MITSUBISHI ELECTRIC

Programmable Controller

MELSEC iQ-R series

MELSEC iQ-R Thermocouple Input Module/RTD Input Module Function Block Reference

CONTENTS

1 FUNCTION BLOCK (FB) LIST

This FB list is intended for those who use the MELSEC iQ-R series thermocouple input module and RTD input module.

Thermocouple input module FB

Name[*1]	Description
M+R60TDG_RequestSetting	Enables the settings of each function.
M+R60TDG_OperateError	Monitors error codes and resets errors.
M+R60TDG_SetLoggingParam	Sets up the logging function of a specified channel.
M+R60TDG_SaveLogging	Saves the logging data of a specified channel into a file.

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

RTD input module FB

Name[*1]	Description
M+R60RDG_RequestSetting	Enables the settings of each function.
M+R60RDG_OperateError	Monitors error codes and resets errors.
M+R60RDG_SetLoggingParam	Sets up the logging function of a specified channel.
M+R60RDG_SaveLogging	Saves the logging data of a specified channel into a file.

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

MEMO

2 TEMPERATURE INPUT MODULE FB

2.1 M+R60TDG_RequestSetting, M+R60RDG_RequestSetting

Name

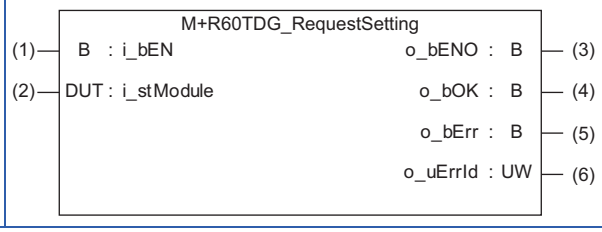
■R60TD8-G

M+R60TDG_RequestSetting

■R60RD8-G

M+R60RDG_RequestSetting

Overview

Item	Description
Overview	Enables the settings of each function.
Symbol	

Labels to use

■Input labels

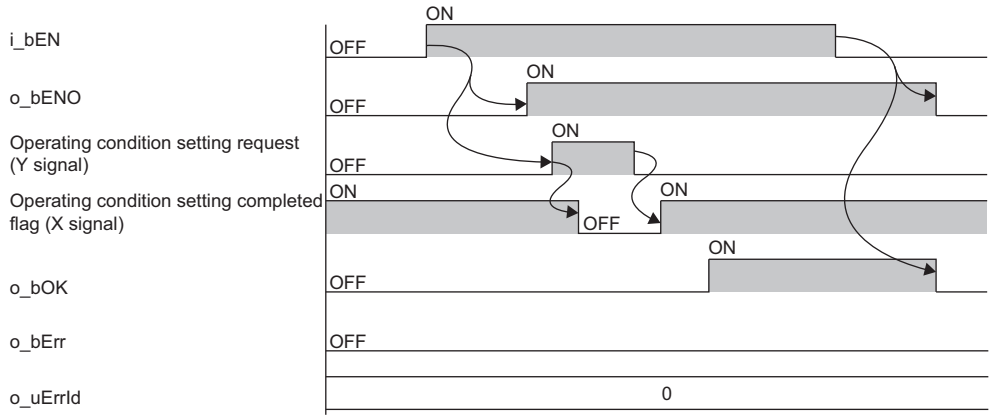
No.	Variable name	Name	Data type	Scope	Description
(1)	i_bEN	Execution command	Bit	On or off	On: The FB is activated. Off: The FB is not activated.
(2)	i_stModule	Module label	Structure	The scope differs depending on the module label.	Specifies a module label of a temperature input module.

■Output labels

No.	Variable name	Name	Data type	Default value	Description
(3)	o_bENO	Execution status	Bit	Off	On: The execution command is on. Off: The execution command is off.
(4)	o_bOK	Normal completion	Bit	Off	The on state indicates that the operation to enable each setting is complete.
(5)	o_bErr	Error completion	Bit	Off	Always off
(6)	o_uErrId	Error code	Word [unsigned]	0	Always 0

FB details

Item	Description	
Relevant devices	Target module	R60TD8-G, R60RD8-G
	CPU module	MELSEC iQ-R series CPU modules
	Engineering tool	GX Works3
Language to use	Ladder diagram	
Number of basic steps	25 steps The number of steps of the FB embedded in a program depends on the CPU module used, the input/output definitions, and the options setting of GX Works3. For the options setting of GX Works3, refer to the GX Works3 Operating Manual.	

