DATA OPERATION FB LIBRARY REFERENCE MANUAL

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Reference Manual Revision History

Reference Manual Number	Date	Description
FBM-M047-A	2011/03/22	First edition



1. M+CPU-Data_CalculateCheckCode (Check code calculation)

FB Name

M+CPU-Data_CalculateCheckCode

Item	Description					
Function overview	Calculates the horizontal parity value and addition value (sum), which are used to check for					
	errors in communic	cation, etc.				
Symbol		M+CPU-Data_CalculateCheckCode				
	Execution command	B : FB_EN	FB_ENO : B	Execution status		
	Conversion mode -	B:i_Conv_Mode	FB_OK : B	- Completed without error		
	Start device No	W : i_Check_Data	FB_ERROR : B	-Error flag		
	No. of data ⁻	W:i_Num_Data	ERROR_ID : W	- Error code		
			o_Result_Sum : W	- Addition (Sum) data		
			o_Result_Parity : W——	-Horizontal parity data		
Applicable hardware	Hardware details					
and software	Q series	High performance mod	el			
	Q series	Universal model				
	L series	LCPU				
	*Not applicable for	QCPU (A mode)				
	Compatible softwar	re: GX Works 2 Version	1.31H or later			
Programming	Ladder					
language						
Number of steps	For high performan	For high performance model CPU: 258*				
(maximum value)	*The value is the no	*The value is the number of steps in the label program, and is therefore stated as a				
	reference value. F	or details, refer to the C	GX Works2 Version1 Ope	eration Manual (Simple		
	Project).					



Item	Description						
Function description	1) By turning ON FB_EN (Execution command), the addition value and horizontal parity						
	value of the check data are calculated. Two types of conversion modes are supported:						
	16-bit conversion mode and 8-bit conversion mode. In the 8-bit conversion mode, only						
	the lower 8 bits of each check data are valid.						
	2) When the input value is invalid, the FB_ERROR output turns ON, processing is						
	interrupted, and the error code is stored in ERROR_ID (Error code).						
	Refer to the error code explanation section for details.						
Compiling method	Macro type						
Restrictions and	The FB does not include error recovery processing. Program the error recovery						
precautions	processing separately in accordance with the required system operation.						
	2) The FB cannot be used in an interrupt program.						
	3) If a message stating "Insufficient word device points in device/label (VAR)						
	automatic-assign setting" appears when a program is compiled, adjust the automatically						
	assigned device setting.						
	4) This FB uses index registers Z9 and Z8. Please do not use these index registers in an						
	interrupt program.						
FB operation type	Pulsed execution (1 scan execution type)						
Timing chart	Operation of I/O signals						
	[When operation completes without error] [When an error occurs]						
	FB_EN(Execution command) FB_EN(Execution command)						
	FB_ENO(Execution status) FB_ENO(Execution status)						
	FB_OK (Completed without error) (Completed without error)						
	FB_ERROR(Error flag) FB_ERROR(Error flag)						
	ERROR ID(Error code) 0 ERROR ID(Error code) 0 10(Decimal) 0						
Relevant manual	MELSEC-Q/L Programming Manual (Common Instructions)						

Error codes

■Error code list

Error code	Description
10	i_Num_Data (No. of data) is not valid. Set the number of data within the range of 1 to 256,
	and turn OFF FB_EN and then ON again.



■Input labels

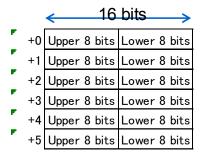
Name	Variable name	Data	Setting range	Description
		type		
Execution command	FB_EN	В	ON, OFF	ON: The FB is activated.
				OFF: The FB is not
				activated.
Conversion mode	i_Conv_Mode	В	OFF: 16-bit conversion	Specify the input type for
			mode	the check data.
			ON: 8-bit conversion mode	
Start device No.	i_Check_Data	W	Valid device range	Set the start device of the
				device to be checked.
No. of data	i_Num_Data	W	1~256	Specify the number of
				data to be checked.

Name	Variable name	Data	Initial	Description
		type	value	
Execution status	FB_ENO	В	OFF	ON: Execution command is ON.
				OFF: Execution command is OFF.
Completed without	FB_OK	В	OFF	When ON, it indicates that the processing is
error				completed.
Error flag	FB_ERROR	В	OFF	When ON, it indicates that an error has
				occurred.
Error code	ERROR_ID	W	0	FB error code output.
Addition (Sum) data	o_Result_Sum	W	0	Return the addition (Sum) data that was
				calculated.
Horizontal parity	o_Result_Parity	W	0	Return the horizontal parity data that was
data				calculated.



1) Data to be checked in each conversion mode are as follows.

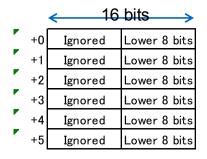
16-bit conversion mode (when i_Num_Data (No. of data) is 6)



	Decimal	Hexa	decimal
	Decimal	Upper	Lower
D0	24932	H61	H64
D1	4219	H10	Н7В
D2	-1333	HFA	нсв
D3	-1	HFF	HFF
D4	32761	H7F	HF9
D5	10000	H27	H10

In the above 16-bit conversion mode example, the 6 bytes shown in the shaded cells are added up. Thus the addition data becomes H315 (789 _{decimal}). ---1)

8-bit conversion mode (i_Num_Data (No. of data) is 6)



	Decimal	Hexa	decimal
	Decimal	Upper	Lower
D0	24932	H61	H64
D1	4219	H10	Н7В
D2	-1333	HFA	HCB
D3	-1	HFF	HFF
D4	32761	H7F	HF9
D5	10000	H27	H10

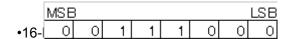
In the above 8-bit conversion mode example, the 6 bytes shown in the shaded cells are added up. Thus the addition data becomes H3B2 (946 decimal). --- 2)

- 2) Stores the total sum value of the target data, which was calculated for every 8 bits, in the addition (sum) data.
- •16-bit conversion mode --- 1) •8-bit conversion mode --- 2)
- 3) The number of ONs of each bit of the target data is calculated for every 8 bits. Ultimately the parity value is calculated so that the horizontal parity value is turned ON when the number of ONs is odd, and the horizontal parity value is turned OFF when the number of ONs is even. Then, the parity value is stored in the horizontal parity data.

<Horizontal parity is ON when No. of ONs is odd>

<Horizontal parity is OFF when No. of ONs is even>





	Decimal	Hexa	decimal
	Decimal	Upper	Lower
D0	24932	H61	H64
D1	4219	H10	Н7В
D2	-1333	HFA	нсв
D3	-1	HFF	HFF
D4	32761	H7F	HF9
D5	10000	H27	H10

The data in the shaded cells are used to calculate the horizontal parity.

	MSE	3						LSB
•8-bit d	0	0	1	0	1	0	0	0

	Decimal	Hexa	adecimal
	Decimal	Upper	Lower
D0	24932	H61	H64
D1	4219	H10	Н7В
D2	-1333	HFA	нсв
D3	-1	HFF	HFF
D4	32761	H7F	HF9
D5	10000	H27	H10

The data in the shaded cells are used to calculate the horizontal parity.

The horizontal parity value is calculated as follows.

•16-bit conversion mode

	Upper 8 bits	Lower 8 bits
D0	01100001	01100100
D1	00010000	01111011
D2	11111010	11001011

	b7	b6	b5	b4	b3	b2	b1	b0	
Upper 8 bits of D0	0	1	1	0	0	0	0	1	H61
Lower 8 bits of D0	0	1	1	0	0	1	0	0	H64
Upper 8 bits of D1	0	0	0	1	0	0	0	0	H10
Lower 8 bits of D1	0	1	1	1	1	0	1	1	H7B
Upper 8 bits of D2	1	1	1	1	1	0	1	0	HFA
Lower 8 bits of D2	1	1	0	0	1	0	1	1	HCB
Horizontal parity value (D10)	0	1	0	1	1	1	1	1	H5F

The horizontal parity is OFF because the
number of ONs at the 5th bit is even.

The horizontal parity is ON because the number of ONs at the 0th bit is odd.

•8-bit conversion mode

	Lower 8 bits
D0	01100100
D1	01111011
D2	11001011
D3	111111111
D4	11111001
D5	00010000



	b7	b6	b5	b4	b3	b2	b1	b0			
Lower 8 bits of D0	0	1	1	0	0	1	0	0	H64		
Lower 8 bits of D1	0	1	1	1	1	0	1	1	Н7В		
Lower 8 bits of D2	1	1	0	0	1	0	1	1	HCB		
Lower 8 bits of D3	1	1	1	1	1	1	1	1	HFF		
Lower 8 bits of D4	1	1	1	1	1	0	0	1	HF9		
Lower 8 bits of D5	0	0	0	1	0	0	0	0	H10		
Horizontal parity value (D10)	1	1	0	0	0	0	1	0	HC2		
1								1	\		
The horizontal parity is ON because the number of ONs at the 6 th bit is odd.)	TI nı	ne ho umbe	rizontal parity i r of ONs at the	is OFF becaus e 0 th bit is ever	se the

Version Upgrade History

Version	Date	Description
1.00A	2011/03/22	First edition

Note

This chapter includes information related to the M+CPU-Data_CalculateCheckCode function block.

It does not include information on restrictions of use such as combination with modules or programmable controller CPUs.

Before using any Mitsubishi products, please read all the relevant manuals.



2. M+CPU-Data_CalculateCRC16 (CRC-16 calculation)

FB Name

M+CPU-Data_CalculateCRC16

Item	Description							
Function overview	Calculates CRC-1	6 (Cyclic Redundancy	Check) value, which is	one of the error check				
	methods used for o	nethods used for communication.						
Symbol		M+CPU-Data_CalculateCRC16						
	Execution command	B : FB_EN	FB_ENO : B	Execution status				
	Conversion mode	B : i_Conv_Mode	FB_OK : B	— Completed without error				
	Start device No.	W: i_Check_Data	FB_ERROR : B	— Error flag				
	No. of data	W : i_Num_Data	ERROR_ID : W-	— Error code				
			o_Result_CRC : W	— CRC data				
Applicable hardware	Hardware details							
and software	Q series	High performance mod	del					
	Q series	Universal model						
	L series	LCPU						
	*Not applicable for	QCPU (A mode)						
	Compatible softwa	re: GX Works 2 Versior	1.31H or later					
Programming	Ladder							
language								
Number of steps	For high performar	nce model CPU: 279*						
(maximum value)	*The value is the number of steps in the label program, and is therefore stated as a							
	reference value. F	reference value. For details, refer to the GX Works2 Version1 Operation Manual (Simple						
	Project).							



Item	Description						
Function description	1) By turning ON FB_EN (Execution command), the CRC-16 value is calculated. Two types						
	of conversion modes are supported: 16-bit conversion mode and 8-bit conversion mode.						
	In the 8-bit conversion mode, only the lower 8 bits of each check data are valid.						
	The calculation is performed in the following polynomial, using CRC-16 as a CRC value.						
	$[X^{16} + X^{15} + X^2 + 1]$						
	2) When the input value is invalid, the FB_ERROR output turns ON, processing is						
	interrupted, and the error code is stored in ERROR_ID (Error code).						
	Refer to the error code explanation section for details.						
Compiling method	Macro type						
Restrictions and	1) The FB does not include error recovery processing. Program the error recovery						
precautions	processing separately in accordance with the required system operation.						
	2) The FB cannot be used in an interrupt program.						
	3) If a message stating "Insufficient word device points in device/label (VAR)						
	automatic-assign setting" appears when a program is compiled, adjust the automatically						
	assigned device setting.						
	4) This FB uses index registers Z9 and Z8. Please do not use these index registers in an						
	interrupt program.						
FB operation type	Pulsed execution (1 scan execution type)						
Timing chart	Operation of I/O signals						
	[When operation completes without error] [When an error occurs]						
	FB_EN(Execution command)						
	FB_ENC(Execution status)						
	o_Result_CRC						
	(CRC data) refreshing (CRC data) No refreshing (CRC data) FB_OK FB_OK						
	(Completed without error) (Completed without error)						
	FB_ERROR(Error flag)						
Relevant manual	MELSEC-Q/L Programming Manual (Common Instructions)						

Error codes

■Error code list

Error code	Description
10	i_Num_Data (No. of data) is not valid. Set the number of data within the range of 1 to 256,
	and turn OFF FB_EN and then ON again.



■Input labels

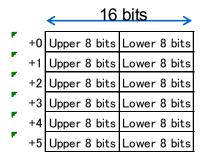
Name	Variable name	Data	Setting range	Description
		type		
Execution command	FB_EN	В	ON, OFF	ON: The FB is activated.
				OFF: The FB is not
				activated.
Conversion mode	i_Conv_Mode	В	OFF: 16-bit conversion	Specify the input type of
			mode	the check data.
			ON: 8-bit conversion mode	
Start device No.	i_Check_Data	W	Valid device range	Set the start device of the
				device to be checked.
No. of data (in byte	i_Num_Data	W	1~256	Specify the number of
units)				data to be checked.

Name	Variable name	Data	Initial	Description
		type	value	
Execution status	FB_ENO	В	OFF	ON: Execution command is ON.
				OFF: Execution command is OFF.
Completed without	FB_OK	В	OFF	When ON, it indicates that the processing is
error				completed.
Error flag	FB_ERROR	В	OFF	When ON, it indicates that an error has
				occurred.
Error code	ERROR_ID	W	0	FB error code output.
CRC data	o_Result_CRC	W	0	Return the CRC data that was calculated.



(1) Data to be checked in each conversion mode are as follows.

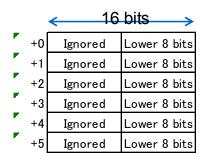
16-bit conversion mode (when i_Num_Data (No. of data) is 6)



	Decimal	Hexadecimal		
	Decimal	Upper	Lower	
D0	24932	H61	H64	
D1	4219	H10	Н7В	
D2	-1333	HFA	НСВ	
D3	-1	HFF	HFF	
D4	32761	H7F	HF9	
D5	10000	H27	H10	

In the example above, the target data are the 6 bytes shown in the shaded cells of the right table.

8-bit conversion mode (i_Num_Data (No. of data) is 6)



	Decimal	Hexadecimal		
	Decimal	Upper	Lower	
D0	24932	H61	H64	
D1	4219	H10	Н7В	
D2	-1333	HFA	нсв	
D3	-1	HFF	HFF	
D4	32761	H7F	HF9	
D5	10000	H27	H10	

In the example above, the target data are the 6 bytes shown in the shaded cells of the right table.

(2) The target data are used as variables in groups of 8 bits when calculating CRC-16. The CRC value is calculated using the following polynomial and is stored in the CRC data.

Polynomial for CRC-16:

$$X^{16} + X^{15} + X^2 + 1$$

16-bit conversion mode HA57B (-23173 _{decimal})

8-bit conversion mode HBDA1 (-16991 _{decimal})

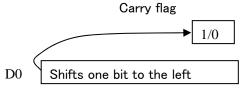


CRC-16 is calculated as follows.

The polynomial is $X^{16} + X^{15} + X^2 + 1$.

A: Internal label

- 1. Clears A to zero.
- 2. Loops by the calculated data length (by No. of data).
 - (a) Reads one byte of the data.
 - (b) Loops 8 times.



- 1) Shifts the data one bit to the left (the carry flag is set for overflow).
- 2) Rotates A one bit to the left (substitute LSB with the above carry flag).
- 3) If overflow occurs when exceeding 16 bits, performs an XOR operation for A using the polynomial.
- 3. Stores the result A in the CRC data when all data have been processed.

Version Upgrade History

Version	Date	Description
1.00A	2011/03/22	First edition

Note

This chapter includes information related to the M+CPU-Data_CalculateCRC16 function block.

It does not include information on restrictions of use such as combination with modules or programmable controller CPUs.

Before using any Mitsubishi products, please read all the relevant manuals.



3. M+CPU-Data_CopyDigit (Digit copy)

FB Name

M+CPU-Data_CopyDigit

Item	Description					
Function overview	Copies 16-bit data by digits (4 bits per digit).					
Symbol	M+CPU-Data_CopyDigit					
	Execution command		B : FB_EN	FB_ENO : B	Execution status	
	With/without BIN→BC	D conversion —	B:i_BCD_Chg	FB_OK : B	Completed without error	
	Transfer source	data (binary)	W:i_Src_Data	FB_ERROR : B	Error flag	
	Start digit position	on to transfer	W:i_Src_TopDigit	ERROR_ID : W	Error code	
	No. of dig	ts to transfer —	W:i_Num_Digit	o_Result_Data : W	Transfer result data (binary)	
	Transfer destination	data (binary) ——	W : i_Dest_Data			
		git position of er destination	W:i_Dest_TopDigit			
Applicable hardware	Hardware details				_	
and software	Q series	High perfor	mance model			
	Q 3CHC3	Universal model				
	L series	LCPU				
	*Not applicable for QCPU (A mode)					
	Compatible software: GX Works 2 Version 1.31H or later					
Programming	Ladder					
language						
Number of steps	For high performa	nce model C	PU: 343*			
(maximum value)	*The value is the i	number of ste	eps in the label pro	ogram, and is ther	efore stated as a	
	reference value.	For details, re	efer to the GX Wo	rks2 Version1 Ope	eration Manual (Simple	
	Project).					
Function description	1) Copy data in di	gits of 4 bits a	according to the sta	art position and nu	ımber of digits to transfer	
	of the source data and the start digit position of the transfer destination. With/without BIN					
	→BCD convers	sion enables	to perform a BIN/E	BCD conversion.		
	2) When the input value is invalid, the FB_ERROR output turns ON, processing is					
	interrupted, and the error code is stored in ERROR_ID (Error code).					
	Refer to the err	or code expla	anation section for	r details.		



