MITSUBISHI ELECTRIC

Programmable Controller

MELSEC iQ-F series

MELSEC iQ-F Time Calculation 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

Manual name	Description
MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware) <SH-082452ENG>	Details of hardware of the CPU module, including performance specifications, wiring, installation, and maintenance
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 Programming Manual (Instructions, Standard Functions/Function Blocks) <JY997D55801>	Specifications of the instructions and functions that can be used in programs
MELSEC iQ-F FX5 Programming Manual (Program Design) <JY997D55701>	Program specifications (ladder, ST, FBD/LD, and SFC programs) and labels
GX Works3 Operating Manual <SH-081215ENG>	Explanation of system configuration, parameter settings, and online operations of GX Works3

TERMS

Unless otherwise specified, this manual uses the following terms.

Term	Description
Engineering tool	A tool used for setting up programmable controllers, programming, debugging, and maintenance

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.
FX5 CPU module	A generic term for FX5S CPU module, FX5UJ CPU module, FX5U CPU module, and FX5UC CPU module

MEMO

1 OVERVIEW

The function blocks in this reference manual mean the FB libraries for time calculation processing in the MELSEC iQ-F series.

1.1 Features

This section describes the features of this function.

Shortening programming time

By simply inputting a specific date and the time to add or subtract, the year, month, day, hour, minute, second, and day of the week can be output, thereby shortening the programming time.

1.2 List of FB Libraries

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

○: Required, —: Not required

Name*1	Description	Parameter setting
M+TimeCalc_DateAdd_F (time data addition)	For the specified date and time data (year, month, day, hour, minute, second), adds the specified time data (day, hour, minute, second), and outputs the year, month, day, hour, minute, second, and day of the week.	—
M+TimeCalc_DateSub_F (time data subtraction)	For the specified date and time data (year, month, day, hour, minute, second), subtracts the specified time data (day, hour, minute, second), and outputs the year, month, day, hour, minute, second, and day of the week.	—
M+TimeCalc_DATE2SEC_F (conversion of date and time data (date and time to seconds))	Converts the input date and time data into seconds and outputs the result. This FB operates when called from M+TimeCalc_DateAdd_F (time data addition) or M+TimeCalc_DateSub_F (time data subtraction), so users should not use it in their programs.	—
M+TimeCalc_SEC2DATE_F (conversion of date and time data (seconds to date and time))	Converts the input seconds data into a date and time and outputs the result. This FB operates when called from M+TimeCalc_DateAdd_F (time data addition) or M+TimeCalc_DateSub_F (time data subtraction), so users should not use it in their programs.	—

*1 An FB name ends in the FB version information such as "_00A"; however, this reference manual leaves it out.

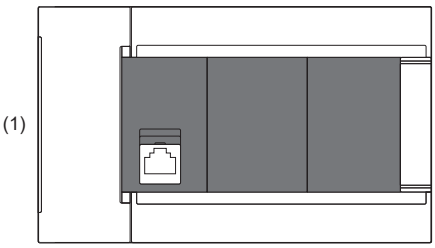
For these FB libraries and software, please consult your local Mitsubishi Electric representative.

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

GX Works3 Operating Manual

1.3 System Configuration

The following figure shows an example of system configuration for using the FB libraries in this reference manual.



(1)FX5 CPU module

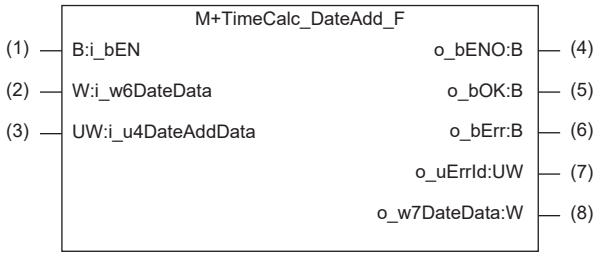
MEMO

2 DETAILS OF FB LIBRARIES

2.1 M+TimeCalc_DateAdd_F (Time Data Addition)

Overview

This FB adds any time data (day, hour, minute, second) to the specified date and time data (year, month, day, hour, minute, second), and outputs the year, month, day, hour, minute, second, and day of the week as the operation result.