Item	Description
Functional description	• Turning on i_bEN (execution command) allows the settings of all channels to be enabled. For what settings are enabled, refer to the MELSEC iQ-R Channel Isolated Thermocouple Input Module/Channel Isolated RTD Input Module User's Manual (Application). • This FB continues its execution until the completion of the settings of each function after i_bEN (execution command) turns on.
FB compilation method	Macro type
FB operation	Pulse execution type (multiple scan execution type)
Timing chart of I/O signals	
Restrictions and precautions	• This FB does not include the error recovery processing. Prepare the error recovery processing separately to suit the user's system and the expected operation. • The FB cannot be used in an interrupt program. • As this FB is executed, the temperature conversion processing stops, and thereafter when o_bOK (normal completion) turns on, the conversion processing resumes. • Putting a temperature input module into operation requires the module parameters of GX Works3 to be set up according to the connected devices and the system in use. For how to set up the module parameters, refer to the MELSEC iQ-R Channel Isolated Thermocouple Input Module/Channel Isolated RTD Input Module User's Manual (Application).

Error code

Error code	Description	Action
None	None	None

2.2 M+R60TDG_OperateError, M+R60RDG_OperateError

Name

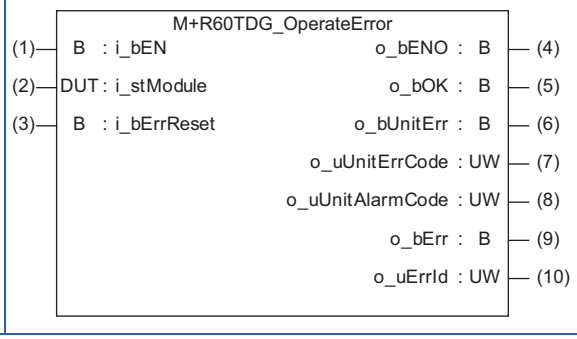
■R60TD8-G

M+R60TDG_OperateError

■R60RD8-G

M+R60RDG_OperateError

Overview

Item	Description
Overview	Monitors error codes and resets errors.
Symbol	

Labels to use

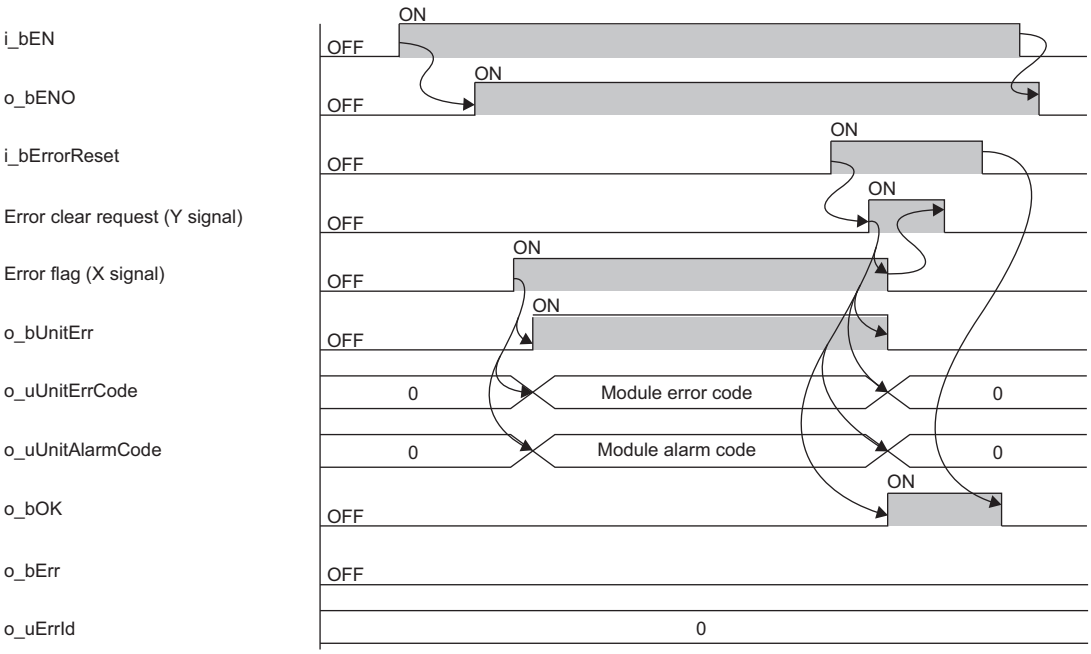
■Input labels

No.	Variable name	Name	Data type	Scope	Description
(1)	i_bEN	Execution command	Bit	On or off	On: The FB is activated. Off: The FB is not activated.
(2)	i_stModule	Module label	Structure	The scope differs depending on the module label.	Specifies a module label of a temperature input module.
(3)	i_bErrReset	Error reset request	Bit	On or off	Turn on this label to reset the errors. Turn off this label after the error reset.