Item	Description				
Compiling method	Macro type				
Restrictions and	The FB does not include error recovery processing. Program the error recovery				
precautions	processing separately in accordance with the required system operation.				
	2) The FB cannot be used in an interrupt program.				
FB operation type	Pulsed execution (1 scan execution type)				
Application example	Refer to Appendix - Application examples.				
Timing chart	Operation of I/O signals				
	[When operation completes without error] [When an error occurs]				
	FB_EN(Execution command) FB_EN(Execution command)				
	FB_ENO(Execution status) FB_ENO(Execution status)				
	o_Result_Data (Transfer result data) No refreshing Refreshing No refreshing (Transfer result data) No refreshing (Transfer result data)				
	FB_OK (Completed without error) (Completed without error)				
	FB_ERROR(Error flag) FB_ERROR(Error flag)				
	ERROR_ID(Error code) 0 ERROR_ID(Error code) 0 10~14(Decimal) 0				
Relevant manual	MELSEC-Q/L Programming Manual (Common Instructions)				

Error codes

■Error code list

Error code	Description				
10	i_Src_TopDigit (Start digit position to transfer) is not valid.				
	Please try again after confirming the setting.				
	This error occurs when the difference of [Start digit position to transfer] minus [No. of digits				
	to transfer] is smaller than 0.				
11	i_Num_Digit (No. of digits to transfer) is not valid.				
	Please try again after confirming the setting.				
12	i_Dest_TopDigit (Start digit position of transfer destination) is not valid.				
	Please try again after confirming the setting.				
	This error occurs when the difference of [Start digit position of transfer destination] minus				
	[No. of digits to transfer] is smaller than 0.				
13	i_Src_Data (Transfer source data) is not valid. Only when with/without BIN→BCD				
	conversion is enabled.				
	Please try again after confirming the setting.				



Error code	Description
14	i_Dest_Data (Transfer destination data) is not valid. Only when with/without BIN→BCD
	conversion is enabled.
	Please try again after confirming the setting.

■Input labels

Name	Label name	Data	Setting range	Description
		type		
Execution	FB_EN	В	ON, OFF	ON: The FB is activated.
command				OFF: The FB is not activated.
With/without	i_BCD_Chg	В	ON, OFF	OFF: Do not perform
BIN→BCD				conversion.
conversion				ON: Perform conversion.
Transfer source	i_Src_Data	W	Without BCD conversion:	Specify the source data to
data			-32768~32767	transfer from.
			With BCD conversion:	
			0~9999	
Start digit position	i_Src_TopDigit	W	1~4	Specify the start digit position
to transfer			[Start digit position to	to transfer from.
			transfer]-[No. of digits to	
			transfer]≥0	
No. of digits to	i_Num_Digit	W	1~4	Set the number of digits to
transfer				transfer from.
Transfer	i_Dest_Data	W	Without BCD conversion:	Specify the destination data to
destination data			-32768~32767	transfer to.
			With BCD conversion:	
			0~9999	
Start digit position	i_Dest_TopDigit	W	1~4	Set the position of the start
of transfer			[Start digit position of	digit to transfer to.
destination			transfer destination] – [No.	
			of digits to transfer]≥0.	

Name	Label name	Data	Initial	Description
		type	value	

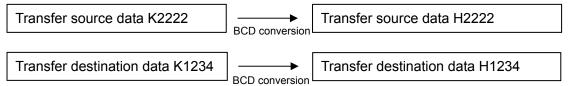


Execution status	FB_ENO	В	OFF	ON: Execution command is ON.	
				OFF: Execution command is OFF.	
Completed without	FB_OK	В	OFF	When ON, it indicates that the processing is	
error				completed.	
Error flag	FB_ERROR	В	OFF	When ON, it indicates that an error has occurred.	
Error code	ERROR_ID	W	0	FB error code output.	
Transfer result	o_Result_Data	W	0	Return the copy result.	
data					

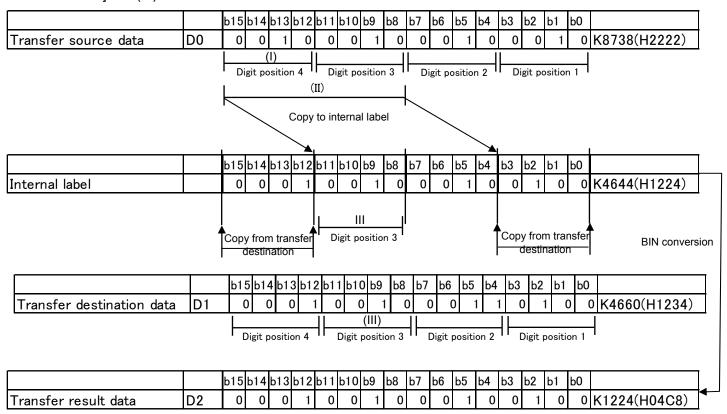


- 1. Copies the value, which was converted to BCD, when with/without BIN→BCD conversion is ON.
 - The transfer source data is K2222 and transfer destination data is K1234:

After BCD conversion, the transfer source data is K8738 (H2222) and transfer destination data K4660 (H1234).



• [Start digit position to transfer] is 4 (I), [No. of digits to transfer] is 2 (II), and [Start digit position of transfer destination] is 3 (III):



2. Copies without converting from BIN to BCD when with/without BIN→BCD conversion is OFF.



Version Upgrade History

Version	Date	Description
1.00A	2011/03/22	First edition

Note

This chapter includes information related to the M+CPU-Data_CopyDigit function block.

It does not include information on restrictions of use such as combination with modules or programmable controller CPUs.

Before using any Mitsubishi products, please read all the relevant manuals.



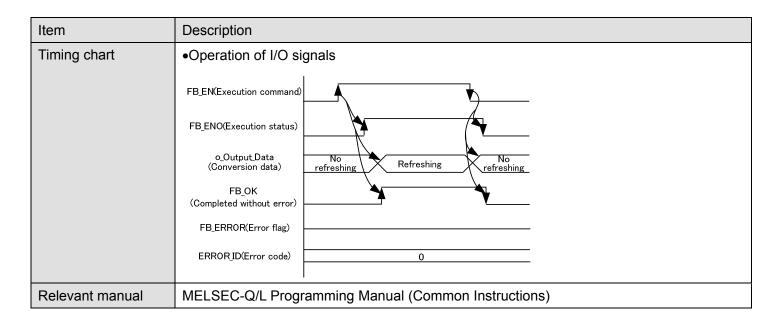
4. M+CPU-Data_DSwap (32-bit upper/lower byte exchange)

FB Name

M+CPU-Data_DSwap

Item	Description				
Function overview	Exchanges the upper/lower 8-bit of the input data (32-bit data) in word units.				
Symbol		M+CPU-Data_Dswap			
	Execution command	d B : FB_EN FB_ENO : B Execution status			
	Input data	a D : i_Input_Data FB_OK : B Completed without error			
		o_Output_Data : D —— Conversion data			
Applicable hardware	Hardware details				
and software	Operios	High performance model			
	Q series	Universal model			
	L series	LCPU			
	*Not applicable for QCPU (A mode)				
	Compatible software: GX Works 2 Version 1.31H or later				
Programming	Ladder				
language					
Number of steps	For high performance model CPU: 55*				
(maximum value)	*The value is the number of steps in the label program, and is therefore stated as a				
		For details, refer to the GX Works2 Version1 Operation Manual (Simple			
	Project).				
Function description		B_EN (Execution command), the upper/lower 8 bits of the input data are			
	exchanged in word units and they are stored in the exchange data.				
Compiling method	Macro type				
Restrictions and	1) The FB does not include error recovery processing. Program the error recovery				
precautions	processing separately in accordance with the required system operation.				
	2) The FB cannot be used in an interrupt program.				
FB operation type	Pulsed execution (1 scan execution type)				
Application example	Refer to Appendix - Application examples.				





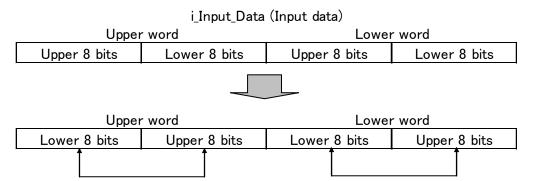
■Input labels

Name	Label name	Data	Setting range	Description
		type		
Execution	FB_EN	В	ON, OFF	ON: The FB is activated.
command				OFF: The FB is not activated.
Input data	i_Input_Data	D	-2147483648~2147483647	Specify the data whose upper
				and lower bytes are
				exchanged.

Name	Label name	Data	Initial	Description
		type	value	
Execution status	FB_ENO	В	OFF	ON: Execution command is ON.
				OFF: Execution command is OFF.
Completed without	FB_OK	В	OFF	When ON, it indicates that the processing is
error				completed.
Exchange data	o_Output_Data	D	0	Return the result of the exchange of the upper and
				lower bytes.



1) Exchanges the bytes of the input data as follows.



2) Stores the exchange result in the exchange data.

Version Upgrade History

Version	Date	Description
1.00A	2011/03/22	First edition

Note

This chapter includes information related to the M+CPU-Data_DSwap function block.

It does not include information on restrictions of use such as combination with modules or programmable controller CPUs.

Before using any Mitsubishi products, please read all the relevant manuals.



5. M+CPU-Data_RShiftBit (Bit right shift)

FB Name

M+CPU-Data_RShiftBit

Item	Description								
Function overview	Shifts the word de	vice dat	ta to the right by the	specified number of I	oits. Transfers the data to				
	be stored in the s	be stored in the shift result from the most significant bit of the shifted data by the specified							
	number of bits.								
Symbol			M+CPU-Da	ta_RShiftBit					
	Execution comr	mand ——	B : FB_EN	FB_ENO : B	Execution status				
	Start device N data stored in shift re	esult	W : i_Set_Data	FB_OK : B	Completed without error				
	Start device N shift target		W : i_Shift_Data	FB_ERROR : B	— Error flag				
	Bit data length of target		W:i_Num_SFDataBit	ERROR_ID : W	Error code				
	No. of bits to right	shift ——	W:i_Num_ShiftBit	o_Shift_Data : W	Start device No. of shift result data				
Applicable hardware	Hardware details				_				
and software	Q series	High p	performance model						
	Q SCIICS	Unive	rsal model						
	L series	LCPU	l						
	*Not applicable fo	r QCPU	J (A mode)		_				
	Compatible softwa	are: GX	Works 2 Version 1.3	31H or later					
Programming	Ladder								
language									
Number of steps	For high performance model CPU: 609*								
(maximum value)	*The value is the number of steps in the label program, and is therefore stated as a								
	reference value.	For deta	ails, refer to the GX \	Works2 Version1 Op	eration Manual (Simple				
	Project).								



Item	Description							
Function description	By turning ON FB_EN (Execution command), the following processing is performed.							
	1) Shifts [Shift target data] by [No. of bits to right shift] to the right.							
	2) Sets the data, which is to be stored in the shift result, from the most significant bit of the							
	shifted data.							
	3) When the input value is invalid, the FB_ERROR output turns ON, processing is							
	interrupted, and the error code is stored in ERROR_ID (Error code).							
	Refer to the error code explanation section for details.							
Compiling method	Macro type							
Restrictions and	1) The FB does not include error recovery processing. Program the error recovery							
precautions	processing separately in accordance with the required system operation.							
	2) The FB cannot be used in an interrupt program.							
	3) If a message stating "Insufficient word device points in device/label (VAR)							
	automatic-assign setting" appears when a program is compiled, adjust the automatically							
	assigned device setting.							
	4) This FB uses index registers Z9, Z8, Z7, Z6 and Z5. Please do not use these index							
	registers in an interrupt program.							
FB operation type	Pulsed execution (1 scan execution type)							
Application example	Refer to Appendix - Application examples.							
Timing chart	Operation of I/O signals							
	[When operation completes without error] [When an error occurs]							
	FB_EN(Execution command)							
	FB_ENC(Execution command) FB_ENC(Execution status)							
	o, Shift Data No. Refreshing No. O Shift Data							
	FB_OK (Shift result) (Shift result)							
	(Completed without error) FB_ERROR(Error flag) FB_ERROR(Error flag)							
	ERROR_ID(Error code) 0 ERROR_ID(Error code) 0 10~12(Decimal) 0							
Relevant manual	MELSEC-Q/L Programming Manual (Common Instructions)							

Error codes

■Error code list

Error code	Description
10	i_Num_SFDataBit (Bit data length of shift target data) is not valid. Set the data within the
	range of 1 to 1024, and turn OFF FB_EN and then ON again.



Error code	Description
11	i_Num_ShiftBit (No. of bits to right shift) is not valid. Set the data within the range of 1 to
	1024, and turn OFF FB_EN and then ON again.
12	The number of bits to shift is too large (i_Num_SFDataBit < i_Num_ShiftBit). Set
	i_Num_ShiftBit (No. of bits to right shift), which is smaller than i_Num_SFDataBit (Bit data
	length of shift target data). Then turn OFF FB_EN and then ON again.

■Input labels

Name	Label name	Data	Setting range	Description
		type		
Execution	FB_EN	В	ON, OFF	ON: The FB is activated.
command				OFF: The FB is not activated.
Start device No. of	i_Set_Data	W	Valid device range	Set the device that stores data
data stored in shift				to be stored in the shift result.
result				Use devices for
				i_Num_ShiftBit.
Start device No. of	i_Shift_Data	W	Valid device range	Set the start device of the data
shift target data				to shift.
				Use devices for
				i_Num_SFDataBit.
Bit data length of	i_Num_SFDataB	W	1~1024	Set the number of bit data of
shift target data	it		n2≤n1≤1024	the data to shift.
	(n1)			
No. of bits to right	i_Num_ShiftBit	W	1~1024	Set the number of bits to shift
shift	(n2)		n2≤n1≤1024	to the right.

Name	Label name	Data	Initial	Description
		type	value	
Execution status	FB_ENO	В	OFF	ON: Execution command is ON.
				OFF: Execution command is OFF.
Completed without	FB_OK	В	OFF	When ON, it indicates that the processing is
error				completed.
Error flag	FB_ERROR	В	OFF	When ON, it indicates that an error has occurred.

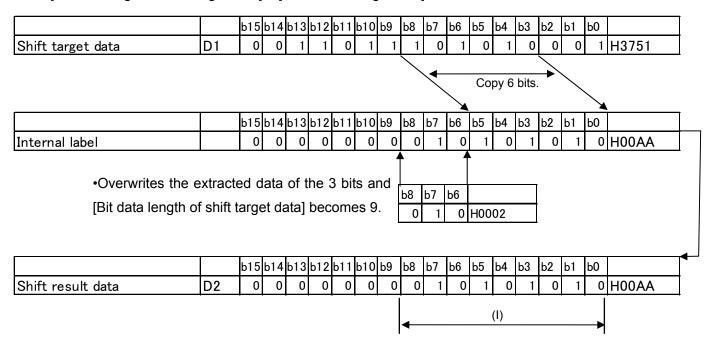


Name	Label name	Data	Initial	Description
		type	value	
Error code	ERROR_ID	W	0	FB error code output.
Start device No. of	o_Shift_Data	W	0	Store the shift result.
shift result data				Use devices for i_Num_SFDataBit.

- (1) Shifts [Shift target data] by [No. of bits to right shift] to the right.
- (2) Sets the data, which is to be stored in the shift result, from the most significant bit of the shift result (I).
 - •[Bit data length of shift target data] is 9 (I) and [No. of bits to right shift] is 3 (II)

		b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
Data stored in shift result	D0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	H0002
 						(II)												
Extracts the 3 bits because [No. of bits to right shift] is 3.							b2 0		b0 0	H0002								

•Copies the 6 bits, which are calculated as follow, from [Shift target data] to the internal label. [Bit data length of shift target data] – [No. of bits to right shift] = 6 bits





Version Upgrade History

Version	Date	Description
1.00A	2011/03/22	First edition

Note

This chapter includes information related to the M+CPU-Data_RShiftBit function block.

It does not include information on restrictions of use such as combination with modules or programmable controller CPUs.

Before using any Mitsubishi products, please read all the relevant manuals.



6. M+CPU-Data_LShiftBit (Bit left shift)

FB Name

M+CPU-Data_LShiftBit

Item	Description								
Function overview	Shifts the word device data to the left by the specified number of bits. Transfers the data to								
	be stored in the s	be stored in the shift result from the least significant bit of the shifted data by the specified							
	number of bits.								
Symbol			M+CPU-Data	a_LShiftBit					
	Execution com	ımand —	B : FB_EN	FB_ENO : B	Execution status				
	Start device N data stored in shift i		W : i_Set_Data	FB_OK : B	Completed without error				
	Start device N shift targe		W : i_Shift_Data	FB_ERROR : B	Error flag				
	Bit data leng shift targe		W:i_Num_SFDataBit	ERROR_ID : W	Error code				
	No. of bits to left shift		W: i_Num_ShiftBit	o_Shift_Data : W	Start device No. of shift result data				
Applicable hardware	Hardware details				_				
and software	Q series	High _I	performance model						
	Q series	Unive	ersal model						
	L series	LCPU	J						
	*Not applicable fo	r QCPL	J (A mode)		-				
	Compatible softw	are: GX	Works 2 Version 1.31	H or later					
Programming	Ladder								
language									
Number of steps	For high performa	For high performance model CPU: 490*							
(maximum value)	*The value is the	*The value is the number of steps in the label program, and is therefore stated as a							
	reference value.	For det	ails, refer to the GX W	orks2 Version1 Ope	eration Manual (Simple				
	Project).								



Item	Description								
Function description	By turning ON FB_EN (Execution command), the following processing is performed.								
	1) Shift [Shift target data] by [No. of bits to left shift] to the left.								
	2) Sets the bit data, which is to be stored in the shift result, from the least significant bit of								
	the shifted data.								
	3) When the input value is invalid, the FB_ERROR output turns ON, processing is								
	interrupted, and the error code is stored in ERROR_ID (Error code).								
	Refer to the error code explanation section for details.								
Compiling method	Macro type								
Restrictions and	1) The FB does not include error recovery processing. Program the error recovery								
precautions	processing separately in accordance with the required system operation.								
	2) The FB cannot be used in an interrupt program.								
	3) If a message stating "Insufficient word device points in device/label (VAR)								
	automatic-assign setting" appears when a program is compiled, adjust the automatically								
	assigned device setting.								
	4) This FB uses index registers Z9, Z8, Z7 and Z6. Please do not use these index registers								
	in an interrupt program.								
FB operation type	Pulsed execution (1 scan execution type)								
Application example	Refer to Appendix - Application examples.								
Timing chart	Operation of I/O signals								
	[When operation completes without error] [When an error occurs]								
	FB_EN(Execution command)								
	FB_ENC(Execution status)								
	o Shift Data (Shift result) Refreshing Refreshing O Shift Data Refreshing O Shift Data No refreshing O Shift Data								
	(Shift result) No recreasing								
	(Completed without error) FB_ERROR(Error flag) FR_ERROR(Error flag)								
	ERROR[D(Error code) 0 ERROR[D(Error code) 0 10~12(Decimal) 0								
Relevant manual	MELSEC-Q/L Programming Manual (Common Instructions)								

Error codes

■Error code list

Error code	Description
10	i_Num_SFDataBit (Bit data length of shift target data) is not valid. Set the data within the
	range of 1 to 1024, and turn OFF FB_EN and then ON again.