Labels

Input labels

No.	Label	Label name	Data type	Setting range	Description
(1)	i_bEN	Execution command	Bit	On, Off	On: FB starts. Off: FB does not start.
(2)	i_w6DateData	Date and time data	Word [signed] (0..5)	Refer to the Description column.	Inputs the date and time data to be the basis for calculation. 1st word • Year (2000 to 2099) 2nd word • Month (1 to 12) 3rd word • Day (1 to 31) 4th word • Hour (0 to 23) 5th word • Minute (0 to 59) 6th word • Second (0 to 59)
(3)	i_u4DateAddData	Time data to add	Word [unsigned]/bit string [16 bits] (0..3)	Refer to the Description column.	Inputs the time data to add to i_w6DateData (date and time data). 1st word • Day (0 to 36524) 2nd word • Hour (0 to 65535) 3rd word • Minute (0 to 65535) 4th word • Second (0 to 65535)

Output labels

No.	Label	Label name	Data type	Default value	Description
(4)	o_bENO	Execution status	Bit	Off	On: The execution command is on. Off: The execution command is off.
(5)	o_bOK	Normal completion	Bit	Off	The on state indicates that the FB has been completed successfully.
(6)	o_bErr	Error completion	Bit	Off	The on state indicates that an error has occurred in the FB.
(7)	o_uErrId	Error code	Word [unsigned]/bit string [16 bits]	0	The error code of an error that occurred in the FB is stored.
(8)	o_w7DateData	Date and time data after calculation	Word [signed] (0..6)	0	Outputs the date and time data of the operation result. 1st word • Year (2000 to 2099) 2nd word • Month (1 to 12) 3rd word • Day (1 to 31) 4th word • Hour (0 to 23) 5th word • Minute (0 to 59) 6th word • Second (0 to 59) 7th word*1 • Day of the week (0 to 6)

*1 In the 7th word, the day of the week, "Sunday to Saturday" are stored as "0 to 6".

Stored data	Day of the week
0	Sunday
1	Monday
2	Tuesday
3	Wednesday
4	Thursday
5	Friday
6	Saturday

Function details

Applicable hardware and software

Target module	Firmware version	Engineering tool
FX5S CPU module	1.010 or later	GX Works3 Version 1.095Z or later
FX5UJ CPU module	1.050 or later	GX Works3 Version 1.095Z or later
FX5U CPU module	1.290 or later	GX Works3 Version 1.095Z or later
FX5UC CPU module	1.290 or later	GX Works3 Version 1.095Z or later

Basic specifications

Item	Description
Language to use	— (The programs in this FB are not disclosed.)
Number of steps	2.11K 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: 0.34K 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 registers used	File register: 0 points (Word)
FB dependency	M+TimeCalc_DateAdd_F (time data addition) ├ M+TimeCalc_DATE2SEC_F (conversion of date and time data (date and time to seconds)) └ M+TimeCalc_SEC2DATE_F (conversion of date and time data (seconds to date and time))
FB compilation method	Subroutine type
FB operation	On-demand execution type

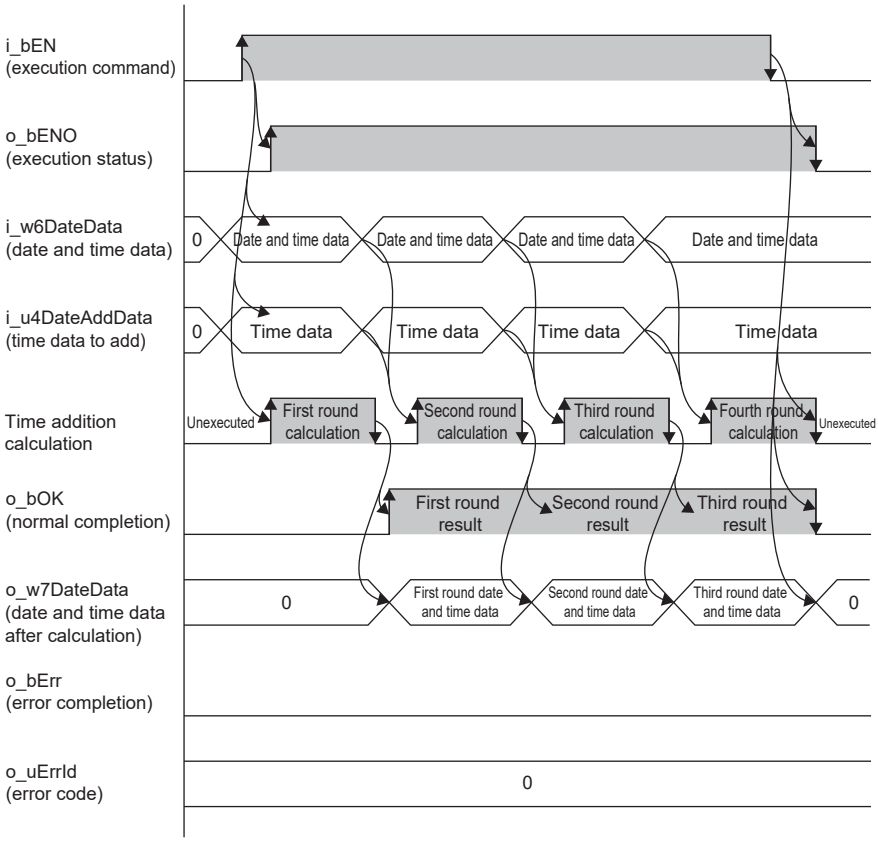
Function description

When i_bEN (execution command) is turned on, this function performs the following processing.