■Output labels

No.	Variable name	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 error reset is complete.
(6)	o_bUnitErr	Module error flag	Bit	Off	The on state indicates that a module error has occurred.
(7)	o_uUnitErrCode	Module error code	Word [unsigned]	0	The error code of an error occurred is stored.
(8)	o_uUnitAlarmCode	Module alarm code	Word [unsigned]	0	The alarm code of an alarm occurred is stored.
(9)	o_bErr	Error completion	Bit	Off	Always off
(10)	o_uErrId	Error code	Word [unsigned]	0	Always 0

FB details

Item	Description	
Relevant devices	Target module	R60TD8-G, R60RD8-G
	CPU module	MELSEC iQ-R series CPU modules
	Engineering tool	GX Works3
Language to use	Ladder diagram	
Number of basic steps	61 steps The number of steps of the FB embedded in a program depends on the CPU module used, the input/output definitions, and the options setting of GX Works3. For the options setting of GX Works3, refer to the GX Works3 Operating Manual.	
Functional description	• As i_bEN (execution command) turns on, errors in the target module are monitored. • After i_bEN (execution command) turns on, turning on i_bErrReset (error reset request) during an error allows the error to be reset.	
FB compilation method	Macro type	
FB operation	Arbitrary execution type	
Timing chart of I/O signals		
Restrictions and precautions	• This FB does not include the error recovery processing. Prepare the error recovery processing separately to suit the user's system and the expected operation. • The FB cannot be used in an interrupt program. • Putting a temperature input module into operation requires the module parameters of GX Works3 to be set up according to the connected devices and the system in use. For how to set up the module parameters, refer to the MELSEC iQ-R Channel Isolated Thermocouple Input Module/Channel Isolated RTD Input Module User's Manual (Application).	

Error code

Error code	Description	Action
None	None	None

2.3 M+R60TDG_SetLoggingParam, M+R60RDG_SetLoggingParam

Name

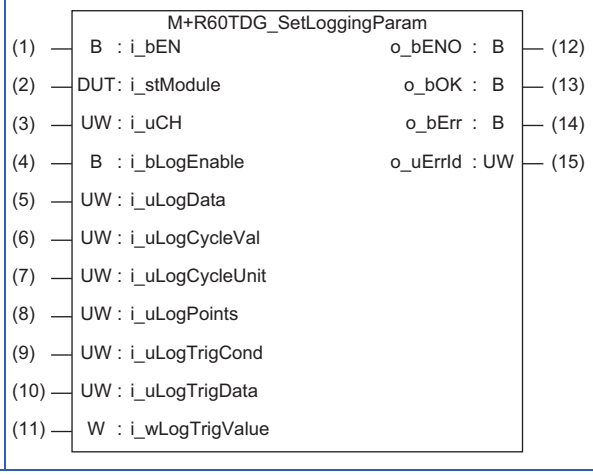
■R60TD8-G

M+R60TDG_SetLoggingParam

■R60RD8-G

M+R60RDG_SetLoggingParam

Overview

Item	Description
Overview	Sets up the logging function of a specified channel.
Symbol	

