MITSUBISHI

Mitsubishi Safety Programmable Controller

MELSEC QS series

QSCPU

Programming Manual (Common Instructions)

● SAFETY PRECAUTIONS ●

(Always read these cautions before using the product)

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

Please store this manual in a safe place and make it accessible when required. Always forward a copy of the manual to the end user.

REVISIONS

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

Print Date	*Manual Number	Revision
Sep., 2006	SH(NA)-080628ENG-A	First edition
Sep.,2007	SH(NA)-080628ENG-B	Partial corrections Section 3.2, 5.2.3, 5.3.3, 5.4.1, 6.2.5, 6.3.1, 6.3.2, 6.4.1, INDEX
Apr.,2008	SH(NA)-080628ENG-C	Partial corrections ABOUT MANUALS, Section 1.2, 3.2.2, 3.2.3, Chapter 4, Section 6.1.1, 6.1.2, 6.2.1, 6.2.2, 6.2.3, 6.2.4, 6.2.5, 6.2.6, 6.3.1, 6.3.2, 6.3.3, 6.3.4, 7.1.1, 7.1.2, 7.1.3, 7.1.4, 9.1.1, 9.1.4, 9.1.5, 9.1.6, 9.1.8, Appendix1.1, Appendix 2, Appendix3

Japanese Manual Version SH-080610-C

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INTRODUCTION

Thank you for choosing the Mitsubishi MELSEC-QS Series of Safety Programmable Logic Controllers.
Before using the equipment, please read this manual carefully to develop full familiarity with the functions and performance of the QS series PLC you have purchased, so as to ensure correct use.
A copy of this manual should be forwarded to the end User.

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ABOUT MANUALS

Introduction Manual

Before constructing or designing the safety-related system, be sure to read the following manual.

Manual Name	Manual Number (Model Code)
Safety Application Guide Explains the overview, construction method, laying and wiring examples, and application programs of the safety-related system. (Sold separately)	SH-080613ENG (13JR90)

Related Manuals

The following manuals are related to this product.
If necessary, order them by quoting the details in the tables below.

Manual Name	Manual Number (Model Code)
QSCPU User’s Manual (Hardware Design, Maintenance and Inspection) Explains the specifications of the QSCPU, safety power supply module, and safety base unit. (Sold separately)	SH-080626ENG (13JR92)
QSCPU User's Manual (Function Explanation, Program Fundamentals) Explains the functions, programming methods, devices and others that are necessary to create programs with the QSCPU. (Sold separately)	SH-080627ENG (13JR93)
CC-Link Safety System Master Module User's Manual Explains the specifications, procedures and settings before system operation, parameter setting, and troubleshooting of the QS0J61BT12 CC-Link Safety system master module. (Sold separately)	SH-080600ENG (13JR88)
CC-Link Safety System Remote I/O Module User's Manual Explains the specifications, procedures and settings before system operation, parameter setting, and troubleshooting of the CC-Link Safety system remote I/O module. (Sold separately)	SH-080612ENG (13JR89)
CC-Link IE Controller Network Reference Manual Explains the system configuration, performance specifications, functions, handling, wiring, and troubleshooting of the CC-Link IE controller network. (Sold separately)	SH-080668ENG (13JV16)
Q corresponding MELSECNET/H Network System Reference Manual (PLC to PLC network) Explains the specifications, procedures and settings before system operation, parameter setting, programming, and troubleshooting of a MELSECNET/H network system for PLC to PLC network. (Sold separately)	SH-080049 (13JF92)
Q Corresponding Ethernet Interface Module User’s Manual (Basic) Explains the specifications, procedures for data communication with external devices, line connection (open/close), fixed buffer communication, random access buffer communication, and troubleshooting of the Ethernet module. (Sold separately)	SH-080009 (13JL88)

Manual Name	Manual Number (Model Code)
Q Corresponding Ethernet Interface Module User's Manual (Application) Explains the e-mail function, programmable controller CPU status monitoring function, communication function via CC-Link IE controller network, MELSECNET/H or MELSECNET/10, communication function using the data link instructions, file transfer function (FTP server) of the Ethernet module. (Sold separately)	SH-080010 (13JL89)
Q Corresponding MELSEC Communication Protocol Reference Manual Explains the communication methods and control procedures using the MC protocol, which is used by external devices to read and write data of the programmable controller CPU via the serial communication module or Ethernet module. (Sold separately)	SH-080008 (13JF89)
GX Developer Version 8 Operating Manual Explains the online functions of the GX Developer, such as the programming, printout, monitoring, and debugging methods. (Sold separately)	SH-080373E (13JU41)
GX Developer Version 8 Operating Manual (Safety Programmable Controller) Explains the GX Developer functions added and modified for the compatibility with the safety programmable controller. (Sold separately)	SH-080576ENG (13JU53)

Remark

Printed materials are separately available for single item purchase. Order the manual by quoting the manual number on the table above (Model code).

MEMO

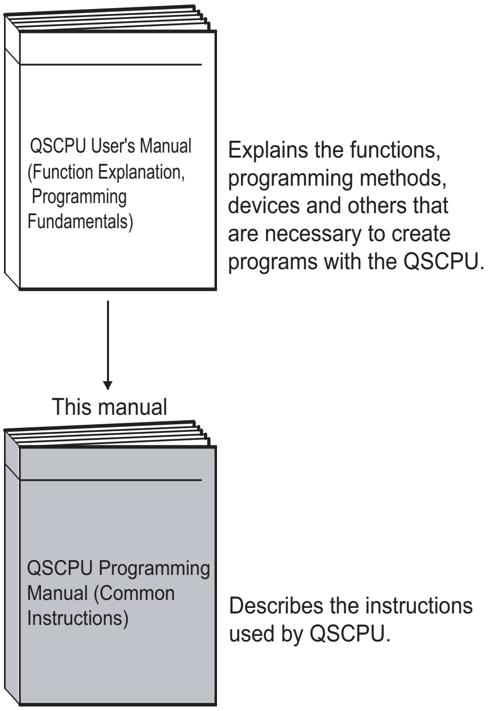
1 GENERAL DESCRIPTION

This manual describes the instructions required to execute programming of the QSCPU.

1.1 Manuals Essential for Programming

Before reading this manual, check the functions, programming methods, devices and others that are necessary to create programs with the QSCPU in the manuals below:

- QSCPU User’s Manual (Function Explanation, Program Fundamentals)


QSCPU User's Manual (Function Explanation, Programming Fundamentals)
Explains the functions, programming methods, devices and others that are necessary to create programs with the QSCPU.
This manual
QSCPU Programming Manual (Common Instructions)
Describes the instructions used by QSCPU.

1.2 Generic Terms and Abbreviations

This manual describes the QS series CPU module using the following generic terms and abbreviations, unless otherwise specified.

Generic term/Abbreviation	Description
Safety PLC	Generic term for safety CPU module, safety power supply module, safety main base unit, CC-Link safety master module and CC-Link safety remote I/O module.
Standard PLC	Generic term of each module for MELSEC-Q series, MELSEC-QnA series, MELSEC-A series and MELSEC-FX series. (Used for distinction from safety PLC.)
QS Series	Abbreviation for Mitsubishi Safety PLC MELSEC-QS Series
QS001CPU	Abbreviation for QS001CPU-type safety CPU module
CPU Module	Other name for QS001CPU
GX Developer	Generic product name for product models SW8D5C-GPPW-E, SW8D5C-GPPW-EA, SW8D5C-GPPW-EV and SW8D5C-GPPW-EVA
QS0J61BT12	Abbreviation for QS0J61BT12-type CC-Link Safety system master module
CC-Link Safety	Abbreviation for the CC-Link Safety system
CC-Link Safety master module	Other name for QS0J61BT12
CC-Link IE controller network module	Abbreviation for the QJ71GP21-SX CC-Link IE controller network module and QJ71GP21S-SX CC-Link IE controller network module (with external power supply function)
MELSECNET/H	Abbreviation for the MELSECNET/H network system
MELSECNET/H module	Abbreviation for the QJ71LP21-25, QJ71LP21S-25, QJ71LP21G, QJ71BR11 MELSECNET/H network module
Ethernet	Abbreviation for the Ethernet network system
Ethernet module	Abbreviation for the QJ71E71-100, QJ71E71-B5, QJ71E71-B2 Ethernet interface module
Intelligent function module	Generic term for the CC-Link Safety master module, CC-Link IE controller network module, MELSECNET/H module, and Ethernet module
QS0J65BTS2-8D	Abbreviation for the QS0J65BTS2-8D CC-Link Safety remote I/O module
QS0J65BTS2-4T	Abbreviation for the QS0J65BTS2-4T CC-Link Safety remote I/O module
QS0J65BTB2-12DT	Abbreviation for QS0J65BTB2-12DT-type CC-Link Safety remote I/O module
CC-Link Safety remote I/O module	Generic term for the QS0J65BTS2-8D, QS0J65BTS2-4T, QS0J65BTB2-12DT

MEMO

2 INSTRUCTION TABLES

2.1 Types of Instructions

The major types of safety CPU module instructions are sequence instructions, basic instructions, application instructions, and QSCPU dedicated instructions as shown in Table 2.1

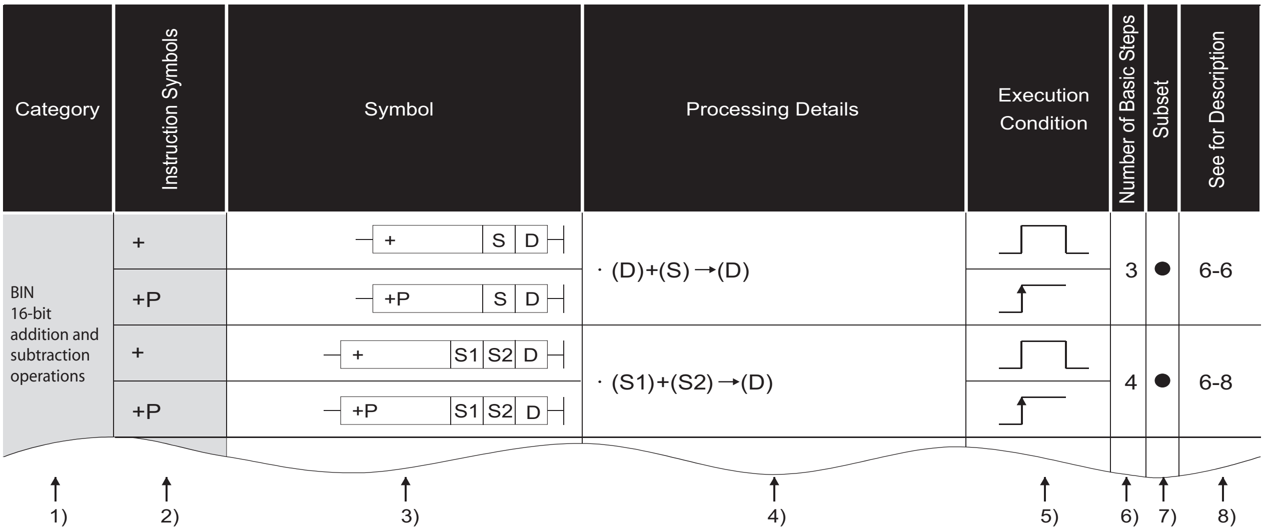
Table 2.1 Types of Instructions

Types of Instructions		Meaning	Reference Chapter
Sequence instruction	Contact instruction	Operation start, series connection, parallel connection	5
	Connection instructions	Ladder block connection, store/read operation results, creation of pulses from operation results	
	Output instruction	Bit device output, output reversal	
	Master control instruction	Master control	
	Termination instruction	Program termination	
	Other instructions	Instructions such as no operation which do not fit in the above categories	
Basic instructions	Comparison operation instruction	Comparisons such as =, >, <	6
	Arithmetic operation instruction	Addition, subtraction, multiplication or division of BIN	
	BCD ↔ BIN conversion instruction	Conversion from BCD to BIN and from BIN to BCD	
	Data transfer instruction	Transmits designated data	
Application instructions	Logical operation instructions	Logical operations such as logical sum, logical product, etc.	7
QSCPU dedicated instruction	QSCPU dedicated instruction	Forced control stop	8

2.2 How to Read Instruction Tables

The instruction tables found from Section 2.3 to 2.6 have been made according to the following format:

Table 2.2 How to Read Instruction Tables



Category	Instruction Symbols	Symbol	Processing Details	Execution Condition	Number of Basic Steps	Subset	See for Description
BIN 16-bit addition and subtraction operations	+	+ S D	· (D)+(S) → (D)		3	●	6-6
	+P	+P S D					
	+	+ S1 S2 D	· (S1)+(S2) → (D)		4	●	6-8
	+P	+P S1 S2 D					

Description

1) . . . . . Classifies instructions according to their application.

2) . . . . . Indicates the instruction symbol used in a program.
Instruction code is built around the 16-bit instruction.
The following notations are used to mark 32-bit instructions, instructions executed only at the leading edge of OFF to ON.

- 32-bit instruction . . The letter "D" is added to the first line of the instruction.

Example + ➡ D+
↓ 16-bit instruction
↓ 32-bit instruction

- Instructions executed only at the leading edge of OFF to ON
. . . . The letter "P" is added to the end of the instruction.

Example + ➡ +P
↓ Instruction executed during ON
↓ Instruction executed only at the leading edge of OFF to ON

3) . . . . .Shows symbol diagram on the ladder.

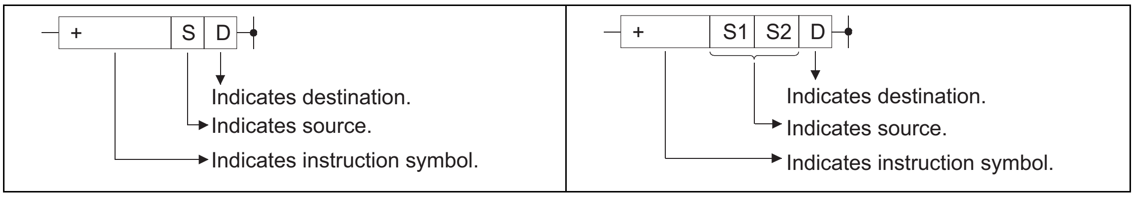


Fig. 2.1 Shows Symbol Diagram on the Ladder

Destination . . . . . .Indicates where data will be sent after operation.

Source . . . . .Stores data prior to operation.

4) . . . . .Indicates the type of processing that is performed by individual instructions.

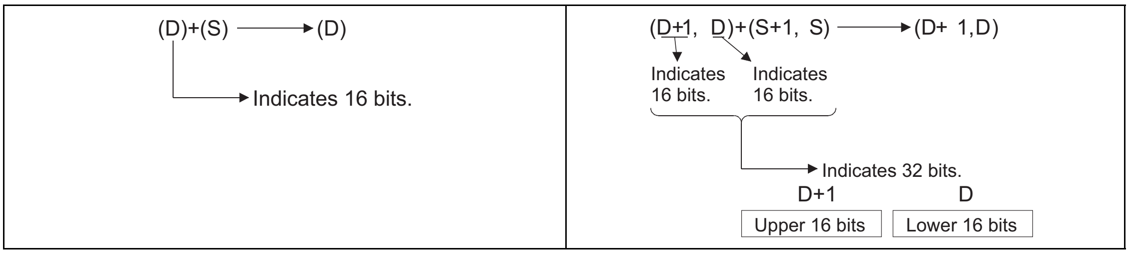
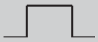
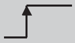
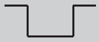
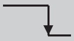


Fig. 2.2 Type of Processing Performed by Individual Instructions

5) . . . . .The details of conditions for the execution of individual instructions are as follows:

Symbol	Execution Condition
No symbol recorded	Instruction executed under normal circumstances, with no regard to the ON/OFF status of conditions prior to the instruction. If the precondition is OFF, the instruction will conduct OFF processing.
	Executed during ON; instruction is executed only while the precondition is ON. If the preconditions is OFF, the instruction is not executed, and no processing is conducted.
	Executed once at ON; instruction executed only at leading edge when precondition goes from OFF to ON. Following execution, instruction will not be executed and no processing conducted even if condition remains ON.
	Executed during OFF; instruction is executed only while the precondition is OFF. If the precondition is ON, the instruction is not executed, and no processing is conducted.
	Executed once at OFF; instruction executed only at trailing edge when precondition goes from ON to OFF. Following execution, instruction will not be executed and no processing conducted even if condition remains OFF.

6) . . . . .Indicates the basic number of steps for individual instructions.

See 3.6 for a description of the number of steps.

7) . . . . .The ● mark indicates instructions for which subset processing is possible.

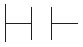
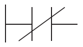
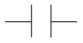
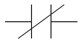
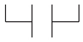
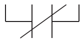
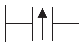
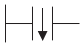
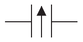
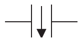
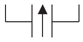
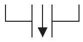
See Section 3.3 for details on subset processing.

8) . . . . .Indicates the page numbers where the individual instructions are explained.

2.3 Sequence Instruction

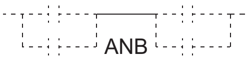
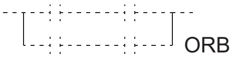
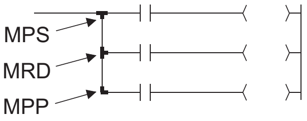
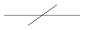
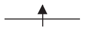
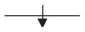
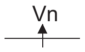
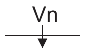
2.3.1 Contact instructions

Table 2.3 Contact Instructions

Category	Instruction Symbols	Symbol	Processing Details	Execution Condition	Number of Basic Steps	Subset	See for Description
Contact	LD		• Starts logic operation (Starts a contact logic operation)		1	●	5-2
	LDI		• Starts logical NOT operation (Starts b contact logic operation)				
	AND		• Logical product (a contact series connection)				
	ANI		• Logical product NOT (b contact series connection)				
	OR		• Logical sum (a contact parallel connection)				
	ORI		• Logical sum NOT (b contact parallel connection)				
	LDP		• Starts leading edge pulse operation		1	●	5-5
	LDF		• Starts trailing edge pulse operation				
	ANDP		• Leading edge pulse series connection				
	ANDF		• Trailing edge pulse series connection				
	ORP		• Leading edge pulse parallel connection				
	ORF		• Trailing edge pulse parallel connection				

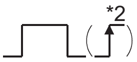
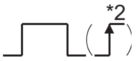
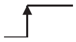
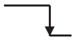
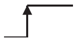
2.3.2 Connection instructions

Table 2.4 Connection Instructions

Category	Instruction Symbols	Symbol	Processing Details	Execution Condition	Number of Basic Steps	Subset	See for Description
Connection	ANB		• AND between logical blocks (Series connection between logical blocks)		1	-	5-7
	ORB		• OR between logical blocks (Series connection between logical blocks)				
	MPS		• Memory storage of operation results		1	-	5-9
	MRD		• Read of operation results stored with MPS instruction				
	MPP		• Read and reset of operation results stored with MPS instruction				
	INV		• Inversion of operation result		1	-	5-12
	MEP		• Conversion of operation result to leading edge pulse		1	-	5-14
	MEF		• Conversion of operation result to trailing edge pulse				
	EGP		• Conversion of operation result to leading edge pulse (Stored at Vn)		1	-	5-15
	EGF		• Conversion of operation result to trailing edge pulse (Stored at Vn)		2		

2.3.3 Output instructions

Table 2.5 Output Instructions

Category	Instruction Symbols	Symbol	Processing Details	Execution Condition	Number of Basic Steps	Subset	See for Description
Output	OUT	—( )—	• Device output		*1	-	5-17 5-19 5-23 5-25
	SET	—[SET D]—	• Set device		*1	-	5-27 5-31
	RST	—[RST D]—	• Reset device		*1	-	5-29 5-31
	PLS	—[PLS D]—	• Generates 1 cycle program pulse at leading edge of input signal.		2	-	5-33
	PLF	—[PLF D]—	• Generates 1 cycle program pulse at trailing edge of input signal.				
	FF	—[FF D]—	• Reversal of device output		2	-	5-36

*1: The number of steps may vary depending on the device being used. See description pages of individual instructions for number of steps.

*2: The execution condition applies only when an annunciator (F) is in use.

2.3.4 Master control instructions

Table 2.6 Master Control Instructions

Category	Instruction Symbols	Symbol	Processing Details	Execution Condition	Number of Basic Steps	Subset	See for Description
Master control	MC	—[MC n D]—	• Starts master control		2	-	5-38
	MCR	—[MCR n]—	• Resets master control		1		

2.3.5 Termination instruction

Table 2.7 Termination Instruction

Category	Instruction Symbols	Symbol	Processing Details	Execution Condition	Number of Basic Steps	Subset	See for Description
Termination	END	├──── [END] ┤	• Termination of sequence program		1	-	5-42

2.3.6 Other instructions

Table 2.8 Other Instructions

Category	Instruction Symbols	Symbol	Processing Details	Execution Condition	Number of Basic Steps	Subset	See for Description
No-operation	NOP	────	• Ignored (For program deletion or space)		1	-	5-43
	NOPLF	├──── [NOPLF] ┤	• Ignored (To change pages during printouts)				
	PAGE	├──── [PAGE | n] ┤	• Ignored (Subsequent programs will be controlled from step 0 of page n)				

2.4 Basic Instructions

2.4.1 Comparison operation instructions

Table 2.9 Comparison Operation Instructions

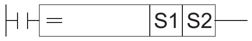
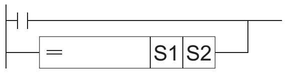
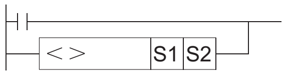
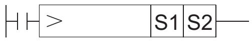
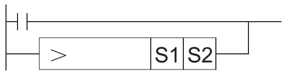
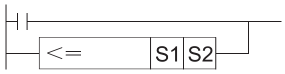
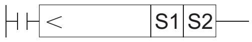
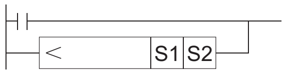
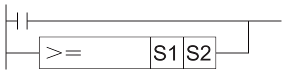
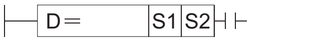
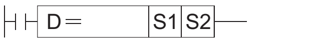
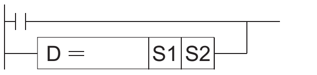
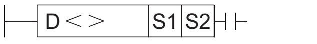
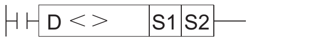
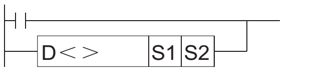
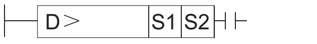
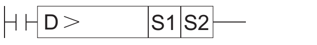
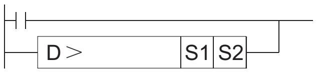
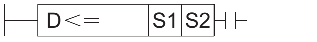
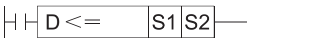
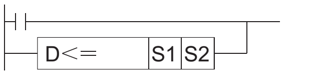
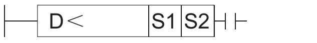
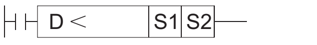
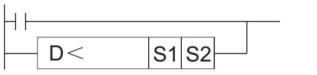
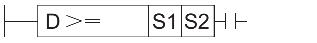
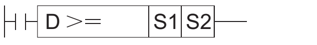
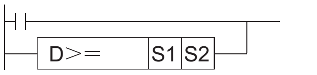
Category	Instruction Symbols	Symbol	Processing Details	Execution Condition	Number of Basic Steps	Subset	See for Description
BIN 16-bit data comparisons	LD =		• Conductive status when (S1) = (S2) • Non-conductive status when (S1) ≠ (S2)		3	●	6-2
	AND =						
	OR =						
	LD<>		• Conductive status when (S1) ≠ (S2) • Non-conductive status when (S1) = (S2)		3	●	
	AND<>						
	OR<>						
	LD>		• Conductive status when (S1) > (S2) • Non-conductive status when (S1) ≦ (S2)		3	●	
	AND>						
	OR>						
	LD<=		• Conductive status when (S1) ≦ (S2) • Non-conductive status when (S1) > (S2)		3	●	
	AND<=						
	OR<=						
	LD<		• Conductive status when (S1) < (S2) • Non-conductive status when (S1) ≧ (S2)		3	●	
	AND<						
	OR<						
	LD>=		• Conductive status when (S1) ≧ (S2) • Non-conductive status when (S1) < (S2)		3	●	
	AND>=						
	OR>=						

Table 2.9 Comparison Operation Instructions (Continued)

Category	Instruction Symbols	Symbol	Processing Details	Execution Condition	Number of Basic Steps	Subset	See for Description
BIN 32-bit data comparisons	LDD =		• Conductive status when (S1+1, S1) = (S2+1, S2) • Non-Conductive status when (S1+1, S1) ≠ (S2+1, S2)		3	●	6-4
	ANDD =						
	ORD =						
	LDD<>		• Conductive status when (S1+1, S1) ≠ (S2+1, S2) • Non-Conductive status when (S1+1, S1) = (S2+1, S2)		3	●	
	ANDD<>						
	ORD<>						
	LDD>		• Conductive status when (S1+1, S1) > (S2+1, S2) • Non-Conductive status when (S1+1, S1) ≦ (S2+1, S2)		3	●	
	ANDD>						
	ORD>						
	LDD<=		• Conductive status when (S1+1, S1) ≦ (S2+1, S2) • Non-Conductive status when (S1+1, S1) > (S2+1, S2)		3	●	
	ANDD<=						
	ORD<=						
	LDD<		• Conductive status when (S1+1, S1) < (S2+1, S2) • Non-Conductive status when (S1+1, S1) ≧ (S2+1, S2)		3	●	
	ANDD<						
	ORD<						
	LDD>=		• Conductive status when (S1+1, S1) ≧ (S2+1, S2) • Non-Conductive status when (S1+1, S1) < (S2+1, S2)		3	●	
	ANDD>=						
	ORD>=						