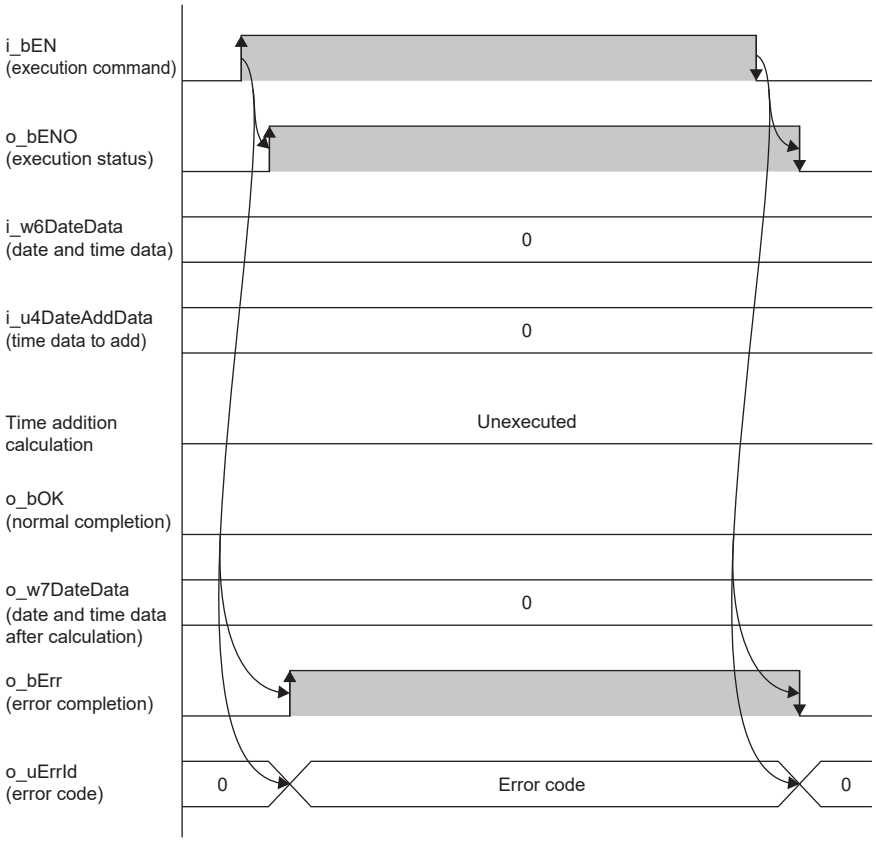
- Converts the date and time data stored in i_w6DateData (date and time data) into seconds, using January 1, 2000, 0:00:00 as the starting point (0 seconds).
- Converts the time data stored in i_u4DateAddData (time data to add) into seconds.
- Adds the time data to add to the seconds-converted date and time data.
- Converts the added sum of seconds data to a date and time, using January 1, 2000, 0:00:00 as the starting point (0 seconds). The conversion result is output to o_w7DateData (date and time data after calculation).

Timing chart of I/O signals

■Normal completion



■Error completion



Precautions

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

☞ Page 22 PRECAUTIONS

Parameter settings

Parameter settings are not required for this FB.

Performance values

The following table lists examples of performance values that do not become different depending on the input label setting details.

CPU module	Processing time	Maximum scan time	Number of scans
FX5S	0.311ms	1.610ms	1 scan
FX5UJ	0.218ms	1.060ms	1 scan
FX5U, FX5UC*1*2	0.204ms	0.858ms	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.

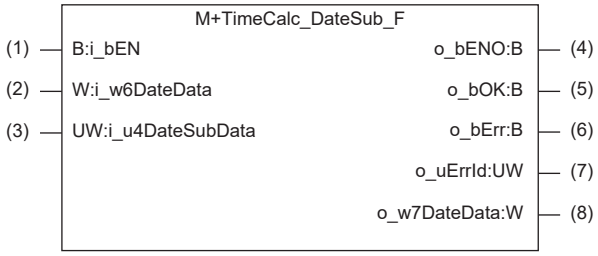
Error code

Error code	Description	Action
100H	The setting value of i_w6DateData (date and time data) is invalid.	After adjusting the input setting value so that i_w6DateData (date and time data) represents a valid date and time, re-execute the FB.
101H	The output value of o_w7DateData (date and time data after calculation) is out of range.	After adjusting the setting values of the input labels i_w6DateData (date and time data) and i_u4DateAddData (time data to add) so that the date and time data after calculation are in range, re-execute the FB.
102H	The setting value of i_u4DateAddData (time data to add) is out of range. The 1st word has a value set outside of the following range. • Day (0 to 36524)	After adjusting the input setting value so that i_u4DateAddData (time data to add) is in range, re-execute the FB.