Labels to use

■Input labels

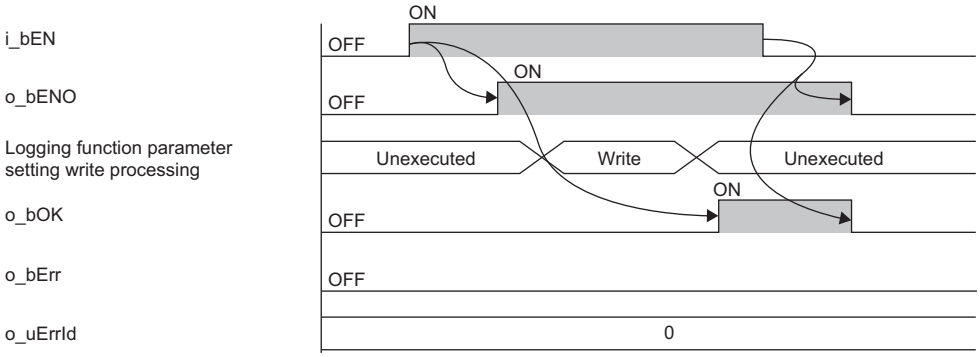
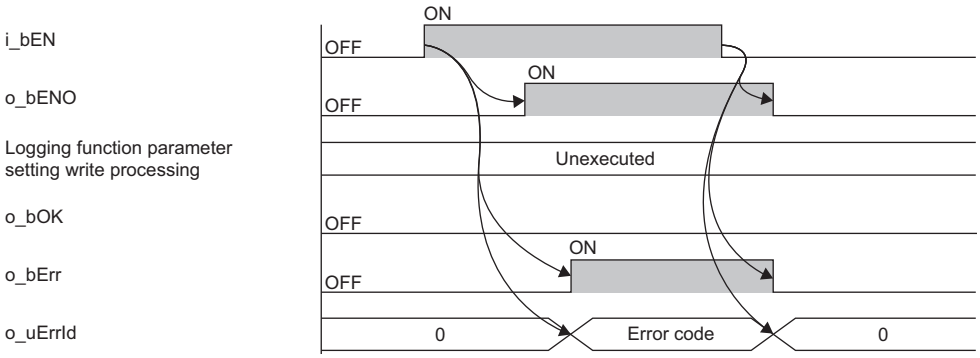
No.	Variable name	Name	Data type	Scope	Description
(1)	i_bEN	Execution command	Bit	On or off	On: The FB is activated. Off: The FB is not activated.
(2)	i_stModule	Module label	Structure	The scope differs depending on the module label.	Specifies a module label of a temperature input module.
(3)	i_uCH	Target channel	Word [unsigned]	1 to 8	Specifies a channel number.
(4)	i_bLogEnable	Logging enable/ disable setting	Bit	On or off	On: Enables the logging function. Off: Disables the logging function.
(5)	i_uLogData	Logging data setting	Word [unsigned]	0: Measured temperature value 1: Scaling value	Sets the data to be logged.
(6)	i_uLogCycleVal	Logging cycle setting value	Word [unsigned]	When the logging cycle unit setting is 1 R60TD8-G: 30 to 32767 R60RD8-G: 10 to 32767 When the logging cycle unit setting is 2: 1 to 3600	Sets the interval of cycles at which data is stored.
(7)	i_uLogCycleUnit	Logging cycle unit setting	Word [unsigned]	1: ms 2: s	Specifies the unit of cycles at which data is stored.
(8)	i_uLogPoints	Post-trigger logging points	Word [unsigned]	1 to 1000	Specifies the number of data to be logged after a hold trigger occurs.
(9)	i_uLogTrigCond	Level trigger condition setting	Word [unsigned]	0: Disable 1: Rise 2: Fall 3: Rise and fall	Sets the condition in which a level trigger is to be used. Set 0 if using no lever trigger.

No.	Variable name	Name	Data type	Scope	Description
(10)	i_uLogTrigData	Trigger data	Word [unsigned]	0 to 9999	Specifies a buffer memory address to be monitored by level trigger.
(11)	i_wLogTrigValue	Trigger setting value	Word [signed]	-32768 to 32767	Sets the level at which a level trigger is generated.

■Output labels

No.	Variable name	Name	Data type	Default value	Description
(12)	o_bENO	Execution status	Bit	Off	On: The execution command is on. Off: The execution command is off.
(13)	o_bOK	Normal completion	Bit	Off	The on state indicates that the setting of the logging function parameters is completed.
(14)	o_bErr	Error completion	Bit	Off	The on state indicates that an error has occurred in the FB.
(15)	o_uErrId	Error code	Word [unsigned]	0	The error code of an error occurred in the FB is stored.

FB details

Item	Description	
Relevant devices	Target module	R60TD8-G, R60RD8-G
	CPU module	MELSEC iQ-R series CPU modules
	Engineering tool	GX Works3
Language to use	Ladder diagram	
Number of basic steps	R60TD8-G: 437 steps R60RD8-G: 422 steps The number of steps of the FB embedded in a program depends on the CPU module used, the input/output definitions, and the options setting of GX Works3. For the options setting of GX Works3, refer to the GX Works3 Operating Manual.	
Functional description	• Turning on i_bEN (execution command) allows the logging function of a specified channel to be set. • This FB works for only one shot as i_bEN (execution command) turns on. • The set values are enabled by turning on and off Operating condition setting request (Yn9) or executing the operating condition setting request FB (M+R60TDG_RequestSetting, M+R60RDG_RequestSetting). • If the set value of the target channel is out of the range, o_bErr (error completion) turns on and the processing of the FB is interrupted. In addition, the error code is stored in o_uErrId (error code). For the error code, refer to the list of error codes.	
FB compilation method	Macro type	
FB operation	Pulse execution type (single scan execution type)	
Timing chart of I/O signals	■When the operation is completed successfully  ■When the operation is completed with an error  	

Item	Description
Restrictions and precautions	• This FB does not include the error recovery processing. Prepare the error recovery processing separately to suit the user's system and the expected operation. • The FB cannot be used in an interrupt program. • Using the FB in a program that is to be executed only once, such as a subroutine program or a FOR-NEXT loop, has a problem that i_bEN (execution command) can no longer be turned off and normal operation is not possible; Always use the FB in a program that is capable of turning off the execution command. • To use more than one of this FB, care must be taken to avoid duplication of the target channel. • The FB requires the configuration of the ladder for every input label. • If the parameters are set by means of the configuration function of GX Works3, this FB is not required. • Putting a temperature input module into operation requires the module parameters of GX Works3 to be set up according to the connected devices and the system in use. For how to set up the module parameters, refer to the MELSEC iQ-R Channel Isolated Thermocouple Input Module/Channel Isolated RTD Input Module User's Manual (Application).