Error code	Description
11	i_Num_ShiftBit (No. of bits to left shift) is not valid. Set the data within the range of 1 to
	1024, and turn OFF FB_EN and then ON again.
12	The number of bits to shift is too large (i_Num_SFDataBit < i_Num_ShiftBit). Set
	i_Num_ShiftBit (No. of bits to left shift), which is smaller than i_Num_SFDataBit (Bit data
	length of shift target data). Then turn OFF FB_EN and ON again.

■Input labels

Name	Label name	Data	Setting range	Description
		type		
Execution	FB_EN	В	ON, OFF	ON: The FB is activated.
command				OFF: The FB is not activated.
Start device No. of	i_Set_Data	W	Valid device range	Set the device that stores data
data stored in shift				to be stored in the shift result.
result				Use devices for
				i_Num_ShiftBit.
Start device No. of	i_Shift_Data	W	Valid device range	Set the start bit device of the
shift target data				data to shift.
				Use devices for
				i_Num_SFDataBit.
Bit data length of	i_Num_SFDataB	W	1~1024	Set the number of bit data of
shift target data	it		n2≤n1≤1024	the data to shift.
	(n1)			
No. of bits to left	i_Num_ShiftBit	W	1~1024	Set the number of bits to shift
shift	(n2)		n2≤n1≤024	to the left.

Name	Label name	Data	Initial	Description
		type	value	
Execution status	FB_ENO	В	OFF	ON: Execution command is ON.
				OFF: Execution command is OFF.
Completed without	FB_OK	В	OFF	When ON, it indicates that the processing is
error				completed.
Error flag	FB_ERROR	В	OFF	When ON, it indicates that an error has occurred.



Name	Label name	Data	Initial	Description
		type	value	
Error code	ERROR_ID	W	0	FB error code output.
Start device No. of	o_Shift_Data	W	0	Return the shift result data.
shift result data				Use devices for i_Num_SFDataBit.

- (1) Shifts [Shift target data] by [No. of bits to left shift] to the left.
- (2) Sets the data, which is to be stored in the shift result, from the least significant bit of the shift result (I).
 - •[Bit data length of shift target data] is 9 (I) and [No. of bits to left shift] is 3 (II)

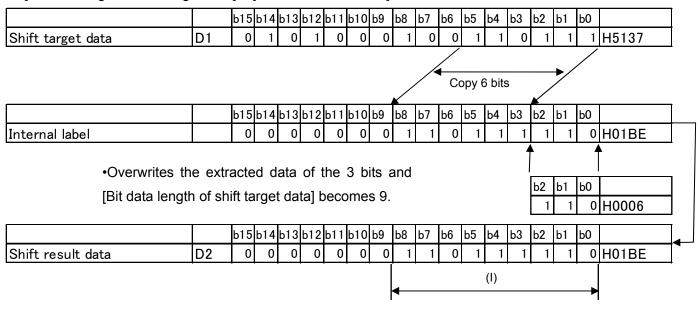
		b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
Data stored in shift result	D0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	H0006
															I	(II)		
																		1

Extracts the 3 bits because [No. of bits to left shift] is 3.

b2 b1 b0 1 1 0 H0006

•Copies the 6 bits, which are calculated as follow, from [Shift target data] to the internal label.

[Bit data length of shift target data] - [No. of bits to left shift] = 6 bits





Version Upgrade History

Version	Date	Description
1.00A	2011/03/22	First edition

Note

This chapter includes information related to the M+CPU-Data_LShiftBit function block.

It does not include information on restrictions of use such as combination with modules or programmable controller CPUs.

Before using any Mitsubishi products, please read all the relevant manuals.



7. M+CPU-Data_RShiftWord (Word right shift)

FB Name

M+CPU-Data_RShiftWord

Item	Description								
Function overview	Shifts the word device data to the right by the specified number of words. Transfers the data								
	to be stored in the shift result from the most significant word of the shifted data by the								
	specified number	of word	ds.						
Symbol			M+CPU-Data_R	ShiftWord					
	Execution com	mand —	B : FB_EN	FB_ENO : B	Execution status				
	Start device N data stored in shift i		W : i_Set_Data	FB_OK : B	Completed without error				
	Start device N shift targe	t data	W : i_Shift_Data	FB_ERROR : B	— Error flag				
	Word data leng shift targe		W: i_Num_SFDataWord	ERROR_ID : W	Error code				
	No. of words to right	shift —	W: i_Num_ShiftWord	o_Shift_Data:W	Start device No. of shift result data				
Applicable hardware	Hardware details				-				
and software	Q series	High	performance model						
	Q selles	Unive	ersal model						
	L series	LCPU	J						
	*Not applicable fo	r QCPl	J (A mode)		-				
	Compatible softwa	are: GX	Works 2 Version 1.31H	l or later					
Programming	Ladder								
language									
Number of steps	For high performa	ince mo	odel CPU: 255*						
(maximum value)	*The value is the	numbe	r of steps in the label pro	ogram, and is there	efore stated as a				
	reference value.	For det	tails, refer to the GX Wo	orks2 Version1 Ope	eration Manual (Simple				
	Project).								



Item	Description									
Function description	By turning ON FB_EN (Execution command), the following processing is performed.									
	1) Shifts [Shift target data] by [No. of bits to right shift] to the right.									
	2) Sets the word data, which is to be stored in the shift result, from the most significant word									
	of the shifted data.									
	3) When the input value is invalid, the FB_ERROR output turns ON, processing is									
	interrupted, and the error code is stored in ERROR_ID (Error code).									
	Refer to the error code explanation section for details.									
Compiling method	Macro type									
Restrictions and	1) The FB does not include error recovery processing. Program the error recovery									
precautions	processing separately in accordance with the required system operation.									
	2) The FB cannot be used in an interrupt program.									
	3) If a message stating "Insufficient word device points in device/label (VAR)									
	automatic-assign setting" appears when a program is compiled, adjust the automatically									
	assigned device setting.									
FB operation type	Pulsed execution (1 scan execution type)									
Application example	Refer to Appendix - Application examples.									
Timing chart	Operation of I/O signals									
	[When operation completes without error] [When an error occurs]									
	FB_EN/Execution command)									
	FB_ENC(Execution status)									
	FB_ENC(Execution status)									
	o_Shift_Data (Shift result) Refreshing No refreshing									
	(Completed without error) (Completed without error)									
	FB_ERROR(Error flag) FB_ERROR(Error flag)									
	ERROR_ID(Error code) 0 ERROR_ID(Error code) 0 10~12(Decimal) 0									
Relevant manual	MELSEC-Q/L Programming Manual (Common Instructions)									

Error codes

■ Error code list

Error code	Description
10	i_Num_SFDataWord (Word data length of shift target data) is not valid. Set the data within
	the range of 1 to 512, and turn OFF FB_EN and then ON again.
11	i_Num_ShiftWord (No. of words to right shift) is not valid. Set the data within the range of 1
	to 512, and turn OFF FB_EN and then ON again.



Error code	Description
12	The number of words to shift is too large. Make sure i_Num_SFDataWord is equal to or
	greater than i_Num_ShiftWord. Set the data within the range of 1 to 512, and turn OFF
	FB_EN and then ON again.

■Input labels

Name	Label name	Data	Setting range	Description
		type		
Execution	FB_EN	В	ON, OFF	ON: The FB is activated.
command				OFF: The FB is not activated.
Start device No. of	i_Set_Data	W	Valid device range	Set the device that stores data
data stored in shift				to be stored in the shift result.
result				Use devices for
				i_Num_ShiftBit.
Start device No. of	i_Shift_Data	W	Valid device range	Set the start word device of
shift target data				the data to shift. Use devices
				for i_Num_SFDataWord.
Word data length	i_Num_SFData	W	1~512	Set the number of word data
of shift target data	Word		n2≤n1≤512	of the data to shift.
	(n1)			
No. of words to	i_Num_ShiftWor	W	1~512	Set the number of words to
right shift	d		n2≤n1≤512	shift to the right.
	(n2)			

Name	Label name	Data	Initial	Description				
		type	value					
Execution status	FB_ENO	В	OFF	ON: Execution command is ON.				
				OFF: Execution command is OFF.				
Completed without	FB_OK	В	OFF	When ON, it indicates that the processing is				
error				completed.				
Error flag	FB_ERROR	В	OFF	When ON, it indicates that an error has occurred.				
Error code	ERROR_ID	W	0	FB error code output.				

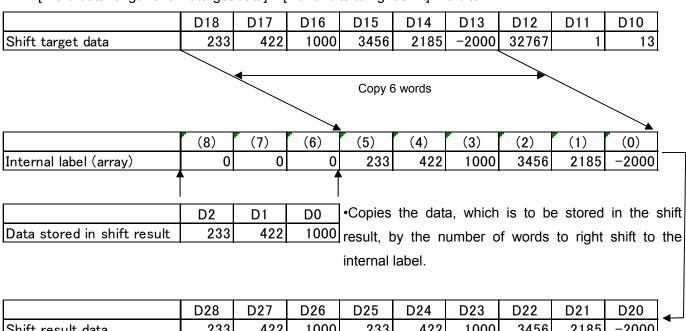


Start device No. of o_Shift_Data	W	0	Return the shift result data.
shift result data			Use devices for i_Num_SFDataWord.

- (1) Shifts the [shift target data] by [No. of words to right shift] to the right.
- (2) Sets the data, which is to be stored in the shift result, from the most significant word of the shift result (I).
 - •[Word data length of shift target data] is 9 (I) and [No. of words to right shift] is 3 (II)
 - •Sets the data, which is to be stored in shift result, to 3 words from D0.

	D2	D1	D0
Data stored in shift result	233	422	1000

- •Stores the target data to shift in 9 words in D10 onwards.
- •Copies the 6 words, which are calculated as follows, to the array of the internal label. [Word data length of shift target data] – [No. of bits to right shift] = 6 bits



	D28	D27	D26	D25	D24	D23	D22	D21	D20]_
Shift result data	233	422	1000	233	422	1000	3456	2185	-2000	



Version Upgrade History

Version	Date	Description
1.00A	2011/03/22	First edition

Note

This chapter includes information related to the M+CPU-Data_RShiftWord function block.

It does not include information on restrictions of use such as combination with modules or programmable controller CPUs.



8. M+CPU-Data_LShiftWord (Word left shift)

FB Name

M+CPU-Data_LShiftWord

Item	Description					
Function overview	Shifts the word device data by the specified number of words to the left. Transfers the data					
	to be stored in the	to be stored in the shift result from the least significant word of the shifted data by				
	specified number	of word	ds.			
Symbol			M+CPU-Data_L	ShiftWord		
	Execution com	mand —	B : FB_EN	FB_ENO : B	Execution status	
	Start device N data stored in shift r		W:i_Set_Data	FB_OK : B	Completed without error	
	Start device N shift target		W:i_Shift_Data	FB_ERROR : B	Error flag	
	Word data length of shift target data		W:i_Num_SFDataWord	ERROR_ID : W	Error code	
			W: i_Num_ShiftWord	o_Shift_Data : W	Start device No. of shift result data	
Applicable hardware	Hardware details					
and software	Q series	High	performance model			
	Q series	Unive	ersal model			
	L series	LCPU	J			
	*Not applicable fo	r QCPL	J (A mode)			
	Compatible softwa	are: GX	Works 2 Version 1.31F	l or later		
Programming	Ladder					
language						
Number of steps	For high performance model CPU: 222*					
(maximum value)	*The value is the number of steps in the label program, and is therefore stated as a					
	reference value.	reference value. For details, refer to the GX Works2 Version1 Operation Manual (Simple				
	Project).					



Item	Description					
Function description	By turning ON FB_EN (Execution command), the following processing is performed.					
	1) Shifts [Shift target data] by [No. of words to left shift] to the left.					
	2) Sets the word data, which is to be stored in the shift result, from the least significant word					
	of the shifted data.					
	3) When the input value is invalid, the FB_ERROR output turns ON, processing is					
	interrupted, and the error code is stored in ERROR_ID (Error code).					
	Refer to the error code explanation section for details.					
Compiling method	Macro type					
Restrictions and	1) The FB does not include error recovery processing. Program the error recovery					
precautions	processing separately in accordance with the required system operation.					
	2) The FB cannot be used in an interrupt program.					
	3) If a message stating "Insufficient word device points in device/label (VAR)					
	automatic-assign setting" appears when a program is compiled, adjust the automatically					
	assigned device setting.					
FB operation type	Pulsed execution (1 scan execution type)					
Application example	Refer to Appendix - Application examples.					
Timing chart	Operation of I/O signals					
	[When operation completes without error] [When an error occurs]					
	FB_EN/Execution command)					
	FB_ENC(Execution status)					
	FB_ENO(Execution status)					
	(Shift result) refreshing Refreshing o Shift Data (Shift result) No refreshing (Shift result)					
	(Completed without error) (Completed without error) (Completed without error)					
	FB_ERRUNError flag)					
	ERROR_ID(Error code) 0 ERROR_ID(Error code) 0 10~12(Decimal) 0					
Relevant manual	MELSEC-Q/L Programming Manual (Common Instructions)					

■Error code list

Error code	Description				
10	i_Num_SFDataWord (Word data length of shift target data) is not valid. Set the data within				
	the range of 1 to 512, and turn OFF FB_EN and then ON again.				
11	i_Num_ShiftWord (No. of words to left shift) is not valid. Set the data within the range of 1 to				
	512, and turn OFF FB_EN and then ON again.				



Error code	Description
12	The number of words to shift is too large. Make sure i_Num_SFDataWord is equal to or
	greater than i_Num_ShiftWord. Set correct data, and turn OFF FB_EN and then ON again.

Labels

■Input labels

Name	Label name	Data	Setting range	Description	
		type			
Execution	FB_EN	В	ON, OFF	ON: The FB is activated.	
command				OFF: The FB is not activated.	
Start device No. of	i_Set_Data	W	Valid device range	Set the device that stores data	
data stored in shift				to be stored in the shift result.	
result				Use devices for	
				i_Num_ShiftBit.	
Start device No. of	i_Shift_Data	W	Valid device range	Set the start word device of	
shift target data				the data to shift. Use devices	
				for i_Num_SFDataWord.	
Word data length	i_Num_SFData	W	1~512	Set the number of word data	
of shift target data	Word(n1)		n2≤n1≤512	of the data to shift.	
No. of words to left	i_Num_ShiftWor	W	1~512	Set the number of words to	
shift	d		n2≤n1≤512	shift to the left.	
	(n2)				

Name	Label name	Data	Initial	Description
		type	value	
Execution status	FB_ENO	В	OFF	ON: Execution command is ON.
				OFF: Execution command is OFF.
Completed without	FB_OK	В	OFF	When ON, it indicates that the processing is
error				completed.
Error flag	FB_ERROR	В	OFF	When ON, it indicates that an error has occurred.
Error code	ERROR_ID	W	0	FB error code output.
Start device No. of	o_Shift_Data	В	0	Return the shift result data.
shift result data				Use devices for i_Num_SFDataWord.

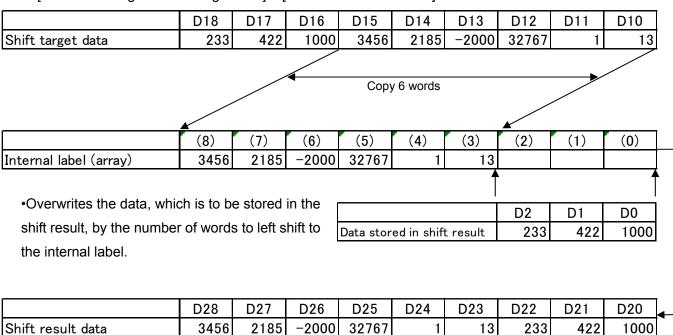


- (1) Shifts the [Shift target data] by [No. of words to left shift] to the left.
- (2) Sets the data, which is to be stored in the shift result, from the least significant word of the shift result (I).
 - •[Word data length of shift target data] is 9 (I) and [No. of words to left shift] is 3.
 - •Sets the data, which is to be stored in the shift result, to 3 words from D0.

	D2	D1	D0
Data stored in shift result	233	422	1000

- •Stores the target data to shift in 9 words in D10 onwards.
- •Copies the 6 words, which are calculated as follows, to the internal label.

 [Word data length of shift target data] [No. of words to left shift] = 6 words





Version Upgrade History

Version	Date	Description
1.00A	2011/03/22	First edition

Note

This chapter includes information related to the M+CPU-Data_LShiftWord function block.

It does not include information on restrictions of use such as combination with modules or programmable controller CPUs.



9. M+CPU-Data_SortArrayData (Data sort)

FB Name

M+CPU-Data_SortArrayData

Item	Description					
Function overview	Sorts the data table, which consists of lines and columns, by				lines in ascending or	
	descending order based on a specified column.					
	The data table stores consecutive values (16-bit data) in columns.					
Symbol			M+CPU-Data	_SortArrayData		
	Execution cor	nmand —	B : FB_EN	FB_ENO : B	Execution status	
	Start device data	No. of a table	-W:i_Table_Data	FB_OK : B	Completed without error	
	No. o	f lines ——	-W:i_Num_Lines	FB_ERROR : B	—— Error flag	
	No. of co	olumns ——	-W:i_Num_Columns	ERROR_ID : W-	——Error code	
	Sort (ascending/desce	order nding)	B:i_Sort_Type	o_Result_Data:W	Start device No. of	
	Sort reference colun	nn No.	W:i_Sort_Column_No		0010100000	
Applicable hardware	Hardware details					
and software	Q series	High pe	erformance model			
	Q series	Univers	sal model			
	L series	LCPU				
	*Not applicable fo	r QCPU	(A mode)		•	
	Compatible softwa	are: GX \	Works 2 Version 1.3	1H or later		
Programming	Ladder					
language						
Number of steps	For high performance model CPU: 378*					
(maximum value)	*The value is the number of steps in the label program, and is therefore stated as a					
	reference value.	For detai	ils, refer to the GX \	Works2 Version1 Ope	eration Manual (Simple	
	Project).					