2.2 M+TimeCalc_DateSub_F (Time Data Subtraction)

Overview

This FB subtracts any time data (day, hour, minute, second) from the specified date and time data (year, month, day, hour, minute, second), and outputs the year, month, day, hour, minute, second, and day of the week as the operation result.



Labels

Input labels

No.	Label	Label name	Data type	Setting range	Description
(1)	i_bEN	Execution command	Bit	On, Off	On: FB starts. Off: FB does not start.
(2)	i_w6DateData	Date and time data	Word [signed] (0..5)	Refer to the Description column.	Inputs the date and time data to be the basis for calculation. 1st word • Year (2000 to 2099) 2nd word • Month (1 to 12) 3rd word • Day (1 to 31) 4th word • Hour (0 to 23) 5th word • Minute (0 to 59) 6th word • Second (0 to 59) 7th word*1 • Day of the week (0 to 6)
(3)	i_u4DateSubData	Time data to subtract	Word [unsigned]/bit string [16 bits] (0..3)	Refer to the Description column.	Inputs the time data to subtract from i_w6DateData (date and time data). 1st word • Day (0 to 36524) 2nd word • Hour (0 to 65535) 3rd word • Minute (0 to 65535) 4th word • Second (0 to 65535)

Output labels

No.	Label	Label name	Data type	Default value	Description
(4)	o_bENO	Execution status	Bit	Off	On: The execution command is on. Off: The execution command is off.
(5)	o_bOK	Normal completion	Bit	Off	The on state indicates that the FB has been completed successfully.
(6)	o_bErr	Error completion	Bit	Off	The on state indicates that an error has occurred in the FB.
(7)	o_uErrId	Error code	Word [unsigned]/bit string [16 bits]	0	The error code of an error that occurred in the FB is stored.
(8)	o_w7DateData	Date and time data after calculation	Word [signed] (0..6)	0	Outputs the date and time data of the operation result. 1st word • Year (2000 to 2099) 2nd word • Month (1 to 12) 3rd word • Day (1 to 31) 4th word • Hour (0 to 23) 5th word • Minute (0 to 59) 6th word • Second (0 to 59) 7th word*1 • Day of the week (0 to 6)

*1 In the 7th word, the day of the week, "Sunday to Saturday" are stored as "0 to 6".

Stored data	Day of the week
0	Sunday
1	Monday
2	Tuesday
3	Wednesday
4	Thursday
5	Friday
6	Saturday

Function details

Applicable hardware and software

Target module	Firmware version	Engineering tool
FX5S CPU module	1.010 or later	GX Works3 Version 1.095Z or later
FX5UJ CPU module	1.050 or later	GX Works3 Version 1.095Z or later
FX5U CPU module	1.290 or later	GX Works3 Version 1.095Z or later
FX5UC CPU module	1.290 or later	GX Works3 Version 1.095Z or later

Basic specifications

Item	Description
Language to use	— (The programs in this FB are not disclosed.)
Number of steps	2.10K 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: 0.34K 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 registers used	File register: 0 points (Word)
FB dependency	M+TimeCalc_DateSub_F (time data subtraction) M+TimeCalc_DATE2SEC_F (conversion of date and time data (date and time to seconds)) M+TimeCalc_SEC2DATE_F (conversion of date and time data (seconds to date and time))
FB compilation method	Subroutine type
FB operation	On-demand execution type