Error code

Error code	Description	Action
100H	The target channel is set out of the range. Set the target channel within 1 to 8.	Review and correct the setting and then execute the FB again.

2.4 M+R60TDG_SaveLogging, M+R60RDG_SaveLogging

Name

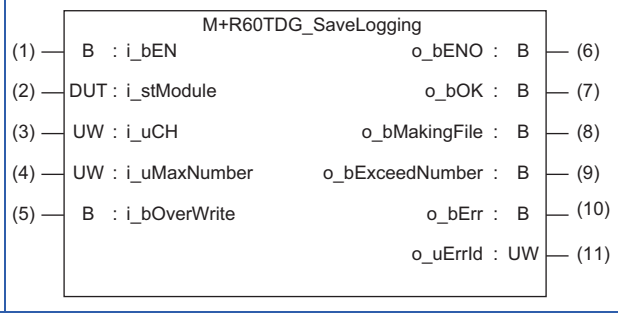
■R60TD8-G

M+R60TDG_SaveLogging

■R60RD8-G

M+R60RDG_SaveLogging

Overview

Item	Description
Overview	Saves the logging data of a specified channel into a file.
Symbol	

Labels to use

■Input labels

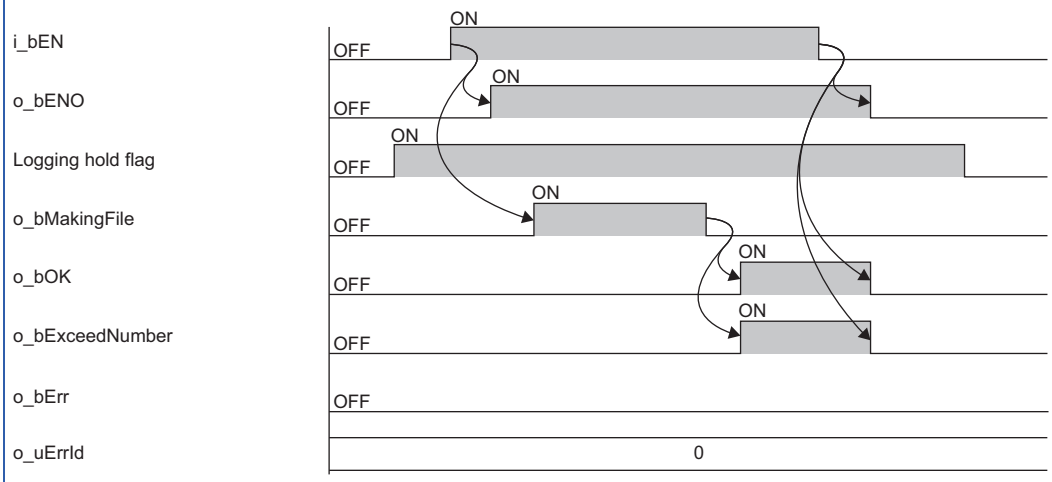
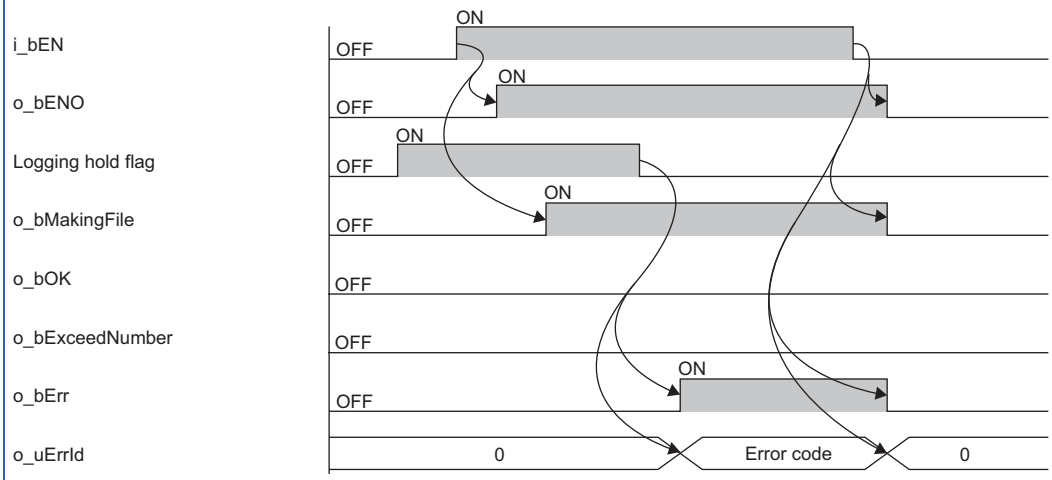
No.	Variable name	Name	Data type	Scope	Description
(1)	i_bEN	Execution command	Bit	On or off	On: The FB is activated. Off: The FB is not activated.
(2)	i_stModule	Module label	Structure	The scope differs depending on the module label.	Specifies a module label of a temperature input module.
(3)	i_uCH	Target channel	Word [unsigned]	1 to 8	Specifies a channel number.
(4)	i_uMaxNumber	Maximum number of save files	Word [unsigned]	1 to 999	Specifies the maximum number of CSV files that this FB saves.
(5)	i_bOverWrite	Overwrite save command	Bit	On or off	Specifies whether or not to overwrite the CSV files having smaller consecutive numbers when the number of CSV files that this FB has saved reaches the maximum number of save files. If the setting is off, the save processing of logging data stops.