2.4.2 Arithmetic operation instructions

Table 2.10 Arithmetic Operation Instructions

Category	Instruction Symbols	Symbol	Processing Details	Execution Condition	Number of Basic Steps	Subset	See for Description
BIN 16-bit addition and subtraction operations	+	+ S D	• (D) + (S) → (D)	⎍	3	●	6-6
	+P	+P S D		↑			
	+	+ S1 S2 D	• (S1) + (S2) → (D)	⎍	4	●	6-8
	+P	+P S1 S2 D		↑			
	–	− S D	• (D) − (S) → (D)	⎍	3	●	6-6
	–P	−P S D		↑			
	–	− S1 S2 D	• (S1) − (S2) → (D)	⎍	4	●	6-8
	–P	−P S1 S2 D		↑			
BIN 32-bit addition and subtraction operations	D+	D+ S D	• (D+1, D) + (S+1, S) → (D+1, D)	⎍	3	●	6-10
	D+P	D+P S D		↑			
	D+	D+ S1 S2 D	• (S1+1, S1) + (S2+1, S2) → (D+1, D)	⎍	4	●	6-12
	D+P	D+P S1 S2 D		↑			
	D–	D− S D	• (D+1, D) − (S+1, S) → (D+1, D)	⎍	3	●	6-10
	D–P	D−P S D		↑			
	D–	D− S1 S2 D	• (S1+1, S1) − (S2+1, S2) → (D+1, D)	⎍	4	●	6-12
	D–P	D−P S1 S2 D		↑			
BIN 16-bit multiplication and division operations	*	* S1 S2 D	• (S1) × (S2) → (D+1,D)	⎍	4	●	6-14
	*P	*P S1 S2 D		↑			
	/	/ S1 S2 D	• (S1) / (S2) → Quotient(D), Remainder (D+1)	⎍	4	●	
	D/P	/P S1 S2 D		↑			
BIN 32-bit multiplication and division operations	D *	D* S1 S2 D	• (S1+1, S1) × (S2+1, S2) → (D+3, D+2, D+1, D)	⎍	4	●	6-16
	D * P	D*P S1 S2 D		↑			
	D/	D/ S1 S2 D	• (S1+1, S1) / (S2+1, S2) → Quotient (D+1, D), Remainder (D+3, D+2)	⎍	4	●	
	D/P	D/P S1 S2 D		↑			

Table 2.10 Arithmetic Operation Instructions (Continued)

Category	Instruction Symbols	Symbol	Processing Details	Execution Condition	Number of Basic Steps	Subset	See for Description
BIN data increment	INC	—[INC | D]—	• (D) + 1 → (D)	_⊓_	2	●	6-18
	INCP	—[INCP | D]—		_↑‾			
	DINC	—[DINC | D]—	• (D+1, D) + 1 → (D+1, D)	_⊓_	2	●	6-20
	DINCP	—[DINCP | D]—		_↑‾			
	DEC	—[DEC | D]—	• (D) − 1 → (D)	_⊓_	2	●	6-18
	DECP	—[DECP | D]—		_↑‾			
	DDEC	—[DDEC | D]—	• (D+1, D) − 1 → (D+1, D)	_⊓_	2	●	6-20
	DDECP	—[DDECP | D]—		_↑‾			

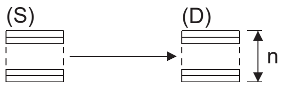
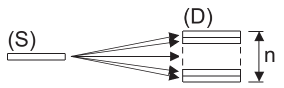
2.4.3 Data conversion instructions

Table 2.11 Data Conversion Instructions

Category	Instruction Symbols	Symbol	Processing Details	Execution Condition	Number of Basic Steps	Subset	See for Description
BCD conversions	BCD	—[BCD | S | D]—	• $\underline{(S)} \xrightarrow{\text{BCD conversion}} (D)$ BIN (0 to 9999)	_⊓_	3	●	6-22
	BCDP	—[BCDP | S | D]—		_↑‾			
	DBCD	—[DBCD | S | D]—	• $\underline{(S+1, S)} \xrightarrow{\text{BCD conversion}} (D+1, D)$ BIN (0 to 99999999)	_⊓_	3	●	
	DBCDP	—[DBCDP | S | D]—		_↑‾			
BIN conversions	BIN	—[BIN | S | D]—	• $\underline{(S)} \xrightarrow{\text{BIN conversion}} (D)$ BCD (0 to 9999)	_⊓_	3	●	6-24
	BINP	—[BINP | S | D]—		_↑‾			
	DBIN	—[DBIN | S | D]—	• $\underline{(S+1, S)} \xrightarrow{\text{BIN conversion}} (D+1, D)$ BCD (0 to 99999999)	_⊓_	3	●	
	DBINP	—[DBINP | S | D]—		_↑‾			
Complement to 2	NEG	—[NEG | D]—	• $\overline{(D)} \longrightarrow (D)$ BIN data	_⊓_	2	–	6-27
	NEGP	—[NEGP | D]—		_↑‾			
	DNEG	—[DNEG | D]—	• $\overline{(D+1, D)} \longrightarrow (D+1, D)$ BIN data	_⊓_	2	–	
	DNEGP	—[DNEGP | D]—		_↑‾			

2.4.4 Data transfer instructions

Table 2.12 Data Transfer Instructions

Category	Instruction Symbols	Symbol	Processing Details	Execution Condition	Number of Basic Steps	Subset	See for Description
16-bit data transfer	MOV	MOV S D	• (S) → (D)	⎍	*1	●	6-29
	MOVP	MOVP S D		↑			
32-bit data transfer	DMOV	DMOV S D	• (S+1,S) → (D+1,D)	⎍	*2	●	
	DMOVP	DMOVP S D		↑			
16-bit data negation transfer	CML	CML S D	$\bullet\ \overline{(S)} \longrightarrow (D)$	⎍	*1	●	6-31
	CMLP	CMLP S D		↑			
32-bit data negation transfer	DCML	DCML S D	$\bullet\ \overline{(S+1,S)} \longrightarrow (D+1,D)$	⎍	*2	●	
	DCMLP	DCMLP S D		↑			
Block transfer	BMOV	BMOV S D n		⎍	4	●	6-34
	BMOVP	BMOVP S D n		↑			
Multiple transfers of same data block	FMOV	FMOV S D n		⎍	4	●	6-36
	FMOVP	FMOVP S D n		↑			

*1: The number of steps may vary depending on the device being used.

Device	Number of Steps
· Word device: Internal device · Bit device: Devices whose device Nos. are multiples of 16 and whose digit designation is K4 · Constant: No limitations	2
Devices other than above	3

*2: The number of steps may vary depending on the device being used.

Device	Number of Steps
· Word device: Internal device · Bit device: Devices whose device Nos. are multiples of 16 and whose digit designation is K8 · Constant: No limitations $^{\text{Note 1)}}$	3
Devices other than above	3 $^{\text{Note 1)}}$

Note 1) The number of steps may increase due to the conditions described in 3.6.

2.5 Application Instructions

2.5.1 Logical operation instructions

Table 2.13 Logical Operation Instructions

Category	Instruction Symbols	Symbol	Processing Details	Execution Condition	Number of Basic Steps	Subset	See for Description
Logical product	WAND	WAND S D	· (D) ∧ (S) → (D)	⎍	3	●	7-3
	WANDP	WANDP S D		↑			
	WAND	WAND S1 S2 D	· (S1) ∧ (S2) → (D)	⎍	4	●	7-5
	WANDP	WANDP S1 S2 D		↑			
	DAND	DAND S D	· (D+1,D) ∧ (S+1,S) → (D+1,D)	⎍	*1 3	●	7-3
	DANDP	DANDP S D		↑			
	DAND	DAND S1 S2 D	· (S1+1,S1) ∧ (S2+1,S2) → (D+1,D)	⎍	*1 4	●	7-5
	DANDP	DANDP S1 S2 D		↑			
Logical sum	WOR	WOR S D	· (D) ∨ (S) → (D)	⎍	3	●	7-8
	WORP	WORP S D		↑			
	WOR	WOR S1 S2 D	· (S1) ∨ (S2) → (D)	⎍	4	●	7-10
	WORP	WORP S1 S2 D		↑			
	DOR	DOR S D	· (D+1,D) ∨ (S+1,S) → (D+1,D)	⎍	*1 3	●	7-8
	DORP	DORP S D		↑			
	DOR	DOR S1 S2 D	· (S1+1,S1) ∨ (S2+1,S2) → (D+1,D)	⎍	*1 4	●	7-10
	DORP	DORP S1 S2 D		↑			
Exclusive OR	WXOR	WXOR S D	· (D) ⊻ (S) → (D)	⎍	3	●	7-12
	WXORP	WXORP S D		↑			
	WXOR	WXOR S1 S2 D	· (S1) ⊻ (S2) → (D)	⎍	4	●	7-14
	WXORP	WXORP S1 S2 D		↑			
	DXOR	DXOR S D	· (D+1,D) ⊻ (S+1,S) → (D+1,D)	⎍	*1 3	●	7-12
	DXORP	DXORP S D		↑			
	DXOR	DXOR S1 S2 D	· (S1+1,S1) ⊻ (S2+1,S2) → (D+1,D)	⎍	*1 4	●	7-14
	DXORP	DXORP S1 S2 D		↑			

*1: The number of steps may increase due to the conditions described in 3.6.

Table 2.13 Logical Operation Instructions (Continued)

Category	Instruction Symbols	Symbol	Processing Details	Execution Condition	Number of Basic Steps	Subset	See for Description
NON exclusive logical sum	WXNR	─┤ WXNR │ S │ D ├┤	· $\overline{(D)\veebar(S)}\rightarrow(D)$	⎍	3	●	7-16
	WXNRP	─┤ WXNRP │ S │ D ├┤		↑			
	WXNR	─┤ WXNR │ S1 │ S2 │ D ├┤	· $\overline{(S1)\veebar(S2)}\rightarrow(D)$	⎍	4	●	7-18
	WXNRP	─┤ WXNRP │ S1 │ S2 │ D ├┤		↑			
	DXNR	─┤ DXNR │ S │ D ├┤	· $\overline{(D+1,D)\veebar(S+1,S)}\rightarrow(D+1,D)$	⎍	*1 3	●	7-16
	DXNRP	─┤ DXNRP │ S │ D ├┤		↑			
	DXNR	─┤ DXNR │ S1 │ S2 │ D ├┤	· $\overline{(S1+1,S1)\veebar(S2+1,S2)}\rightarrow(D+1,D)$	⎍	*1 4	●	7-18
	DXNRP	─┤ DXNRP │ S1 │ S2 │ D ├┤		↑			

*1: The number of steps may increase due to the conditions described in 3.6.

2.6 QSCPU Dedicated Instruction

2.6.1 Forced control stop instruction

Table 2.14 Forced Control Stop Instruction

Category	Instruction Symbols	Symbol	Processing Details	Execution Condition	Number of Basic Steps	Subset	See for Description
Forced control stop	S.QSABORT	─┤ S.QSABORT │ S ├┤	• Stops program execution. • Places safety CPU module in the stop error state.	_⎍_	*1 7	–	8-2

*1: 8 steps when a constant is used.

3 CONFIGURATION OF INSTRUCTIONS

3.1 Configuration of Instructions

Most safety CPU module instructions consist of an instruction part and a device part.

Each part is used for the following purpose:

- Instruction part .. Indicates the function of the instruction.
- Device part........ Indicates the data that is to be used with the instruction.

The device part is classified into source data, destination data, and number of devices.

(1) Source (S)

(a) Source is the data used for operations.

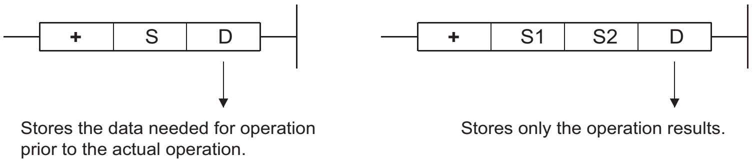
(b) The following source types are available, depending on the designated device:

- Constant .... Designates a numeric value to be used in the operation.
This is set when the program is created, and cannot be changed during the execution of the program.
- Bit devices and word devices .... Designates the device that stores the data to be used in the operation.
Data must be stored in the designated device until the operation is executed.
By changing the data stored in a designated device during program execution, the data to be used in the instruction can be changed.

(2) Destination (D)

(a) The destination stores the data after the operation has been conducted.
However, some instructions require storing the data to be used in an operation at the destination prior to the operation execution.

Example An addition instruction involving BIN 16-bit data

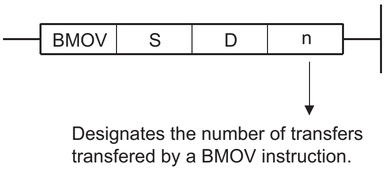

+
S
D
+
S1
S2
D
Stores the data needed for operation prior to the actual operation.
Stores only the operation results.

(b) A device for the data storage must always be set to the destination.

(3) Number of devices and number of transfers (n)

(a) The number of devices and number of transfers designate the numbers of devices and transfers used by instructions involving multiple devices.

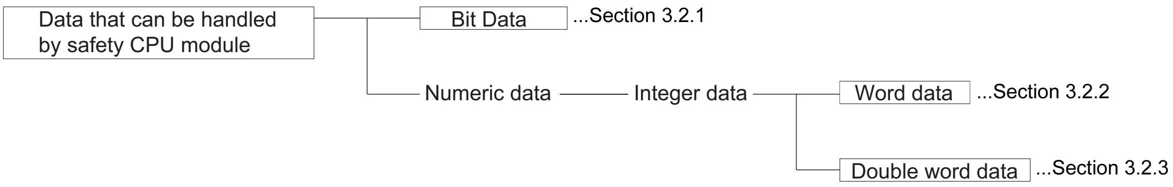
Example Block transfer instruction


BMOV
S
D
n
Designates the number of transfers transfered by a BMOV instruction.

(b) The number of devices or number of transfers can be set between 0 and 32767.
However, if the number is 0, the instruction will be a no-operation instruction.

3.2 Designating Data

The following three types of data can be used with safety CPU module instructions:



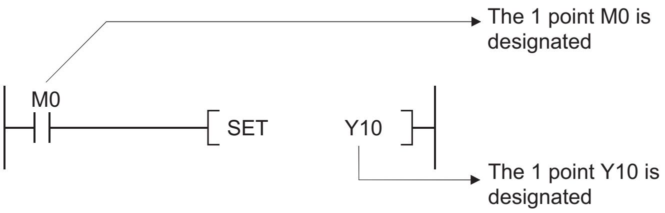
3.2.1 Using bit data

Bit data is data used in one-bit units, such as for contact points or coils.

"Bit devices" and "Bit designated word devices" can be used as bit data.

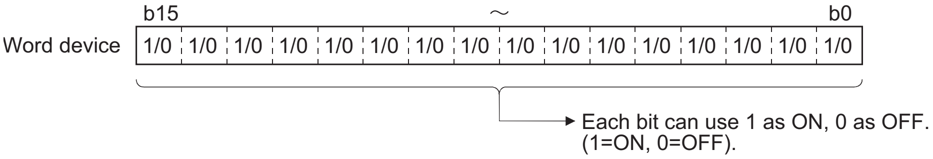
(1) When using bit devices

Bit devices are designated in one-point units.

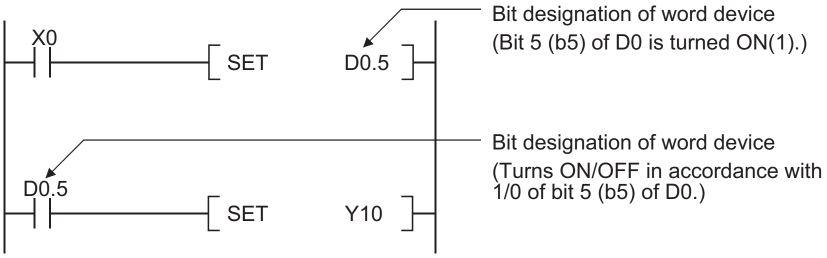


(2) Using word devices

(a) Word devices enable the use of a designated bit number 1/0 as bit data by the designation of that bit number.



(b) Word device bit designation is done by designating " **Word device** . **Bit No.** ". (Designation of bit numbers is done in hexadecimal.)
For example, bit 5 (b5) of D0 is designated as D0.5, and bit 10 (b10) of D0 is designated as D0.A.
However, there can be no bit designation for timers (T), retentive timers (ST) or counters (C). (Example: C0.0 is not available)


X0
SET
D0.5
Bit designation of word device
(Bit 5 (b5) of D0 is turned ON(1).)
D0.5
SET
Y10
Bit designation of word device
(Turns ON/OFF in accordance with 1/0 of bit 5 (b5) of D0.)

3.2.2 Using word (16 bits) data

Word data is 16-bit numeric data used by basic instructions and application instructions.

The following two types of word data can be used with safety CPU module:

- Decimal constants...................... K-32768 to K32767
- Hexadecimal constants.............. H0000 to HFFFF

Word devices and bit devices designated by digit can be used as word data.

(1) When Using Bit Devices

(a) Bit devices can deal with word data when digits are designated.

Digit designation of bit devices is done by designating " Number of digits Start number of bit device ".

Digit designation of bit devices can be done in 4-point (4-bit) units, and designation can be made for K1 to K4.

For example, if X0 is designated for digit designation, the following points would be designated:

- K1X0.......The 4 points X0 to X3 are designated
- K2X0.......The 8 points X0 to X7 are designated
- K3X0.......The 12 points X0 to XB are designated
- K4X0.......The 16 points X0 to XF are designated

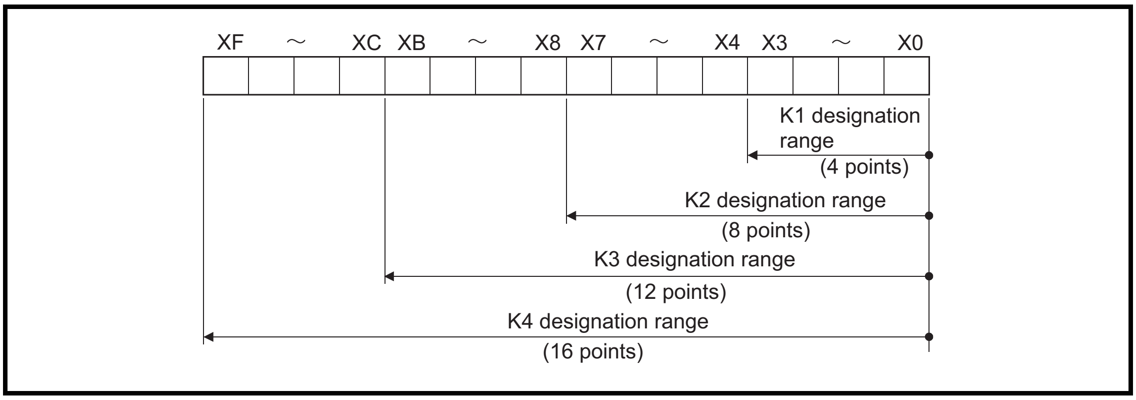

XF ~ XC XB ~ X8 X7 ~ X4 X3 ~ X0
K1 designation range (4 points)
K2 designation range (8 points)
K3 designation range (12 points)
K4 designation range (16 points)

Fig 3.1 Digit Designation Setting Range for 16-Bit Instruction

(b) In cases where digit designation has been made at the source (S), the numeric values shown in Table 3.1 are those which can be dealt with as source data.

Table 3.1 List of Numeric Values that Can Be Dealt with as Digit Designation

Number of Digits Designated	With 16-Bit Instruction
K1 (4 points)	0 to 15
K2 (8 points)	0 to 255
K3 (12 points)	0 to 4095
K4 (16 points)	–32768 to 32767

(c) When destination (D) data is a word device
The word device for the destination becomes 0 following the bit designated by digit designation at the source.

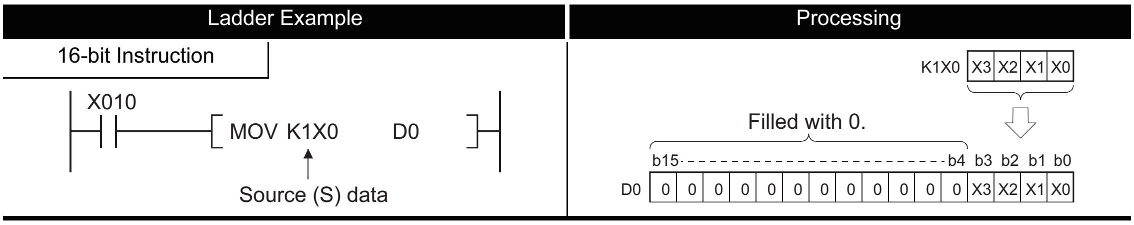


Fig 3.2 Ladder Example and Processing Conducted

(d) In cases where digit designation is made at the destination (D), the number of points designated are used as the destination.
Bit devices below the number of points designated as digits do not change.

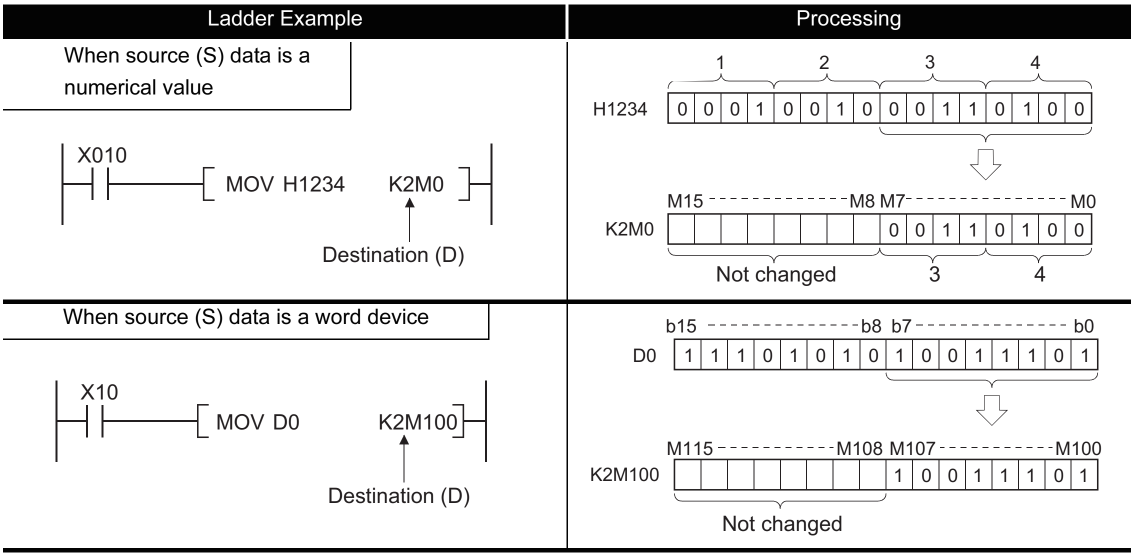
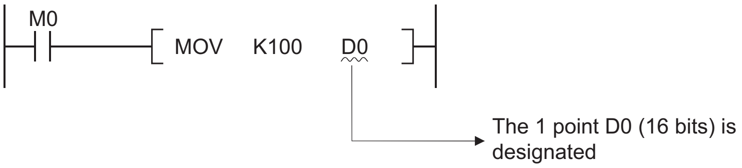


Fig 3.3 Ladder Example and Processing Conducted

(2) Using word devices

Word devices are designated in 1-point (16 bits) units.



☒POINT

When digit designation processing is conducted, a random value can be used for the bit device head device number.

3.2.3 Using double word (32 bits) data

Double word data is 32-bit numerical data used by basic instructions and application instructions.

The two types of double word data that can be dealt with by CPU module are as follows:

- Decimal constants...................... K–2147483648 to K2147483647
- Hexadecimal constants............. H00000000 to HFFFFFFFF

Word devices and bit devices designated by digit designation can be used as double word data.

(1) When Using Bit Devices

(a) Digit designation can be used to enable a bit device to deal with double word data.

Digit designation of bit devices is done by designating "Number of digits Start number of bit device".

Digit designation of bit devices can be done in 4-point (4-bit) units, and designation can be made for K1 to K8.

For example, if X0 is designated for digit designation, the following points would be designated:

- K1X0.. The 4 points X0 to X3 are designated
- K2X0.. The 8 points X0 to X7 are designated
- K3X0.. The 12 points X0 to XB are designated
- K4X0.. The 16 points X0 to XF are designated
- K5X0...The 20 points X0 to X13 are designated
- K6X0...The 24 points X0 to X17 are designated
- K7X0...The 28 points X0 to X1B are designated
- K8X0...The 32 points X0 to X1F are designated

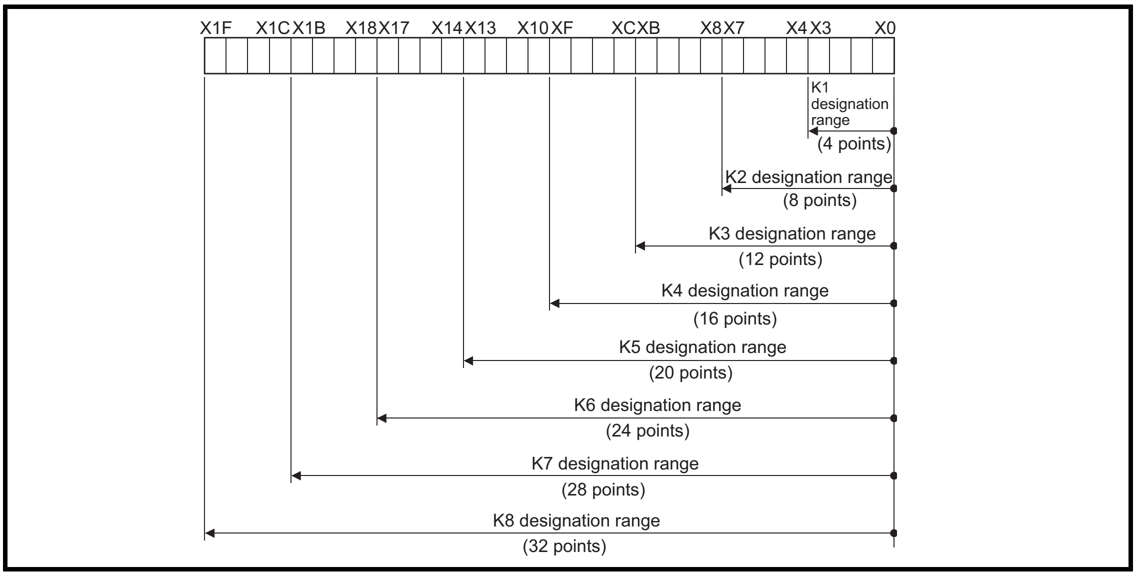


Fig 3.4 Digit Designation Setting Range for 32-Bit Instructions

(b) In cases where digit designation has been made at the source (S) , the numeric values shown in Table 3.2 are those which can be dealt with as source data.

Table 3.2 List of Numeric Values that Can Be Dealt with as Digit Designation

Number of Digits Designated	With 32 bit Instructions	Number of Digits Designated	With 32 bit Instructions
K1 (4 points)	0 to 15	K5 (20 points)	0 to 1048575
K2 (8 points)	0 to 255	K6 (24 points)	0 to 16777215
K3 (12 points)	0 to 4095	K7 (28 points)	0 to 268435455
K4 (16 points)	0 to 65535	K8 (32 points)	–2147483648 to 2147483647

(c) When destination (D) data is a word device
The word device for the destination becomes 0 following the bit designated by digit designation at the source.