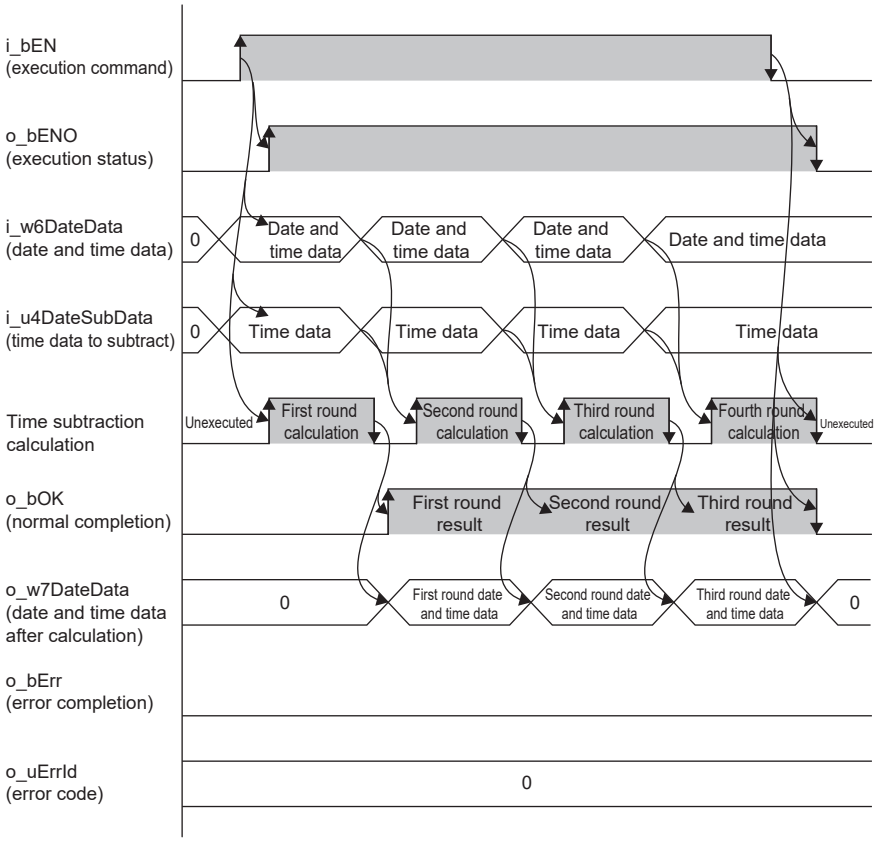
Function description

When i_bEN (execution command) is turned on, this function performs the following processing.

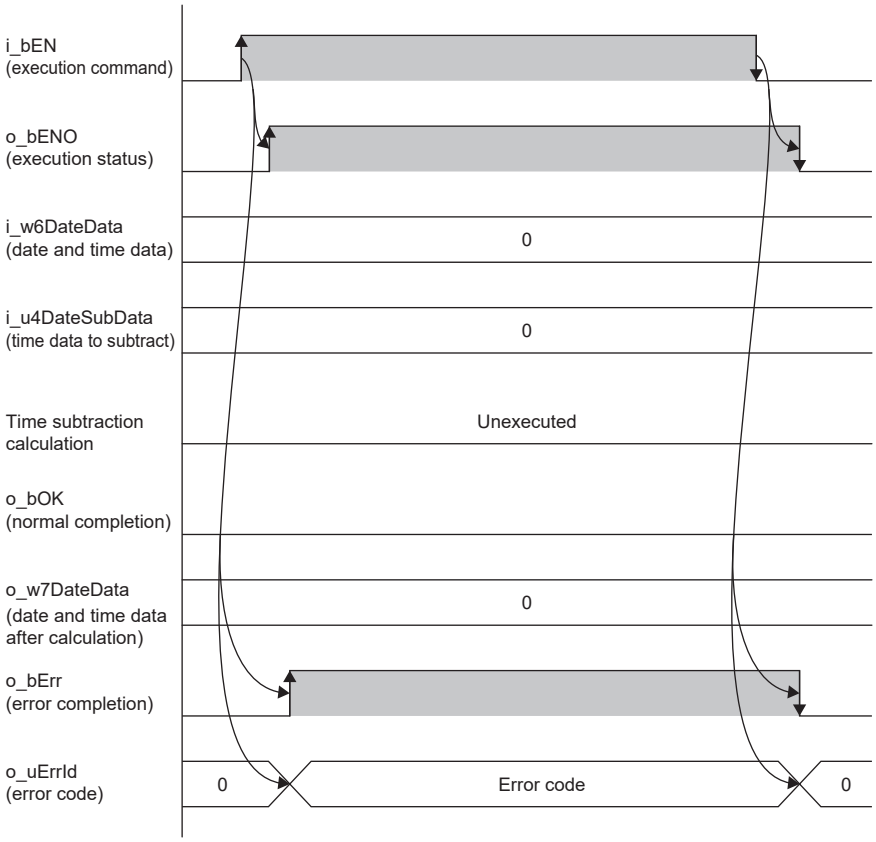
- Converts the date and time data stored in i_w6DateData (date and time data) into seconds, using January 1, 2000, 0:00:00 as the starting point (0 seconds).
- Converts the time data stored in i_u4DateSubData (time data to subtract) into seconds.
- Subtracts the time data to subtract from the seconds-converted date and time data.
- Converts the subtracted difference of seconds data to a date and time, using January 1, 2000, 0:00:00 as the starting point (0 seconds). The conversion result is output to o_w7DateData (date and time data after calculation).

Timing chart of I/O signals

■Normal completion



■Error completion



Precautions

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

☞ Page 22 PRECAUTIONS

Parameter settings

Parameter settings are not required for this FB.