■Output labels

No.	Variable name	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 the file save is complete. This label turns off as logging resumes.
(8)	o_bMakingFile	Creating file	Bit	Off	The on state indicates that files are being created.
(9)	o_bExceedNumber	Maximum number reach flag	Bit	Off	The on state indicates that the number of CSV files that this FB has saved has reached the maximum number of save files.
(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]	0	The error code of an error occurred in the FB is stored.

FB details

Item	Description	
Relevant devices	Target module	R60TD8-G, R60RD8-G
	CPU module	MELSEC iQ-R series CPU modules
	Engineering tool	GX Works3
Language to use	Ladder diagram	
Number of basic steps	2008 steps The number of steps of the FB embedded in a program depends on the CPU module used, the input/output definitions, and the options setting of GX Works3. For the options setting of GX Works3, refer to the GX Works3 Operating Manual.	
Functional description	• As i_bEN (execution command) turns on and the logging hold flag turns on, the FB sorts the logging data, the number of which is equal to the number of logging points from the head pointer, in a chronological order, and saves the data along with the trigger generation information in the SD memory card inserted in the CPU module, in a CSV format. • Provided that i_bEN (execution command) is on, this FB starts the save processing of logging data every time the logging hold flag turns on. • It takes multiple scans to complete the save processing of logging data. Check o_bOK (normal completion) to see that the processing is complete. • When this FB saves data in an SD memory card, the file name for a thermocouple input module is given as follows: "TD" + "Middle two digits of the four digits representing the start I/O number of the thermocouple input module" + "Target channel" + "Consecutive number" + ".CSV". The file name for a RTD input module is "RD" + "Middle two digits of the four digits representing the start I/O number of the RTD input module" + "Target channel" + "Consecutive number" + ".CSV". The maximum number of consecutive number varies with i_uMaxNumber (maximum number of save files). Turning off i_bEN (execution command) results in the consecutive number being reset, and thereafter a consecutive number is given from 1 again. Suppose that the start I/O number of the thermocouple input module is H0450, the target channel is 3, i_uMaxNumber (maximum number of save files) is 30, and the number of file creation by this FB is 6th. The file name is "TD453006.CSV". • When this FB creates a CSV file in an SD memory card, a file of the same name, if already exists in the SD memory card, is replaced with the newly created file. • If i_bOverWrite (overwrite save command) is on and the number of files that this FB has saved in an SD memory card exceeds i_uMaxNumber (maximum number of save files), the consecutive number returns back to 1 and the save processing of logging data continues. • If i_bOverWrite (overwrite save command) is off and the number of files that this FB has saved in an SD memory card reaches i_uMaxNumber (maximum number of save files), the save processing of logging data stops. • If the number of files that this FB has saved in an SD memory card reaches i_uMaxNumber (maximum number of save files), o_bExceedNumber (maximum number reach flag) turns on regardless of the on or off state of i_bOverWrite (overwrite save command). • If an incorrect value is set in i_uCH (target channel) or i_uMaxNumber (maximum number of save files), o_bErr (error completion) turns on and the processing of the FB is interrupted. In addition, the error code is stored in o_uErrId (error code). • A CPU error occurs in the following cases: when this FB has been executed with no SD memory card inserted into the CPU module; when the inserted SD memory card has no sufficient free space; or when the number of files stored exceeds the limit. In the event of an error, if the CPU module is in a stop error state, o_bErr (error completion) and o_uErrId (error code) are not updated. In the event of an error, if the CPU module is in a continuation error state, o_bErr (error completion) turns on and the error code is stored in o_uErrId (error code). For the capacity of SD memory cards and the number of files stored, refer to the MELSEC iQ-R Module Configuration Manual. The operating status (continue or stop) of the CPU module at the time of the failure of access to the SD memory card can be set with the parameter. • For the format of CSV files that this FB creates, refer to CSV File Output Format of the FB for Saving Logging Data (☞ Page 15 CSV File Output Format of the FB for Saving Logging Data).	
FB compilation method	Macro type	
FB operation	Pulse execution type (multiple scan execution type)	