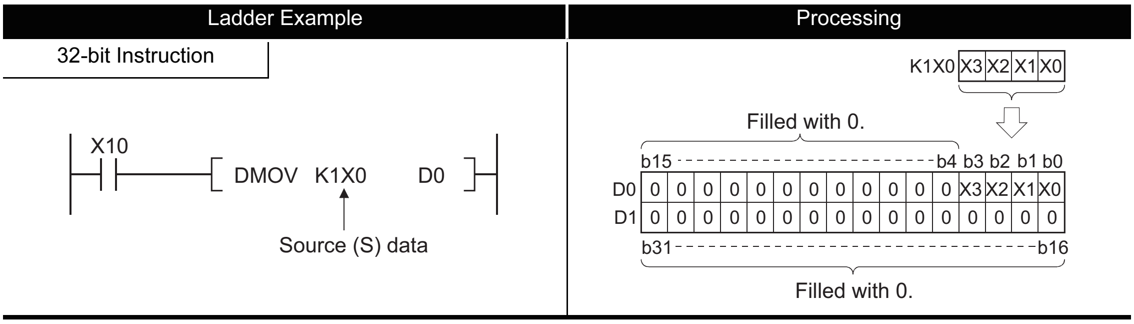


Fig 3.5 Ladder Example and Processing Conducted

(d) In cases where digit designation is made at the destination (D), the number of points designated are used as the destination.
Bit devices below the number of points designated as digits do not change.

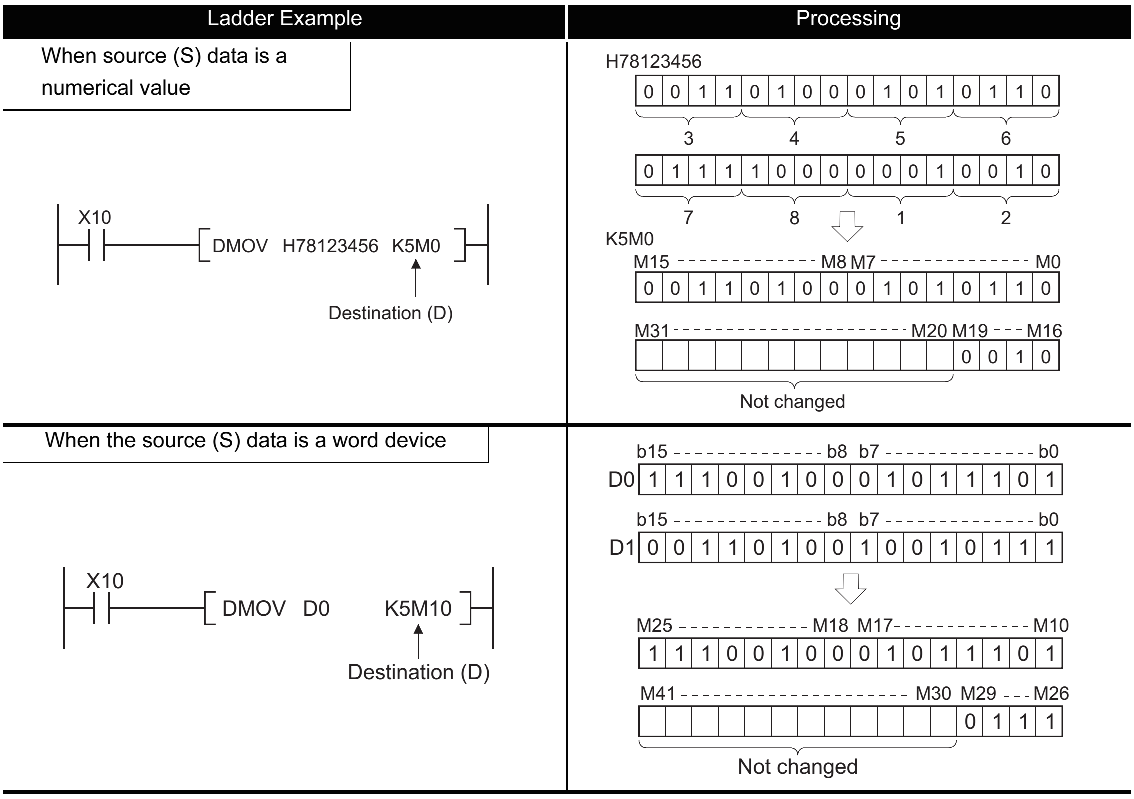


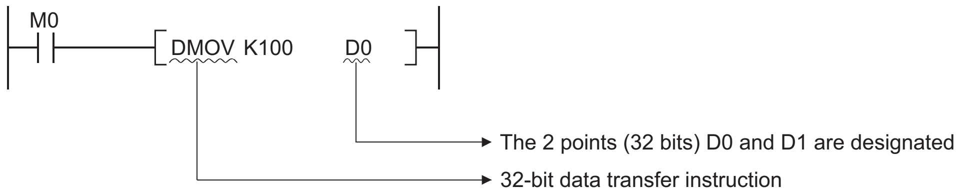
Fig 3.6 Ladder Example and Processing Conducted

☒POINT

When digit designation processing is conducted, a random value can be used for the bit device head device number.

(2) Using word devices

A word device designates devices used by the lower 16 bits of data.
A 32-bit instruction uses (designation device number) and (designation device number + 1).


M0
DMOV K100 D0
The 2 points (32 bits) D0 and D1 are designated
32-bit data transfer instruction

3.3 Subset Processing

Subset processing is used to place limits on bit devices used by basic instructions and application instructions in order to increase processing speed.

However, the instruction symbol does not change.

To shorten scans, run instructions under the conditions indicated below.

(1) Conditions which each device must meet for subset processing

(a) When using word data

Device	Condition
Bit device	• Designates a bit device number in a factor of 16 • Only K4 can be designated for digit designation.
Word device	• Internal Device
Constants	• No limitations

(b) When using double word data

Device	Condition
Bit device	• Designates a bit device number in a factor of 16 • Only K8 can be designated for digit designation.
Word device	• Internal Device
Constants	• No limitations

(2) Instructions for which subset processing can be used

Types of Instructions	Instruction Symbols
Comparison operation instruction	• ＝, ＜＞, ＜, ＜=, ＞, ＞=, D＝, D＜＞, D＜, D＜=, D＞, D＞=
Arithmetic operation	• +, －, ＊, /, INC, DEC, D+, D－, D＊, D/, DINC, DDEC
Data conversion instructions	• BCD, BIN, DBCD, DBIN
Data transfer instruction	• MOV, DMOV, CML, DCML • FMOV, BMOV
Logic operations	• WAND, DAND, WOR, DOR, WXOR, DXOR, WXNR, DXNR

3.4 Cautions on Programming (Operation Errors)

Operation errors are returned in the following cases when executing basic instructions, application instructions and QSCPU dedicated instructions with safety CPU module:

- An error listed on the explanatory page for the individual instruction occurred.

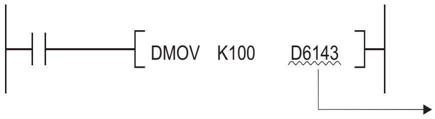
(1) Device range check

Device range checks for the devices used by basic instructions and application instructions in safety CPU module are as indicated below:

(a) No device range check is made for instructions dealing with fixed-length devices (MOV, DMOV, etc.).

In cases where the corresponding device range is exceeded, data is written to other devices.[*1]

For example, in a case where the data register has been allocated 6 k points, there will be no error even if it exceeds D6143.

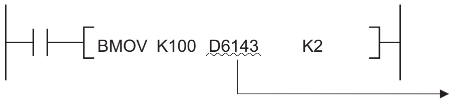


D6143 and D6144 are designated, but since D6144 does not exist, data in other device will be destroyed.

(b) Device range checks are conducted for instructions dealing with variable-length devices (BMOV, FMOV, and others which designate transfer numbers).

In cases where the corresponding device range has been exceeded, an operation error will be returned.

For example, in a case where the data register has been allocated 6 k points, there will be an error if it exceeds D6143.



D6143 and D6144 are designated but since D6144 does not an operation error is returned.

*1: See the figure below for the internal user device assignment order.

	SM
Head address (fixed)	X
	Y
	M
	B
	F
	SB
	V
	Contact and coil of T
	Contact and coil of ST
	Contact and coil of C
	Present value of T
	Present value of ST
	Present value of C
	D
	W
	Empty area
	SW
	SD

Remark

Refer to the manual below for how to change the internal user device allocation:

- QSCPU User's Manual (Function Explanation, Program Fundamentals)

(2) Device data check

Device data checks for the devices used by basic instructions and application instructions in safety CPU module are as indicated below:

(a) When using BIN data
No error is returned even if the operation results in overflow or underflow.
The carry flag does not go on at such times, either.

(b) When using BCD data
1) Each digit is check for BCD value (0 to 9).
An operation error is returned if individual digits are outside the 0 to 9 (A to F) range.
2) No error is returned even if the operation results in overflow or underflow.
The carry flag does not go on at such times, either.

3.5 Conditions for Execution of Instructions

The following four types of execution conditions exist for the execution of safety CPU module sequence instructions, basic instructions, application instructions and QSCPU dedicated instructions:

- Non-conditional execution..... Instructions executed without regard to the ON/OFF status of the device

  Example LD X0, OUT Y10
- Executed at ON..................... Instructions executed while input condition is ON

  Example MOV instruction, FMOV instruction
- Executed at leading edge...... Instructions executed only at the leading edge of the input condition (when it goes from OFF to ON)

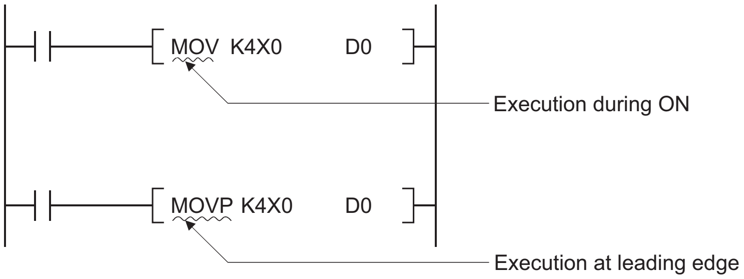
  Example PLS instruction, MOVP instruction
- Executed at trailing edge....... Instructions executed only at the trailing edge of the input condition (when it goes from ON to OFF)

  Example PLF instruction

For coil or equivalent basic instructions or application instructions, where the same instruction can be designated for either execution at ON or leading edge execution, a "P" is added after the instruction name to specify the condition for execution.

- Instruction to be executed at ON Instruction
- Instruction to be executed at leading edge Instruction + P

Execution at ON and execution at leading edge for the MOV instruction are designated as follow:

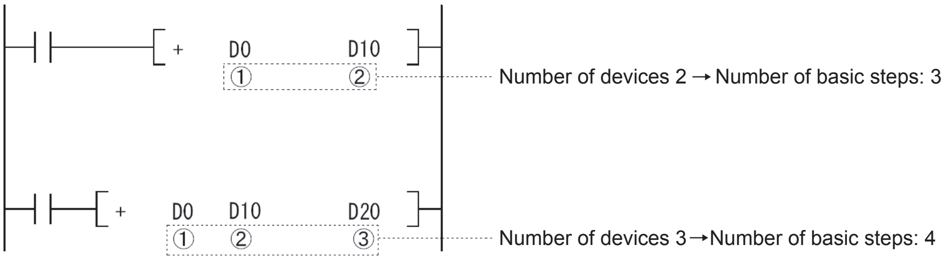


3.6 Counting Step Number

The number of steps in basic instructions and application instructions of the safety CPU module may increase depending on the devices to be used.

(1) Counting the number of basic steps

The basic number of steps for basic instructions and application instructions is calculated by adding the device number and 1.
For example, the "+ instruction" would be calculated as follows:

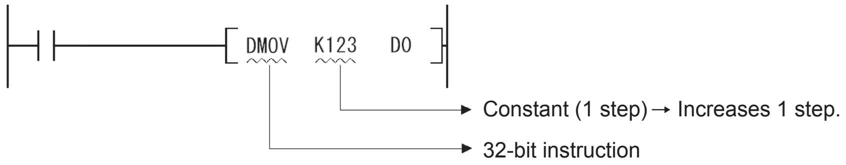

+ D0 D10
① ②
Number of devices 2 → Number of basic steps: 3
+ D0 D10 D20
① ② ③
Number of devices 3 → Number of basic steps: 4

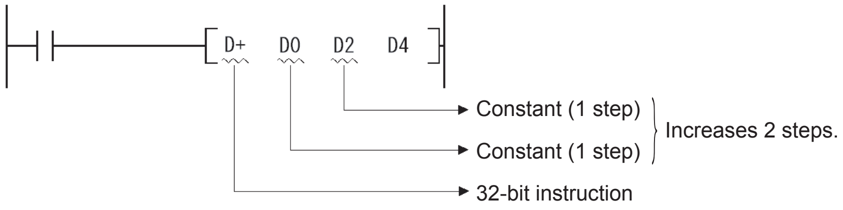
(2) Conditions for increasing the number of steps

In the following case, the number of steps increases over the number of basic steps.

- When a constant is used in device designation with a 32-bit instruction.

Example





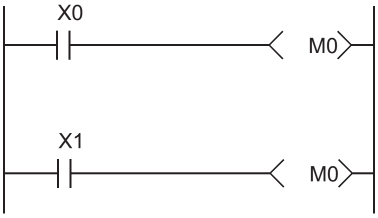
3.7 Operation when OUT, SET/RST, or PLS/PLF Instructions Use the Same Device

The following describes the operation for executing multiple instructions of OUT, SET/RST, or PLS/PLF that use the same device in one scan.

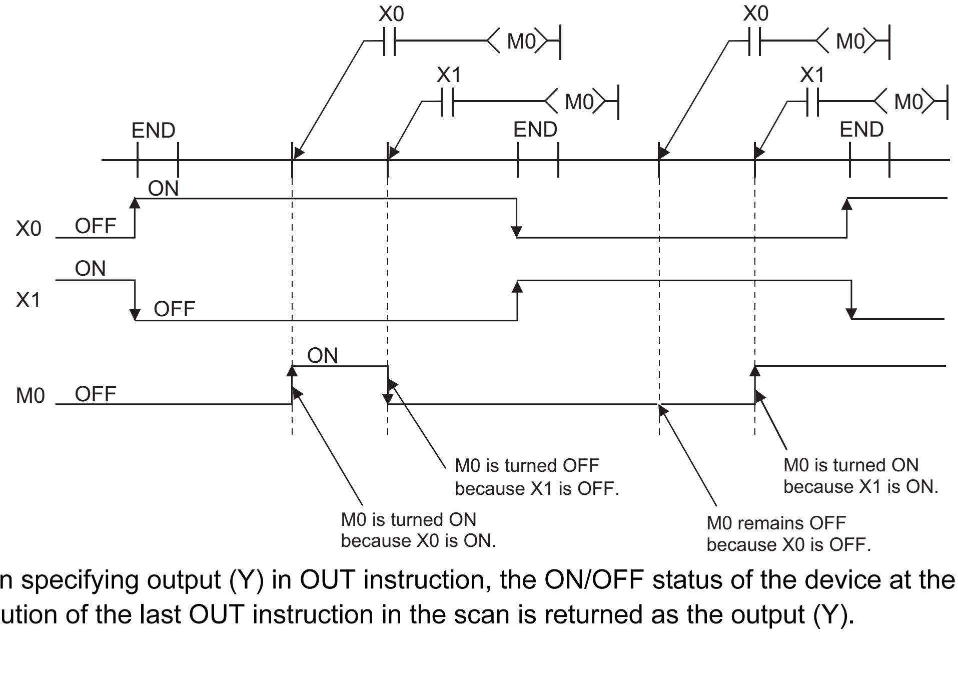
(1) OUT instructions using the same device

Do not program more than one OUT instruction using the same device in one scan.
If the OUT instructions using the same device are programmed in one scan, the specified device will turn ON or OFF every time the OUT instruction is executed, depending on the operation result of the program up to the relevant OUT instruction.
Since turning ON or OFF of the device is determined when each OUT instruction is executed, the device may turn ON and OFF repeatedly during one scan.
The following diagram shows an example of a circuit that turns the same internal relay (M0) with inputs X0 and X1 ON and OFF.

[Circuit]



[Timing Chart]



When specifying output (Y) in OUT instruction, the ON/OFF status of the device at the execution of the last OUT instruction in the scan is returned as the output (Y).

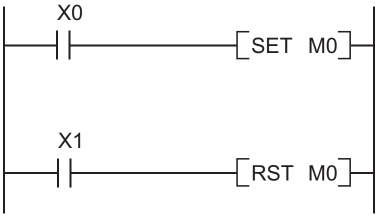
(2) SET/RST instructions using the same device

(a) The SET instruction turns ON the specified device when the execution command is ON and performs nothing when the execution command is OFF.
For this reason, when SET instructions using the same device are executed two or more times in one scan, the specified device will be ON if any one of the execution commands is ON.

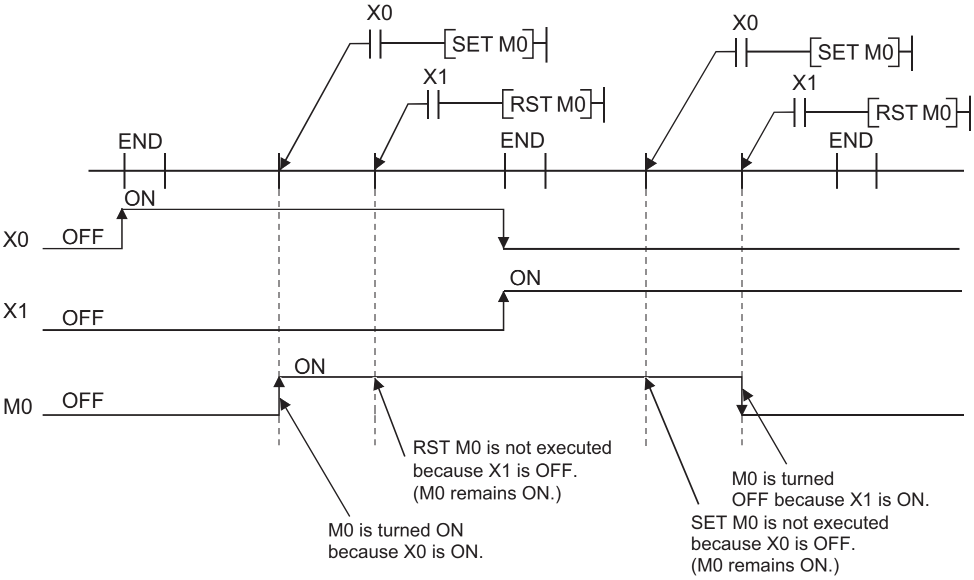
(b) The RST instruction turns OFF the specified device when the execution command is ON and performs nothing when the execution command is OFF.
For this reason, when RST instructions using the same device are executed two or more times in one scan, the specified device will be OFF if any one of the execution commands is ON.

(c) When the SET instruction and RST instruction using the same device are programmed in one scan, the SET instruction turns ON the specified device when the SET execution command is ON and the RST instruction turns OFF the specified device when the RST execution command is ON.
When both the SET and RST execution commands are OFF, the ON/OFF status of the specified device will not be changed.

[Circuit]



[Timing Chart]

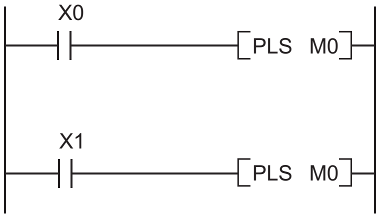

X0
SET M0
X1
RST M0
X0
SET M0
X1
RST M0
END
END
END
ON
X0
OFF
ON
X1
OFF
ON
M0
OFF
RST M0 is not executed because X1 is OFF. (M0 remains ON.)
M0 is turned ON because X0 is ON.
M0 is turned OFF because X1 is ON.
SET M0 is not executed because X0 is OFF. (M0 remains ON.)

When specifying output (Y) in SET/RST instruction, the ON/OFF status of the device at the execution of the last instruction in the scan is returned as the output (Y).

(3) PLS instructions using the same device

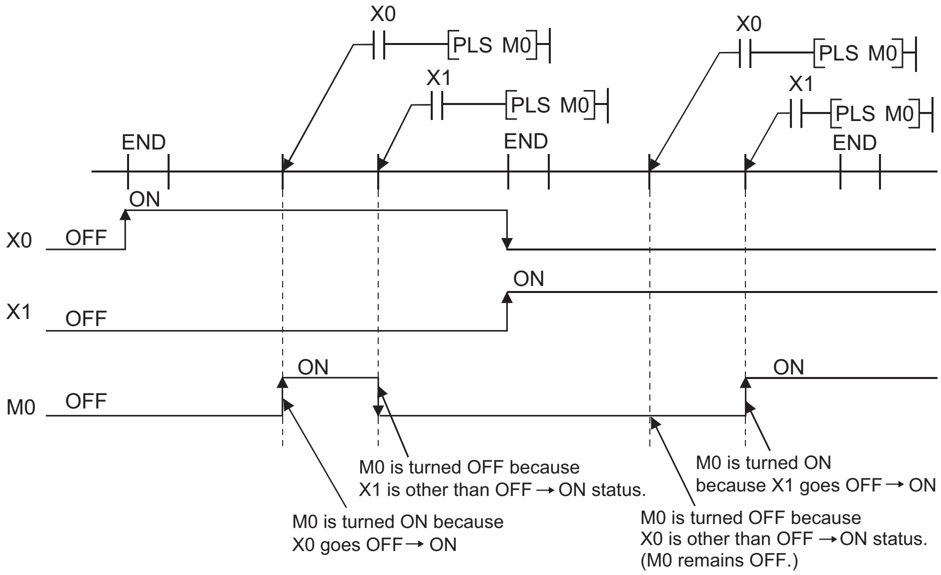
The PLS instruction turns ON the specified device when the execution command is turned ON from OFF.
It turns OFF the device at any other time (OFF to OFF, ON to ON, or ON to OFF).
If two or more PLS instructions using the same device are executed in one scan, each instruction turns ON the device when the corresponding execution command is turned ON from OFF and turns OFF the device in other cases.
For this reason, if multiple PLS instructions using the same device are executed in a single scan, a device that has been turned ON by a PLS instruction may not be turned ON during one scan.

[Circuit]

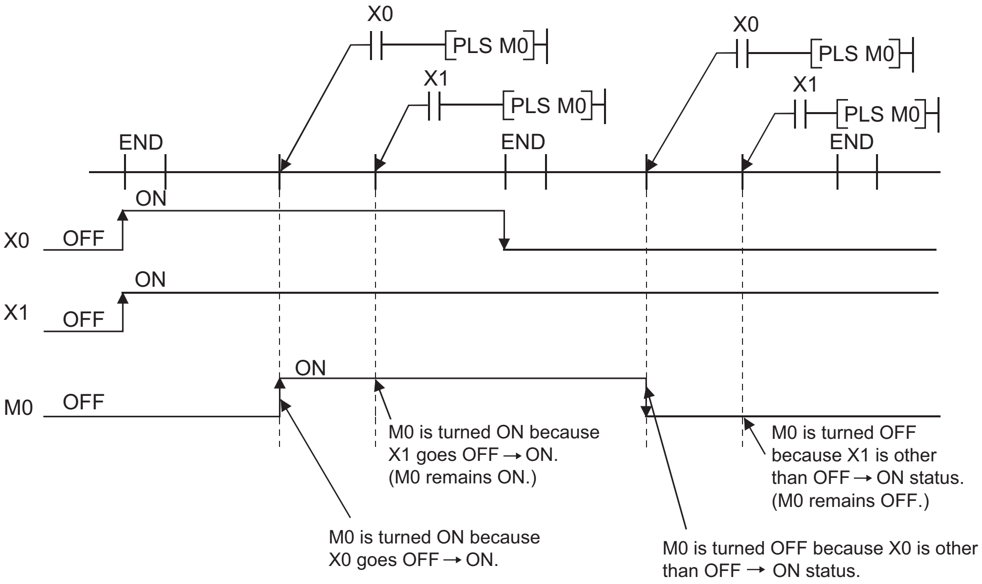


[Timing Chart]

- The ON/OFF timing of the X0 and X1 is different. (The specified device does not turn ON throughout the scan.)



- The X0 and X1 turn ON from OFF at the same time.


X0
PLS M0
X1
PLS M0
END
X0
PLS M0
X1
PLS M0
END
END
X0
OFF
ON
X1
OFF
ON
M0
OFF
ON
M0 is turned ON because X1 goes OFF → ON. (M0 remains ON.)
M0 is turned OFF because X1 is other than OFF → ON status. (M0 remains OFF.)
M0 is turned ON because X0 goes OFF → ON.
M0 is turned OFF because X0 is other than OFF → ON status.

When specifying output (Y) in PLS instructions, the ON/OFF status of the device at the execution of the last PLS instruction in the scan is returned as the output (Y).

(4) PLF instructions using the same device

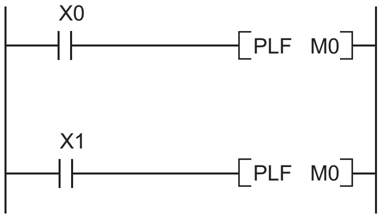
The PLF instruction turns ON the specified device when the execution command is turned OFF from ON.

It turns OFF the device at any other time (OFF to OFF, OFF to ON, or ON to ON).

If two or more PLF instructions using the same device are executed in one scan, each instruction turns ON the device when the corresponding execution command is turned OFF from ON and turns OFF the device in other cases.