Item	Description					
Function description	By turning ON FB_EN (Execution command), the sort is performed as follows.					
	1) Checks if it is necessary to sort the data in the sort reference column in					
	ascending/descending order.					
	2) If the data sort is performed, the data in the same lines are sorted as well.					
	3) If the data in the sort reference column are the same, the sort is performed based on the					
	line numbers.					
	4) If the values in the reference column are the same, the sort result is not changed.					
	5) When the input value is invalid, the FB_ERROR output turns ON, processing is					
	interrupted, and the error code is stored in ERROR_ID (Error code).					
	Refer to the error code explanation section for details.					
Compiling method	Macro type					
Restrictions and	1) The FB does not include error recovery processing. Program the error recovery					
precautions	processing separately in accordance with the required system operation.					
	2) The FB cannot be used in an interrupt program.					
	3) If a message stating "Insufficient word device points in device/label (VAR)					
	automatic-assign setting" appears when a program is compiled, adjust the automatically					
	assigned device setting.					
	4) This FB uses index registers Z9, Z8, Z7, Z6, Z5 and Z4. Please do not use these index					
	registers in an interrupt program.					
FB operation type	Pulsed execution (1 scan execution type)					
Application example	Refer to Appendix - Application examples.					
Timing chart	Operation of I/O signals					
	[When operation completes without error] [When an error occurs]					
	FB_EN(Execution command)					
	FB_ENC(Execution status)					
	o_ResultData No Personal No ResultData					
	FB_OK FB OK					
	(Completed without error) (Completed without error)					
	FB_ERROR_ID(Error code) FB_ERROR_ID(Erro					
	Elitor galetino codo Tonica de la calegoria de					
Relevant manual	MELSEC-Q/L Programming Manual (Common Instructions)					



■ Error code list

Error code	Description		
10	i_Num_Lines (No. of lines) is not valid. Set the data within the range of 1 to 32, and turn		
	OFF FB_EN and then ON again.		
11	i_Num_Columns (No. of columns) is not valid. Set the data within the range of 1 to 6, ar		
	turn OFF FB_EN and then ON again.		
12	i_Sort_Column_No (Sort reference column No.) is not valid. Set the data within the range		
	(1 to i_Num_Columns), and turn OFF FB_EN and then ON again.		

Labels

■Input labels

Name	Label name	Data	Setting range	Description	
		type			
Execution	FB_EN	В	ON, OFF	ON: The FB is activated.	
command				OFF: The FB is not activated.	
Start device No. of	i_Table_Data	W	Valid device range	Set the start device number of	
data table				the data to be sorted. Use	
				devices for (No. of lines \times No.	
				of columns).	
No. of lines	i_Num_Lines	W	1~32	Set the number of lines to	
				construct the data table.	
No. of columns	i_Num_Columns	W	1~6	Set the number of columns to	
				construct the data table.	
Sort order	i_Sort_Type B		ON, OFF	ON: Descending order	
				OFF: Ascending order	
Sort reference	i_Sort_Column_	W	1~i_Num_Columns	Set the reference column	
column No.	No			number for sort.	

Name	Label name	Data	Initial	Description
		type	value	
Execution status	FB_ENO	В	OFF	ON: Execution command is ON.
				OFF: Execution command is OFF.



Name	Label name	Data	Initial	Description	
		type	value		
Completed without	FB_OK	В	OFF	When ON, it indicates that the processing is	
error				completed.	
Error flag	FB_ERROR	В	OFF	When ON, it indicates that an error has occurred.	
Error code	ERROR_ID	W	0	FB error code output.	
Start device No. of	o_Result_Data	W	0	Return the sort result data. The same structure as	
sort result				the data table (No. of lines x No. of columns).	

1) The data table structure is as follows.

Data table structure

	Column 1	Column 2	Column 3	Column 4
Line 1	S	S+5	S+10	S+15
Line 2	S+1	S+6	S+11	S+16
Line 3	S+2	S+7	S+12	S+17
Line 4	S+3	S+8	S+13	S+18
Line 5	S+4	S+9	S+14	S+19

i_Num_Columns=4

i_Num_Lins=5

2) Sorts the data in ascending or descending order based on the data in the reference column.

If the data sort is performed, the data in the same lines are sorted at the same time.

Data table structure

	Column 1	Column 2	Column 3	Column 4
Line 1	1	150	45	20
Line 2	2	180	50	40
Line 3	3	160	70	30
Line 4	4	100	20	8
Line 5	5	150	50	45

Sort reference column

Sort result (Ascending order)

	Column 1	Column 2	Column 3	Column 4
Line 1	4	100	20	8
Line 2	1	150	45	20
Line 3	5	150	50	45
Line 4	3	160	70	30
Line 5	2	180	50	40



3) The following table shows the devices for the above data table.

Sort reference column

Sort reference column

When i_Table_Data (Start device No. of data table) is D100

D100	1
D101	2
D102	3
D103	4
D104	5
D105	150
D106	180
D107	160
D108	100
D109	150
D110	45
D111	50
D112	70
D113	20
D114	50
D115	20
D116	40
D117	30
D118	8
D119	45

Data in the lines corresponding to the reference column before sort

Value	1	150	45	20
Value	2	180	50	40
Value	3	160	70	30
Value	4	100	20	8
Value	5	150	50	45



D100	4
D101	1
D102	5
D103	3
D104	2
D105	100
D106	150
D107	150
D108	160
D109	180
D110	20
D111	45
D112	50
D113	70
D114	50
D115	8
D116	20
D117	45
D118	30
D119	40

	Value	4	100	20	8
	Value	1	150	45	20
1	Value	5	150	50	45
	Value	3	160	70	30
	Value	2	180	50	40

Data in the lines corresponding to the reference column after sort



Version Upgrade History

Version	Date	Description
1.00A	2011/03/22	First edition

Note

This chapter includes information related to the M+CPU-Data_SortArrayData function block.

It does not include information on restrictions of use such as combination with modules or programmable controller CPUs.



10. M+CPU-Data_DSortArrayData (32-bit data sort)

FB Name

M+CPU-Data_DSortArrayData

Item	Description						
Function overview	Sorts the data to	Sorts the data table, which consists of lines and columns, by lines in ascending or					
	descending order based on a specified column.						
	The data table sto	res con	secutive values (32	-bit data) in columns.			
Symbol			M+CPU-Data	_DSortArrayData			
	Execution con	nmand —	B : FB_EN	FB_ENO : B	Execution status		
	Start device data	No. of table	D : i_Table_Data	FB_OK : B	Completed without error		
	No. o	lines —	-W:i_Num_Lines	FB_ERROR : B	Error flag		
	No. of co	lumns —	W: i_Num_Columns	ERROR_ID: W	—— Error code		
	Sort (ascending/desce	order nding)	B:i_Sort_Type	o_Result_Data : D	Start device No. of sort result		
	Sort reference colum	ın No. —	W:i_Sort_Column_No				
Applicable hardware	Hardware details						
and software	Q series	High p	performance model				
	Q selles	Unive	rsal model				
	L series	LCPU					
	*Not applicable fo	r QCPU	(A mode)		_		
	Compatible softwa	are: GX	Works 2 Version 1.3	31H or later			
Programming	Ladder						
language							
Number of steps	For high performance model CPU: 441*						
(maximum value)	*The value is the number of steps in the label program, and is therefore stated as a						
	reference value.	For deta	ails, refer to the GX	Works2 Version1 Op	eration Manual (Simple		
	Project).						



Item	Description					
Function description	By turning ON FB_EN (Execution command), the sort is performed as follows.					
	1) Checks if it is necessary to sort the data in the sort reference column in					
	ascending/descending order.					
	2) If the data sort is performed, the data in the same lines are sorted as well.					
	3) If the data in the sort reference column are the same, the sort is performed based on the					
	line numbers.					
	4) When the input value is invalid, the FB_ERROR output turns ON, processing is					
	interrupted, and the error code is stored in ERROR_ID (Error code).					
	Refer to the error code explanation section for details.					
Compiling method	Macro type					
Restrictions and	The FB does not include error recovery processing. Program the error recovery					
precautions	processing separately in accordance with the required system operation.					
	2) The FB cannot be used in an interrupt program.					
	3) If a message stating "Insufficient word device points in device/label (VAR)					
	automatic-assign setting" appears when a program is compiled, adjust the automatically					
	assigned device setting.					
	4) This FB uses index registers Z9, Z8, Z7, Z6, Z5 and Z4. Please do not use these index					
ED anaration time	registers in an interrupt program.					
FB operation type	Pulsed execution (1 scan execution type)					
Application example	Refer to Appendix - Application examples.					
Timing chart	Operation of I/O signals [M/hap aparation completes without arrar] [M/hap aparation accurate accura					
	[When operation completes without error] [When an error occurs]					
	FB_EN(Execution command) FB_EN(Execution command)					
	FB_ENO(Execution status) FB_ENO(Execution status)					
	o_Result_Data (Sort result) No Refreshing					
	FB.OK (Completed without error) (Completed without error)					
	FB_ERROR(Error flag) FB_ERROR(Error flag)					
	ERROR_ID(Error code) 0 ERROR_ID(Error code) 0 10~12(Decimal)					
Relevant manual	MELSEC-Q/L Programming Manual (Common Instructions)					



■ Error code list

Error code	Description
10	i_Num_Lines (No. of lines) is not valid. Set the data within the range of 1 to 32, and turn
	OFF FB_EN and then ON again.
11	i_Num_Lines (No. of columns) is not valid. Set the data within the range of 1 to 6, and turn
	OFF FB_EN and then ON again.
12	i_Sort_Column_No (Sort reference column No.) is not valid. Set the data within the range
	(1 to i_Num_Columns), and turn OFF FB_EN and then ON again.

Labels

■Input labels

Name	Label name	Data type	Setting range	Description	
Execution	FB_EN	В	ON, OFF	ON: The FB is activated.	
command				OFF: The FB is not activated.	
Start device No. of	i_Table_Data	D	Valid device range	Set the start device number of	
data table				the data to be sorted. Use	
				devices for (No. of lines \times No.	
				of columns \times 2).	
No. of lines	i_Num_Lines	W	1~32	Set the number of lines to	
				construct the data table.	
No. of columns	i_Num_Columns	W	1~6	Set the number of columns to	
				construct the data table.	
Sort order	i_Sort_Type	В	ON, OFF	ON: Descending order	
				OFF: Ascending order	
Sort reference	i_Sort_Column_	W	1~i_Num_Columns	Set the reference column	
column number	No			number for sort.	

Name	Label name	Data	Initial	Description
		type	value	
Execution status	FB_ENO	В	OFF	ON: Execution command is ON.
				OFF: Execution command is OFF.



Name	Label name	Data	Initial	Description	
		type	value		
Completed without	FB_OK	В	OFF	When ON, it indicates that the processing is	
error				completed.	
Error flag	FB_ERROR	В	OFF	When ON, it indicates that an error has occurred.	
Error code	ERROR_ID	W	0	FB error code output.	
Start device No. of	o_Result_Data	D	0	Return the sort result data. The same structure as	
sort result				the data table (No. of lines x No. of columns).	

1) The data table structure is as follows.

Data table structure

		Column 1	Column 2	Column 3	Column 4
	Line 1	S+1,S	S+11,S+10	S+21,S+20	S+31,S+30
	Line 2	S+3,S+2	S+13,S+12	S+23,S+22	S+33,S+32
ĺ	Line 3	S+5,S+4	S+15,S+14	S+25,S+24	S+35,S+34
ĺ	Line 4	S+7,S+6	S+17,S+16	S+27,S+26	S+37,S+36
ĺ	Line 5	S+9,S+8	S+19,S+18	S+29,S+28	S+39,S+38

i_Num_Columns=4

2) Sorts the data in ascending or descending order based on the data in the reference column.

If the data sort is performed, the data in the same lines are sorted at the same time.

Data table structure

	Column 1	Column 2	Column 3	Column 4
Line 1	1	150	45	20
Line 2	2	180	50	40
Line 3	3	160	70	30
Line 4	4	100	20	8
Line 5	5	150	50	45



Sort result (Ascending order)

	Column 1	Column 2	Column 3	Column 4
Line 1	4	100	20	8
Line 2	1	150	45	20
Line 3	5	150	50	45
Line 4	3	160	70	30
Line 5	2	180	50	40



i_Num_Lins=5

3) The following table shows the devices for the above data table.

Sort reference column

When i_Table_Data (Start device No. of data table) is D100

D100	1
D102	2
D104	3
D106	4
D108	5
D110	150
D112	180
D114	160
D116	100
D118	150
D120	45
D122	50
D124	70
D126	20
D128	50
D130	20
D132	40
D134	30
D136	8
D138	45

Data in the lines corresponding to the reference column before sort

Value	1	150	45	20
Value	2	180	50	40
Value	3	160	70	30
Value	4	100	20	8
Value	5	150	50	45



D100	4
D102	1
D104	5
D106	5 3 2
D108	2
D110	100
D112	150
D114	150
D116	160
D118	180
D120	20
D122	45
D124	50
D126	70
D128	50
D130	8
D132	20
D134	45
D136	30
D138	40

Sort reference column

Data in the lines corresponding to the reference column after sort

Value	4	100	20	8
Value	1	150	45	20
Value	5	150	50	45
Value	3	160	70	30
Value	2	180	50	40



Version Upgrade History

Version	Date	Description
1.00A	2011/03/22	First edition

Note

This chapter includes information related to the M+CPU-Data_DSortArrayData function block.

It does not include information on restrictions of use such as combination with modules or programmable controller CPUs.



11. M+CPU-Data_SortArrayData2 (Data sort 2)

FB Name

M+CPU-Data_SortArrayData2

Item	Description				
Function overview	Sorts the data to	Sorts the data table, which consists of lines and columns, by lines in ascending or			
	descending order based on a specified column.				
	The data table sto	res cons	secutive values (16-	bit data) in lines.	
Symbol			M+CPU-Data_	SortArrayData2	
	Execution con	nmand ——	B : FB_EN	FB_ENO : B	Execution status
	Start device data	No. of table	-W:i_Table_Data	FB_OK : B	Completed without error
	No. o	f lines —	W: i_Num_Lines	FB_ERROR : B	—— Error flag
	No. of co	lumns —	W : i_Num_Columns	ERROR_ID: W	——Error code
	Sort (ascending/desce	order nding)	B:i_Sort_Type	o_Result_Data : W	Start device No. of sort result
	Sort reference colum	n No.	W : i_Sort_Column_No		
Applicable hardware	Hardware details				
and software	Q series	High p	erformance model		
	Q series	Univer	rsal model		
	L series	LCPU			
	*Not applicable fo	r QCPU	(A mode)		-
	Compatible softwa	are: GX	Works 2 Version 1.3	1H or later	
Programming	Ladder				
language					
Number of steps	For high performance model CPU: 399*				
(maximum value)	*The value is the	number	of steps in the label	program, and is ther	efore stated as a
	reference value.	For deta	ails, refer to the GX V	Works2 Version1 Ope	eration Manual (Simple
	Project).				



Item	Description						
Function description	By turning ON FB_EN (Execution command), the sort is performed as follows.						
·	Checks if it is necessary to sort the data in the sort reference column in						
	ascending/descending order.						
	2) If the data sort is performed, the data in the same lines are sorted as well.						
	3) If the data in the sort reference column are the same, the sort is performed based on the						
	line numbers.						
	4) When the input value is invalid, the FB_ERROR output turns ON, processing is						
	interrupted, and the error code is stored in ERROR_ID (Error code).						
	Refer to the error code explanation section for details.						
Compiling method	Macro type						
Restrictions and	1) The FB does not include error recovery processing. Program the error recovery						
precautions	processing separately in accordance with the required system operation.						
	2) The FB cannot be used in an interrupt program.						
	3) If a message stating "Insufficient word device points in device/label (VAR)						
	automatic-assign setting" appears when a program is compiled, adjust the automatically						
	assigned device setting.						
	4) This FB uses index registers Z9, Z8, Z7, Z6, Z5 and Z4. Please do not use these index						
	registers in an interrupt program.						
FB operation type	Pulsed execution (1 scan execution type)						
Application example	Refer to Appendix - Application examples.						
Timing chart	Operation of I/O signals						
	[When operation completes without error] [When an error occurs]						
	FB_EN(Execution command) FB_EN(Execution command)						
	FB_ENC(Execution status) FB_ENC(Execution status)						
	o Result Data (Sort result) Refreshing Refreshing Refreshing No Refreshing Refreshing						
	FB_OK FB_OK						
	FB_ERROR(Error flag) FB_ERROR(Error flag)						
	ERROR JD(Error code) 0 ERROR JD(Error code) 0 10~12(Decimal) 0						
Relevant manual	MELSEC-Q/L Programming Manual (Common Instructions)						



■ Error code list

Error code	Description	
10	i_Num_Lines (No. of lines) is not valid. Set the data within the range of 1 to 32, and turn	
	OFF FB_EN and then ON again.	
11	i_Num_Columns (No. of columns) is not valid. Set the data within the range of 1 to 6, a	
	turn OFF FB_EN and then ON again.	
12	i_Sort_Column_No (Sort reference column No.) is not valid. Set the data within the rai	
	(1 to i_Num_Columns), and turn OFF FB_EN and then ON again.	

Labels

■Input labels

Name	Label name	Data	Setting range	Description
		type		
Execution	FB_EN	В	ON, OFF	ON: The FB is activated.
command				OFF: The FB is not activated.
Start device No. of	i_Table_Data	W	Valid device range	Set the start device number of
data table				the data to be sorted. Use
				devices for (No. of lines \times No.
				of columns).
No. of lines	i_Num_Lines	W	1~32	Set the number of lines to
				construct the data table.
No. of columns	i_Num_Columns	ns W 1~6		Set the number of columns to
				construct the data table.
Sort order	i_Sort_Type	В	ON, OFF	ON: Descending order
				OFF: Ascending order
Sort reference	i_Sort_Column_	W	1~i_Num_Columns	Set the reference column
column number	No			number for sort.