Item	Description
Timing chart of I/O signals	■When the operation is completed successfully  ■When the operation is completed with an error 
Restrictions and precautions	• This FB does not include the error recovery processing. Prepare the error recovery processing separately to suit the user's system and the expected operation. • The FB cannot be used in an interrupt program. • Using the FB in a program that is to be executed only once, such as a subroutine program or a FOR-NEXT loop, has a problem that i_bEN (execution command) can no longer be turned off and normal operation is not possible; Always use the FB in a program that is capable of turning off the execution command. • This FB cannot save logging data in a medium other than an SD memory card. • This FB makes use of the SP.FWRITE instruction, and thus if an error occurs in the execution of the SP.FWRITE instruction, a CPU error occurs. • To use more than one of this FB, create an interlock to avoid simultaneous execution. When saving logging data of channel 1 and channel 2, first check that o_bOK (normal completion) of the FB on channel 1 is on, and turn on i_bEN (execution command) of the FB on channel 2. • If SM606 (SD memory card forced disable instruction) is on at the time of saving logging data, the SP.FWRITE instruction is not processed, resulting in the logging data not being saved. In this case, o_bErr (error completion) turns on and the error code is stored in o_uErrId (error code). • The FB requires the configuration of the ladder for every input label. • Set i_uMaxNumber (maximum number of save files) with consideration for the capacity of the SD memory card and the number of files stored. If the capacity of the SD memory card or the number of files stored is exceeded as a result of execution of this FB, a CPU error occurs. For the capacity of SD memory cards and the number of files stored, refer to the MELSEC iQ-R CPU Module User's Manual (Startup). • Putting a temperature input module into operation requires the module parameters of GX Works3 to be set up according to the connected devices and the system in use. For how to set up the module parameters, refer to the MELSEC iQ-R Channel Isolated Thermocouple Input Module/Channel Isolated RTD Input Module User's Manual (Application).

Error code

Error code	Description	Action
100H	The target channel is set out of the range. Set the target channel within 1 to 8.	Review and correct the setting and then execute the FB again.
101H	The maximum number of save files is set out of the range. The maximum number of save files is set out of the range of 1 to 999.	Review and correct the setting and then execute the FB again.
200H	The processing is interrupted because the logging hold flag turns off while logging data is being saved. The partially created CSV file is saved in the SD memory card.	—
201H	An access to the SD memory card has failed because SM606 (SD memory card forced disable instruction) is turned on. While logging data is being saved, turning on SM606 (SD memory card forced disable instruction) results in the partially created CSV file being saved in the SD memory card.	Turn off SM606 and check that SM607 (SD memory card forced stop status flag) is turned off, then execute the FB again.
202H	Execution of this FB has been attempted without inserting an SD memory card into the CPU module.	Insert an SD memory card for saving the target CSV files into the CPU module, and then execute the FB again.
203H	An access to the SD memory card has failed because SM600 (Memory card available flag) is off (unavailable).	Make the SD memory card an available state, and then execute the FB again.
204H	The SD memory card is frequently accessed from programs in addition to this FB, and a timeout has occurred in the logging data write processing.	Reduce the frequency of the access to the SD memory card.
205H	Because SM601 (Memory card protect flag) is on (write inhibited), data cannot be written to the SD memory card.	Turn off the protect switch on the SD memory card (write enabled), check that SM601 is off, and execute the FB again.
Error codes other than the above	Error codes related to the SP.FWRITE instruction executed when logging data is written to an SD memory card	For details on the error code that has occurred, refer to the description of the SP.FWRITE instruction. (📖 MELSEC iQ-R Programming Manual (Instructions, Standard Functions/Function Blocks))

APPENDIX

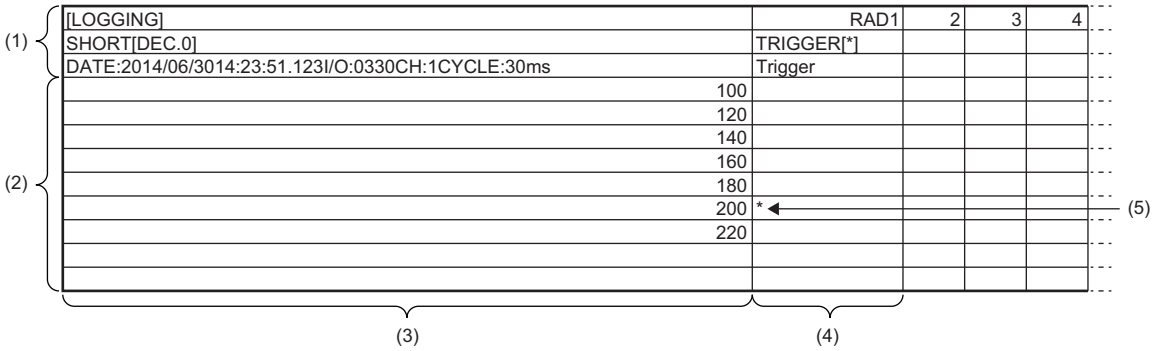
Appendix 1 CSV File Output Format of the FB for Saving Logging Data