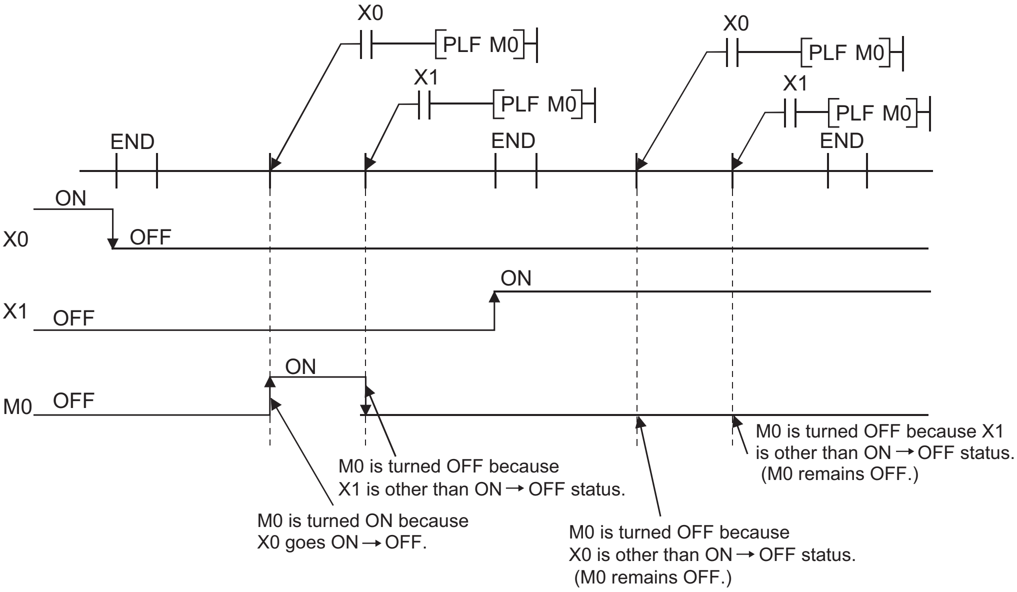
For this reason, if multiple PLF instructions using the same device are executed in a single scan, a device that has been turned ON by a PLF instruction may not be turn ON during one scan.

[Circuit]

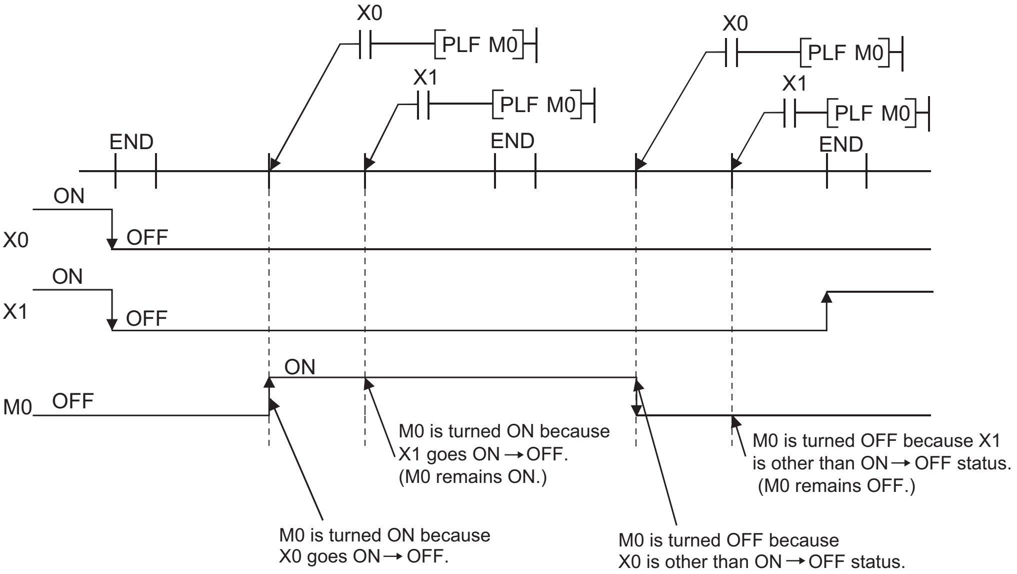


[Timing Chart]

- The ON/OFF timing of the X0 and X1 is different. (The specified device does not turn ON throughout the scan.)


X0
[PLF M0]
X1
[PLF M0]
X0
[PLF M0]
X1
[PLF M0]
END
END
END
ON
X0
OFF
ON
X1
OFF
ON
M0
OFF
M0 is turned OFF because X1 is other than ON → OFF status. (M0 remains OFF.)
M0 is turned OFF because X1 is other than ON → OFF status.
M0 is turned ON because X0 goes ON → OFF.
M0 is turned OFF because X0 is other than ON → OFF status. (M0 remains OFF.)

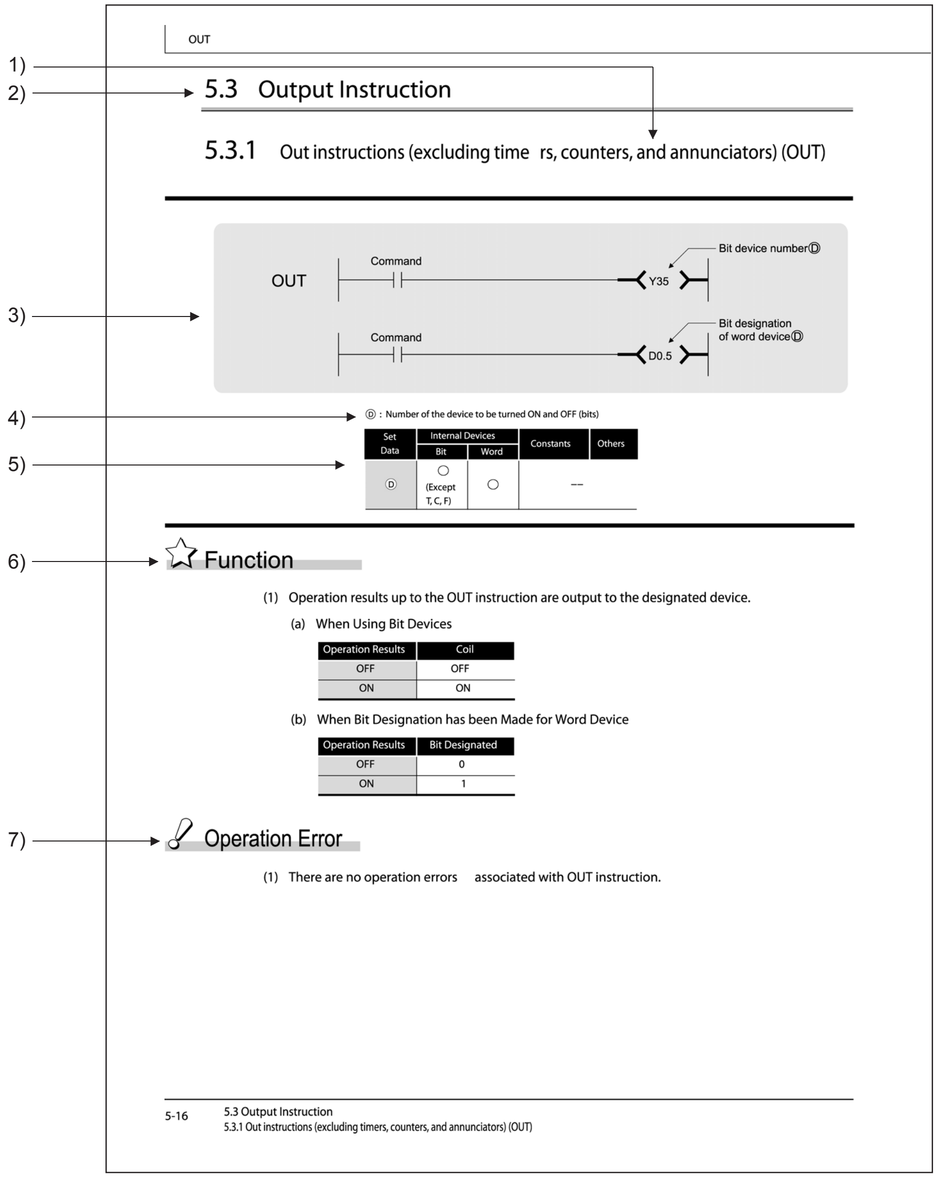
- The X0 and X1 turn OFF from ON at the same time.


X0
[PLF M0]
X1
[PLF M0]
X0
[PLF M0]
X1
[PLF M0]
END
END
END
ON
X0
OFF
ON
X1
OFF
ON
M0
OFF
M0 is turned ON because X1 goes ON → OFF. (M0 remains ON.)
M0 is turned OFF because X1 is other than ON → OFF status. (M0 remains OFF.)
M0 is turned ON because X0 goes ON → OFF.
M0 is turned OFF because X0 is other than ON → OFF status.

When specifying output (Y) in PLF instructions, the ON/OFF status of the device at the execution of the last PLF instruction in the scan is returned as the output (Y).

4 HOW TO READ INSTRUCTIONS

The description of instructions that are contained in the following chapters are presented in the following format.



OUT

5.3 Output Instruction

5.3.1 Out instructions (excluding time rs, counters, and annunciators) (OUT)

Ⓓ : Number of the device to be turned ON and OFF (bits)

Set Data	Internal Devices		Constants	Others
	Bit	Word		
Ⓓ	○ (Except T, C, F)	○	—	

Function

(1) Operation results up to the OUT instruction are output to the designated device.

(a) When Using Bit Devices

Operation Results	Coil
OFF	OFF
ON	ON

(b) When Bit Designation has been Made for Word Device

Operation Results	Bit Designated
OFF	0
ON	1

Operation Error

(1) There are no operation errors associated with OUT instruction.

5-16 5.3 Output Instruction
5.3.1 Out instructions (excluding timers, counters, and annunciators) (OUT)

1) Code used to write instruction (instruction symbol).

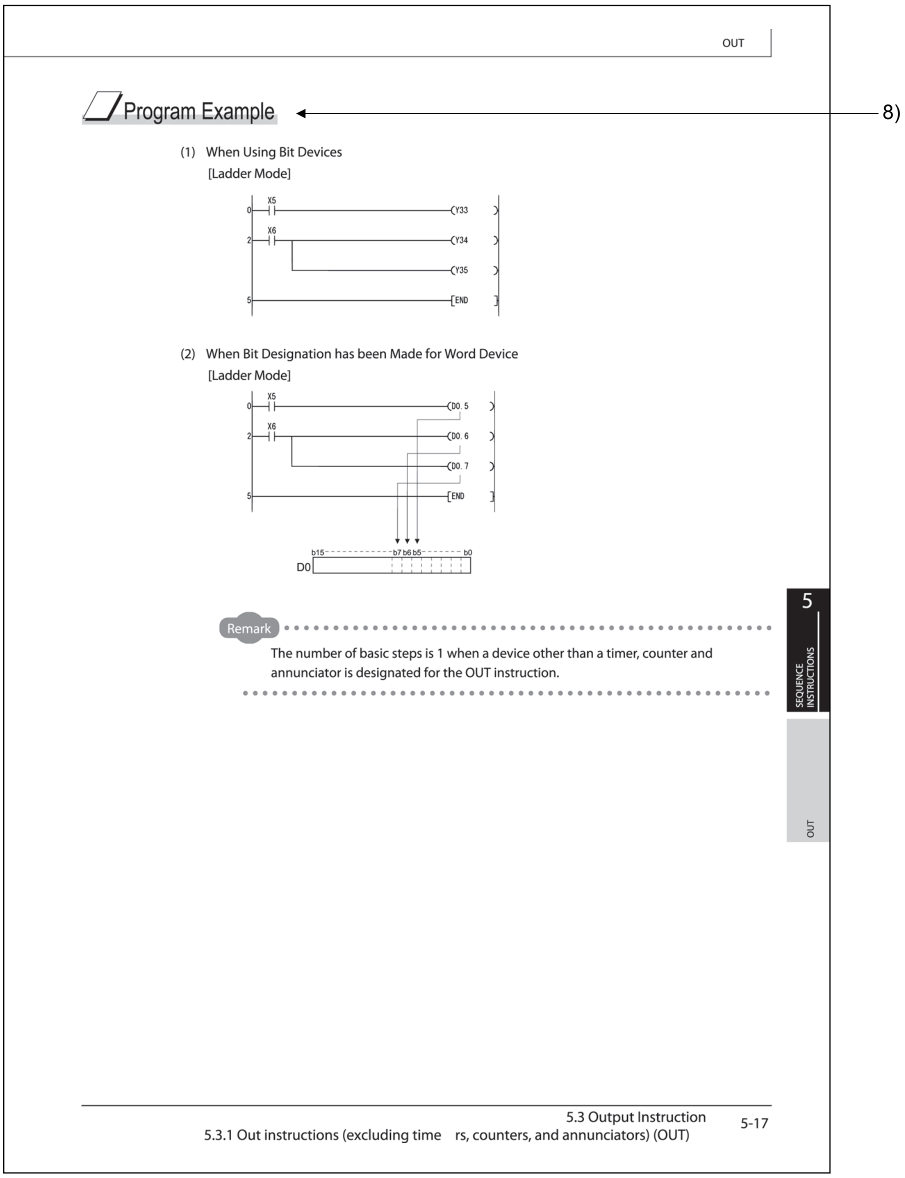
2) Section number and general category of instructions being discussed.

3) Indicates ladder mode expressions and execution conditions for instructions.

Execution Condition	Non-conditional Execution	Executed while ON	Executed One Time at ON	Executed One Time at OFF
Code recorded on description page	No symbol recorded	⎍	↑	↓

4) Discusses the data set for each instruction and the data type.

Data Type	Meaning
Bit	Bit data or start number of bit device
BIN 16 bits	BIN 16-bit data or start number of word device
BIN 32 bits	BIN 32-bit data or start number of double word device
BCD 4-digit	4-digit BCD data
BCD 8-digit	8-digit BCD data



OUT

Program Example

8)

(1) When Using Bit Devices
[Ladder Mode]

(2) When Bit Designation has been Made for Word Device
[Ladder Mode]

Remark

The number of basic steps is 1 when a device other than a timer, counter and annunciator is designated for the OUT instruction.

5
SEQUENCE INSTRUCTIONS

OUT

5.3 Output Instruction
5.3.1 Out instructions (excluding time rs, counters, and annunciators) (OUT) 5-17

5) Devices which can be used by the instruction in question are indicated with circle. The types of devices that can be used are as indicated below:

Device Type	Internal Devices (System, User)		Constant *3	Others *3
	Bit	Word		
Applicable devices *1	X, Y, M SM, F, B, SB,	T, ST, C, *2 D, W, SD, SW	K, H	N, V

*1: Refer to the manual below for the description for the individual devices.
- QSCPU User's Manual (Function Explanation, Program Fundamentals)

*2: When T, ST and C are used for other than the instructions below, only word data can be used. (Bit data cannot be used.)
[Instructions that can be used with bit data]
LD, LDI, AND, ANI, OR, ORI, LDP, LDF, ANDP, ANDF, ORP, ORF, OUT, RST

*3: Devices which can be set are described in the "Constant" and the "Others" columns.

6) Indicates the function of the instruction.

7) Indicates conditions under which error is returned, and error number.

8) Indicates simple program examples.
Also indicates the types of individual devices used when the program is executed.

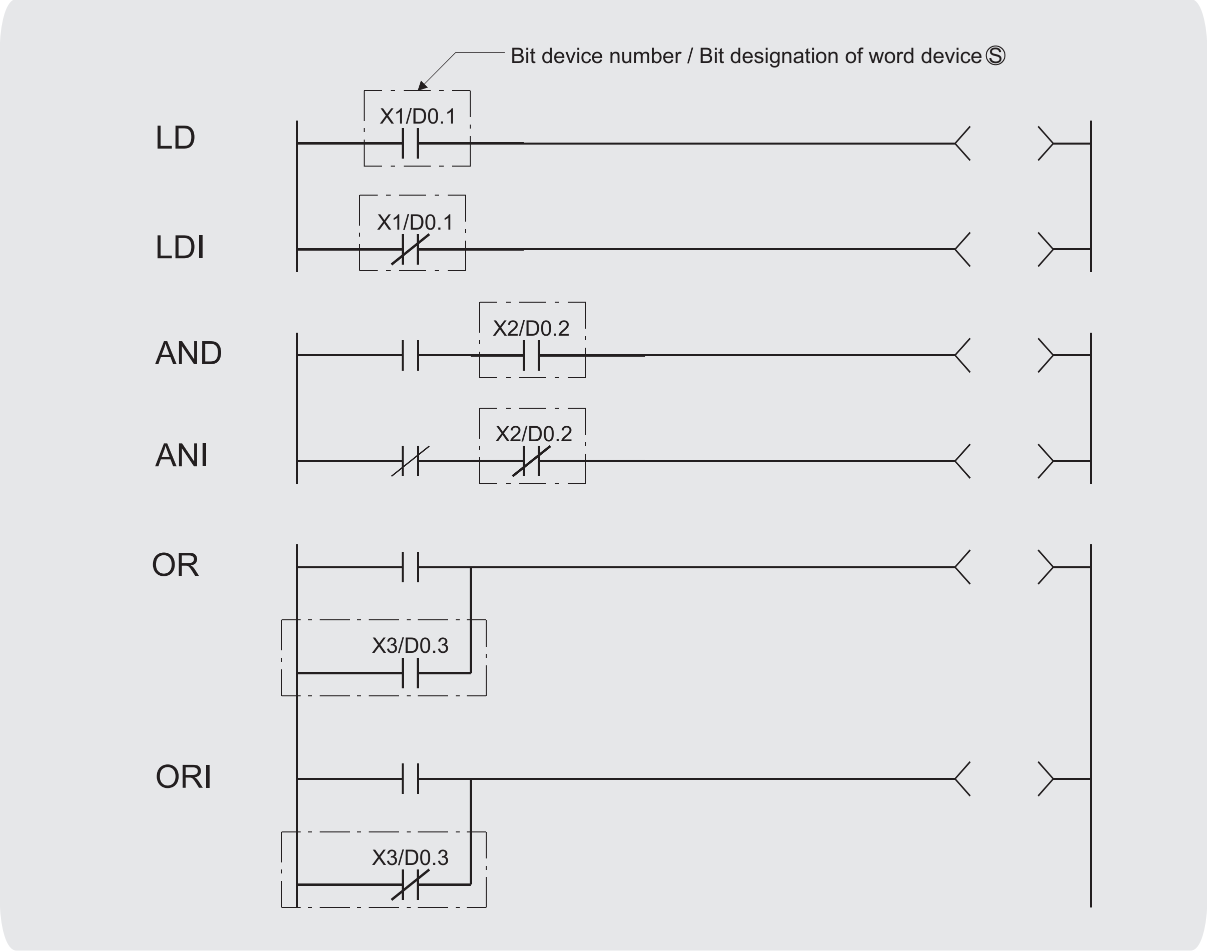
MEMO

5 SEQUENCE INSTRUCTIONS

Category	Processing Details	Reference section
Contact instruction	Operation start, series connection, parallel connection	5.1
Connection instructions	Ladder block connection, creation of pulses from operation results, store/read operation results	5.2
Output instruction	Bit device output, output reversal	5.3
Master control instruction	Master control	5.4
Termination instruction	Program termination	5.5
Other instructions	Instructions such as no operation which do not fit in the above categories	5.6

5.1 Contact Instruction

5.1.1 Operation start, series connection, parallel connection (LD, LDI, AND, ANI, OR, ORI)



Ⓢ : Devices used as contacts (bits)

Set Data	Internal Devices		Constants	Others
	Bit	Word		
Ⓢ	○		—	

Function

LD, LDI

(1) LD is the A contact operation start instruction, and LDI is the B contact operation start instruction. They read ON/OFF information from the designated device[*1], and use that as an operation result.

[*1] When a bit designation is made for a word device, the device turns ON or OFF depending on the 1/0 status of the designated bit.

AND, ANI

(1) AND is the A contact series connection instruction, and ANI is the B contact series connection instruction. They read the ON/OFF data of the designated bit device[*2], perform an AND operation on that data and the operation result to that point, and take this value as the operation result.

[*2] When a bit designation is made for a word device, the device turns ON or OFF depending on the 1/0 status of the designated bit.

(2) There are no restrictions on the use of AND or ANI, but the following applies to the ladder mode of the GX Developer:

(a) Write.... When AND and ANI are connected in series, a ladder with up to 24 stages can be displayed.
(b) Read ... When AND and ANI are connected in series, a ladder with up to 24 stages can be displayed. If the number exceeds 24 stages, up to 24 will be displayed.

OR, ORI

(1) OR is the A contact single parallel connection instruction, and ORI is the B contact single parallel connection instruction. They read ON/OFF information from the designated device[*3], and perform an OR operation with the operation results to that point, and use the resulting value as the operation result.

[*3] When a bit designation is made for a word device, the device turns ON or OFF depending on the 1/0 status of the designated bit.

(2) There are no restrictions on the use of OR or ORI, but the following applies to the ladder mode of the GX Developer

(a) Write.... OR and ORI can be used to create connections of up to 23 ladders.
(b) Read ... OR and ORI can be used to create connections of up to 23 ladders. The 24th or subsequent ladders cannot be displayed properly.

Remark

Word device bit designations are made in hexadecimal.
Bit b11 of D0 would be D0.0B.
See 3.2.1 for more information on word device bit designation.

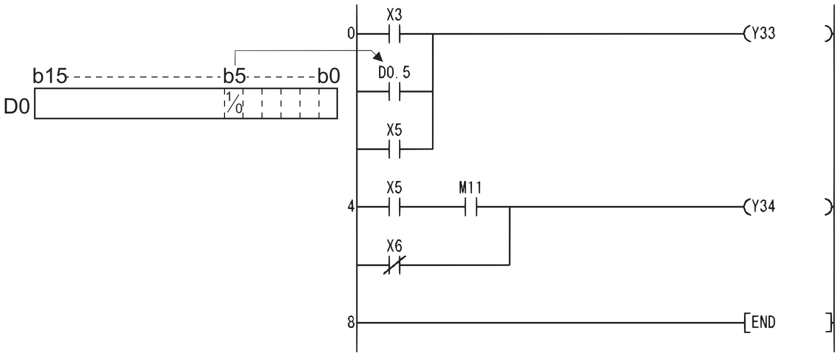
Operation Error

(1) There are no operation errors with LD, LDI, AND, ANI, OR, or ORI instructions.

Program Example

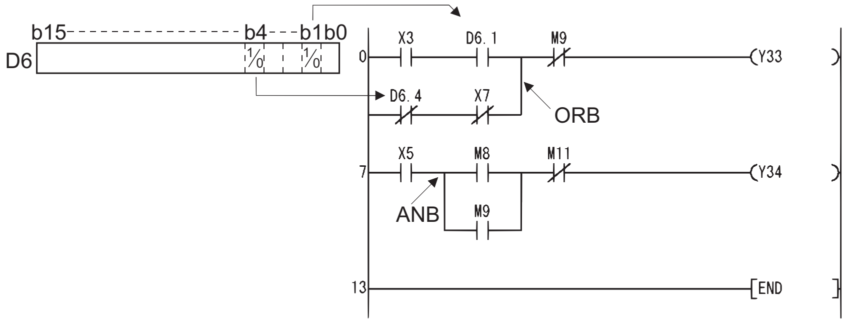
(1) A program using LD, AND, OR, and ORI instructions.

[Ladder Mode]



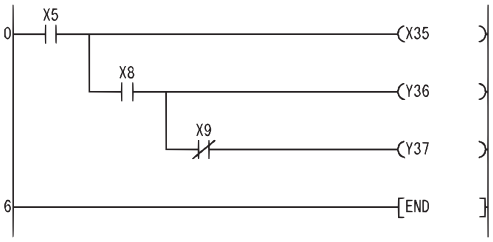
(2) A program linking contact points established through the use of ANB and ORB instructions.

[Ladder Mode]

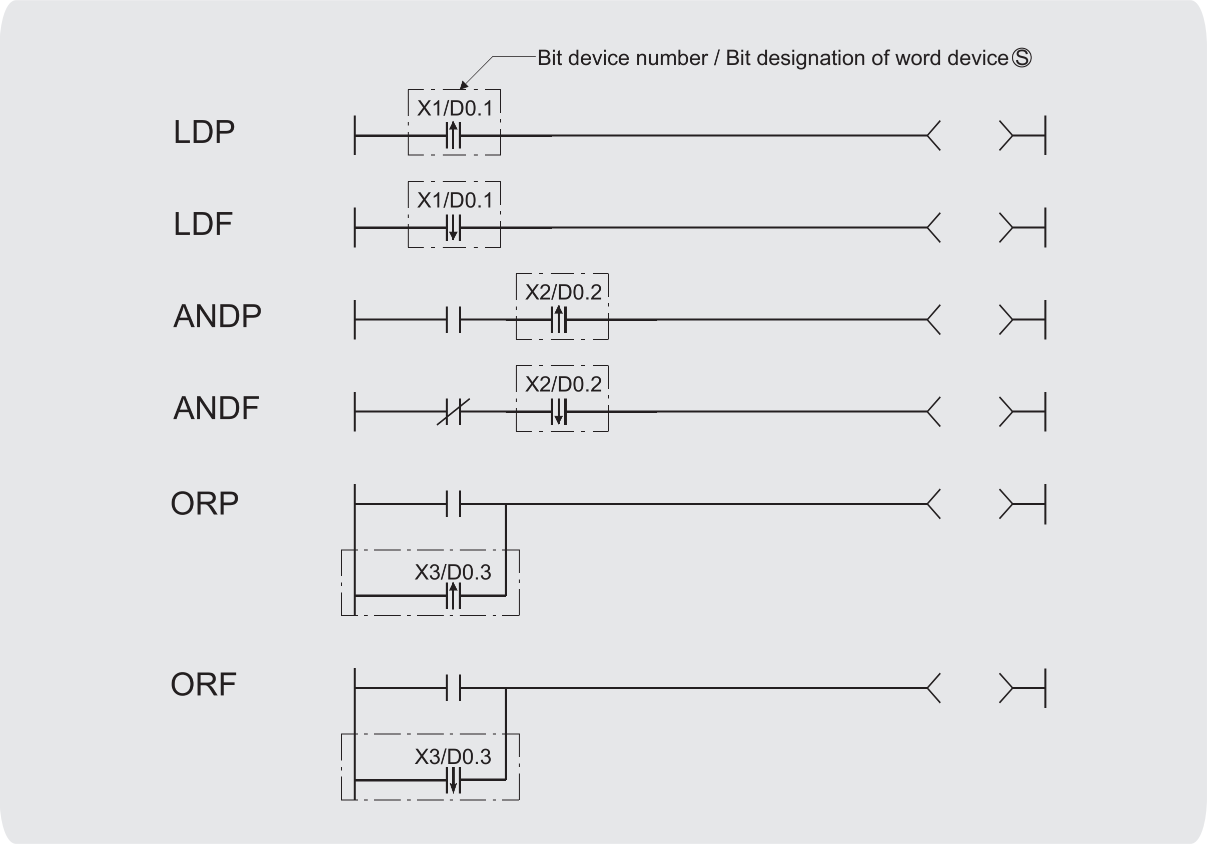


(3) A parallel program with OUT instruction.

