device	X1		Input label (VAR_INPUT)	i_Count	Bit
Output device	Y12	$\Box >$	Output label (VAR_OUTPUT)	o_C_Up	Bit
Internal device	D1		Internal label (VAR)	m_Cnt	Word [Signed]

Set the input label, output label, and internal label to be used in the FB in the following section.

Operating procedure

1. Double-click "Local Label" of the added FB and display the Function/FB Label Setting screen.



2. The Function/FB Label Setting screen is displayed.

1	Function/FB Label Setting C	×			4 Þ	Ŧ
	Class	Label Name	Data Type	Constant	Comment	•
1						=
2	_					
3						
4	•					
5	-					
6	•					
7	-					
8	-					
9	-					
10	-					
11	-					
12	-					
13	-					
14	-					
15	-					
16	-					
17	-					
18				 		

3. Set the labels as follows.



Creating design data in Excel or other format in advance for the internal labels that are used normally, and entering the label by copying and pasting from the data, reduces the development man-hours.

④ Creating FB Programs

This section explains how to create a sequence program in an FB using the set labels.

Operating procedure

1. Select Project view \rightarrow "POU" \rightarrow "FB_Pool" \rightarrow "Count_Num", and double-click "Program".

Project	
Provide Comment	
Parameter Intelligent Function Module Global Device Comment	
Global Label Program Setting POU Program Pogram Pogram Device Memory	

2. The [FB] Count_Num window is displayed.

MELSOFT Series GX Works2 (Unset Project) - [[FB] Count_Num]				
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- Contract Comment				
Orice Memory				
- 👼 Device Initial Value				

3. Create an FB sequence program.



Sequence program of the FB to be created is described as follows.



5 Performing Conversion/Compilation

In order to operate an FB, a conversion/compilation process is required.

This section explains how to convert/compile all programs.

Operating procedure

1. Select [Compile] \rightarrow [Rebuild All].

🗰 MELSOFT Series GX Works2 (Unset Project) - [[PRG] MAIN]								
Eroject Edit Find/Replace	⊆on	npile	⊻iew	<u>O</u> nline	De <u>b</u> ug	Diagno		
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	.	Onli	ne Prod	ram Chan	ae Shift	+F4		
	P	<u>R</u> eb	uild All		Shift+Alt	+F4		

2. The following message is displayed.



3. All programs are converted/compiled and the result is displayed in the Output window.

build All				
Io. Result	Data Name	Class	Content	Error Code
1 Information			Word device (VAR range) 5 points used (Range D12283 - D12287)	F1301
2 Information			Bit device (VAR range) 3 points used (Range M8189 - M8191)	F1305
3 Information	•	-	Pointer (VAR range) 0 point used	F1310
4 Information	-	-	Timer (VAR range) 0 point used	F1312
			Counter (VAR range) 0 point used	F1324
		\sim		

This completes the creation of a new FB.

For details of the procedures to use the created FBs, refer to the section '(3) Pasting FBs' in 'Using FB Libraries' onward.



When pasting multiple FBs, which describe the device output (such as OUT Y0Z9) by using index modification internally, duplicate coil warnings occur while compiling. However, this is not a usage problem.

The sequence program created by pasting the created FB is as follows.



Protecting Created FBs

A created FB can be protected by setting up a block password.

Outflow of technological know-how can be prevented by using a password, as the protection using a password disables opening of programs in the FB.

This section explains how to set up a block password for the created FB.



If you forget the password, you cannot open the program in the FB. Do not lose the password.

Operating procedure

1. Select Project view \rightarrow "POU" \rightarrow "FB_Pool" \rightarrow "Count_Num".



2. The "Set Block Password" dialog is displayed.



To the next page

3. The "Change Block Password" dialog is displayed.



4. The block password is set to "Count_Num".



Utilizing FBs in Other Projects

FBs can be utilized in other projects.

When utilizing FBs in other projects, open the source and the destination projects respectively, and copy the FBs from the source project to the destination project.

This section explains how to use FBs in other projects by using the FB "Count_Num" created in this Quick start guide as an example.

Operating procedure

1. Start another GX Works2, and open the project in which the FB "Count_Num" is utilized.

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- 🐻 Device Initial Value								
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2. Drag and drop the FB "Count_Num" to the "FB_Pool" icon of the destination project.



3. The FB "Count_Num" is copied to the destination project.



- If the programmable controller types of the source project and the destination project are different, copying FBs will not be possible.
- FBs created in GX Developer can also be utilized in the GX Works2 projects. Use the following procedure to copy FBs.
 - (1) Open the GX Developer source project with GX Works2.
 - $\text{Select} \; [\text{Project}] \rightarrow [\text{Open Other Data}] \rightarrow [\text{Open Other Project}].$
 - (For details, refer to the GX Works2 Version 1 Operating Manual (Common).)
 - (2) Start another GX Works2, and open the destination project.
 - (3) Drag and drop the FB from the source project to the destination project.

Techniques for Creating FBs

This section introduces techniques for creating FB sequence programs.

1. To transfer multiple bits to a word label

Multiple bits can be transferred to a word label by using BSET and BRST instructions and setting up ON/OFF information for each bit of the target word.

int_FB_run	int_BitArray[0] 	-[взет	int_WordData	KO]
	lint_BitArray[5] 	-[BRST	int_WordData	К5	-

2. To refer to multiple consecutive data in FBs

Continuous domain of the input and output labels of an FB can be imported to the FB internal label by the following method.

An example of an input label is explained below.

- (1) Store values on D register from D1000 up to n point in the main program.
- (2) Specify D1000 to the FB input label.
- (3) In the FB, transfer to BMOV internal label from the input label (i_Write_Data) up to n point (required to secure arrays for up to n point).



In this case, however, if the input and output labels of the FB are omitted, an unexpected data file will be stored in the internal label, resulting unintentional operations such as overrun of a sequence program. Never omit the input and output labels.

3. To use index registers in an FB

When using index registers in an FB, add a save program and restore program for the index registers to protect them.

[Example of creation]

The following shows an example of saving index registers Z7, Z8, and Z9 in the FB prior to executing a program and restoring the index that will be saved at the time when the program is end.

Label name	Туре	Purpose
int_Z_tmp[0]	bit	For saving index register Z9
int_Z_tmp[1]	bit	For saving index register Z8
int_Z_tmp[2]	bit	For saving index register Z7



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- The products have been manufactured under strict quality control. However, when
 installing the products where major accidents or losses could occur if the products fail,
 install appropriate backup or fail-safe functions in the system.

Engineering Software MELSOFT GX Works2 FB Quick Start Guide

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Mitsubishi Electric Corporation Nagoya Works is a factory certified for ISO 14001 (standards for environmental management systems) and ISO 9001(standards for quality assurance management systems)





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