Name	Label name	Data	Initial	Description
		type	value	
Execution status	FB_ENO	В	OFF	ON: Execution command is ON.
				OFF: Execution command is OFF.



Name	Label name	Data	Initial	Description
		type	value	
Completed without	FB_OK	В	OFF	When ON, it indicates that the processing is
error				completed.
Error flag	FB_ERROR	В	OFF	When ON, it indicates that an error has occurred.
Error code	ERROR_ID	W	0	FB error code output.
Start device No. of	o_Result_Data	W	0	Return the sort result data. The same structure as
sort result				the data table (No. of lines x No. of columns).

1) The data table structure is as follows.

Data table structure

	Column 1	Column 2	Column 3	Column 4
Line 1	S	S+1	S+2	S+3
Line 2	S+4	S+5	S+6	S+7
Line 3	S+8	S+9	S+10	S+11
Line 4	S+12	S+13	S+14	S+15
Line 5	S+16	S+17	S+18	S+19

i_Num_Columns=4

2) Sorts the data in ascending or descending order based on the data in the sort reference column.

If the data sort is performed, the data in the same lines are sorted at the same time.

Data table structure

	Column 1	Column 2	Column 3	Column 4
Line 1	1	150	45	20
Line 2	2	180	50	40
Line 3	3	160	70	30
Line 4	4	100	20	8
Line 5	5	150	50	45

Sort reference column

Sort result (ascending order)

	Column 1	Column 2	Column 3	Column 4
Line 1	4	100	20	8
Line 2	1	150	45	20
Line 3	5	150	50	45
Line 4	3	160	70	30
Line 5	2	180	50	40

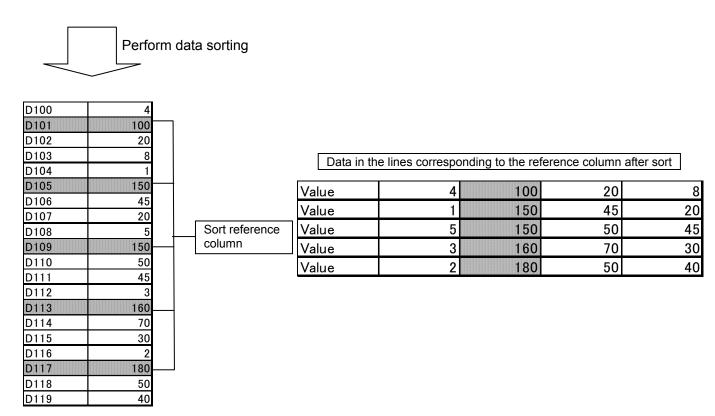


i_Num_Lins=5

3) The following table shows the devices for the above data table.

When i_Table_Data (Start device No. of data table) is D100

D100 D101 D102 D103 D104 D105 D106 D107 D108 D109 D110 D111	1 150 45 20 2 180 50 40 3 160 70 30	column	Data in the Value Value Value Value	e lines corresponding 1 2 3 4	150 180 160 100	e column before 45 50 70 20	20 40 30 8
D108 D109	3 160	column	Value		180	50	40
	30 4						
D113 D114 D115 D116	100 20 8 5	_	valuc	1 3	130	301	43
D117 D118 D119	150 50 45						





Version Upgrade History

Version	Date	Description
1.00A	2011/03/22	First edition

Note

This chapter includes information related to the M+CPU-Data_SortArrayData2 function block.

It does not include information on restrictions of use such as combination with modules or programmable controller CPUs.



12. M+CPU-Data_DSortArrayData2 (32-bit data sort 2)

FB Name

M+CPU-Data_DSortArrayData2

Item	Description	Description				
Function overview	Sorts the data table, which consists of lines and columns, by lines in ascending o					
	descending order	based or	n a specified colur	nn.		
	The data table sto	res cons	ecutive values (32	2-bit data) in lines.		
Symbol			M+CPU-Data	_DSortArrayData2		
	Execution con	nmand ——	B : FB_EN	FB_ENO : E	Execution status	
	Start device data	No. of table	D:i_Table_Data	FB_OK : E	Completed without error	
	No. of	lines ——	W:i_Num_Lines	FB_ERROR : E	B—— Error flag	
	No. of co	lumns ——	W:i_Num_Columns	ERROR_ID: V	VError code	
	Sort (ascending/desce	order nding)	B:i_Sort_Type	o_Result_Data : [Start device No. of	
	Sort reference colum	ın No.	W:i_Sort_Column_No			
Applicable hardware	Hardware details					
and software	Q series	High pe	erformance model			
	Q series	Univers	sal model			
	L series	LCPU				
	*Not applicable fo	r QCPU ((A mode)			
	Compatible softwa	are: GX V	Works 2 Version 1	.31H or later		
Programming	Ladder					
language						
Number of steps	For high performance model CPU: 447*					
(maximum value)	*The value is the number of steps in the label program, and is therefore stated as a					
	reference value.	For detai	ils, refer to the GX	Works2 Version1 Op	peration Manual (Simple	
	Project).					



Item	Description				
Function description	By turning ON FB_EN (Execution command), the sort is performed as follows.				
	1) Checks if it is necessary to sort the data in the sort reference column in				
	ascending/descending order.				
	2) If the data sort is performed, the data in the same lines are sorted as well.				
	3) If the data in the sort reference column are the same, the sort is performed based on the				
	line numbers				
	4) When the input value is invalid, the FB_ERROR output turns ON, processing is				
	interrupted, and the error code is stored in ERROR_ID (Error code).				
	Refer to the error code explanation section for details.				
Compiling method	Macro type				
Restrictions and	1) The FB does not include error recovery processing. Program the error recovery				
precautions	processing separately in accordance with the required system operation.				
	2) The FB cannot be used in an interrupt program.				
	3) If a message stating "Insufficient word device points in device/label (VAR)				
	automatic-assign setting" appears when a program is compiled, adjust the automatically				
	assigned device setting.				
	4) This FB uses index registers Z9, Z8, Z7, Z6, Z5 and Z4. Please do not use these index				
	registers in an interrupt program.				
FB operation type	Pulsed execution (1 scan execution type)				
Application example	Refer to Appendix - Application examples.				
Timing chart	Operation of I/O signals NAME of the state of t				
	[When operation completes without error] [When an error occurs]				
	FB_EN(Execution command) FB_EN(Execution command)				
	FB_ENC(Execution status) FB_ENC(Execution status)				
	o.Result.Data (Sort result) Refreshing No refreshing				
	FB_OK (Completed without error) (Completed without error)				
	FB_ERROR(Error flag) FB_ERROR(Error flag)				
	ERROR JD(Error code) 0 ERROR JD(Error code) 0 10~12(Decimal)				
Relevant manual	MELSEC-Q/L Programming Manual (Common Instructions)				



■ Error code list

Error code	Description	
10	i_Num_Lines (No. of lines) is not valid. Set the data within the range of 1 to 32, and turn	
	OFF FB_EN and then ON again.	
11	i_Num_Columns (No. of columns) is not valid. Set the data within the range of 1 to 6, and	
	turn OFF FB_EN and then ON again.	
12	i_Sort_Column_No (Sort reference column No.) is not valid. Set the data within the range (1	
	to i_Num_Columns), and turn OFF FB_EN and then ON again.	

Labels

■Input labels

Name	Label name	Data type	Setting range	Description	
Execution	FB_EN	В	ON, OFF	ON: The FB is activated.	
command				OFF: The FB is not activated.	
Start device No. of	i_Table_Data	D	Valid device range	Set the start device number of	
data table				the data to be sorted. Use	
				devices for (No. of lines \times No.	
				of columns \times 2).	
No. of lines	i_Num_Lines	W	1~32	Set the number of lines to	
				construct the data table.	
No. of columns	i_Num_Columns	W	1~6	Set the number of columns	
				construct the data table.	
Sort order	i_Sort_Type	В	ON, OFF	ON: Descending order	
				OFF: Ascending order	
Sort reference	i_Sort_Column_	W	1~i_Num_Columns	Set the reference column	
column number	No			number for sort.	

Name	Label name	Data	Initial	Description
		type	value	
Execution status	FB_ENO	В	OFF	ON: Execution command is ON.
				OFF: Execution command is OFF.



Name	Label name	Data	Initial	Description
		type	value	
Completed without	FB_OK	В	OFF	When ON, it indicates that the processing is
error				completed.
Error flag	FB_ERROR	В	OFF	When ON, it indicates that an error has occurred.
Error code	ERROR_ID	W	0	FB error code output.
Start device No. of	o_Result_Data	D	0	Return the sort result data. The same structure as
sort result				the data table (No. of lines x No. of columns).

1) The data table structure is as follows.

Data table structure

		Column 1	Column 2	Column 3	Column 4
ĺ	Line 1	S+1,S	S+3,S+2	S+5,S+4	S+7,S+6
	Line 2	S+9,S+8	S+13,S+12	S+13,S+12	S+15,S+14
	Line 3	S+17,S+16	S+19,S+18	S+21,S+20	S+23,S+22
Ī	Line 4	S+25,S+24	S+27,S+26	S+29,S+28	S+31,S+30
	Line 5	S+33,S+32	S+35,S+34	S+37,S+36	S+39,S+38

i_Num_Columns=4

2) Sorts the data in ascending or descending order based on the data in the sort reference column.

If the data sort is performed, the data in the same lines are sorted at the same time.

Data table structure

	Column 1	Column 2	Column 3	Column 4
Line 1	1	150	45	20
Line 2	2	180	50	40
Line 3	3	160	70	30
Line 4	4	100	20	8
Line 5	5	150	50	45

Sort reference column

Sort result (Ascending order)

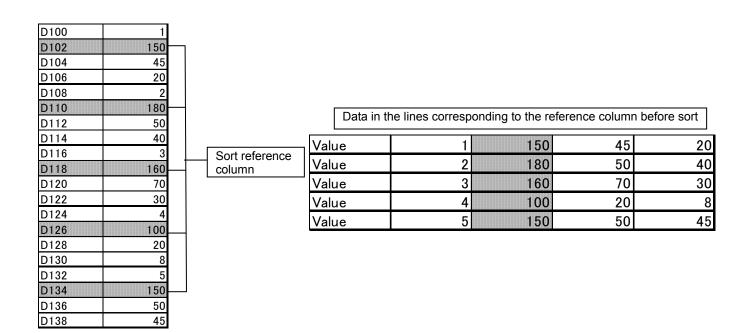
	Column 1	Column 2	Column 3	Column 4
Line 1	4	100	20	8
Line 2	1	150	45	20
Line 3	5	150	50	45
Line 4	3	160	70	30
Line 5	2	180	50	40

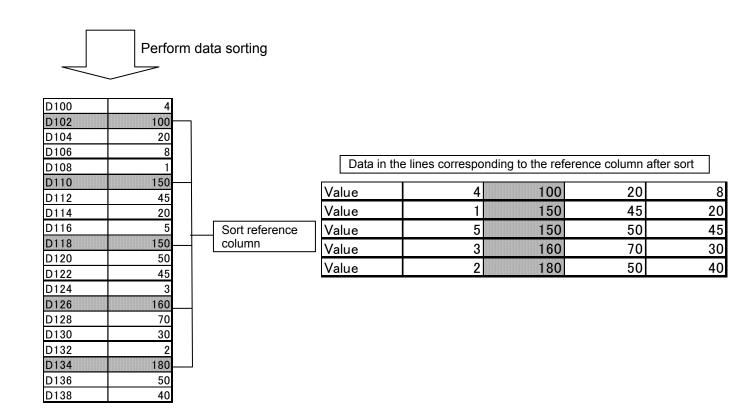


i_Num_Lins=5

3) The following table shows the devices for the above data table.

When i_Table_Data (Start device No. of data table) is D100







Version Upgrade History

Version	Date	Description
1.00A	2011/03/22	First edition

Note

This chapter includes information related to the M+CPU-Data_DSortArrayData2 function block.

It does not include information on restrictions of use such as combination with modules or programmable controller CPUs.



13. M+CPU-Data_CheckBitStatus (16-bit ON/OFF check)

FB Name

M+CPU-Data_CheckBitStatus

Item	Description	Description				
Function overview	Checks the ON/OFF status of the specified bit position of 16-bit data.					
Symbol		M+CPU-Data_0	CheckBitStatus			
	Execution command	B : FB_EN	FB_ENO : B Execution status			
	Check target data	a — W : i_Check_Data	FB_OK : B —— Completed without erro	or		
	Specified bit position	W : i_Check_Bit_No	FB_ERROR : B—— Error flag			
			ERROR_ID : W—— Error code			
			o_Result_Data : B—— Check result			
Applicable hardware	Hardware details					
and software	Q series	High performance mode	el			
	Q series	Universal model				
	L series	LCPU				
	*Not applicable for	QCPU (A mode)				
	Compatible softwar	re: GX Works 2 Version	1.31H or later			
Programming	Ladder					
language						
Number of steps	For high performan	nce model CPU: 110*				
(maximum value)	*The value is the n	umber of steps in the lab	pel program, and is therefore stated as a			
	reference value. F	or details, refer to the G	X Works2 Version1 Operation Manual (Simple	е		
	Project).					
Function description	1) By turning ON F	B_EN (Execution comm	and), the status of the specified bit position of	f		
	the target data is output to the check result.					
	2) When the input value is invalid, the FB_ERROR output turns ON, processing is					
	interrupted, and the error code is stored in ERROR_ID (Error code).					
	Refer to the error code explanation section for details.					
Compiling method	Macro type					



Item	Description						
Restrictions and	1) The FB does not include error recovery processing. Program the error recovery						
precautions	processing separately in accordance with the required system operation.						
	2) The FB cannot be used in an interrupt program.						
FB operation type	Pulsed execution (1 scan execution type)						
Application example	Refer to Appendix - Application examples.						
Timing chart	Operation of I/O signals						
	[When operation completes without error] [When an error occurs]						
	FB_EN(Execution command) FB_EN(Execution command)						
	FB_ENO(Execution status) FB_ENO(Execution status)						
	o_Result_Data (Check result) ON/OFF status o_Result_Data (Check result)						
	FB_OK (Completed without error) (Completed without error)						
	FB_ERROR(Error flag) FB_ERROR(Error flag)						
	ERROR_ID(Error code) 0 ERROR_ID(Error code) 0 10(Decimal) 0						
Relevant manual	MELSEC-Q/L Programming Manual (Common Instructions)						

■Error code list

Error code	Description
10	i_Check_Bit_No (Specified bit position) is not valid. Set the data within the range of 0 to 15,
	and turn OFF FB_EN and then ON again.

Labels

■Input labels

Name	Label name	Data	Setting range	Description
		type		
Execution	FB_EN	В	ON, OFF	ON: The FB is activated.
command				OFF: The FB is not activated.
Check target data	i_Check_Data	W	-32768~32767	Set the device number of the
				data to be checked.
Specified bit	i_Check_Bit_No	W	0~15	Set the bit position.
position				



Name	Label name	Data	Initial	Description
		type	value	
Execution status	FB_ENO	В	OFF	ON: Execution command is ON.
				OFF: Execution command is OFF.
Completed without	FB_OK	В	OFF	When ON, it indicates that the processing is
error				completed.
Error flag	FB_ERROR	В	OFF	When ON, it indicates that an error has occurred.
Error code	ERROR_ID	W	0	FB error code output.
Check result	o_Result_Data	В	0	Return the status of the specified bit position.

Same as "TEST instruction".

Version Upgrade History

Version	Date	Description
1.00A	2011/03/22	First edition

Note

This chapter includes information related to the M+CPU-Data_CheckBitStatus function block.

It does not include information on restrictions of use such as combination with modules or programmable controller CPUs.



14. M+CPU-Data_DCheckBitStatus (32-bit ON/OFF check)

FB Name

M+CPU-Data_DCheckBitStatus

Item	Description				
Function overview	Checks the ON/OFF status of the specified bit position of 32-bit data.				
Symbol		M+CPU-Data_D	M+CPU-Data_DCheckBitStatus		
	Execution command	B : FB_EN	FB_ENO : B	Execution status	
	Check target data	D : i_Check_Data	FB_OK : B	Completed without error	
	Specified bit position	W : i_Check_Bit_No	FB_ERROR : B	– Error flag	
			ERROR_ID : W	- Error code	
			o_Result_Data : B	— Check result	
Applicable hardware	Hardware details				
and software	O sorios	ligh performance mode	I		
	Q series	Iniversal model			
	L series L	CPU			
	*Not applicable for C	CPU (A mode)			
	Compatible software	: GX Works 2 Version 1	1.31H or later		
Programming	Ladder				
language					
Number of steps	For high performance model CPU: 110*				
(maximum value)	*The value is the number of steps in the label program, and is therefore stated as a				
	reference value. For details, refer to the GX Works2 Version1 Operation Manual (Simple				
	Project).				
Function description	1) By turning ON FB_EN (Execution command), the status of the specified bit position of				
	the target data is output to the check result.				
	·	llue is invalid, the FB_E	·		
	interrupted, and the error code is stored in ERROR_ID (Error code).				
	Refer to the error code explanation section for details.				
Compiling method	Macro type				



Item	Description					
Restrictions and	1) The FB does not include error recovery processing. Program the error recovery					
precautions	processing separately in accordance with the required system operation.					
	2) The FB cannot be used in an interrupt program.					
FB operation type	Pulsed execution (1 scan execution type)					
Application example	Refer to Appendix - Application examples.					
Timing chart	Operation of I/O signals					
	[When operation completes without error] [When an error occurs]					
	FB_EN(Execution command) FB_EN(Execution command)					
	FB_ENO(Execution status) FB_ENO(Execution status)					
	o_Result_Data (Check result) ON/OFF status o_Result_Data (Check result)					
	FB_OK (Completed without error) (Completed without error)					
	FB_ERROR(Error flag) FB_ERROR(Error flag)					
	ERROR_ID(Error code) 0 ERROR_ID(Error code) 0 10(Decimal) 0					
Relevant manual	MELSEC-Q/L Programming Manual (Common Instructions)					

■Error code list

Error code	Description
10	i_Check_Bit_No (Specified bit position) is not valid. Set the data within the range of 0 to 31,
	and turn OFF FB_EN and then ON again.