[Ladder Mode]



5.1.2 Pulse operation start, pulse series connection, pulse parallel connection (LDP, LDF, ANDP, ANDF, ORP, ORF)



Ⓢ : Devices used as contacts (bits)

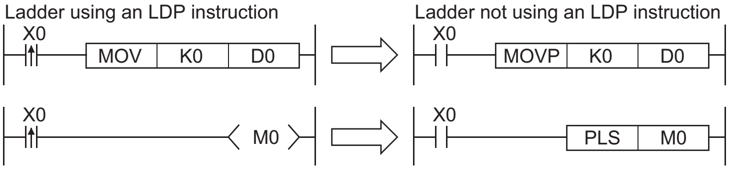
Set Data	Internal Devices		Constants	Others
	Bit	Word		
Ⓢ	○		—	

☆ Function

LDP, LDF

(1) LDP is the leading edge pulse operation start instruction, and is ON only at the leading edge of the designated bit device (when it goes from OFF to ON). If a word device has been designated, it is ON only when the designated bit changes from 0 to 1.

In cases where there is only an LDP instruction, it acts identically to instructions for the creation of a pulse that are executed during ON (⬚ P).


Ladder using an LDP instruction
X0
MOV
K0
D0
X0
M0
Ladder not using an LDP instruction
X0
MOVP
K0
D0
X0
PLS
M0

(2) LDF is the trailing edge pulse operation start instruction, and is ON only at the trailing edge of the designated bit device (when it goes from ON to OFF).

If a word device has been designated, it is ON only when the designated bit changes from 1 to 0.

ANDP, ANDF

(1) ANDP is a leading edge pulse series connection instruction, and ANDF is a trailing edge pulse series connection instruction. They perform an AND operation with the operation result to that point, and take the resulting value as the operation result.

The ON/OFF data used by ANDP and ANDF are indicated in the table below:

Device specified in ANDP or ANDF		ANDP State	ANDF State
Bit device	Bit designated for word device		
OFF to ON	0 to 1	ON	OFF
OFF	0	OFF	
ON	1		
ON to OFF	1 to 0		ON

ORP, ORF

(2) ORP is a leading edge pulse parallel connection instruction, and ORF is a trailing edge pulse serial connection instruction. They perform an OR operation with the operation result to that point, and take the resulting value as the operation result.

The ON/OFF data used by ORP and ORF are indicated in the table below:

Device designated in ORP or ORF		ORP State	ORF State
Bit device	Bit designated for word device		
OFF to ON	0 to 1	ON	OFF
OFF	0	OFF	
ON	1		
ON to OFF	1 to 0		ON

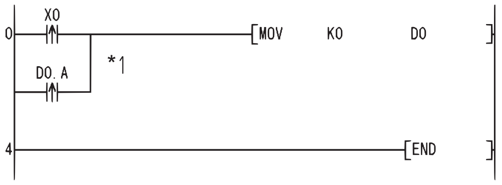
Operation Error

(1) There are no operation errors with LDP, LDF, ANDP, ANDF, ORP, or ORF instructions.

Program Example

(1) The following program executes the MOV instruction at input X0, or at the leading edge of b10 (bit 11) of data register D0:

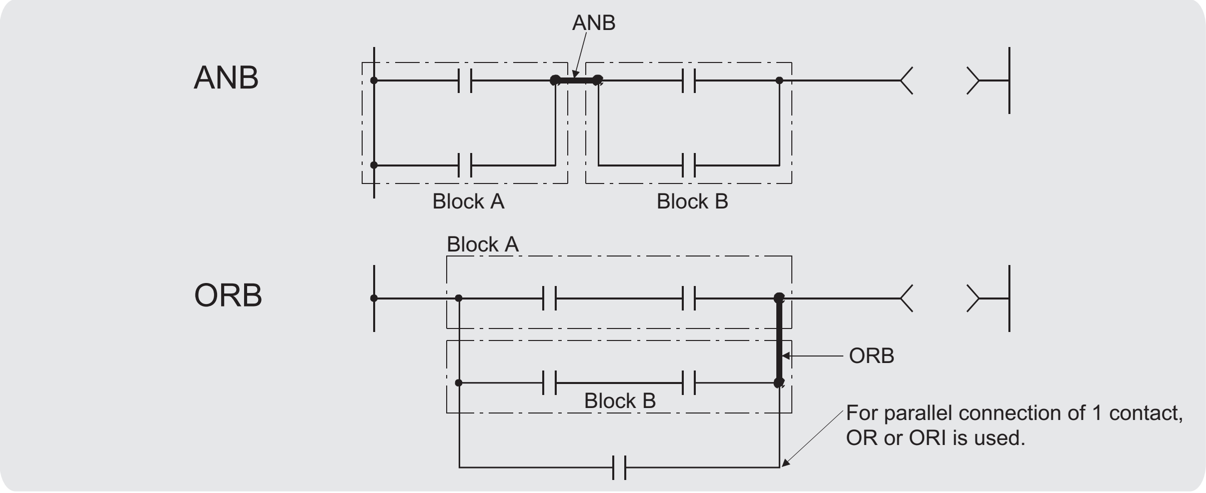
[Ladder Mode]



*1: Word device bit designations are performed in hexadecimal.
Bit b10 of D0 would be D0.A.

5.2 Connection Instructions

5.2.1 Ladder block series connections and parallel connections (ANB, ORB)



Set Data	Internal Devices		Constants	Others
	Bit	Word		
—	—			

Function

ANB

(1) Performs an AND operation on block A and block B, and takes the resulting value as the operation result.

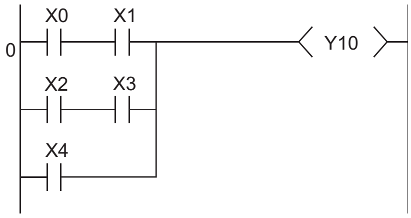
(2) The symbol for ANB is not the contact symbol, but rather is the connection symbol.

ORB

(1) Conducts an OR operation on Block A and Block B, and takes the resulting value as the operation result.

(2) ORB is used to perform parallel connections for ladder blocks with two or more contacts.
For ladder blocks with only one contact, use OR or ORI; there is no need for ORB in such cases.

[Ladder mode]



(3) The ORB symbol is not the contact symbol, but rather is the connection symbol.

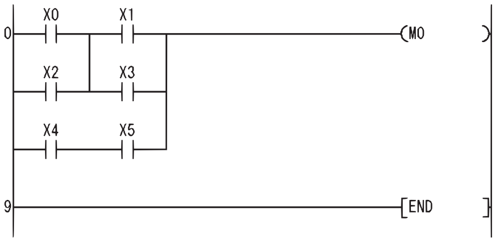
Operation Error

(1) There are no operation errors associated with ANB or ORB instructions.

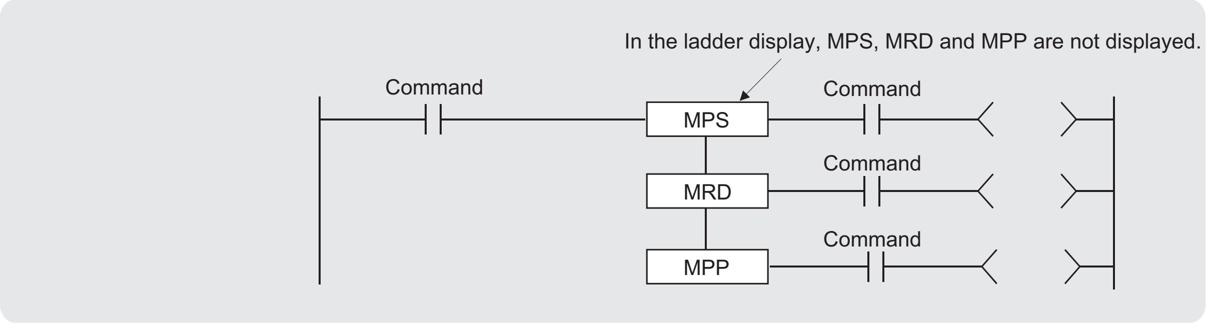
Program Example

(1) A program using ANB and ORB instructions.

[Ladder Mode]



5.2.2 Operation results push, read, pop (MPS, MRD, MPP)


In the ladder display, MPS, MRD and MPP are not displayed.

Set Data	Internal Devices		Constants	Others
	Bit	Word		
—	—			

Function

MPS

(1) Stores in memory the operation result (ON or OFF) immediately prior to the MPS instruction.

(2) Up to 16 MPS instructions can be used successively.
If an MPP instruction is used during this process, the number of uses calculated for the MPS instruction will be decremented by one.

MRD

(1) Reads the operation result stored for the MPS instruction, and uses that result to perform the operation in the next step.

MPP

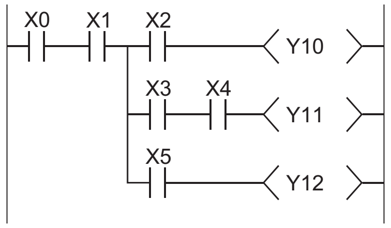
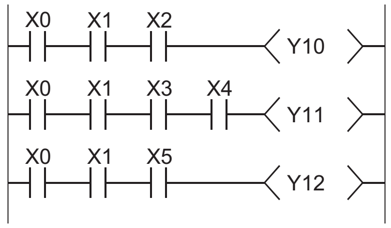
(1) Reads the operation result stored for the MPS instruction, and uses that result to perform the operation in the next step.

(2) Clears the operation results stored by the MPS instruction.

(3) Subtracts 1 from the number of MPS instruction times of use.

☒POINT

1. The following shows ladders both using and not using the MPS, MRD, and MPP instructions.

Ladder Using the MPS, MRD and MPP Instruction	Ladder not Using MPS, MRD, and MPP Instructions
	 X0 X1 X2 Y10 X0 X1 X3 X4 Y11 X0 X1 X5 Y12

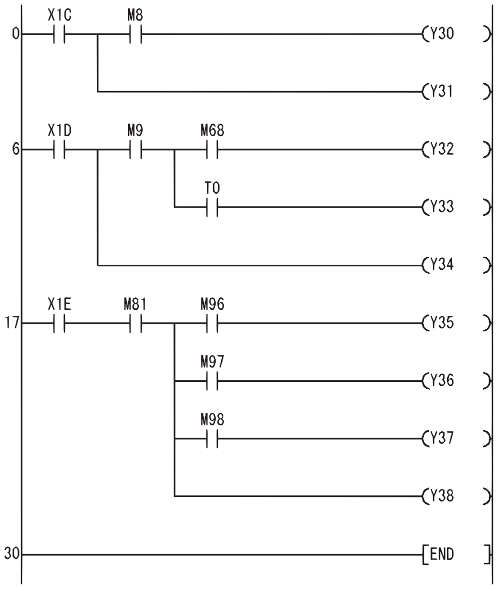
2. The number of times the MPS and MPP instructions are used must be the same.
   If not, correct ladder display is not possible in the ladder mode of the GX Developer.

Operation Error

(1) There are no errors associated with the MPS, MRD, or MPP instructions.

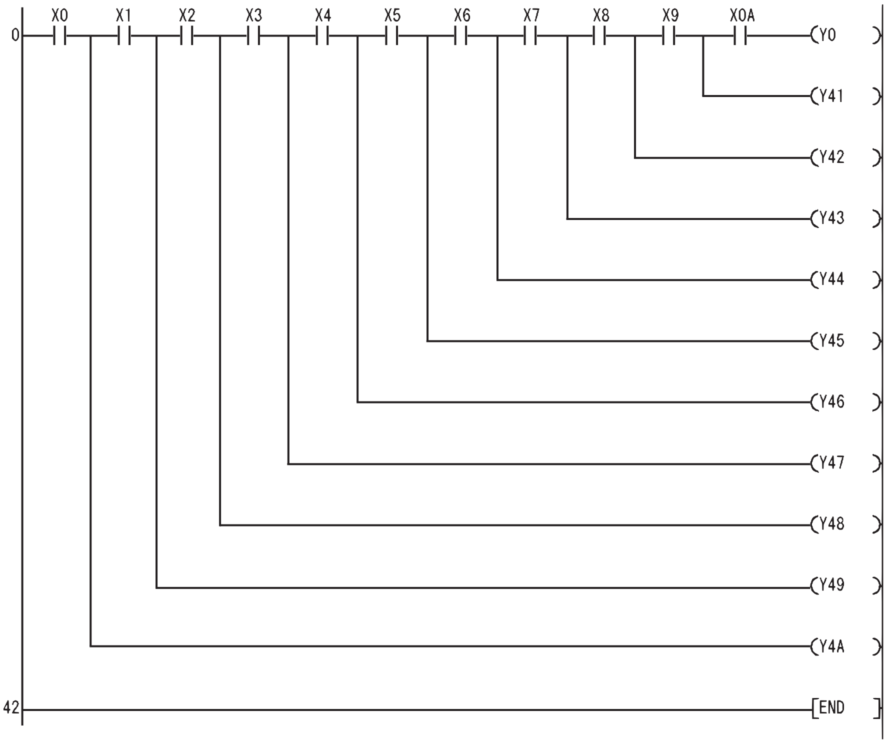
Program Example

(1) A program using the MPS, MRD, and MPP instructions.
[Ladder Mode]

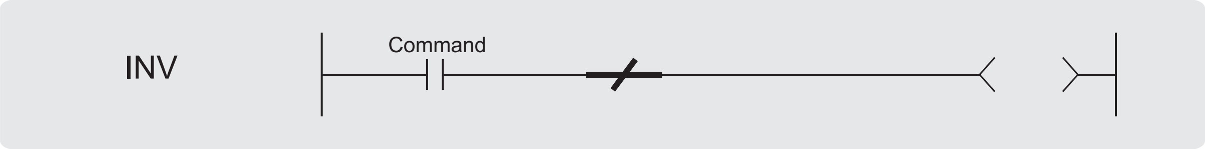


(2) A program using MPS and MPP instructions successively.

[Ladder Mode]



5.2.3 Operation results inversion (INV)



Set Data	Internal Devices		Constants	Others
	Bit	Word		
—	—			

Function

(1) Inverts the operation result immediately prior to the INV instruction.

Operation Result Immediately Prior to the INV Instruction.	Operation Result Following the Execution of the INV Instruction.
OFF	ON
ON	OFF

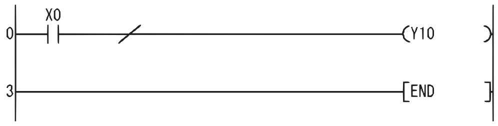
Operation Error

(1) There are no operation errors associated with the INV instruction.

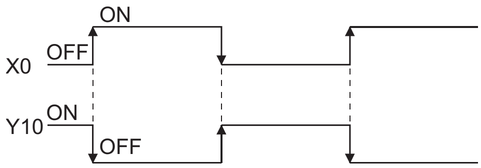
Program Example

(1) A program which inverts the X0 ON/OFF data, and outputs from Y10.

[Ladder Mode]

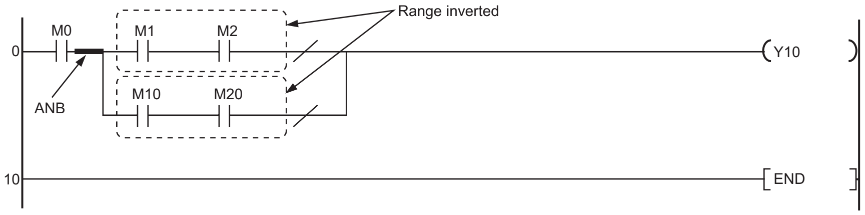


[Timing Chart]



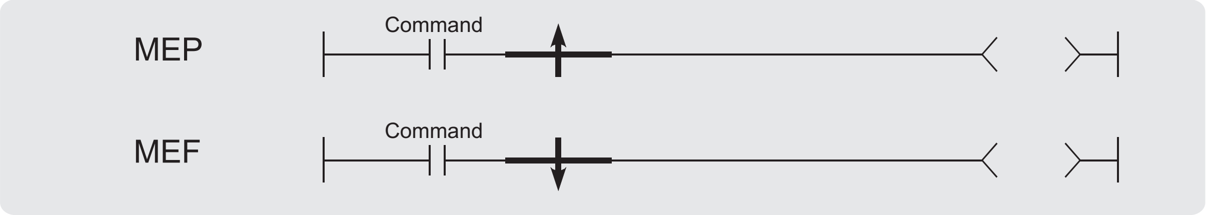
☒POINT

1. The INV instruction operates based on the results of calculation made until the INV instruction is given. Accordingly, use it in the same position as that of the AND instruction.
   The INV instruction cannot be used at the LD and OR positions.
2. When a ladder block is used, the operation result is inverted within the range of the ladder block. To operate a ladder using the INV instruction in combination with the ANB instruction, pay attention to the range that will be inverted.



For details of the ANB instruction, refer to Section 5.2.1.

5.2.4 Operation result pulse conversion (MEP, MEF)



Set Data	Internal Devices		Constants	Others
	Bit	Word		
—	—			

Function

MEP

(1) If operation results up to MEP instruction are leading edge (from OFF to ON), goes ON (continuity status).

If operation results up to MEP instruction are anything other than leading edge, goes OFF (non-continuity status).

(2) Use of the MEP instruction simplifies pulse conversion processing when multiple contacts are connected in series.

MEF

(1) If operation results up to MEF instruction are trailing edge (from ON to OFF), goes ON (continuity status).

If operation results up to MEF instruction are anything other than trailing edge, goes OFF (non-continuity status).

(2) Use of the MEF instruction simplifies pulse conversion processing when multiple contacts are connected in series.

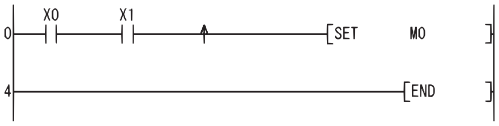
Operation Error

(1) There are no operation errors associated with the MEP or MEF instructions.

Program Example

(1) A program which performs pulse conversion on the operation results of X0 and X1:

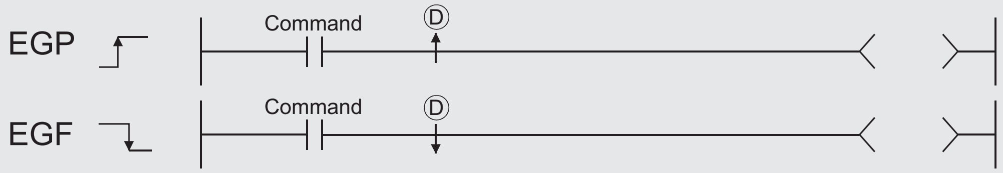
[Ladder Mode]



POINT

Because the MEP and MEF instructions operate according to the operation result immediately before the execution of these instructions, they must be used at the same position as the AND instruction. The MEP and MEF instructions cannot be used at the position of LD or OR instruction.

5.2.5 Pulse conversion of edge relay operation results (EGP, EGF)



Ⓓ : Edge relay number where operation results are stored (bits)

Set Data	Internal Devices		Constants	Others
	Bit	Word		V
Ⓓ	—			○

Function

EGP

(1) Operation results up to the EGP instruction are stored in memory by the edge relay (V).

(2) Goes ON (continuity status) at the leading edge (OFF to ON) of the operation result up to the EGP instruction.

If the operation result up to the EGP instruction is other than a leading edge (i.e., from ON to ON, ON to OFF, or OFF to OFF), it goes OFF (non-continuity status).

(3) The EGP instruction can be used like an AND instruction.

EGF

(1) Operation results up to the EGF instruction are stored in memory by the edge relay (V).

(2) Goes ON at the trailing edge (from ON to OFF) of the operation result up to the EGF instruction.

If the operation result up to the EGF instruction is other than a trailing edge (i.e., from OFF to ON, ON to ON, or OFF to OFF), it goes OFF (non-continuity status).

(3) The EGF instruction can be used like an AND instruction.

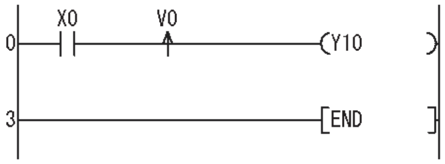
Operation Error

(1) There are no operation errors associated with the EGP or EGF instructions.

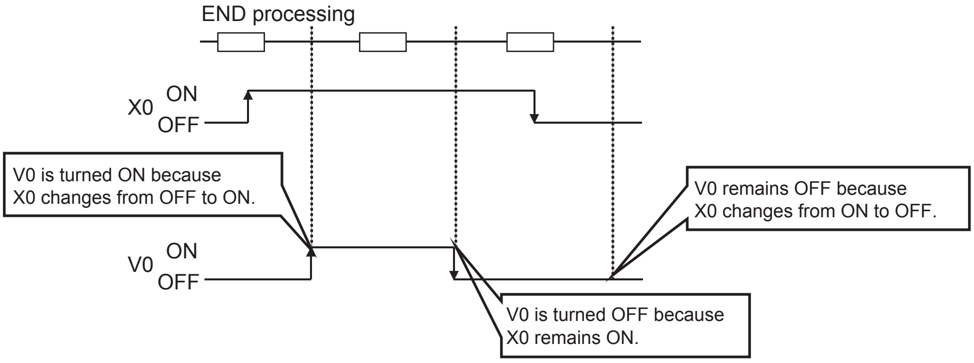
Program Example

(1) A program containing a subroutine program using an EGP instruction

[Ladder Mode]



[Operation]



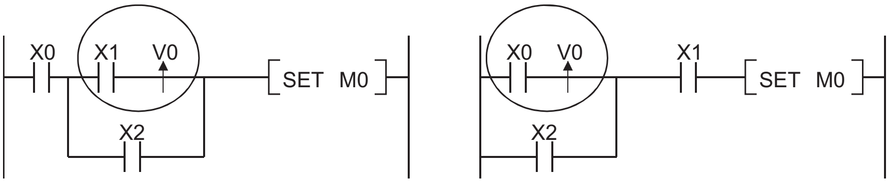
V0 is turned ON because X0 changes from OFF to ON.

V0 remains OFF because X0 changes from ON to OFF.

V0 is turned OFF because X0 remains ON.

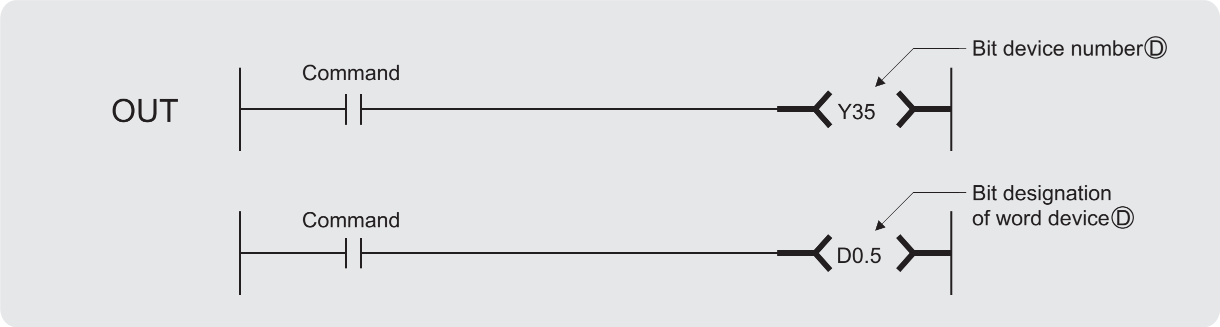
☒POINT

1. Since EGP and EGF instructions are executed according to the results of operation performed immediately before the EGP/EGF instruction, these instructions must be used in the same position as the AND instruction (refer to 5.1.1.). An EGP and EGF instruction cannot be used at the position of an LD or OR instruction.
2. EGP and EGF instructions cannot be used at the circuit block positions shown below.



5.3 Output Instruction

5.3.1 Out instructions (excluding timers, counters, and annunciators) (OUT)



Ⓓ : Number of the device to be turned ON and OFF (bits)

Set Data	Internal Devices		Constants	Others
	Bit	Word		
Ⓓ	○ (Except T, C, F)	○	—	

Function

(1) Operation results up to the OUT instruction are output to the designated device.

(a) When Using Bit Devices

Operation Results	Coil
OFF	OFF
ON	ON

(b) When Bit Designation has been Made for Word Device

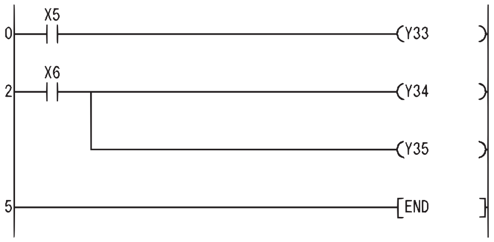
Operation Results	Bit Designated
OFF	0
ON	1

Operation Error

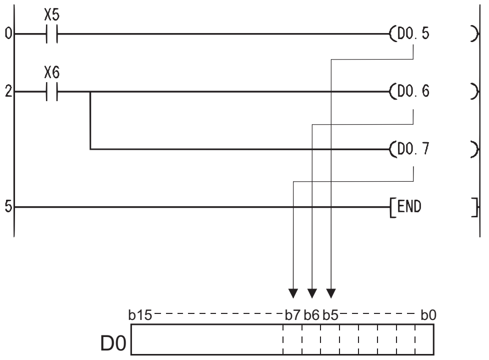
(1) There are no operation errors associated with OUT instruction.

Program Example

(1) When Using Bit Devices
[Ladder Mode]



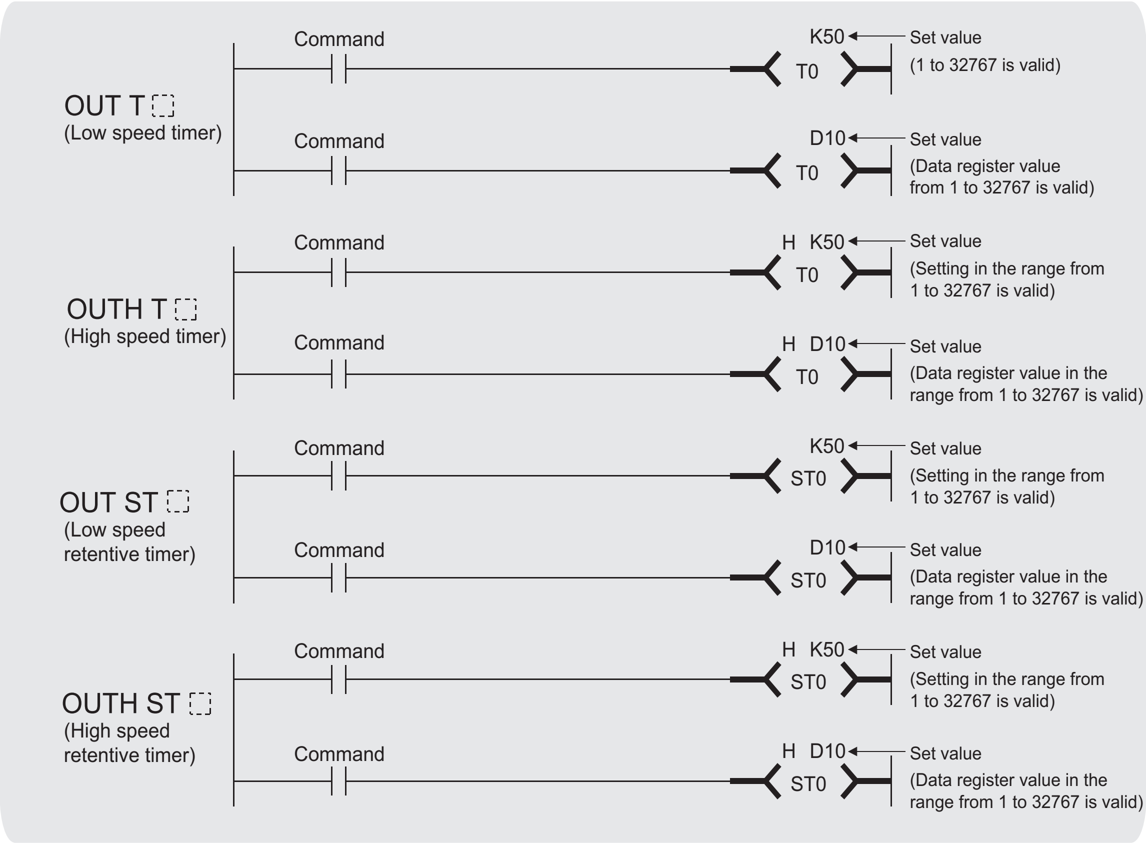
(2) When Bit Designation has been Made for Word Device
[Ladder Mode]



Remark

The number of basic steps is 1 when a device other than a timer, counter and annunciator is designated for the OUT instruction.