The format specifications of CSV files that the FB for saving logging data (M+R60TDG_SaveLogging, M+R60RDG_SaveLogging) output are shown below.

Item	Description
Delimiter	Comma (,)
Line feed code	CRLF (0DH, 0AH)
Character code	ASCII
File size	8130 bytes at maximum*1

*1 When the number of logging data is 1000, and all the logging data are negative numbers with five digits, the file size reaches the maximum.

The following figure is an example of a thermocouple input module regarding how output contents are arranged in the rows and columns after a write to a CSV file.



(1) Header rows
(2) Data rows
(3) Data column
(4) Trigger data column
(5) Data at the time of a hold trigger

Header row

The header row contains necessary information used for display on GX LogViewer; do not make any changes.

The file size of the header row is 128 bytes (fixed).

■File information row

Information related to the CSV file is described in the order shown in the following table.

Column No.	Item	Output content	Size (byte)
Column 1	File type	[LOGGING]	9
Column 2	File version	RAD1 (number indicating the file version)	4
Column 3	Data type information row number	2 (number indicating the row number of the data type information row)	1
Column 4	Data name row number	3 (number indicating the row number of the data name row)	1
Column 5	Data start row number	4 (number indicating the row number of the data row)	1*1

*1 At the end of column 5, 4 bytes of NULL are added.

■Data type information row

The data type of each column is written in the order shown in the following table. The data type of each column is output in the format of "Data type""[Added information]".

Column No.	Item	Output content of "Data type"	Size (byte)	Output content of "[Added information]"	Size (byte)
Column 1	Data column	SHORT (signed 16-bit integer specification)	5	[DEC.0] (decimal format specification)	7
Column 2	Trigger generation information column	TRIGGER	7	[*] (specification of the use of "*" as a generated character)	3

■Data name row

The title of each column is written in the order shown in the following table. The data name of each column is output in the format of "Data name":"Added information". (The information written in the data column is shown as a title when the logging data appears on GX LogViewer.)

Column No.	Column name	Output content of "Data name"	Size (byte)	Output content of "[Added information]"	Size (byte)
Column 1	Data column	DATE: *1	5	Hold trigger generation time*2*3	23
		I/O: *1	4	XY address numbers of the module from which logging data is acquired*4	4
		CH: *1	3	Target channel*4	1
		CYCLE: *1	6	Logging cycle*3	3 to 17
Column 2	Trigger generation information column	Trigger	7	—	7
		—	—	— (NULL)*5	1 to 15

*1 A half-width space is inserted between each output item in the data column.
*2 The time is output in the format of YYYY/MM/DD hh:mm:ss.mmm.
*3 The hold trigger generation time and the logging cycle would have the values of CH☐ Trigger generation time and CH☐ Logging cycle monitor value of the target channel, respectively. A half-width space is inserted between s and ms in the data of CH☐ Logging cycle monitor. (For example, if the module has a logging cycle of 3599 seconds, with a target of 3 channel logging, the logging cycle is 3598 seconds 920ms, which is displayed as "3599s 920ms".)
*4 XY address numbers and the target channel are the values specified as arguments to the FB for saving logging data.
*5 To fix the size of the header row (128 bytes), 1 to 15 bytes of NULL are added at the end of the trigger generation information column.

Data row

Data is written in the order shown in the following table. (This data is the information displayed on GX LogViewer.)

Column name	Output content	Size (byte)
Data column	Logging data stored in the buffer memory of a temperature input module	1 to 6*1
Trigger generation information column	*(output only to the row of the logging data to which the trigger pointer points)	0 to 1

*1 If the logging data of the data row to which the trigger pointer points has a size of less than 6 bytes, NULL is output at the end of the logging data to fix the size to 6 bytes.

MEMO

INSTRUCTION INDEX

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MEMO

REVISIONS

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

Revision date	*Manual number	Description
January 2015	BCN-P5999-0462-A	First edition
April 2016	BCN-P5999-0462-B	■Added or modified parts Section 2.1 to 2.4, Appendix 1
April 2017	BCN-P5999-0462-C	■Added or modified parts Section 2.1 to 2.4, Appendix 1

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