Labels

■Input labels

Name	Label name	Data	Setting range	Description
		type		
Execution	FB_EN	В	ON, OFF	ON: The FB is activated.
command				OFF: The FB is not activated.
Check target data	i_Check_Data	D	-2147483648~2147483647	Set the device number of the
				data to be checked.
Specified bit	i_Check_Bit_No	W	0~31	Set the bit position.
position				



Name	Label name	Data	Initial	Description
		type	value	
Execution status	FB_ENO	В	OFF	ON: Execution command is ON.
				OFF: Execution command is OFF.
Completed without	FB_OK	В	OFF	When ON, it indicates that the processing is
error				completed.
Error flag	FB_ERROR	В	OFF	When ON, it indicates that an error has occurred.
Error code	ERROR_ID	W	0	FB error code output.
Check result	o_Result_Data	В	0	Return the status of the specified bit position.

Same as "DTEST instruction".

Version Upgrade History

Version	Date	Description
1.00A	2011/03/22	First edition

Note

This chapter includes information related to the M+CPU-Data_DCheckBitStatus function block.

It does not include information on restrictions of use such as combination with modules or programmable controller CPUs.



15. M+CPU-Data_SeachSameMaxMinData (Data search)

FB Name

M+CPU-Data_SeachSameMaxMinData

Function Overview

Item	Description				
Function overview	Searches for the identical data and maximum and minimum values in consecutive data				
	area (16-bit data).				
Symbol		M+CPU-Data_Se	achSameMaxMinData		
	Execution command	B : FB_EN	FB_ENO : B	Execution status	
	Start device No. of input data	-W:i_Input_Data	FB_OK : B	Completed without error	
	Search target data —	W : i_Search_Data	FB_ERROR : B	— Error flag	
	No. of searches—	W : i_Num_Search	ERROR_ID : W	— Error code	
			o_Num_Same_Data:W	No. of identical data	
			o_Ps_First_Same:W	First location of identical data (0~)	
			o_Ps_Last_Same:W	Last location of identical data (0~)	
			o_Ps_Last_Min:W	Last location of minimum value (0~)	
			o_Ps_Last_Max:W	— Last location of maximum value (0∼)	
Applicable hardware	Hardware details				
and software	Q series	High performance	model		
	Q series	Jniversal model			
	L series I	_CPU			
	*Not applicable for 0	QCPU (A mode)			
	Compatible software	e: GX Works 2 Vers	sion 1.31H or later		
Programming	Ladder				
language					
Number of steps	For high performance model CPU: 232*				
(maximum value)	*The value is the number of steps in the label program, and is therefore stated as a				
	reference value. Fo	reference value. For details, refer to the GX Works2 Version1 Operation Manual (Simple			
	Project).				



Item	Description			
Function description	1) By turning ON FB_EN (Execution command), the following items are searched from the			
	input data:			
	-No. of the data identical to the target data			
	-The location that was found first			
	-The location that was found last			
	-The location of the minimum value that was found last			
	-The location of the maximum value that was found last			
	Then, the results are output.			
	2) When the input value is invalid, the FB_ERROR output turns ON, processing is			
	interrupted, and the error code is stored in ERROR_ID (Error code).			
	Refer to the error code explanation section for details.			
Compiling method	Macro type			
Restrictions and	1) The FB does not include error recovery processing. Program the error recovery			
precautions	processing separately in accordance with the required system operation.			
	2) The FB cannot be used in an interrupt program.			
	3) If a message stating "Insufficient word device points in device/label (VAR)			
	automatic-assign setting" appears when a program is compiled, adjust the automatically			
	assigned device setting.			
FB operation type	Pulsed execution (1 scan execution type)			
Application example	Refer to Appendix - Application examples.			
Timing chart	Operation of I/O signals			
	[When operation completes without error] [When an error occurs]			
	FB_EN(Execution command) FB_EN(Execution command)			
	FB_ENO(Execution status) FB_ENO(Execution status)			
	FB_OK (Completed without error) (Completed without error)			
	FB_ERROR(Error flag) FB_ERROR(Error flag)			
	ERROR_ID(Error code) 0 ERROR_ID(Error code) 0 10(Decimal) 0			
Relevant manual	MELSEC-Q/L Programming Manual (Common Instructions)			



Error codes

■ Error code list

Error code	Description
10	i_Num_Search (No. of searches) is not valid. Set the data within the range of 1 to 256, and
	turn OFF FB_EN and then ON again.

Labels

■Input labels

Name	Label name	Data type	Setting range	Description
Execution	FB_EN	В	ON, OFF	ON: The FB is activated.
command				OFF: The FB is not activated.
Start device No. of	i_Input_Data	W	Valid device range	Set the start device number of
input data				the data for which to perform a
				search for the identical data,
				minimum and maximum
				values. Use devices for
				i_Num_Search.
Search target data	i_Search_Data	W	-32768~32767	Set the data to search for the
				identical data in the input data.
No. of searches	i_Num_Search	W	1~256	Set the number of data points
				of the input data for which to
				perform a search.

■Output labels

Name	Label name	Data	Initial	Description
		type	value	
Execution status	FB_ENO	В	OFF	ON: Execution command is ON.
				OFF: Execution command is OFF.
Completed without	FB_OK	В	OFF	When ON, it indicates that the processing is
error				completed.
Error flag	FB_ERROR	В	OFF	When ON, it indicates that an error has occurred.
Error code	ERROR_ID	W	0	FB error code output.



Name	Label name	Data	Initial	Description
		type	value	
No. of identical	o_Num_Same_	W	0	Return the number of the identical data.
data	Data			
Identical data first	o_Ps_First_Sam	W	0	Return the first location of the identical data. (0~)
location	е			
Identical data last	o_Ps_Last_Sam	W	0	Return the last location of the identical data. (0~)
location	е			
Minimum value	o_Ps_Last_Min	W	0	Return the last location of the minimum value. (0~)
last location				
Maximum value	o_Ps_Last_Max	W	0	Return the last location of the maximum value. (0~)
last location				

Processing description

This FB checks the input data for the number of searches. After which, it searches for the number of the identical data, the location of the identical data, and the location of the minimum and maximum values.

The following example shows the output from the function block when the data is set to 10 words from D10.

The setting is made so that the output result is stored in D20 onwards.

The target data is 100 (D8).

Input data (i_Input_Data)

	Location	Contents (example)	Target data
D10	0	100	100
D11	1	111	(D8)
D12	2	100	
D13	3	98	
D14	4	123	
D15	5	66	
D16	6	100	
D17	7	95	
D18	8	210	
D19	9	88	

Output label	Device	Result data
No. of identical data	D20	3
Identical data first location	D21	0
Identical data last location	D22	6
Minimum value last location	D23	5
Maximum value last location	D24	8



Version Upgrade History

Version	Date	Description
1.00A	2011/03/22	First edition

Note

This chapter includes information related to the M+CPU-Data_SeachSameMaxMinData function block.

It does not include information on restrictions of use such as combination with modules or programmable controller CPUs.

Before using any Mitsubishi products, please read all the relevant manuals.



16. M+CPU-Data_DSeachSameMaxMinData (32-bit data search)

FB Name

 $M+CPU-Data_DSeachSameMaxMinData$

Function Overview

Item	Description		
Function overview	Searches for the identical data and maximum and minimum values from the consecutive		
	data area (32-bit da	ta).	
Symbol		M+CPU-Data_DSeachSameMaxMinData	
	Execution command—	B:FB_EN FB_ENO:B	Execution status
	Start device No. of input data —	D: i_Input_Data FB_OK: B	Completed without error
	Search target data —	D: i_Search_Data FB_ERROR: B	—— Error flag
	No. of searches —	W:i_Num_Search ERROR_ID:W	—— Error code
		o_Num_Same_Data:W	No. of identical data
		o_Ps_First_Same:W	First location of identical data (0~)
		o_Ps_Last_Same : W	Last location of identical data (0~)
		o_Ps_Last_Min:W	Last location of minimum value (0~)
		o_Ps_Last_Max : W	Last location of maximum value (0~)
Applicable hardware	Hardware details		
and software		High performance model	
	Q series	Universal model	
	L series	LCPU	
	*Not applicable for	QCPU (A mode)	
	Compatible softwar	e: GX Works 2 Version 1.31H or later	
Programming	Ladder		
language			
Number of steps	For high performan	ce model CPU: 247*	
(maximum value)	*The value is the n	mber of steps in the label program, and	is therefore stated as a
	reference value. F	or details, refer to the GX Works2 Version	on1 Operation Manual (Simple
	Project).		



Item	Description				
Function description	1) By turning ON FB_EN (Execution command), the following items are searched from the				
	input data:				
	-No. of data identical to the target data				
	-The location that was found first				
	-The location that was found last				
	-The location of the minimum value that was found last				
	-The location of the maximum value that was found last				
	Then, the results are output.				
	2) When the input value is invalid, the FB_ERROR output turns ON, processing is				
	interrupted, and the error code is stored in ERROR_ID (Error code).				
	Refer to the error code explanation section for details.				
Compiling method	Macro type				
Restrictions and	1) The FB does not include error recovery processing. Program the error recovery				
precautions	processing separately in accordance with the required system operation.				
	2) The FB cannot be used in an interrupt program.				
	3) If a message stating "Insufficient word device points in device/label (VAR)				
	automatic-assign setting" appears when a program is compiled, adjust the automatically				
	assigned device setting.				
	4) This FB uses index register Z9. Please do not use this index register in an interrupt				
	program.				
FB operation type	Pulsed execution (1 scan execution type)				
Application example	Refer to Appendix - Application examples.				
Timing chart	Operation of I/O signals				
	[When operation completes without error] [When an error occurs]				
	FB_EN(Execution command) FB_EN(Execution command)				
	FB_ENO(Execution status) FB_ENO(Execution status)				
	FB_OK (Completed without error) FB_OK (Completed without error)				
	FB_ERROR(Error flag) FB_ERROR(Error flag)				
	ERROR_ID(Error code) 0 ERROR_ID(Error code) 0 10(Decimal) 0				
Relevant manual	MELSEC-Q/L Programming Manual (Common Instructions)				



Error codes

■Error code list

Error code	Description
10	i_Num_Search (No. of searches) is not valid. Set the data within the range of 1 to 128, and
	turn OFF FB_EN and then ON again.

Labels

■Input labels

Name	Label name	Data type	Setting range	Description
Execution	FB_EN	В	ON, OFF	ON: The FB is activated.
command				OFF: The FB is not activated.
Start device No. of	i_Input_Data	D	Valid device range	Set the start device number of
input data				the data for which to perform a
				search for the identical data,
				minimum and maximum
				values. Use devices for
				(i_Num_Search × 2).
Search target data	i_Search_Data	D	-2147483648~2147483647	Set the data to search for the
				identical data in the input data.
No. of searches	i_Num_Search	W	1~128	Set the number of data points
				of the input data for which to
				perform a search.

■Output labels

Name	Label name	Data	Initial	Description
		type	value	
Execution status	FB_ENO	В	OFF	ON: Execution command is ON.
				OFF: Execution command is OFF.
Completed without	FB_OK	В	OFF	When ON, it indicates that the processing is
error				completed.
Error flag	FB_ERROR	В	OFF	When ON, it indicates that an error has occurred.
Error code	ERROR_ID	W	0	FB error code output.



Name	Label name	Data	Initial	Description
		type	value	
No. of identical	o_Num_Same_	W	0	Return the number of the identical data.
data	Data			
Identical data first	o_Ps_First_Sam	W	0	Return the first location of the identical data. (0~)
location	е			
Identical data last	o_Ps_Last_Sam	W	0	Return the last location of the identical data. (0~)
location	е			
Minimum value	o_Ps_Last_Min	W	0	Return the last location of the minimum value. (0~)
last location				
Maximum value	o_Ps_Last_Max	W	0	Return the last location of the maximum value. (0~)
last location				

Processing description

This FB checks the input data for the number of searches. After which, it searches for the number of the identical data, the location of the identical data, and the location of the minimum and maximum values.

The following example shows the output from the function block when the data is set to 20 words in double word from D10.

The setting is made so that the output result is stored in D30 onwards.

The target data is 100 (double word, D8 and D9).

Input data (i_Input_Data)

	Location	Contents (example)	Target data
D10	0	100	100
D12	1	111	(D8,D9)
D14	2	100	
D16	3	98	
D18	4	123	
D20	5	66	
D22	6	100	
D24	7	95	
D26	8	210	
D28	9	88	



Output label	Device	Result data
No. of identical data	D30	3
Identical data first location	D31	0
Identical data last location	D32	6
Minimum value last location	D33	5
Maximum value last location	D34	8

Version Upgrade History

Version	Date	Description
1.00A	2011/03/22	First edition

Note

This chapter includes information related to the M+CPU-Data_DSeachSameMaxMinData function block.

It does not include information on restrictions of use such as combination with modules or programmable controller CPUs.

Before using any Mitsubishi products, please read all the relevant manuals.



17. M+CPU-Data_CalculateSquareRoot (Binary data square root calculation)

FB Name

M+CPU-Data_CalculateSquareRoot

Function Overview

Item	Description			
Function overview	Calculates the square root of the input binary data (16-bit data).			
Symbol	M+CPU-Data_CalculateSquareRoo			
	Execution command	B : FB_EN	FB_ENO : B	Execution status
	Input data	W: i_Input_Data	FB_OK : B	— Completed without error
			FB_ERROR : B	— Error flag
			ERROR_ID : W	— Error code
			o_Output_Data : W—	—— Conversion data
Applicable hardware	Hardware details			
and software	Q series	High performance mod	el	
	Q Series	Universal model		
	L series	LCPU		
	*Not applicable for QCPU (A mode) Compatible software: GX Works 2 Version 1.31H or later			
Programming	Ladder			
language				
Number of steps	For high performance model CPU: 113*			
(maximum value)	*The value is the number of steps in the label program, and is therefore stated as a			
	reference value.	For details, refer to the G	SX Works2 Version1 Ope	eration Manual (Simple
	Project).			
Function description	By turning ON FB_EN (Execution command), the square root of input data is calculated			
	and the result is stored in the conversion data.			
Compiling method	Macro type			
Restrictions and	1) The FB does no	ot include error recovery	processing. Program the	e error recovery
precautions	processing separately in accordance with the required system operation.			
	2) The FB cannot	be used in an interrupt p	rogram.	



Item	Description			
FB operation type	Pulsed execution (1 scan execution type)			
Application example	Refer to Appendix - Application examples.			
Timing chart	Operation of I/O signals [When operation completes without error] [When an error occurs]			
	FB_EN(Execution command) FB_EN(Execution status) O_Output_Data (Conversion data) FB_OK (Completed without error) FB_EN(Execution command) FB_EN(Execution status) FB_OK (Completed without error) FB_ERROR(Error flag) ERROR_ID(Error code) 0 10(Decimal) 0			
Relevant manual	MELSEC-Q/L Programming Manual (Common Instructions)			

Error codes

■Error code list

Error code	Description
10	i_Input_Data (Input data) is not valid. Set the data within the range of 1 to 32767, and turn
	OFF FB_EN and then ON again.

Labels

■Input labels

Name	Label name	Data	Setting range	Description
		type		
Execution	FB_EN	В	ON, OFF	ON: The FB is activated.
command				OFF: The FB is not activated.
Input data	i_Input_Data	W	1~32767	Set the device number of the
				data to be calculated.



■Output labels

Name	Label name	Data	Initial	Description
		type	value	
Execution status	FB_ENO	В	OFF	ON: Execution command is ON.
				OFF: Execution command is OFF.
Completed without	FB_OK	В	OFF	When ON, it indicates that the processing is
error				completed.
Error flag	FB_ERROR	В	OFF	When ON, it indicates that an error has occurred.
Error code	ERROR_ID	W	0	FB error code output.
Conversion data	o_Output_Data	W	0	Store the square root of the input data.
				Return the integer value after dropping the number
				of decimal places.
				Return 0 if the input data is less than 1.

Processing description

- 1) Converts the input data (binary data) into floating decimal point data.
- 2) Executes "SQR instruction".
- 3) Converts the operation result from the floating decimal point data into binary data, and stores it in the conversion data.

Version Upgrade History

Version	Date	Description
1.00A	2011/03/22	First edition

Note

This chapter includes information related to the M+CPU-Data_CalculateSquareRoot function block.

It does not include information on restrictions of use such as combination with modules or programmable controller CPUs.

Before using any Mitsubishi products, please read all the relevant manuals.



18. M+CPU-Data_DCalculateSquareRoot (32-bit binary data square root calculation)

FB Name

M+CPU-Data_DCalculateSquareRoot

Function Overview

Item	Description			
Function overview	Calculates the square root of the input binary data (32-bit data).			
Symbol		M+CPU-Data_D	DCalculateSquareRoot	
	Execution command	B : FB_EN	FB_ENO : B Execution status	
	Input data	D:i_Input_Data	FB_OK : B——— Completed without error	
			FB_ERROR : B Error flag	
			ERROR_ID:W——Error code	
			o_Output_Data : D——— Conversion data	
Applicable hardware	Hardware details			
and software	Operios	High performance mo	odel	
	Q series	Universal model		
	L series	LCPU		
	*Not applicable for	r QCPU (A mode)		
	Compatible softwa	are: GX Works 2 Version	n 1.31H or later	
Programming	Ladder			
language				
Number of steps	For high performance model CPU: 118*			
(maximum value)	*The value is the r	number of steps in the I	abel program, and is therefore stated as a	
	reference value.	For details, refer to the	GX Works2 Version1 Operation Manual (Simple	
	Project).			
Function description	By turning ON FB	_EN (Execution comma	and), the square root of the input data is calculated	
	and the result is stored in the conversion data.			
Compiling method	Macro type			
Restrictions and	1) The FB does not include error recovery processing. Program the error recovery			
precautions	processing separately in accordance with the required system operation.			
	2) The FB cannot	be used in an interrupt	program.	



Item	Description		
FB operation type	Pulsed execution (1 scan execution type)		
Application example	Refer to Appendix - Application examples.		
Timing chart	Operation of I/O signals		
	[When operation completes without error] [When an error occurs] FB_EN(Execution command) FB_EN(Execution status) O_Output_Data (Conversion data) FB_OK (Completed without error) FB_OK (Completed without error) FB_ERROR(Error flag) ERROR[IXError code) 0 10(Decimal) 0		
Relevant manual	MELSEC-Q/L Programming Manual (Common Instructions)		

Error codes

■Error code list

Error code	Description	
10	i_Input_Data (Input data) is not valid. Set the data within the range of 1 to 2147483647, and	
	turn OFF FB_EN and then ON again.	