5.3.2 Timers (OUT T,OUTH T)


OUT T Ⓓ
(Low speed timer)
Command
K50
T0
Set value
(1 to 32767 is valid)
Command
D10
T0
Set value
(Data register value from 1 to 32767 is valid)
OUTH T Ⓓ
(High speed timer)
Command
H K50
T0
Set value
(Setting in the range from 1 to 32767 is valid)
Command
H D10
T0
Set value
(Data register value in the range from 1 to 32767 is valid)
OUT ST Ⓓ
(Low speed retentive timer)
Command
K50
ST0
Set value
(Setting in the range from 1 to 32767 is valid)
Command
D10
ST0
Set value
(Data register value in the range from 1 to 32767 is valid)
OUTH ST Ⓓ
(High speed retentive timer)
Command
H K50
ST0
Set value
(Setting in the range from 1 to 32767 is valid)
Command
H D10
ST0
Set value
(Data register value in the range from 1 to 32767 is valid)

Ⓓ : Timer number (bit)
Set value : Value set for timer (BIN 16 bits)

Set Data	Internal Devices		Constants K	Others
	Bit	Word		
Ⓓ	○ (Only T)	—	—	—
Set value	—	○ (Except T, C)	○*1	—

*1: Timer values can be set only in a decimal constant (K). A hexadecimal constant (H) cannot be used for timer settings.

Function

(1) When the operation results up to the OUT instruction are ON, the timer coil goes ON and the timer starts measurement; at the time-up (measured value ≧ set value), the contact is as follows:

A Contact	Continuity
B Contact	Non-continuity

(2) The contact responds as follows when the operation result up to the OUT instruction is a change from ON to OFF:

Type of Timer	Timer Coil	Present Value of Timer	Prior to Time Up		After Time Up	
			A Contact	B Contact	A Contact	B Contact
Low speed timer	OFF	0	Non-continuity	Continuity	Non-continuity	Continuity
High speed timer						
Low speed retentive timer	OFF	Maintains the present value	Non-continuity	Continuity	Continuity	Non-continuity
High speed retentive timer						

(3) To clear the present value of a retentive timer and turn the contact OFF after time up, use the RST instruction.

(4) A negative number (−32768 to −1) cannot be set as the setting value for the timer.
If the setting value is 0, the timer will time out when the time the OUT instruction is executed.

(5) The following processing is conducted when the OUT instruction is executed:

- OUT T□ coil turned ON or OFF
- OUT T□ contact turned ON or OFF
- OUT T□ present value updated

If the same OUT T□ instruction is executed twice or more times during the same scan, the present value is updated by the number of times the instruction is executed.

Remark

1. Timer's time limit
Time limit of the timer is set in the PLC system setting of the PLC parameter dialog box.

Type of Timer	QSCPU	
	Setting Range	Setting unit
Low speed timer Low speed retentive timer	1 ms to 1000 ms (Default: 100 ms)	1 ms
High speed timer High speed retentive timer	0.1 ms to 100 ms (Default: 10 ms)	0.1 ms

2. Refer to the manual below for information on timer counting methods.
   - QSCPU User's Manual (Function Explanation, Program Fundamentals)
3. The number of basic steps of the OUT T□ instruction is 4.

Operation Error

(1) There are no operation errors associated with the OUT T□ instruction.

Caution

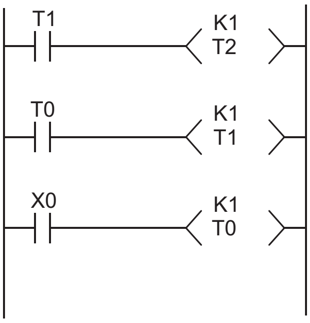
(1) When creating a program in which the operation of the timer contact triggers the operation of other timer, create the program according to the operation order of the timers - create the program for the timer that operates later first.

In the following cases, all timers go ON at the same scan if the program is created in the order the timers operate.

- If the set value is smaller than a scan time.
- If "1" is set.

Example

- For timers T0 to T2, the program is created in the order the timer operates later.

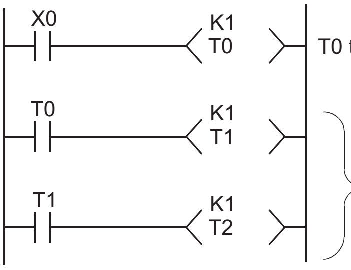


T2 timer starts measurement from the next scan after turning T1 contact ON.

T1 timer starts measurement from the next scan after turning T0 contact ON.

T0 timer starts measurement when X0 is turned ON.

- For timers T0 to T2, the program is created in the order of timer operation.

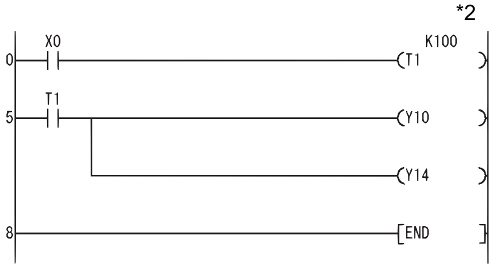


T0 timer starts measurement when X0 is turned ON.

T1 and T2 timer contacts are turned ON when T0 contact is turned ON.

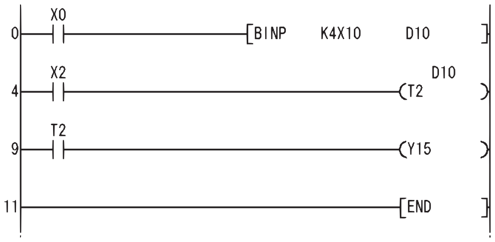
Program Example

(1) The following program turns Y10 and Y14 ON 10 seconds after X0 has gone ON.
[Ladder Mode]



*2: The set value of the low-speed timer indicates its default time limit (100 ms).

(2) The following program uses the BCD data at X10 to X1F as the timer's set value.
[Ladder Mode]

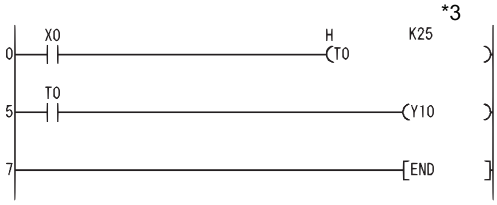


Converts BCD data at X10 to X1F to BIN and stores the converted value in D10.

When X2 is turned ON, starts counting using the data stored in D10 as the set value.

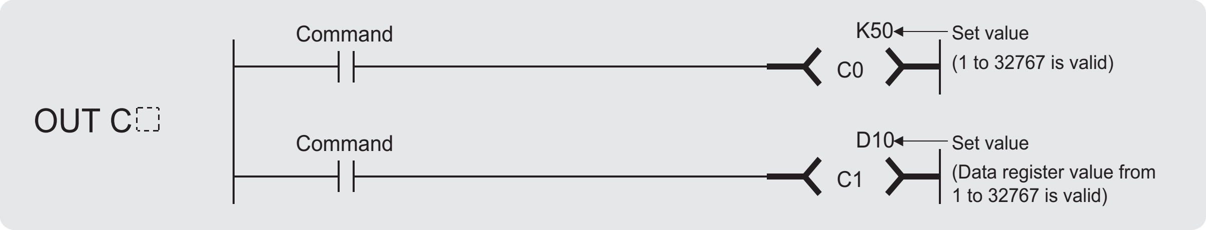
Y15 turns ON at the count up of T2.

(3) The following program turns Y10 ON 250 m after X0 goes ON.
[Ladder Mode]



*3: The set value of the high speed timer indicates its default time limit (10 ms).

5.3.3 Counters (OUT C)



Ⓓ: Counter number (bits)
Set value: Counter set value (BIN 16 bits)

Set Data	Internal Devices		Constants K	Others
	Bit	Word		
Ⓓ	○ (Only C)	—	—	—
Set value	—	○ (Except T, C)	○*1	—

*1: Counter values can be set only in a decimal constant (K). A hexadecimal constant (H) cannot be used for the counter value setting.

Function

(1) When the operation results up to the OUT instruction change from OFF to ON, 1 is added to the present value (count value) and the count up status (present value ≧ set value), and the contacts respond as follows:

A Contact	Continuity
B Contact	Non-continuity

(2) No count is conducted with the operation results at ON. (There is no need to perform pulse conversion on count input.)

(3) After the count up status is reached, there is no change in the count value or the contacts until the RST instruction is executed.

(4) A negative number (−32768 to −1) cannot be set as the setting value for the timer.
If the set value is 0, the processing is identical to that which takes place for 1.

Remark

1. Refer to the manual below for counter counting methods.
   - QSCPU User's Manual (Function Explanation, Program Fundamentals)
2. The number of basic steps of the OUT C□ instruction is 4.

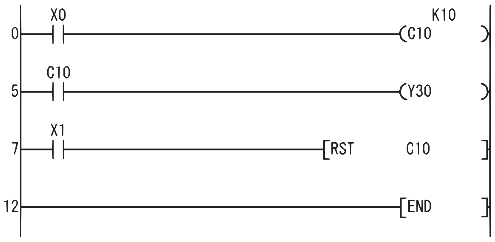
Operation Error

(1) There are no operation errors associated with the OUT C□ instruction.

Program Example

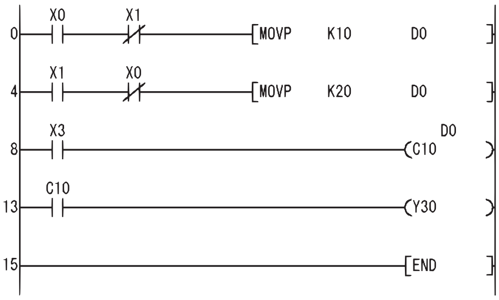
(1) The following program turns Y30 ON after X0 has gone ON 10 times, and resets the counter when X1 goes ON.

[Ladder Mode]



(2) The following program sets the value for C10 at 10 when X0 goes ON, and at 20 when X1 goes ON.

[Ladder Mode]



Stores 10 in D0 when X0 is turned ON.

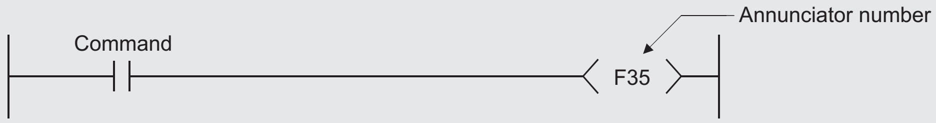
Stores 20 in D0 when X1 is turned ON.

C10 counts data stored in D0 as the set value.

Y30 is turned ON at the count up of C10.

5.3.4 Annunciator output (OUT F)

OUT F□



Ⓓ : Number of the annunciator to be turned ON (bits)

Set Data	Internal Devices		Constants	Others
	Bit	Word		
Ⓓ	○ (Only F)	—		

Function

(1) Operation results up to the OUT instruction are output to the designated annunciator.

(2) The following responses occur when an annunciator (F) is turned ON.
- The "USER" LED goes ON.
- The annunciator numbers which are ON (F numbers) are stored in special registers (SD64 to SD79).
- The value of SD63 is incremented by 1.

(3) If the value of SD63 is 16 (which happens when 16 annunciators are already ON), even if a new annunciator is turned ON, its number will not be stored at SD64 to SD79.

(4) When the annunciator is turned OFF by the OUT instruction, although the coil goes OFF, status of the "USER" LED and the contents of SD63 to SD79 are not changed.
To turn OFF the "USER" LED or to delete the annunciator, which was turned OFF by the OUT F□ instruction from SD63 to SD79, use the RST F□ instruction.

Operation Error

(1) There are no operation errors associated with the OUT F□ instruction.

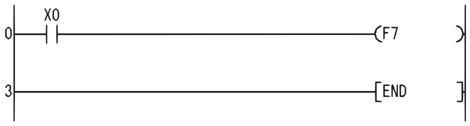
Remark

1. Refer to the manual below for details of annunciators.
   - QSCPU User's Manual (Function Explanation, Program Fundamentals)
2. The number of basic steps for the OUT module F□ instruction is 2.

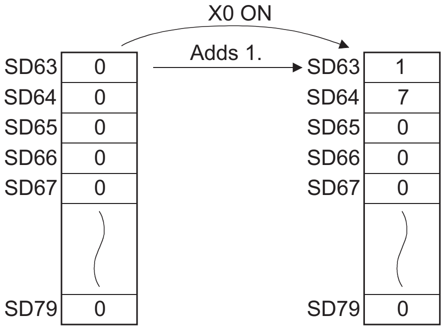
Program Example

(1) The following program turns F7 ON when X0 goes ON, and stores the value 7 from SD64 to SD79.

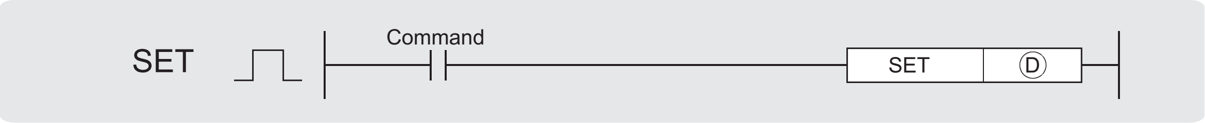
[Ladder Mode]



[Operation]



5.3.5 Setting devices (except for annunciators) (SET)



Ⓓ : Bit device number to be set (ON)/Word device bit designation (bits)

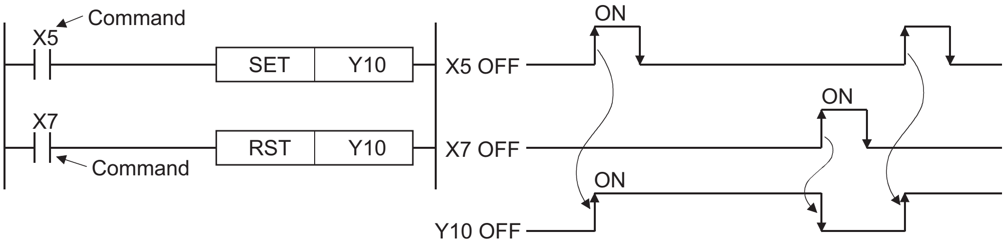
Set Data	Internal Devices		Constants	Others
	Bit	Word		
Ⓓ	○	○ (Except T, C)	—	○

☆ Function

(1) When the execution command is turned ON, the status of the designated devices becomes as shown below:

Device	Device Status
Bit device	Coils and contacts turned ON
When Bit Designation has been Made for Word Device	Designation bit set at 1

(2) Devices turned ON by the instruction remain ON when the same command is turned OFF. Devices turned ON by the SET instruction can be turned OFF by the RST instruction.



(3) When the execution command is OFF, the status of devices does not change.

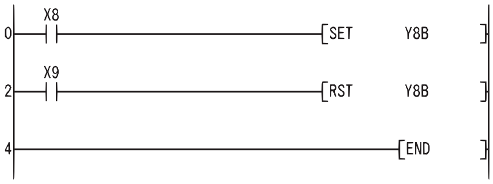
Operation Error

(1) There are no operation errors associated with the SET instruction.

Program Example

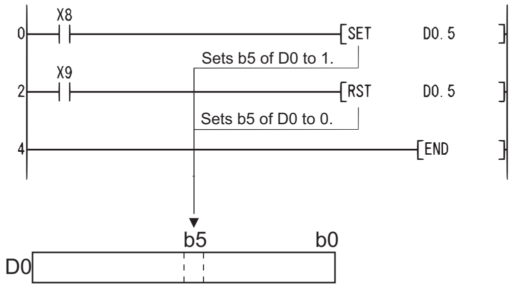
(1) The following program sets Y8B (ON) when X8 goes ON, and resets Y8B (OFF) when X9 goes ON.

[Ladder Mode]



(2) The following program sets the value of D0 bit 5 (b5) to 1 when X8 goes ON, and set the bit value to 0 when X9 goes ON.

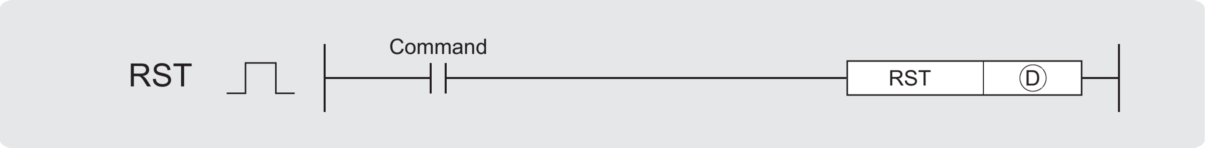
[Ladder Mode]



Remark

1. The number of basic steps is 1 when a device other than an annunciator is designated for the SET instruction.
2. When using X as a device, use the device numbers that are not used for the actual input. If the same number is used for the actual input device and input X, the data of the actual input will be written over the input X specified in the SET instruction.

5.3.6 Resetting devices (except for annunciators) (RST)



Ⓓ : Bit device number to be reset/ Word device bit designation (bits)
Word device number to be reset (BIN 16 bits)

Set Data	Internal Devices		Constants	Others
	Bit	Word		
Ⓓ	○		—	

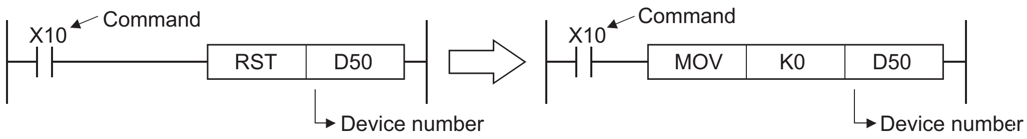
Function

(1) When the execution command is turned ON, the status of the designated devices becomes as shown below:

Device	Device Status
Bit device	Turns coils and contacts OFF
Timers and counters	Sets the present value to 0, and turns coils and contacts OFF
When Bit Designation has been Made for Word Device	Sets value of designated bit to 0
Word devices other than timers and counters	Sets contact to 0

(2) When the execution command is OFF, the status of devices does not change.

(3) The functions of the word devices designated by the RST instruction are identical to the following ladder:



Operation Error

(1) There are no operation errors associated with the RST instruction.

Remark

The basic number of steps of the RST instruction is as follows.

a) For bit processing

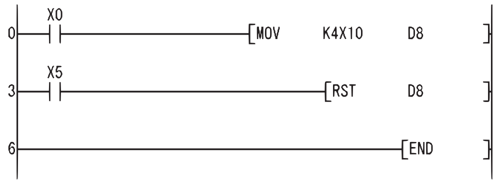
- Internal device (bit to be specified by bit device or word device): 1
- Timer, counter : 4

b) The number of basic steps is 2 for word processing.

Program Example

(1) The following program sets the value of the data register to 0.

[Ladder Mode]

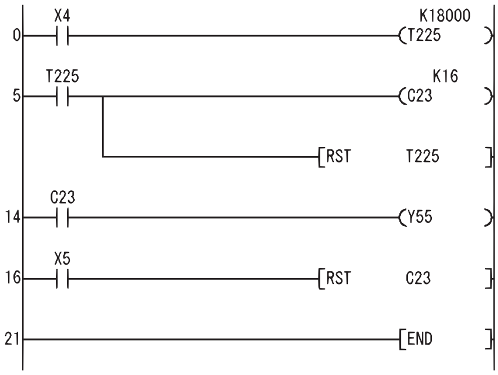


Stores the values of X10 to X1F in D8 when X0 is turned ON.

Sets the value of D8 to 0 when X5 is turned ON.

(2) The following program resets the 100 ms retentive timer and counter.

[Ladder Mode]



When T225 is set as retentive timer, it is turned ON when X4 ON time reaches 30 min.

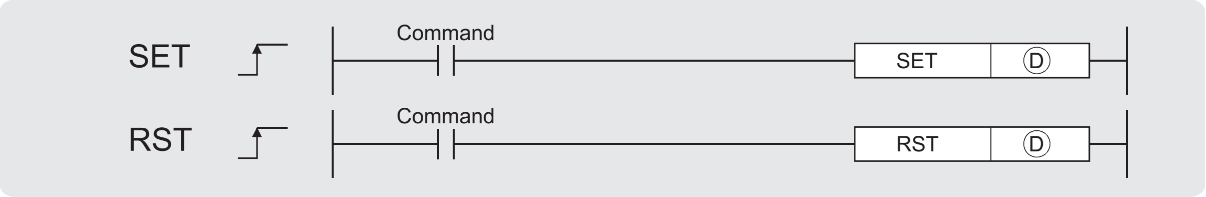
Counts the number of times T225 was turned ON.

Resets the coil, contact and present value of T225 when the contact of T225 is turned ON.

Y55 is turned ON at the count up of C23.

Resets C23 when X5 is turned ON.

5.3.7 Setting and resetting the annunciators (SET F, RST F)



SET Ⓓ : Number of the annunciator to be set (F number) (bits)

RST Ⓓ : Number of the annunciator to be reset (F number) (bits)

Set Data	Internal Devices		Constants	Others
	Bit	Word		
Ⓓ	○ (Only F)	—		

Function

SET

(1) The annunciator designated by Ⓓ is turned ON when the execution command is turned ON.

(2) The following responses occur when an annunciator (F) is turned ON.

- The "USER" LED goes ON.
- The annunciator numbers which are ON (F numbers) are stored in special registers (SD64 to SD79).
- The value of SD63 is incremented by 1.

(3) If the value of SD63 is 16 (which happens when 16 annunciators are already ON), even if a new annunciator is turned ON, its number will not be stored at SD64 to SD79.

RST

(1) The annunciator designated by Ⓓ is turned OFF when the execution command is turned ON.

(2) The annunciator numbers (F numbers) of annunciators that have gone OFF are deleted from the special registers (SD64 to SD79), and the value of SD63 is decremented by 1.

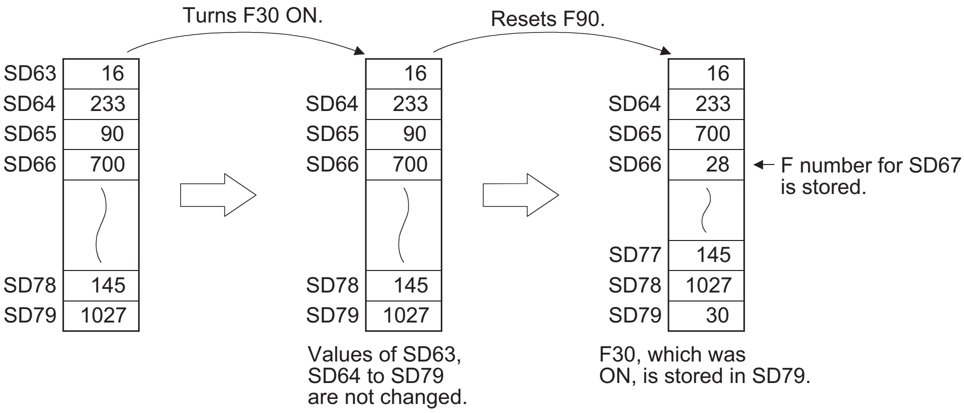
Remark

1. Refer to the manual below for details of annunciators.
   - QSCPU User's Manual (Function Explanation, Program Fundamentals)
2. The number of basic steps for the SET F□ and RST F□ instructions is 2.

(3) When the value of SD63 is "16", the annunciator numbers are deleted from SD64 to SD79 by the use of the RST instruction. If the annunciators whose numbers are not registered in SD64 to SD79 are ON, these numbers will be registered.

If all annunciator numbers from SD64 to SD79 are turned OFF, the "USER" LED on the front of the safety CPU module will be turned OFF.

[Operations which take place when SD63 is 16]



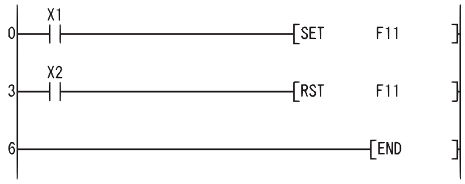
Operation Error

(1) There are no operation errors associated with the SET F□ or RST F□ instructions.

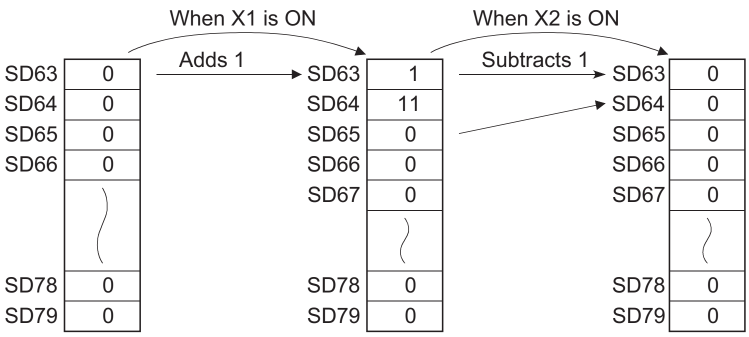
Program Example

(1) The following program turns annunciator F11 ON when X1 goes ON, and stores the value 11 at the special register (SD64 to SD79). Further, the program resets annunciator F11 if X2 goes ON, and deletes the value 11 from the special registers (SD64 to SD79).