Performance values

The following table lists examples of performance values that do not become different depending on the input label setting details.

CPU module	Processing time	Maximum scan time	Number of scans
FX5S	0.342ms	1.280ms	1 scan
FX5UJ	0.244ms	1.060ms	1 scan
FX5U, FX5UC*1*2	0.199ms	0.780ms	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
100H	The setting value of i_w6DateData (date and time data) is invalid.	After adjusting the input setting value so that i_w6DateData (date and time data) represents a valid date and time, re-execute the FB.
103H	The output value of o_w7DateData (date and time data after calculation) is out of range.	After adjusting the setting values of the input labels i_w6DateData (date and time data) and i_u4DateSubData (time data to subtract) so that the date and time data after calculation are in range, re-execute the FB.
104H	The setting value of i_u4DateSubData (time data to subtract) is out of range. The 1st word has a value set outside of the following range. • Day (0 to 36524)	After adjusting the input setting value so that i_u4DateSubData (time data to subtract) is in range, re-execute the FB.

2.3 M+TimeCalc_DATE2SEC_F (Conversion of Date and Time Data (Date and Time to Seconds))

Overview

Converts the input date and time data into seconds and outputs the result.
This FB operates when called from M+TimeCalc_DateAdd_F (time data addition) or M+TimeCalc_DateSub_F (time data subtraction). It should not be used in the user's programs.

2.4 M+TimeCalc_SEC2DATE_F (Conversion of Date and Time Data (Seconds to Date and Time))

Overview

Converts the input seconds data into a date and time and outputs the result.
This FB operates when called from M+TimeCalc_DateAdd_F (time data addition) or M+TimeCalc_DateSub_F (time data subtraction). It should not be used in the user's programs.

3 PRECAUTIONS

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

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.
If the FB is used in a program that is to be executed only once, such as a subroutine program or a FOR-NEXT loop, the processing for turning off an execution command (such as Execute and Enable) cannot be executed and normal operation is not possible. Always use the FB in a program that is capable of turning off the execution command.
The FB requires the configuration of a ladder block for every input label.
The FB cannot be used in an interrupt program.
If an error occurs, o_bErr (error completion) turns on and processing of the FB is interrupted. In addition, an error code is stored in o_uErrId (error code). For other error codes, refer to the following. ☞ Page 10 DETAILS OF FB LIBRARIES
Even if the input label is in range, an error will occur if the operation result is not within the range of January 1, 2000, 0:00:00 to December 31, 2099, 23:59:59.

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4 USAGE PROCEDURE

4.1 Calculating the Day, Hour, Minute, Second, and Day of the Week after Addition from the Addition Data

This section describes the procedure for adding addition data to the original data and then outputting the day, hour, minute, second, and day of the week.

The following FB is used in the usage procedure.

- M+TimeCalc_DateAdd_F (time data addition)

Overview

Set the date and time data (year, month, day, hour, minute, second) and the amount of date and time data (day, hour, minute, second) to add, and obtain the added result data (year, month, hour, minute, second, and day of the week).

Setting details of date and time data

Item	Setting value
i_w6DateData (date and time data)	December 31, 2023, 0:00:00
i_u4DateAddData (time data to add)	60 days 12 hours

Output result

Item	Output result
o_w7DateData (date and time data after calculation)	February 29, 2024, 12:00:00, Thursday

Process flow

The following describes the process flow to add any time data (day, time, minute, second) to the date and time data (year, month, day, hour, minute, second), and output the data.

1. FB library registration

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

GX Works3 Operating Manual

2. Program creation

Create a program.

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Program creation

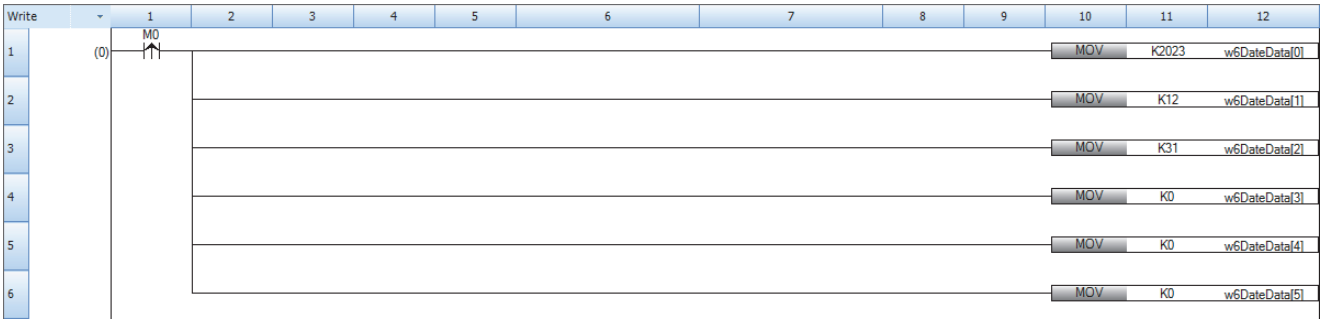
Label list

	Label Name	Data Type		Class
1	M_TimeCalc_DateAdd_F_00A_1	M+TimeCalc_DateAdd_F_00A	...	VAR
2	w6DateData	Word [Signed](0..5)	...	VAR
3	u4DateAddData	Word [Unsigned]/Bit String [16-bit](0..3)	...	VAR
4	w7DateData	Word [Signed](0..6)	...	VAR