Labels

■Input labels

Name	Label name	Data	Setting range	Description
		type		
Execution	FB_EN	В	ON, OFF	ON: The FB is activated.
command				OFF: The FB is not activated.
Input data	i_Input_Data	D	1~2147483647	Set the device number of the
				data to be calculated.



■Output labels

Name	Label name	Data	Initial	Description
		type	value	
Execution status	FB_ENO	В	OFF	ON: Execution command is ON.
				OFF: Execution command is OFF.
Completed without	FB_OK	В	OFF	When ON, it indicates that the processing is
error				completed.
Error flag	FB_ERROR	В	OFF	When ON, it indicates that an error has occurred.
Error code	ERROR_ID	W	0	FB error code output.
Conversion data	o_Output_Data	D	0	Store the square root of the input data.
				Return the integer value after dropping the number
				of decimal places.
				Return 0 if the input data is less than 1.

Processing description

- 1) Converts the input data (binary data) into floating decimal point data.
- 2) Executes "SQR instruction".
- 3) Converts the operation result from the floating decimal point data into binary data, and stores it in the conversion data.

Version Upgrade History

Version	Date	Description
1.00A	2011/03/22	First edition

Note

This chapter includes information related to the M+CPU-Data_DCalculateSquareRoot function block.

It does not include information on restrictions of use such as combination with modules or programmable controller CPUs.

Before using any Mitsubishi products, please read all the relevant manuals.



Appendix 1 – Application Examples Application examples of data operation FB

System configuration

Power supply module	CPU Module	QX40 (X10~X1F)	QY41 (Y20~Y3F)



List of devices

External input (commands)

X.	ternarinput (commanus)					
	Device	FB function name	Application (ON details)			
	X10	Check code calculation	Conversion mode			
	X11	CRC-16 calculation	Conversion mode			
	X12	Digit copy	With/without BIN→BCD conversion			
	X13	Data sort	Sort order			
	X14	32-bit data sort	Sort order			
	X15	Data sort 2	Sort order			
	X16	32-bit data sort 2	Sort order			

External output (checks)

:X	xternal output (checks)					
	Device	FB function name	Application (ON details)			
	Y20	Check code calculation	Check code calculation FB error			
	Y21	CRC-16 calculation	CRC-16 calculation FB error			
	Y22	Digit copy	Digit copy FB error			
	Y23	Bit right shift	Bit right shift FB error			
	Y24	Bit left shift	Bit left shift FB error			
	Y25	Word right shift	Word right shift FB error			
	Y26	Word left shift	Word left shift FB error			
	Y27	Data sort	Data sort FB error			
	Y28	32-bit data sort	32-bit data sort FB error			
	Y29	Data sort 2	Data sort 2 FB error			
	Y2A	32-bit data sort 2	32-bit data sort 2 FB error			
	Y2B	16-bit ON/OFF check	16-bit ON/OFF check FB error			
	Y2C		Check result			
	Y2D	32-bit ON/OFF check	32-bit ON/OFF check FB error			
	Y2E		Check result			
	Y2F	Data search	Data search FB error			
	Y30	32-bit data search	32-bit data search FB error			
	Y31	Binary data square root calculation	Binary data square root calculation error			
	Y32	32-bit binary data square root	Binary data square root error			
		calculation				

Data register

ita register			
Device	FB function name	Application (ON details)	
D0	Check code calculation	Operation data start device	
D2		Check code calculation FB error code	
D3		Addition (Sum) data	
D4		Horizontal parity data	
D10	CRC-16 calculation	CRC-16 calculation FB error code	
D11		CRC data	
D4000		Start device No.	
D4500		No. of data	
D20	Digit copy	Transfer source data	
D21		Start digit position to transfer	
D22		No. of digits to transfer	
D23		Transfer destination data	
D24		Start digit position of transfer destination	
D25		Digit copy FB error code	
D26		Transfer result data	
D30	32-bit upper/lower byte conversion	32-bit upper/lower byte conversion input	
		data	
D32		Conversion data (uses 2 words)	

Relay

Relay		
Device	FB function name	Application (ON details)
M0	Check code calculation	Check code calculation request
M1		Check code calculation FB ready
M2	7	Check code calculation processing
М3	CRC-16 calculation	CRC-16 calculation request
M4		CRC-16 calculation FB ready
M5		CRC-16 calculation processing completed
M6	Digit copy	Digit copy request
M7	19	Digit copy FB ready
M8		Digit copy processing completed
M9	32-bit upper/lower byte conversion	32-bit upper/lower byte conversion request
M10		32-bit upper/lower byte conversion FB ready
		oz bit appointer of byte controller in B ready
M11	-	32-bit upper/lower byte conversion
10111		processing completed
M12	Bit right shift	Bit right shift request
M13	Tournalit still	Bit right shift FB ready
M14	_	Bit right shift processing completed
M15	Bit left shift	Bit left shift request
M16	Teir eir stillt	Bit left shift FB ready
	4	
M17	\$ 0.41111110	Bit left shift processing completed
M18	Word right shift	Word right shift request
M19	_	Word right shift FB ready
M20	101 11 0 120	Word right shift processing completed
M21	Word left shift	Word left shift request
M22		Word left shift FB ready
M23		Word left shift processing completed
M24	Data sort	Data sort request
M25		Data sort FB ready
M26		Data sort processing completed
M27	32-bit data sort	32-bit data sort request
M28		32-bit data sort FB ready
M29		32-bit data sort processing completed
M30	_Data sort 2	Data sort 2 request
M31		Data sort 2 FB ready
M32		Data sort 2 processing completed
M33	32-bit data sort 2	32-bit data sort 2 request
M34		32-bit data sort 2 FB request
M35		32-bit data sort 2 processing completed
M36	16-bit ON/OFF check	16-bit ON/OFF check request
M37		16-bit ON/OFF check FB request
M38		16-bit ON/OFF check processing completed
M39	32-bit ON/OFF check	32-bit ON/OFF check request
M40		32-bit ON/OFF check FB request
M41		32-bit ON/OFF check processing completed



Data register

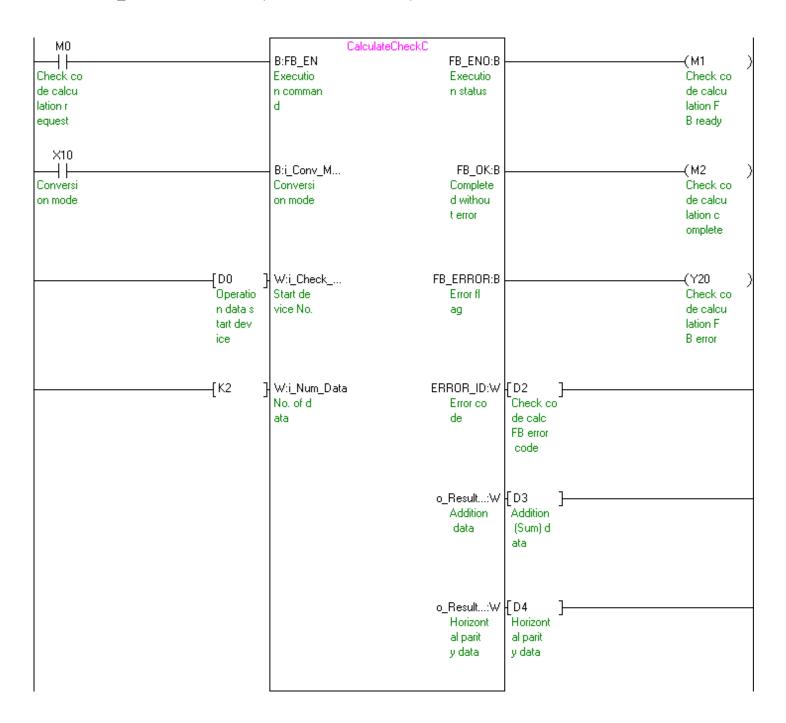
	ta register Parise		
Device	FB function name	Application (ON details)	
	Bit right shift	Data stored in shift result	
D104		Start shift target data	
D105		Bit data length of shift target data	
D106		No. of bits to right shift	
D107		Bit right shift FB error code	
D108		Start device No. of shift result data	
D110	Bit left shift	Data stored in shift result	
D174		Start shift target data	
D175		Bit data length of shift target data	
D176		No. of bits to left shift	
D177		Bit left shift FB error code	
D178		Start device No. of shift result data	
1		otali dovido i i o i me rodale data	
D100	Word right shift	Data stored in shift result	
D180 D181	l	Start shift target data	
D693			
D694		Word data length of shift result data	
		No. of words to right shift	
D695		Word right shift FB error code	
D696	\$42 II 0 I'0	Start device No. of shift result data	
	VVord left shift	Data stored in shift result	
D701		Start shift target data	
D1213		Word data length of shift result data	
D1214	-	No. of words to left shift	
D1215		Word left shift FB error code	
D1216		Start device No. of shift result data	
	Data sort	Start device of data table	
D1412		No. of lines	
D1413		No. of columns	
D1414		Sort reference column No.	
D1415		Data sort FB error code	
D1416		Start device No. of sort result	
D1420	32-bit data sort	Start device No. of data table	
D1804		No. of lines	
D1805		No. of columns	
D1806		Sort reference column No.	
D1807		Data sort FB error code	
D1808		Start device No. of sort result	
	Data sort 2	Start device No. of data table	
D2194	2 414 55/12	No. of lines	
D2195		No. of columns	
D2196		Sort reference column No.	
D2197		Data sort FB error code	
D2198	20 62 4-4	Start device No. of sort result	
	32-bit data sort 2	Start device No. of data table	
D2584		No. of lines	
D2585		No. of columns	
D2586		Sort reference column No.	
D2587		Data sort FB error code	
D2588		Start device No. of sort result	
	16-bit ON/OFF check	Check target data	
D2601		Specified bit position	
D2602		16-bit ON/OFF check FB error code	
	32-bit ON/OFF check	Check target data	
D2612		Specified bit position	
D2613		32-bit ON/OFF check FB error	
D2715	Data search	Start device No. of input data	
D2971		Search target data	
D2972		Data search FB error code	
D2973		No. of identical data	
D2974	1	First position of identical data	
D2975	1	Last position of identical data	
D2976		Last position of minimum value	
D2977	1	Last position of maximum value	
	32-bit data search	Start device No. of input data	
D3234	DE DIE GGEG COGIOTI	Search target data (uses 2 words)	
D3234	1	32-bit data search FB error code	
D3236	1	No. of identical data	
	1		
D3238		First position of identical data	
D3239	-	Last position of identical data	
D3240		Last position of minimum value	
D3241		Last position of maximum value	
	Binary data square root calculation	Input data	
D3243		Error code	
D3244		Conversion data	
	32-bit binary data square root	Input data (uses 2 words)	
D3247	calculation	Error code	
D3248		Conversion data (uses 2 words)	

Relay

ciay		
Device	FB function name	Application (ON details)
M42	Data search	Data search request
M43		Data search FB ready
M44		Data search processing completed
M45	32-bit data search	32-bit data search request
M46		32-bit data search FB ready
M47		32-bit data search processing completed
M48	Binary data square root calculation	Binary data square root calculation request
M49		Binary data square root calculation FB ready
M50		Binary data square root calculation
M52	32-bit binary data square root	32 binary data square root calculation
M53	calculation	32 binary data square root calculation FB
		ready
M54		32 binary data square root calculation
		completed
		•

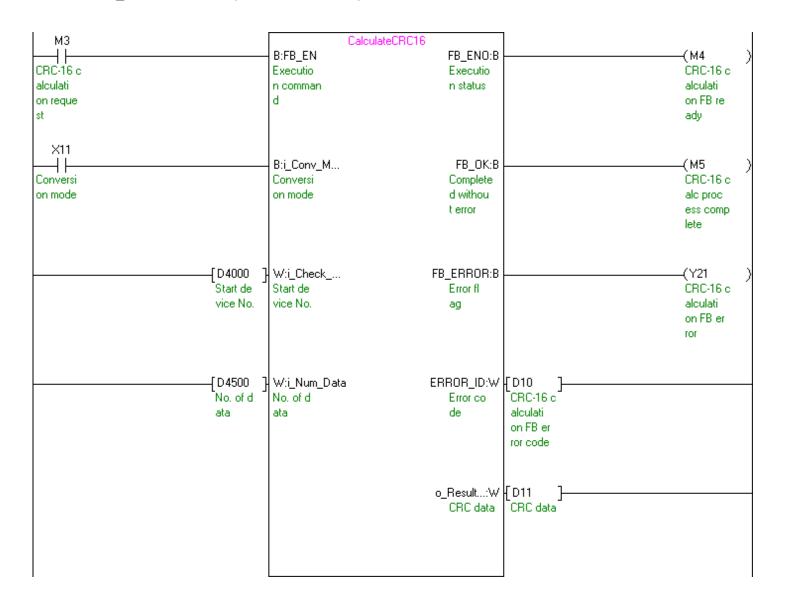


M+CPU-Data_CalculateCheckCode (Check code calculation)



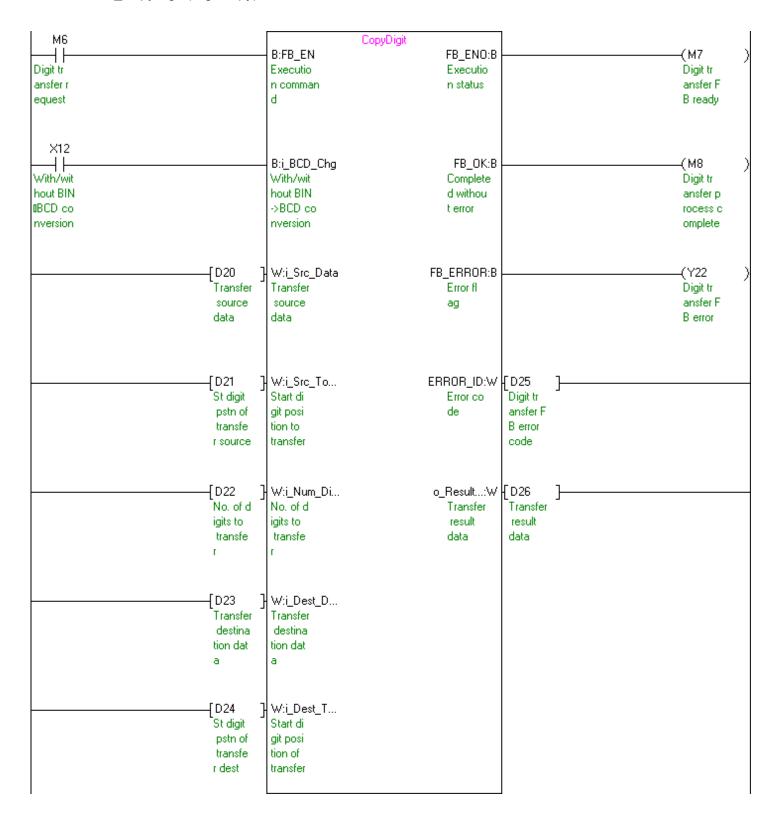


M+CPU-Data_CalculateCRC16 (CRC-16 calculation)



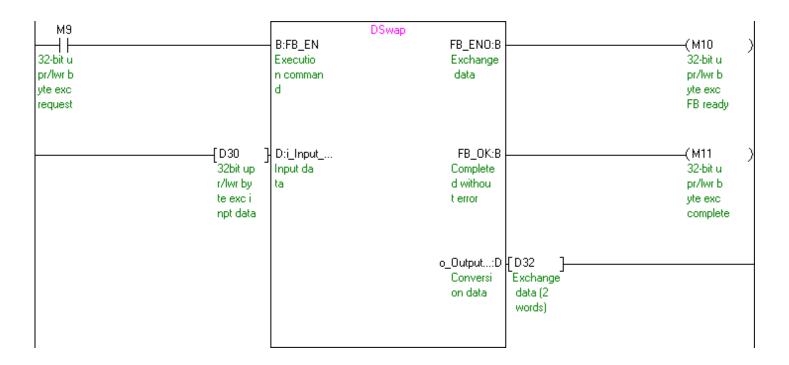


M+CPU-Data_CopyDigit (Digit copy)



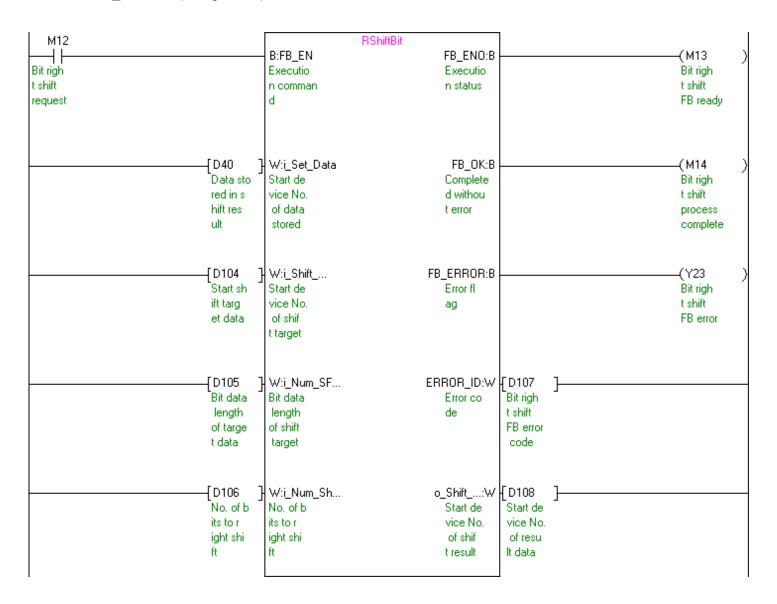


M+CPU-Data_DSwap (32-bit upper/lower byte exchange)





M+CPU-Data_RShiftBit (Bit right shift)