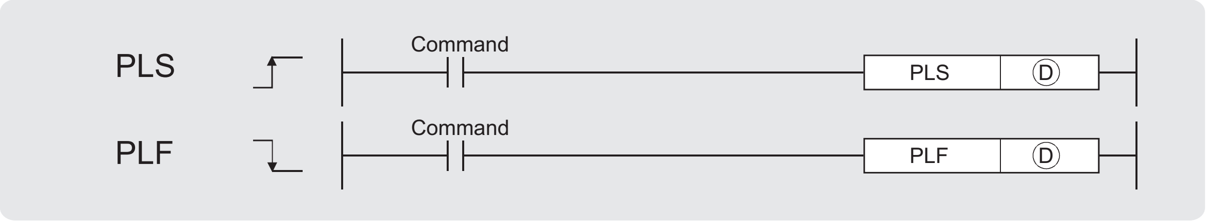
[Ladder Mode]



[Operation]



5.3.8 Leading edge and trailing edge output (PLS, PLF)



Ⓓ : Pulse conversion device (bits)

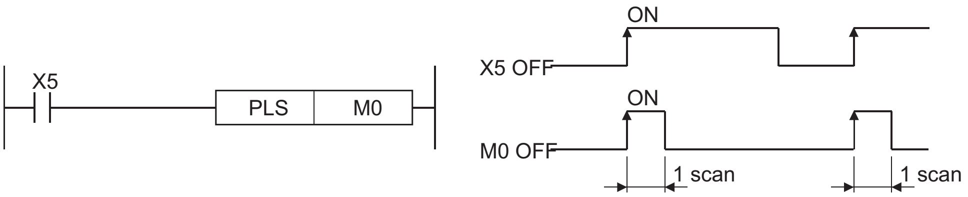
Set Data	Internal Devices		Constants	Others
	Bit	Word		
Ⓓ	○		—	

Function

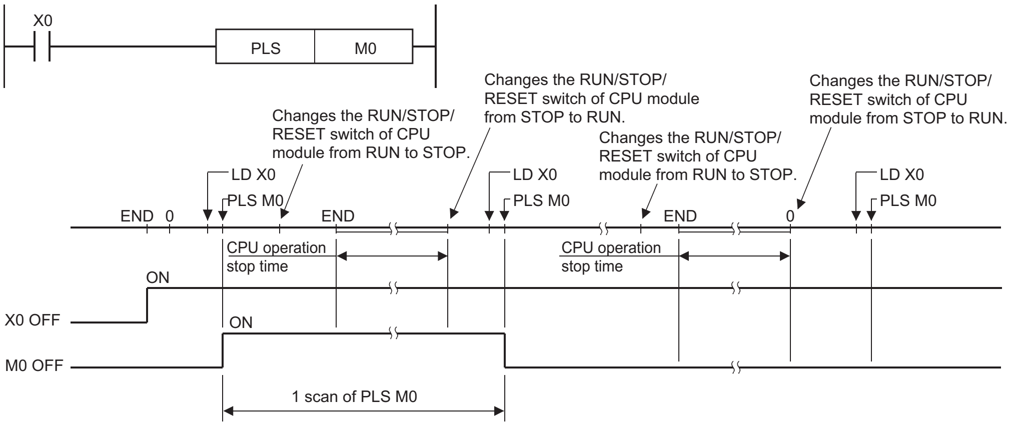
PLS

(1) Turns ON the designated device when the execution command is turned OFF → ON, and turns OFF the device in any other case the execution command is turned OFF → ON (i.e., at ON → ON, ON → OFF or OFF → OFF of the execution command).

When there is one PLS instruction for the device designated by Ⓓ during one scan, the specified device turns ON one scan.
See 3.7 for the operation to be performed when the PLS instruction for the same device is executed more than once during one scan.



(2) If the RUN/STOP/RESET switch is changed from RUN to STOP after the execution of the PLS instruction, the PLS instruction will not be executed again even if the switch is set back to RUN.


X0
PLS
M0
Changes the RUN/STOP/ RESET switch of CPU module from RUN to STOP.
Changes the RUN/STOP/ RESET switch of CPU module from STOP to RUN.
Changes the RUN/STOP/ RESET switch of CPU module from RUN to STOP.
Changes the RUN/STOP/ RESET switch of CPU module from STOP to RUN.
LD X0
PLS M0
LD X0
PLS M0
LD X0
PLS M0
END
0
END
END
0
CPU operation stop time
CPU operation stop time
ON
X0 OFF
ON
M0 OFF
1 scan of PLS M0

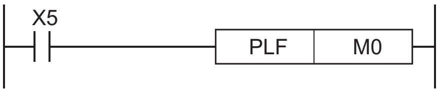
(3) When designating a latch relay (L) for the execution command and turning the power supply OFF to ON with the latch relay ON, the execution command turns OFF to ON at the first scan, executing the PLS instruction and turning ON the designated device.

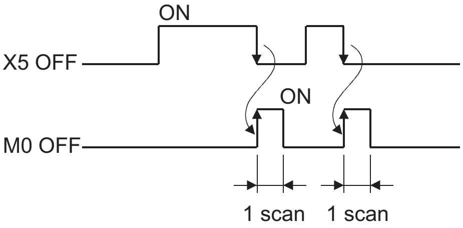
The device turned ON at the first scan after power-ON turns OFF at the next PLS instruction.

PLF

(1) Turns ON the designated device when the execution command is turned ON → OFF, and turns OFF the device in any other case the execution command is turned ON → OFF (i.e., at OFF → OFF, OFF → ON or ON → ON of the execution command).

When there is one PLF instruction for the device designated by Ⓓ during one scan, the specified device turns ON one scan.
See 3.7 for the operation to be performed when the PLF instruction for the same device is executed more than once during one scan.





(2) If the RUN/STOP/RESET switch is changed from RUN to STOP after the execution of the PLF instruction, the PLF instruction will not be executed again even if the switch is set back to RUN.

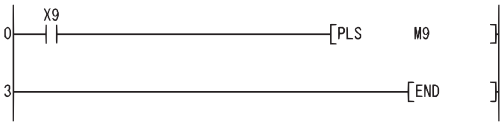
Operation Error

(1) There are no operation errors associated with the PLS or PLF instructions.

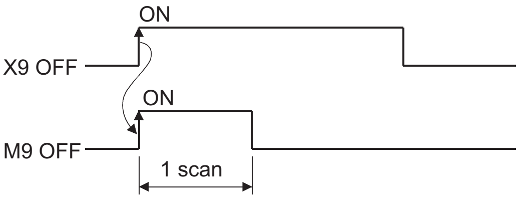
Program Example

(1) The following program executes the PLS instruction when X9 goes ON.

[Ladder Mode]

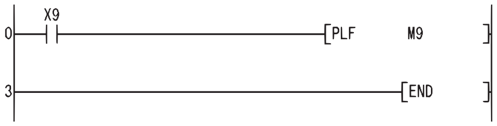


[Timing Chart]

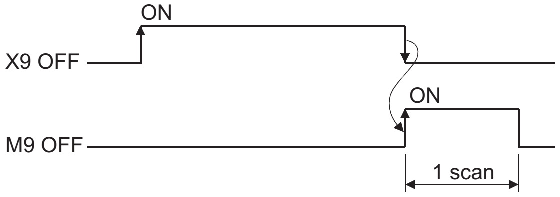


(2) The following program executes the PLF instruction when X9 goes OFF.

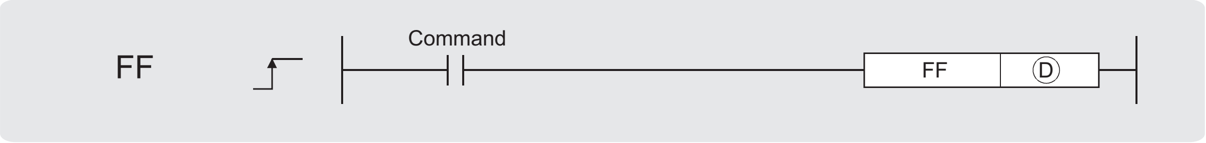
[Ladder Mode]



[Timing Chart]



5.3.9 Bit device output reverse (FF)



Ⓓ : Device number of the device to be reversed (bits)

Set Data	Internal Devices		Constants	Others
	Bit	Word		
Ⓓ	○		—	

Function

(1) Reverses the output status of the device designated by Ⓓ when the execution command is turned OFF → ON.

Device	Device Status	
	Prior to FF execution	After FF execution
Bit device	OFF	ON
	ON	OFF
Bit designated for word device	0	1
	1	0

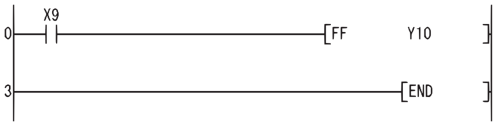
Operation Error

(1) There are no operation errors associated with the FF instruction.

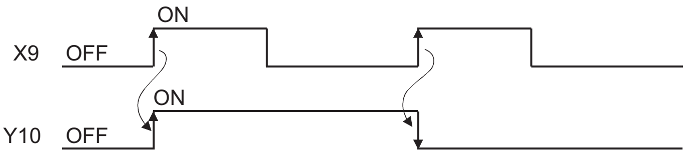
Program Example

(1) The following program reverses the output of Y10 when X9 goes ON.

[Ladder Mode]

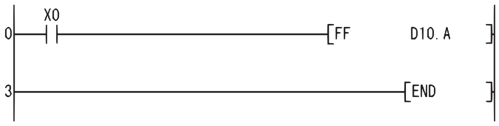


[Timing Chart]

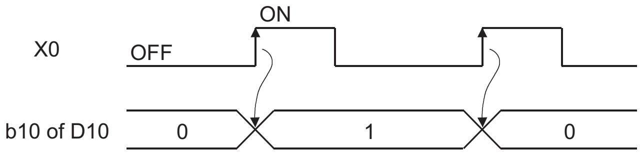


(2) The following program reverses b10 (bit 10) of D10 when X0 goes ON.

[Ladder Mode]

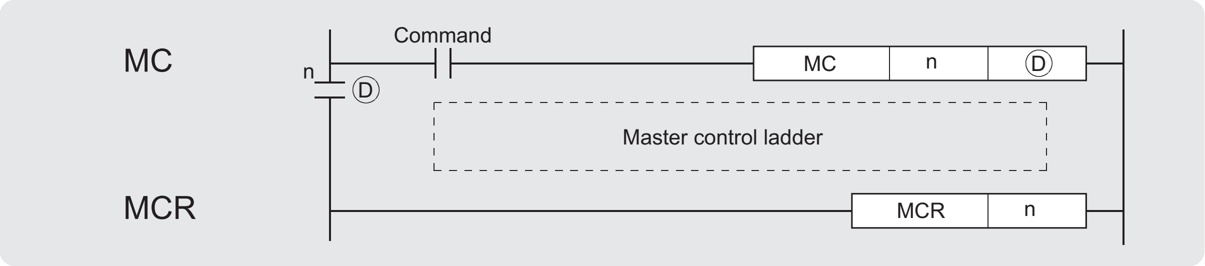


[Timing Chart]



5.4 Master Control Instructions

5.4.1 Setting and resetting the master control (MC, MCR)



n : Nesting (N0 to N14) (Nesting)

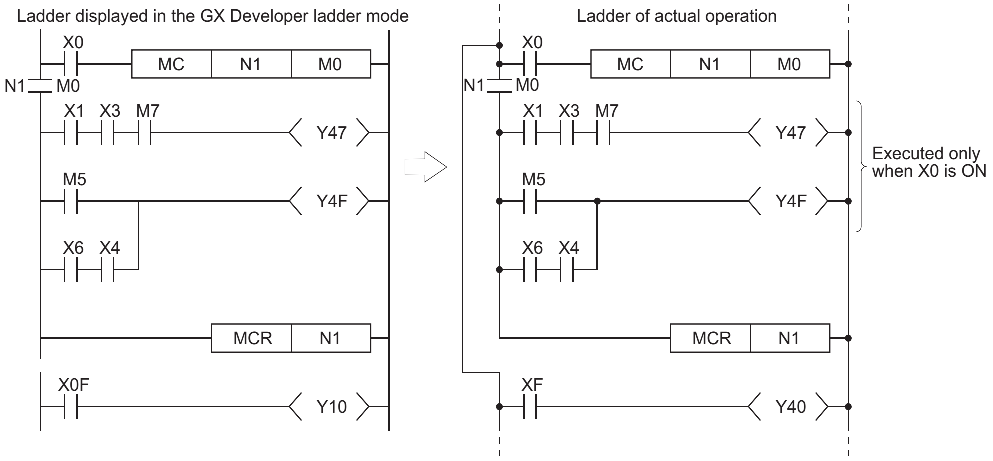
Ⓓ : Number of the device to turn ON (bits)

Set Data	Internal Devices		Constants	Others
	Bit	Word		N
n	—		—	○
Ⓓ	○		—	—

Function

(1) The master control instruction is used to enable the creation of highly efficient ladder switching sequence programs, through the opening and closing of a common bus for ladders.

A ladder using the master control would look as shown below:


Ladder displayed in the GX Developer ladder mode
X0
MC
N1
M0
N1
M0
X1
X3
M7
Y47
M5
Y4F
X6
X4
MCR
N1
X0F
Y10
Ladder of actual operation
X0
MC
N1
M0
N1
M0
X1
X3
M7
Y47
M5
Y4F
X6
X4
MCR
N1
XF
Y40
Executed only when X0 is ON

Remark

Inputting contacts on the vertical bus is not necessary when programming in the write mode of the GX Developer.

These will be automatically displayed when the "conversion" operation is conducted after the creation of the ladder and then "read" mode is set.

MC

(1) If the execution command of the MC instruction is ON when master control is commenced, the result of the operation from the MC instruction to the MCR instruction will be exactly as the instruction (ladder) shows.

If the execution command of the MC instruction is OFF, the result of the operation from the MC instruction to the MCR instruction will be as shown below:

Device	Device Status
High speed timer Low speed timer	Count value goes to 0, coils and contacts all go OFF
High speed retentive timer Low speed retentive timer Counter	Coils go OFF, but counter values and contacts all maintain current status.
Devices in OUT instruction	All turned OFF
Devices in the following instructions: SET, RST Basic, Application	Maintain current status

(2) Even when the MC instruction is OFF, instructions from the MC instruction to the MCR instruction will be executed, so scan time will not be shortened.

(3) By changing the device designated by Ⓓ, the MC instruction can use the same nesting (N) number as often as desired.

(4) Coils from devices designated by Ⓓ are turned ON when the MC instruction is ON.

Further, using these same devices with the OUT instruction or other instructions will cause them to become double coils, so devices designated by Ⓓ should not be used within other instructions.

MCR

(1) This is the instruction for recovery from the master control, and indicates the end of the master control range of operation.

(2) Do not place contact instructions before the MCR instruction.

(3) Use the MC instruction and MCR instruction of the same nesting number as a set.

However, when the MCR instructions are nested in one place, all master controls can be terminated with the lowest nesting (N) number.

(Refer to the "Cautions when Using Nesting Architecture" in the program example.)

Operation Error

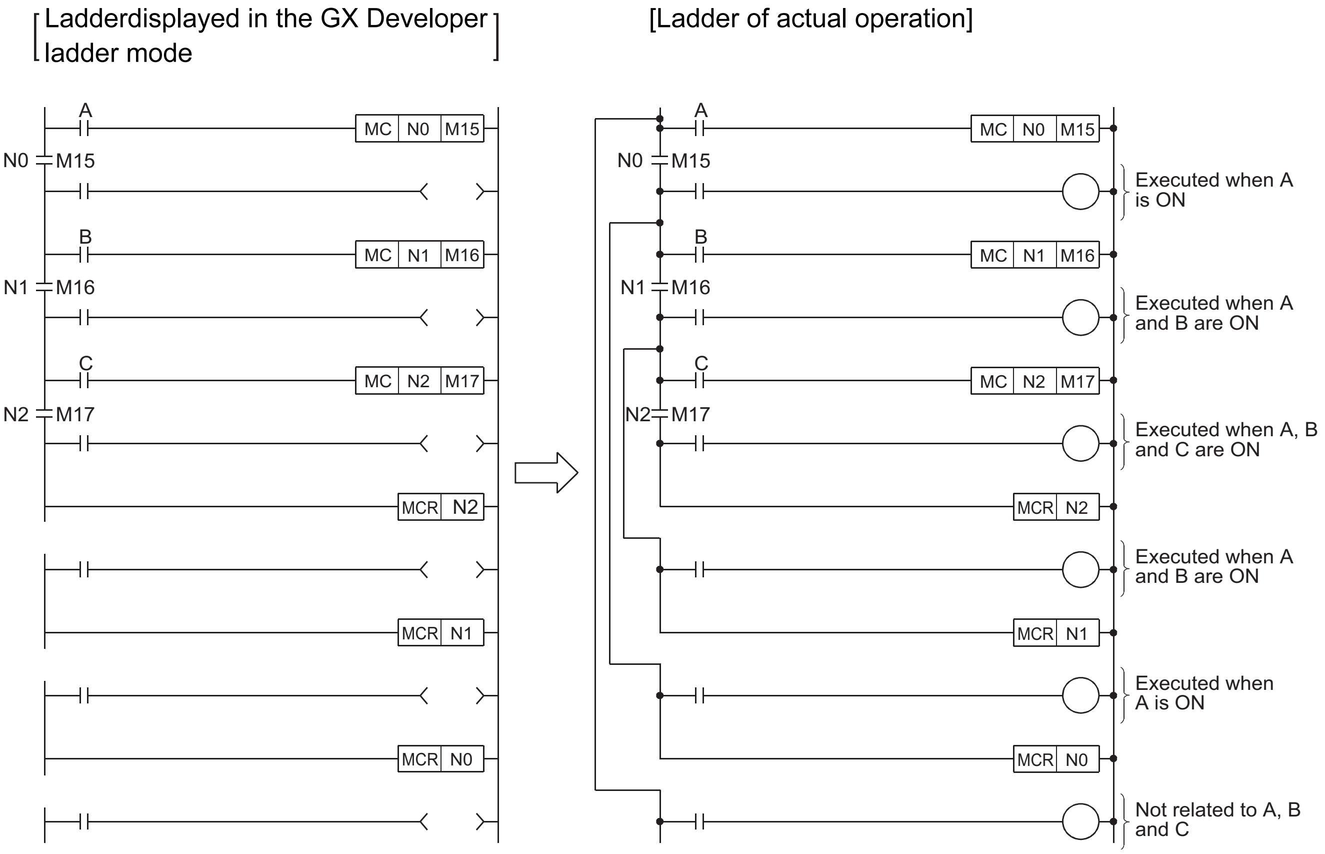
(1) There are no operation errors associated with the MC or MCR instructions.

Program Example

(1) The master control instruction can be used in nesting. The different master control regions are distinguished by nesting (N). Nesting can be performed from N0 to N14.

The use of nesting enables the creation of ladders which successively limit the execution condition of the program.

A ladder using nesting would appear as shown below:

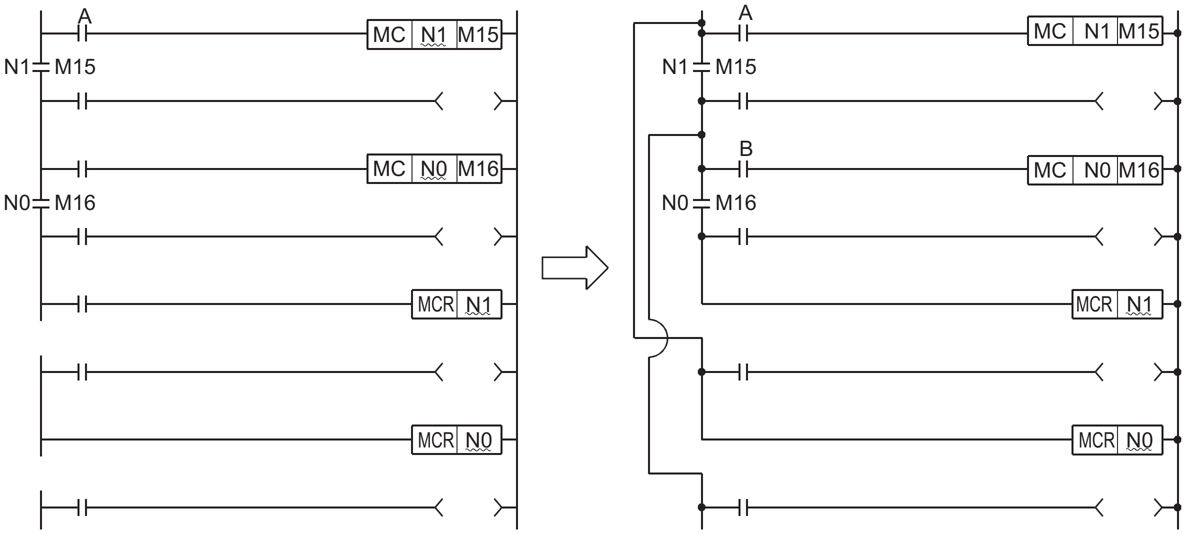

[Ladderdisplayed in the GX Developer ladder mode]
[Ladder of actual operation]
A
MC N0 M15
N0
M15
B
MC N1 M16
N1
M16
C
MC N2 M17
N2
M17
MCR N2
MCR N1
MCR N0
Executed when A is ON
Executed when A and B are ON
Executed when A, B and C are ON
Executed when A and B are ON
Executed when A is ON
Not related to A, B and C

Cautions when Using Nesting Architecture

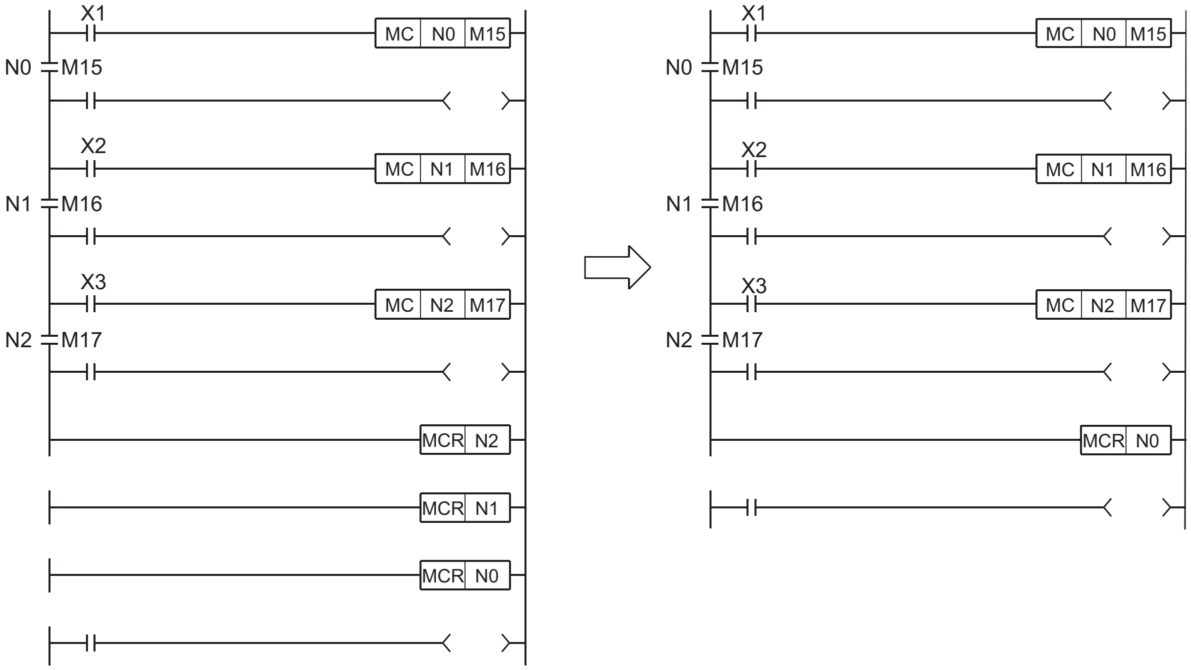
(1) Nesting can be used up to 15 times (N0 to N14)

When using nesting, nests should be inserted from the lower to higher nesting number (N) with the MC instruction, and from the higher to the lower order with the MCR instruction.
If this order is reversed, there will be no nesting architecture, and the safety CPU module will not be capable of performing correct operations.
For example, if nesting is designated in the order N1 to N0 by the MC instruction, and also designated in the N1 to N0 order by the MCR instruction, the vertical bus will intersect and a correct master control ladder will not be produced.

[Ladder displayed in the GX Developer ladder mode] [Ladder of actual operation]

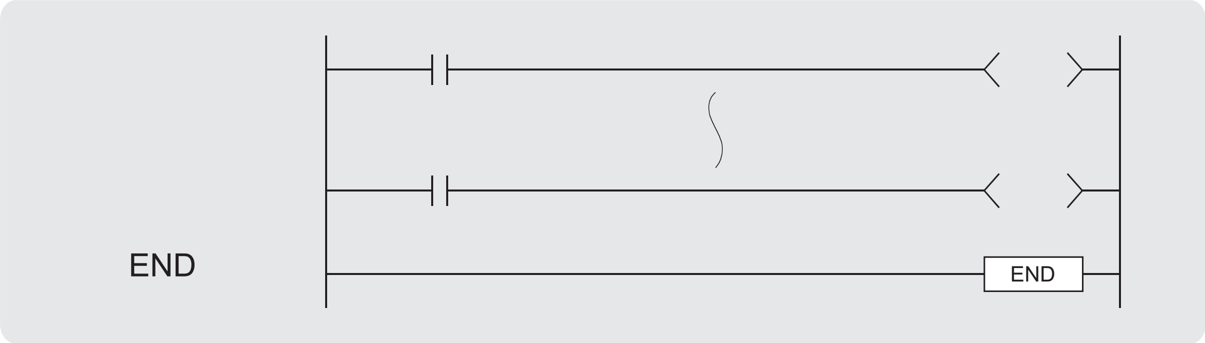


(2) If the nesting architecture results in MCR instructions concentrated in one location, all master controls can be terminated by use of just the lowest nesting number (N).



5.5 Termination Instruction

5.5.1 End sequence program (END)

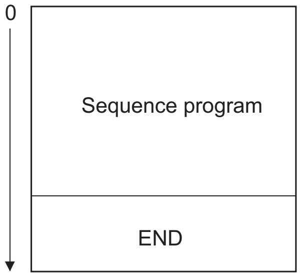


Set Data	Internal Devices		Constants	Others
	Bit	Word		
—	—			

Function

(1) The termination of a sequence program is indicated.

Execution of the END instruction will cause the safety CPU module to terminate the program that was being executed.