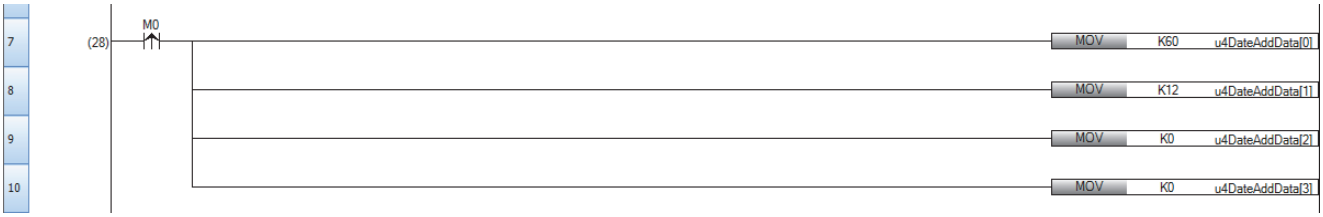
Program

■Setting the date and time data and date and time data to add

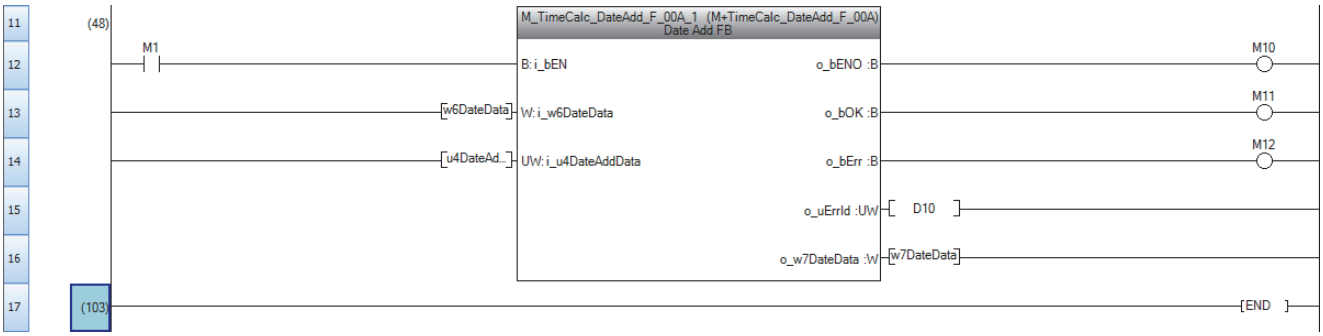
- Setting the date and time data (December 31, 2023, 0:00:00)



- Setting the time data to add (60 days 12 hours 0 minutes 0 seconds)



- Acquisition of added date and time data result



When M1 (execution command) is on, the added result of the date and time data is output to o_w7DateData (date and time data after calculation) based on the values set in i_w6DateData (date and time data) and i_u4DateAddData (time data to add).

4.2 Calculating the Day, Hour, Minute, Second, and Day of the Week after Subtraction from the Subtraction Data

This section describes the procedure for setting the date and time data (year, month, day, hour, minute, second) and the amount of date and time data (day, time, minute, second) to subtract, to acquire the subtracted date and time data (year, month, hour, minute, second, and day of the week).
The following FB is used in the usage procedure.

- M+TimeCalc_DateSub_F (time data subtraction)

Overview

Set the date and time data (year, month, day, hour, minute, second) and the amount of date and time data (day, time, minute, second) to subtract, and acquire the subtracted result data (year, month, hour, minute, second, and day of the week).

Setting details of date and time data

Item	Setting value
i_w6DateData (date and time data)	March 1, 2024, 8:00:00
i_u4DateSubData (time data to subtract)	60 days 12 hours

Output result

Item	Output result
o_w7DateData (date and time data after calculation)	December 31, 2023, 20:00:00, Sunday

Process flow

The following describes the process flow to subtract any time data (day, time, minute, second) from the date and time data (year, month, day, hour, minute, second), and output the data.