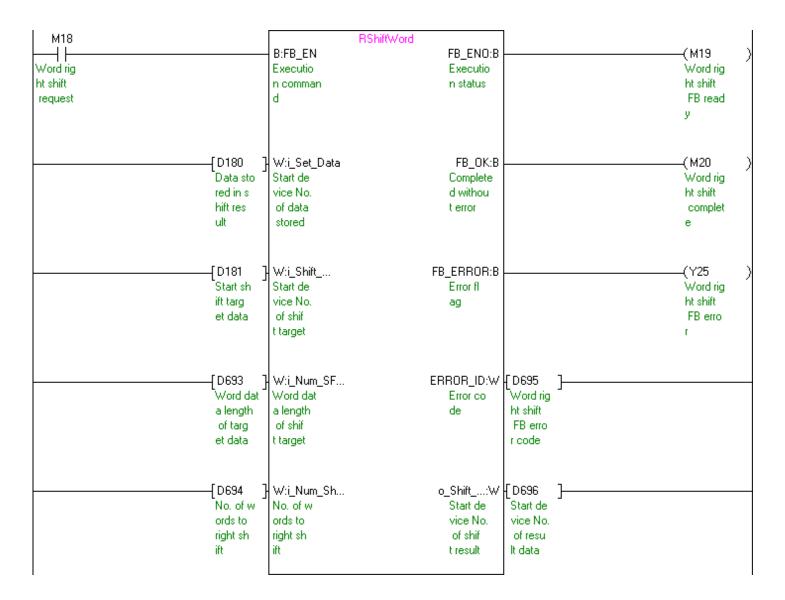


M+CPU-Data_LShiftBit (Bit left shift)

M15	B:FB_EN Executio n comman d	LShiftBit FB_ENO:B - Executio n status		(M16) Bit left shift F B ready
D110] Data sto red in s hift res ult	W:i_Set_Data Start de vice No. of data stored	FB_OK:B - Complete d withou t error		M17) Bit left shift p rocess c omplete
D174] Start sh ift targ et data	W:i_Shift Start de vice No. of shif t target	FB_ERROR:B - Error fl ag		Y24) Bit left shift F B error
D175] Bit data length of targe t data	W:i_Num_SF Bit data length of shift target	ERROR_ID:W - Error co de	[D177] Bit left shift F B error code	
D176] No. of b its to I eft shif t	W:i_Num_Sh No. of b its to I eft shif t	o_Shift:W - Start de vice No. of shif t result	[D178] Start de vice No. of resu It data	

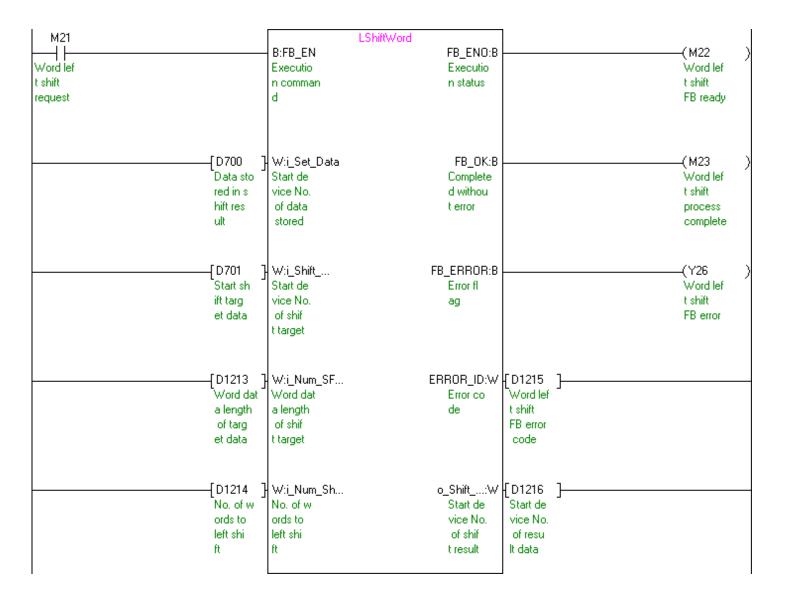


M+CPU-Data_RShiftWord (Word right shift)



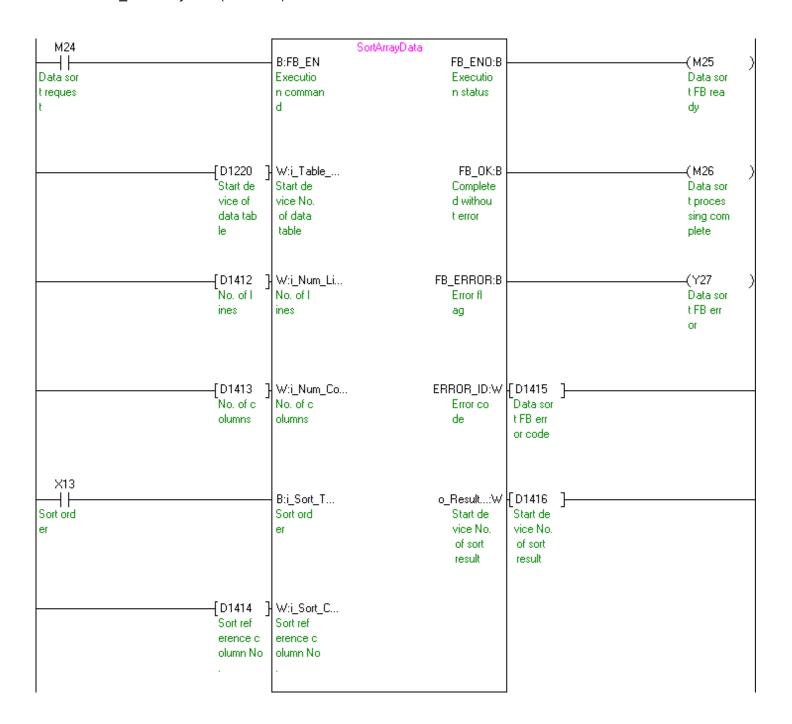


M+CPU-Data_LShiftWord (Word left shift)



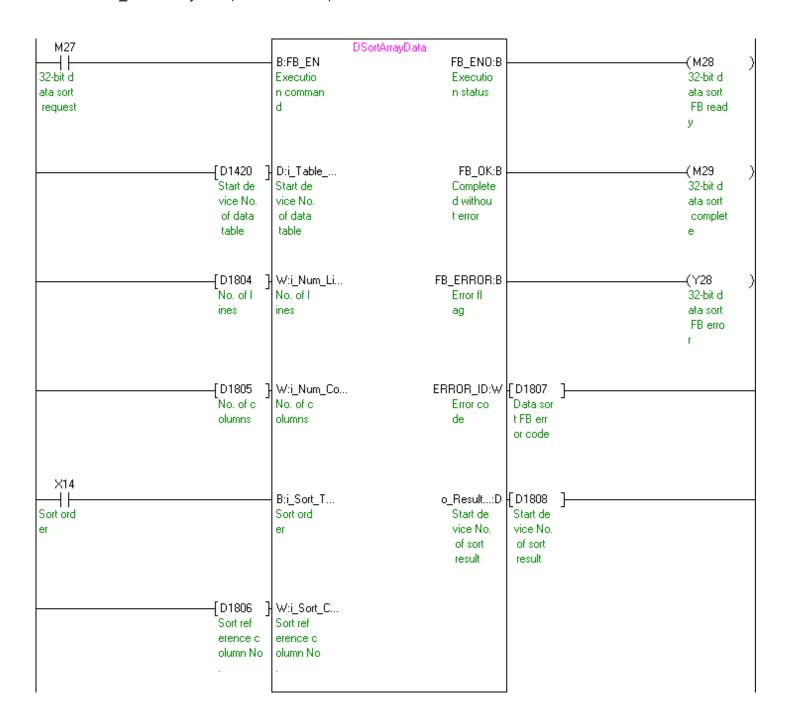


M+CPU-Data_SortArrayData (Data sort)





M+CPU-Data_DSortArrayData (32-bit data sort)



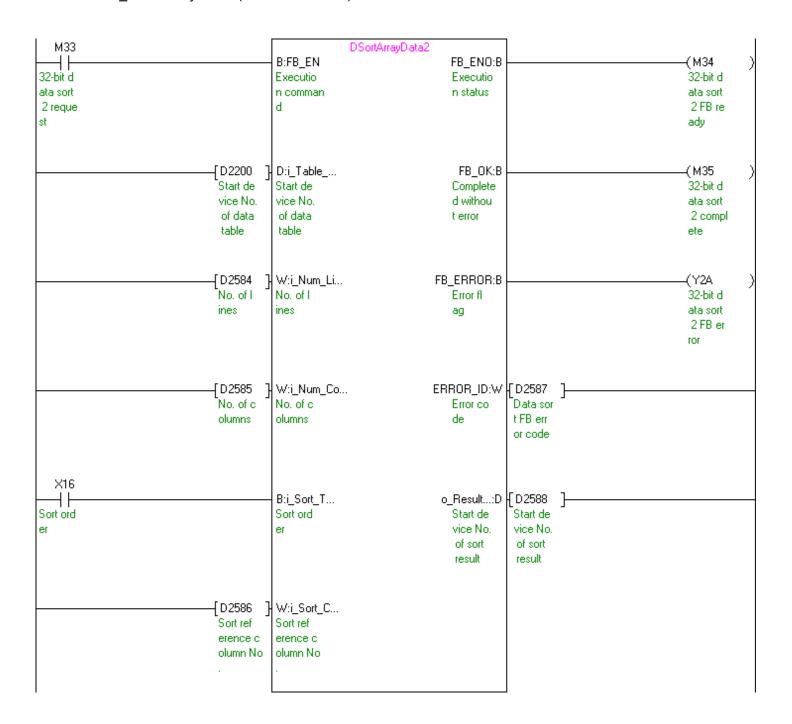


M+CPU-Data_SortArrayData2 (Data sort 2)

M30 ————————————————————————————————————	SortArrayData2 B:FB_EN Executio	FB_ENO:B Executio		—(M31) Data sor
t 2 requ est	n comman d	n status		t 2 FB r eady
[D1810] Start de vice No. of data table	W:i_Table Start de vice No. of data table	FB_OK:B Complete d withou t error		—(M32) Data sor t 2 proc essing c omplete
D2194] No. of I ines	W:i_Num_Li No. of I ines	FB_ERROR:B Error fl ag		—(Y29) Data sor t 2 FB e rror
No. of c olumns	W:i_Num_Co No. of c olumns	ERROR_ID:W Error co de	[D2197] Data sor t FB err or code	
×15 Sort ord er	B:i_Sort_T Sort ord er	o_Result:W Start de vice No. of sort result	[D2198] Start de vice No. of sort result	
[D2196] Sort ref erence c olumn No	W:i_Sort_C Sort ref erence c olumn No			

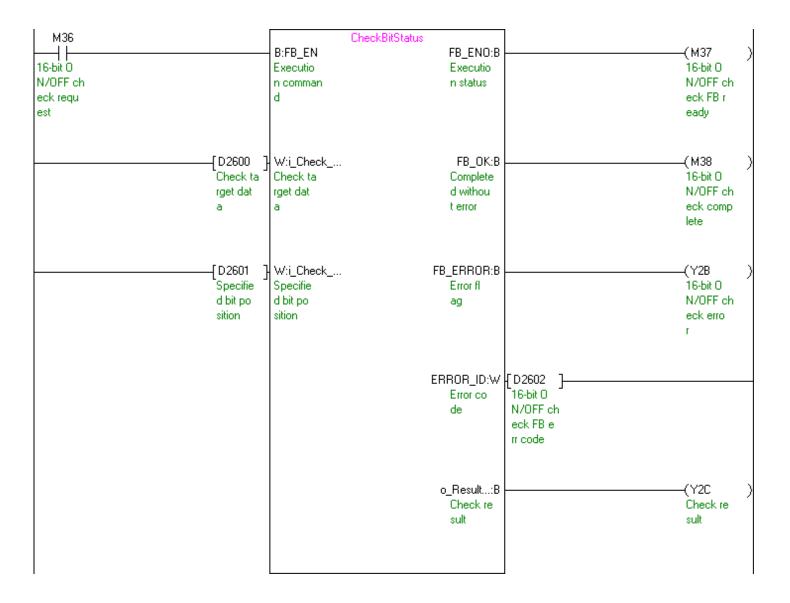


M+CPU-Data_DSortArrayData2 (32-bit data sort 2)



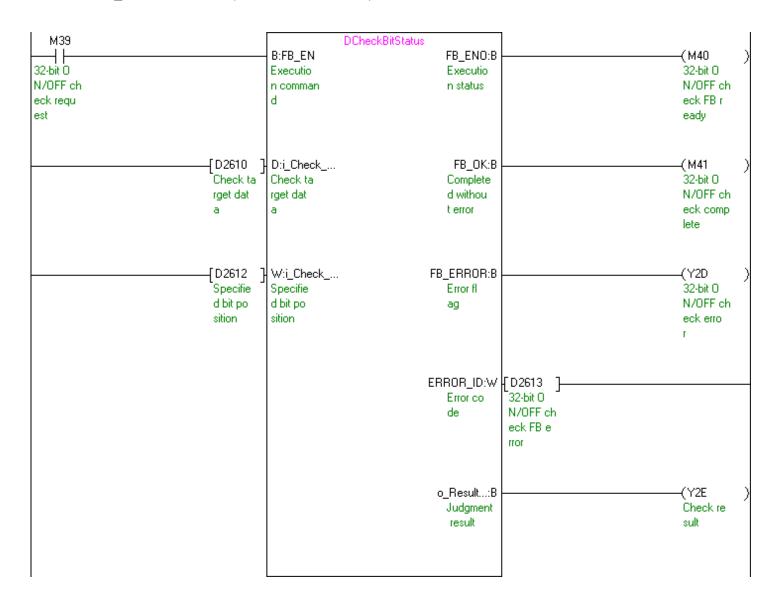


M+CPU-Data_CheckBitStatus (16-bit ON/OFF check)





M+CPU-Data_DCheckBitStatus (32-bit ON/OFF check)





M+CPU-Data_SeachSameMaxMinData (Data search)

M42		SeachSameMaxMin	
Data sea	B:FB_EN Executio	FB_ENO:B Executio	(M43 Data sea
rch requ	n comman	n status	rch FB r
est	d	Ti status	eady
			•
	500745 Juliu	50 OK 0	21111
	[D2715] W:i_Input Start de Start de	FB_OK:B Complete	(M44) Data sea
	vice No. vice No.	d withou	rch proc
	of inpu of inpu	t error	essing c
	t data 🛮 t data		omplete
	[D2971] W:i_Search.	. FB_ERROR:B	(Y2F
	Search t Search t	Error fl	Data sea
	arget da 💮 arget da	ag	rch FB e
	ta ta		rror
	D2978	e ERROR_ID:W	- D2972 1
	Start de No. of s	Error co	Data sea
	vice No. earches	de	rch FB e
	of inpu		rror cod
	t data		е
		o_Num_Sa:W	FD2973 1
		No. of i	No. of i
		dentical	dentical
		data	data
		o_Ps_Fir:W	
		Identica	Identica
		l data f irst loc	I data f irst loc
		ation	ation
		o_Ps_Las:W	[D2975]————————————————————————————————————
		Identica I data I	Identica Idata I
		ast loca	ast loca
		tion	tion
		B 1 52	[D0070]
		o_Ps_Las:W Minimum	D2976 J
		value la	value la
		st locat	st locat
		ion	ion
		o_Ps_Las:W	[D2977]
		o_rs_Las:w Maximum	Maximum
		value la	value la
		st locat	st locat
		ion	ion

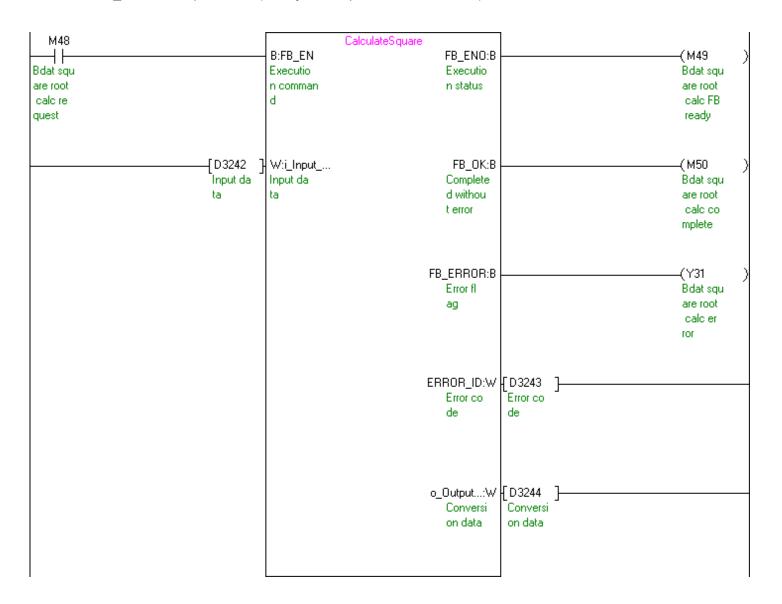


M+CPU-Data_DSeachSameMaxMinData (32-bit data search)

M45	[SameMaxMi		
		B:FB_EN	FB_ENO:B		———(M46
32-bit d		Executio	Executio		32-bit d
ita sear		n comman	n status		ata sear
h reque	I	d			ch FB re
t		_			ady
•					33,
	[50070]	Del James A	ED OK:D		(1117
		D:i_Input	FB_OK:B		(M47
		Start de	Complete		32-bit d
		vice No.	d withou		ata sear
	of inpu	of inpu	t error		ch compl
	t data	t data			ete
					4
		D:i_Search	FB_ERROR:B		(Y30
		Search t	Error fl		32-bit d
		arget da	ag		ata sear
		ta			ch FB er
	rds)				ror
	-				
	——[K5]}	W:i_Num_Se	ERROR_ID:W	√D3236]	
	٦ -	No. of s	Error co	32-bit d	
		earches	de	ata sear	
				ch FB er	
				ror code	
			o_Num_Sa:W	FD3237 1	
			No. of i	No. of i	
			dentical	dentical	
			data	data	
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M+CPU-Data_CalculateSquareRoot (Binary data square root calculation)





M+CPU-Data_DCalculateSquareRoot (32-bit binary data square root calculation)