1. FB library registration

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

2. Program creation

Create a program.
☞ Page 27 Program creation

Program creation

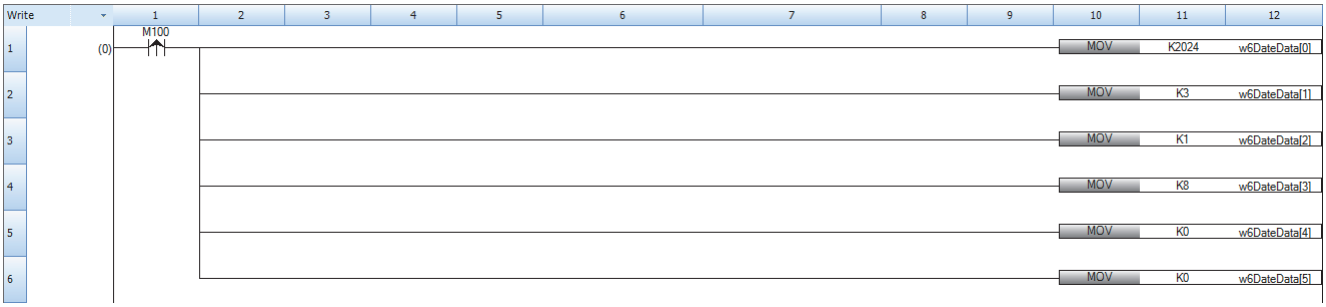
Label list

	Label Name	Data Type		Class
1	M_TimeCalc_DateSub_F_00A_1	M+TimeCalc_DateSub_F_00A	...	VAR
2	w6DateData	Word [Signed](0..5)	...	VAR
3	u4DateSubData	Word [Unsigned]/Bit String [16-bit](0..3)	...	VAR
4	w7DateData	Word [Signed](0..6)	...	VAR

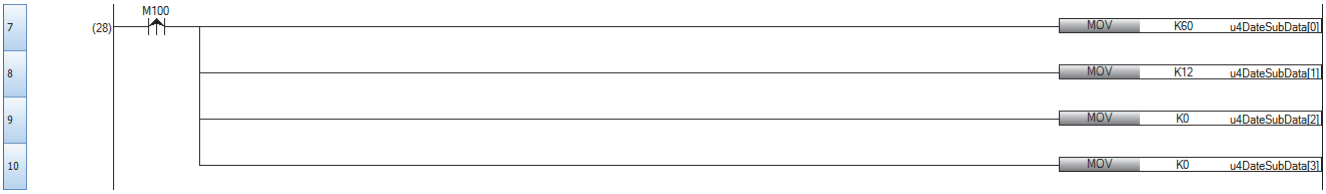
Program

■Setting the date and time data and date and time data to subtract

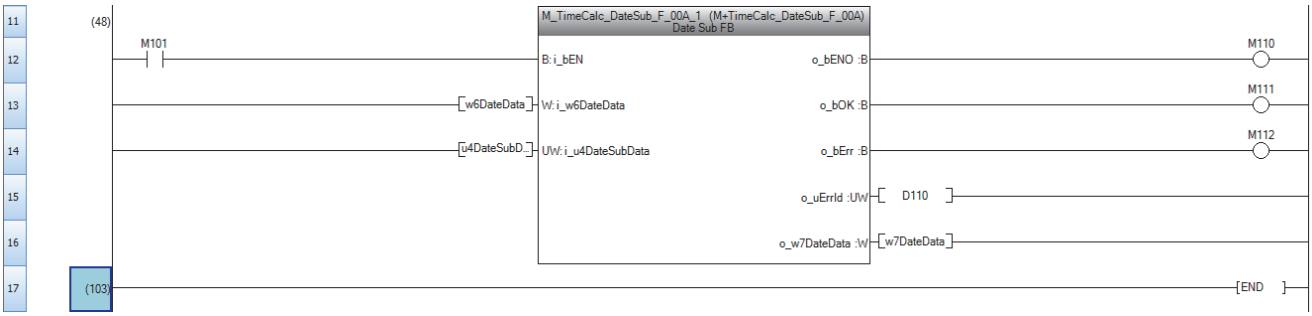
- Setting the date and time data (March 01, 2024, 8:00:00)



- Setting the time data to subtract (60 days 12 hours 0 minutes 0 seconds)



- Acquisition of subtracted date and time data result



When M101 (execution command) is on, the subtracted result of the date and time data is output to o_w7DateData (date and time data after calculation) based on the values set in i_w6DateData (date and time data) and i_u4DateSubData (time data to subtract).

MEMO

INSTRUCTION INDEX

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MEMO

REVISIONS

Revision date	Revision	Description
September 2023	A	First edition
July 2024	B	■Added or modified part GENERIC TERMS AND ABBREVIATIONS

Japanese manual number: SH-082655-B

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