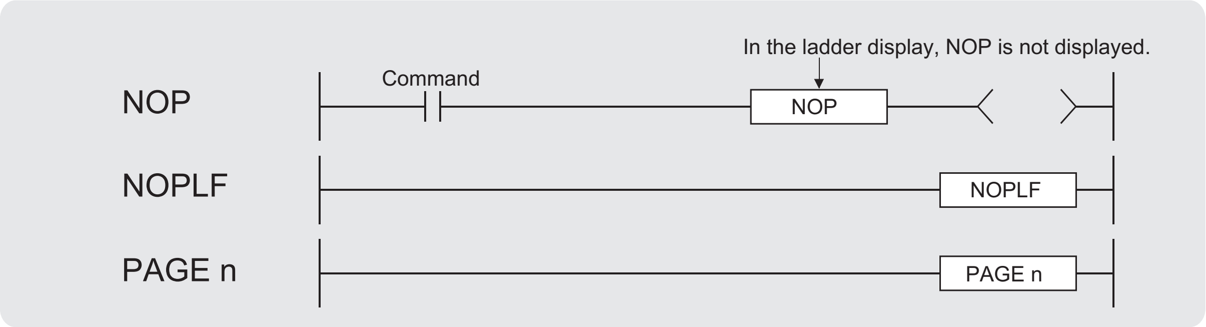
(2) END instruction is automatically set by the GX Developer during programming.

Operation Error

(1) There are no operation errors associated with the END instruction.

5.6 Other Instructions

5.6.1 No-operation (NOP, NOPLF, PAGE n)



Set Data	Internal Devices		Constants K	Others
	Bit	Word		
n	—		○	—

Function

NOP

(1) This is a no operation instruction that has no impact on any operations up to that point.

(2) NOP instruction is used to insert space for debugging a sequence program.

NOPLF

(1) This is a no operation instruction that has no impact on any operations up to that point.

(2) NOPLF instruction is used to make a page break at a desired position when printing out from the GX Developer.

- A page break will be inserted between ladder blocks with the presence of the NOPLF instruction.
- The ladder cannot be displayed correctly if an NOPLF instruction is inserted in the midst of a ladder block.
  Do not insert an NOPLF instruction in the midst of a ladder block.

(3) For the print out operation by the GX Developer, refer to the GX Developer Operating Manual.

PAGE n

(1) This is a no operation instruction that has no impact on any operations up to that point.

(2) No processing is performed at the GX Developer with this instruction.

Operation Error

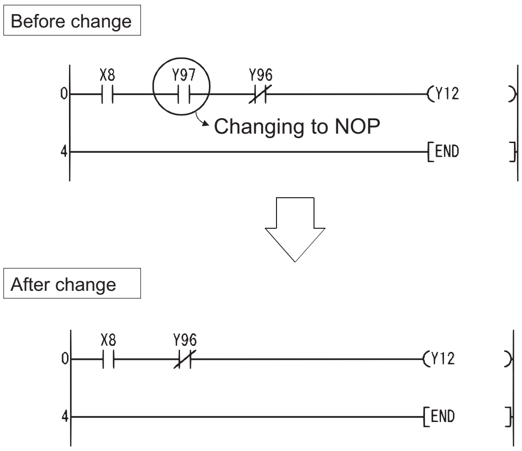
(1) There are no errors associated with the NOP, NOPLF, or PAGE instructions.

Program Example

NOP

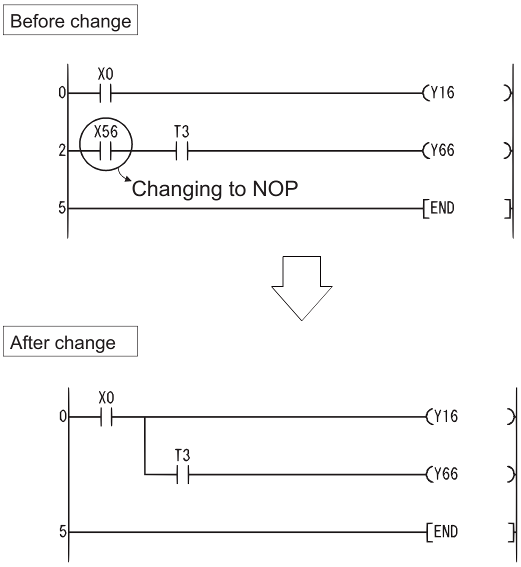
(1) Contact closed......... Deletes AND or ANI instruction.

[Ladder Mode]



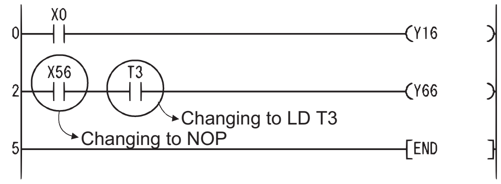
(2) Contact closed......... LD, LDI changed to NOP (Note carefully that changing the LD and LDI instructions to NOP completely changes the nature of the ladder.)

[Ladder Mode]

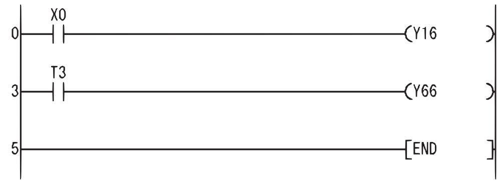


[Ladder Mode]

Before change

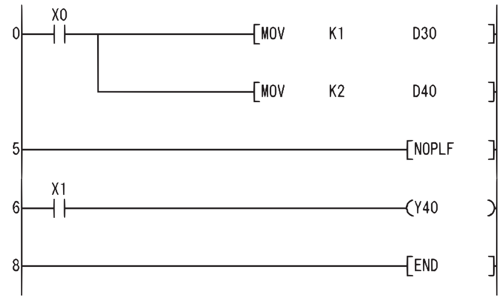


After change

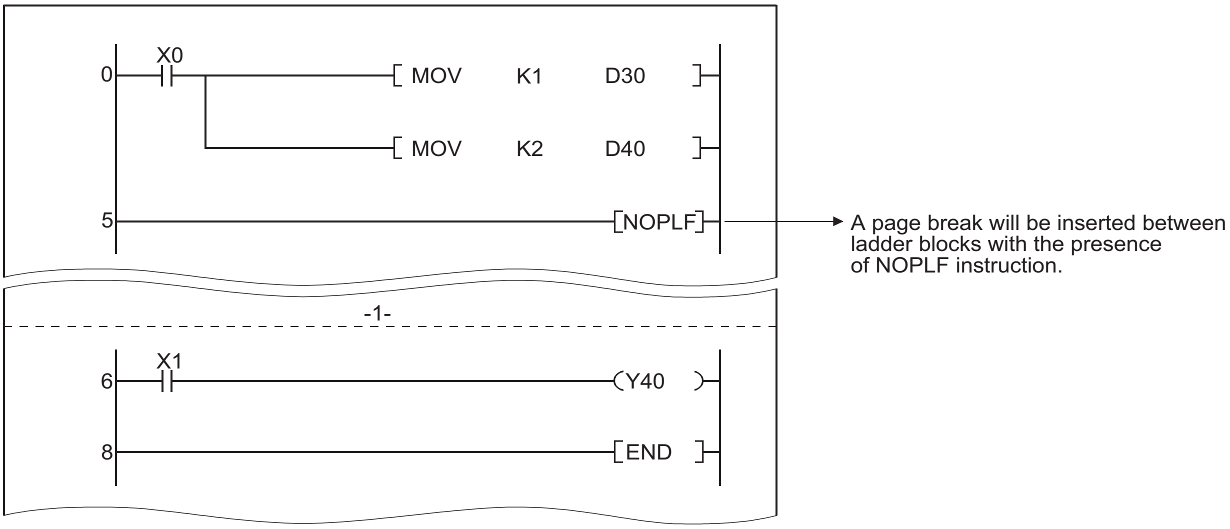


NOPLF

[Ladder Mode]

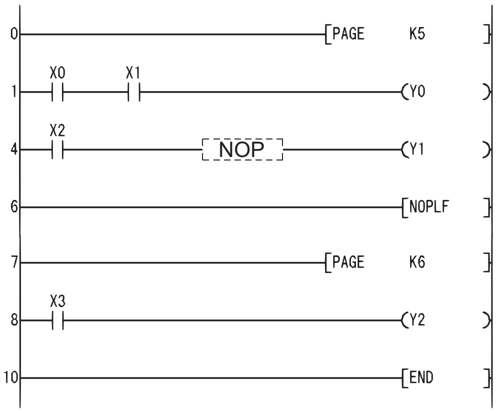


- Printing the ladder will result in the following:


X0
0
MOV K1 D30
MOV K2 D40
5
NOPLF
A page break will be inserted between ladder blocks with the presence of NOPLF instruction.
-1-
X1
6
Y40
8
END

PAGE n

[Ladder Mode]

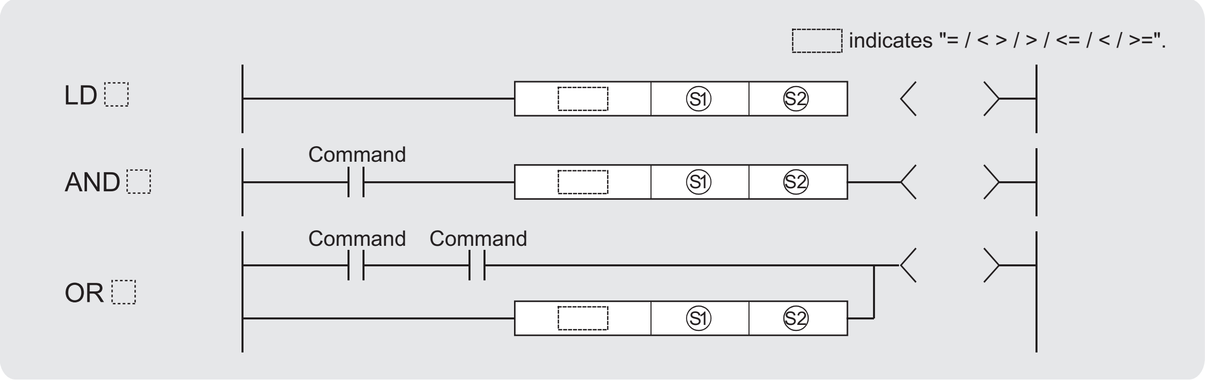


6 BASIC INSTRUCTIONS

Category	Processing Details	Reference section
Comparison operation instruction	Compares data to data	6.1
Arithmetic operation instruction	Adds, subtracts, multiplies, divides, increments, or decrements data with other data	6.2
Data conversion instructions	Converts data types	6.3
Data transfer instruction	Transmits designated data	6.4

6.1 Comparison Operation Instruction

6.1.1 BIN 16-bit data comparisons (= , <> , >, <= , <, >=)



(S1), (S2) : Data for comparison or start number of the devices where the data for comparison is stored (BIN 16 bits)

Set Data	Internal Devices		Constants K, H	Others
	Bit	Word		
(S1)	○		○	—
(S2)	○		○	—

☆ Function

(1) Treats BIN 16-bit data from device designated by (S1) and BIN 16-bit data from device designated by (S2) as an a normally-open contact, and performs comparison operation.

(2) The results of the comparison operations for the individual instructions are as follows:

Instruction Symbol in □	Condition	Comparison Operation Result	Instruction Symbol in □	Condition	Comparison Operation Result
=	(S2) = (S1)	Continuity	=	(S1) ≠ (S2)	Non-continuity
< >	(S1) ≠ (S2)		< >	(S2) = (S1)	
>	(S1) > (S2)		>	(S1) ≦ (S2)	
<=	(S1) ≦ (S2)		<=	(S1) > (S2)	
<	(S1) < (S2)		<	(S1) ≧ (S2)	
>=	(S1) ≧ (S2)		>=	(S1) < (S2)	

(3) When (S1) and (S2) are assigned by a hexadecimal constant and the numerical value (8 to F) whose most significant bit (b15) is "1" is designated as a constant, the value is considered as a negative BIN value in comparison operation.

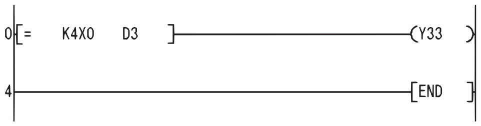
Operation Error

(1) There are no operation errors associated with the =, < >, >, <=, < or >= instructions.

Program Example

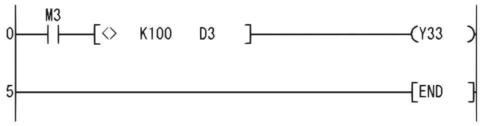
(1) The following program compares the data at X0 to XF with the data at D3, and turns Y33 ON if the data is identical.

[Ladder Mode]



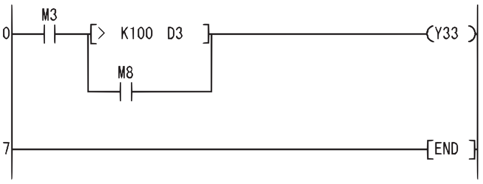
(2) The following program compares BIN value K100 to the data at D3, and establishes continuity if the data in D3 is something other than 100.

[Ladder Mode]



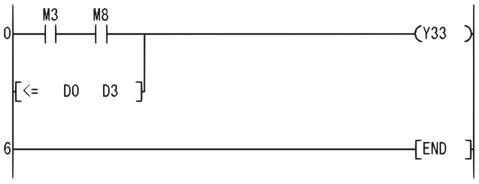
(3) The following program compares the BIN value 100 with the data in X0 to XF, and establishes continuity if the D3 data is less than 100.

[Ladder Mode]

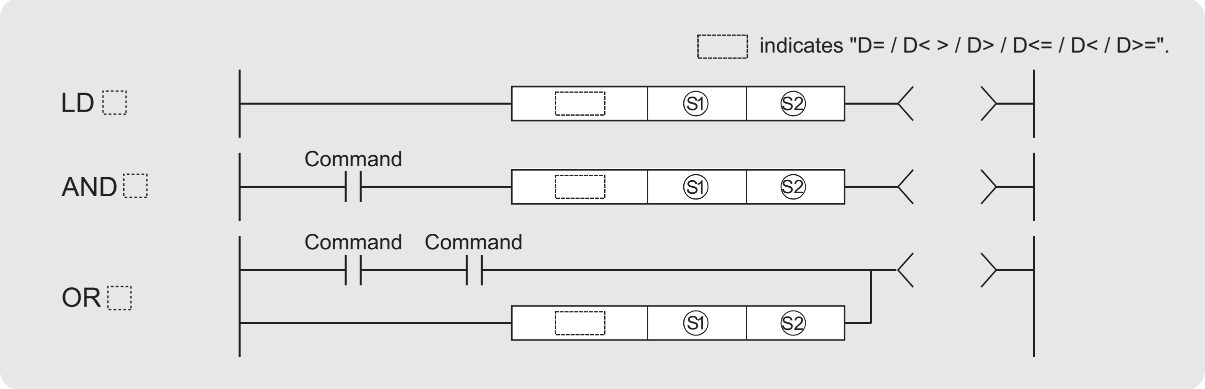


(4) The following program compares the data in D0 and D3, and if the data in D0 is equal to or less than the data in D3, establishes continuity.

[Ladder Mode]



6.1.2 BIN 32-bit data comparisons (D=, D<>, D>, D<=, D<, D>=)



S1, S2 : Data for comparison or start number of the devices where the data for comparison is stored (BIN 32 bits)

Set Data	Internal Devices		Constants K, H	Others
	Bit	Word		
S1	○		○	—
S2	○		○	—

Function

(1) Treats BIN 32-bit data from device designated by S1 and BIN 32-bit data from device designated by S2 as an a normally-open contact, and performs comparison operation.

(2) The results of the comparison operations for the individual instructions are as follows:

Instruction Symbol in ⬚	Condition	Comparison Operation Result	Instruction Symbol in ⬚	Condition	Comparison Operation Result
D =	S2 = S1	Continuity	D =	S1 ≠ S2	Non-continuity
D <>	S1 ≠ S2		D <>	S2 = S1	
D >	S1 > S2		D >	S1 ≦ S2	
D <=	S1 ≦ S2		D <=	S1 > S2	
D <	S1 < S2		D <	S1 ≧ S2	
D >=	S1 ≧ S2		D >=	S1 < S2	

(3) When S1 and S2 are assigned by a hexadecimal constant and the numerical value (8 to F) whose most significant bit (b31) is "1" is designated as a constant, the value is considered as a negative BIN value in comparison operation.

(4) Data used for comparison should be designated by a 32-bit instruction (DMOV instruction, etc.).
If designation is made with a 16-bit instruction (MOV instruction, etc.), comparisons of large and small values cannot be performed correctly.

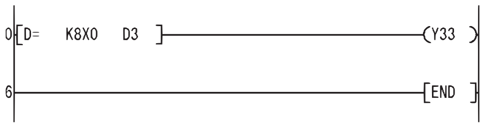
Operation Error

(1) There are no operation errors associated with the D=, D< >, D>, D<=, D< or D>= instruction.

Program Example

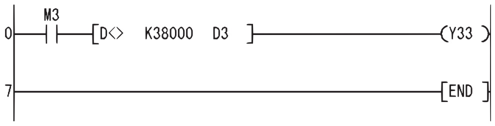
(1) The following program compares the data at X0 to X1F with the data at D3 and D4, and turns Y33 ON, if the data at X0 to X1F and the data at D3 and D4 match.

[Ladder Mode]



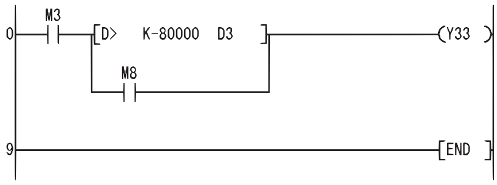
(2) The following program compares BIN value K38000 to the data at D3, and D4, and establishes continuity if the data in D3 and D4 is something other than 38000.

[Ladder Mode]



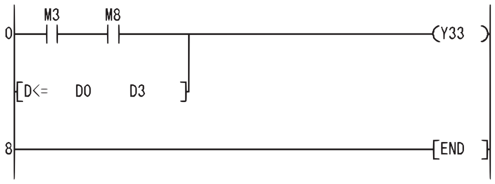
(3) The following program compares BIN value K−80000 to the data at D3 and D4, and establishes continuity if the data in D3 and D4 is less than −80000.

[Ladder Mode]



(4) The following program compares the data in D0 and D1 with the data in D3 and D4, and establishes continuity if the data in D0 and D1 is equal to or less than the data in D3 and D4.

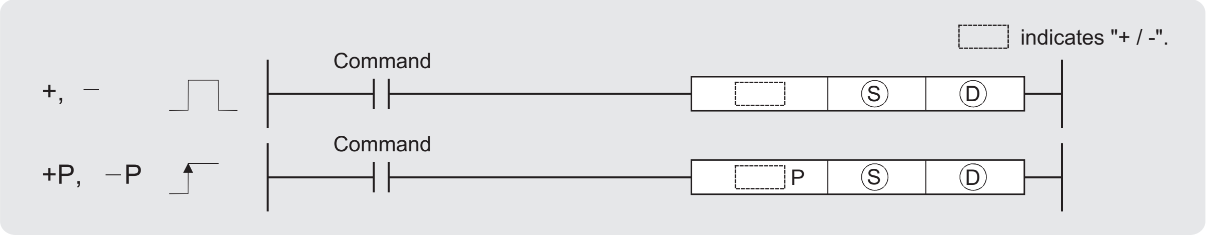
[Ladder Mode]



6.2 Arithmetic Operation Instructions

6.2.1 BIN 16-bit addition and subtraction operations (+(P), –(P))

1 When two data are set (Ⓓ + Ⓢ → Ⓓ, Ⓓ – Ⓢ → Ⓓ)



Ⓢ : Data for additing/subtracting or start number of the devices where the data for additing/subtracting is stored (BIN 16 bits)

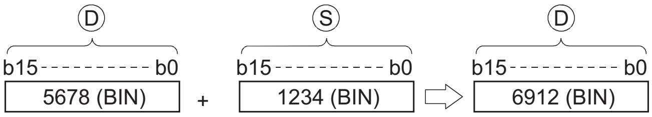
Ⓓ :Start number of the devices where the data to be added to/subtracted from is stored (BIN 16 bits)

Set Data	Internal Devices		Constants K, H	Others
	Bit	Word		
Ⓢ	○		○	—
Ⓓ	○		—	—

Function

+

(1) Adds 16-bit BIN data designated by Ⓓ to 16-bit BIN data designated by Ⓢ and stores the result of the addition at the device designated by Ⓓ.



(2) Values for Ⓢ and Ⓓ can be designated between –32768 and 32767 (BIN, 16 bits).

(3) The judgment of whether data is positive or negative is made by the most significant bit (b15).

- 0: Positive
- 1: Negative

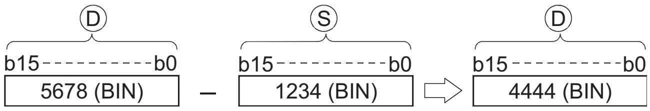
(4) The following will happen when an underflow or overflow is generated in an operation result: The carry flag in this case does not go ON.

```
· K32767   +K2  ———→ K–32767······Since b15 is "1", the judgment is
  (H7FFF)  (H0002)    (H8001)       a negative value.

· K–32768 +K–2———→ K32766······ ···Since b15 is "0", the judgment is
  (H8000)  (HFFFE)    (H7FFE)       a positive value.
```

–

(1) Subtracts 16-bit BIN data designated by Ⓓ from 16-bit BIN data designated by Ⓢ and stores the result of the subtraction at the device designated by Ⓓ.



(2) Values for Ⓢ and Ⓓ can be designated between −32768 and 32767 (BIN, 16 bits).

(3) The judgment of whether data is positive or negative is made by the most significant bit (b15).

- 0: Positive
- 1: Negative

(4) The following will happen when an underflow or overflow is generated in an operation result: The carry flag in this case does not go ON.

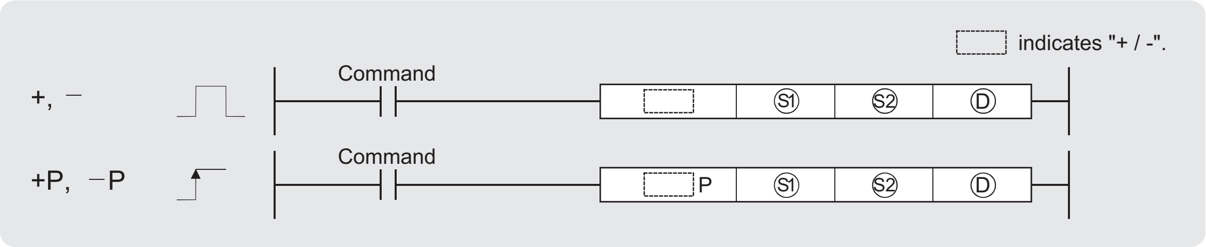
```
· K−32768 −K2  ────────▶ K32766·········Since b15 is "0", the judgment is
  (H8000)     (H0002)     (H7FFE)          a positive value.

· K32767   −K−2 ────────▶ K−32767······Since b15 is "1", the judgment is
  (H7FFF)     (HFFFE)     (H8001)          a negative value.
```

Operation Error

(1) There are no operation errors associated with the +(P) or –(P) instructions.

2 When three data are set (S1 + S2 → D, S1 − S2 → D)



S1 : Data to be added to/subtracted from or start number of the devices where the data to be added to/ subtracted from is stored (BIN 16 bits)

S2 : Data for additing/subtracting or start number of the devices where the data for additing/subtracting is stored (BIN 16 bits)

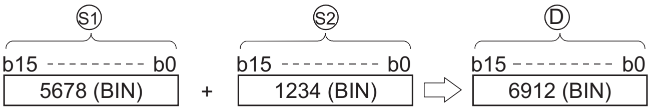
D : Start number of the devices where the addition/subtraction operation result will be stored (BIN 16 bits)

Set Data	Internal Devices		Constants K, H	Others
	Bit	Word		
S1	○		○	—
S2	○		○	—
D	○		—	—

Function

+

(1) Adds 16-bit BIN data designated by S1 to 16-bit BIN data designated by S2 and stores the result of the addition at the device designated by D.



(2) Values for S1, S2 and D can be designated between −32768 and 32767 (BIN, 16 bits).

(3) The judgment of whether data is positive or negative is made by the most significant bit (b15).

- 0: Positive
- 1: Negative

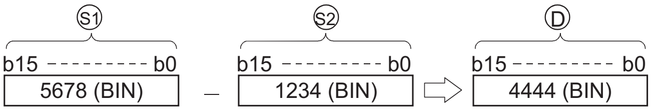
(4) The following will happen when an underflow or overflow is generated in an operation result: The carry flag in this case does not go ON.

· K32767 +K2 → K−32767 ······ Since b15 is "1", the judgment is a negative value.
(H7FFF) (H0002) (H8001)

· K−32768 +K−2 → K32766 ········ Since b15 is "0", the judgment is a positive value.
(H8000) (HFFFE) (H7FFE)

–

(1) Subtracts 16-bit BIN data designated by Ⓢ1 from 16-bit BIN data designated by Ⓢ2 and stores the result of the subtraction at the device designated by Ⓓ.



(2) Values for Ⓢ1, Ⓢ2 and Ⓓ can be designated between –32768 and 32767 (BIN, 16 bits).

(3) The judgment of whether data is positive or negative is made by the most significant bit (b15).

- 0: Positive
- 1: Negative

(4) The following will happen when an underflow or overflow is generated in an operation result: The carry flag in this case does not go ON.

```
· K–32768 –K2       ——▶ K32766·········Since b15 is "0", the judgment is
  (H8000)   (H0002)     (H7FFE)        a positive value.

· K32767  –K–2      ——▶ K–32767······Since b15 is "1", the judgment is
  (H7FFF)   (HFFFE)     (H8001)        a negative value.
```

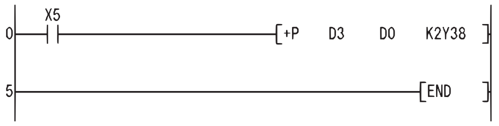
Operation Error

(1) There are no operation errors associated with the +(P) or –(P) instructions.

Program Example

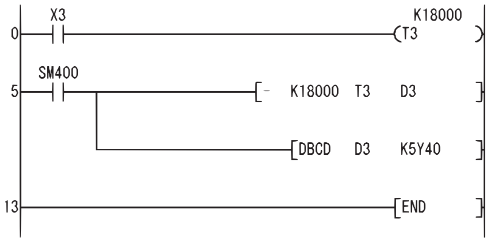
(1) The following program adds, when X5 is turned ON, the data at D3 and D0 and outputs the operation result at Y38 to Y3F.

[Ladder Mode]



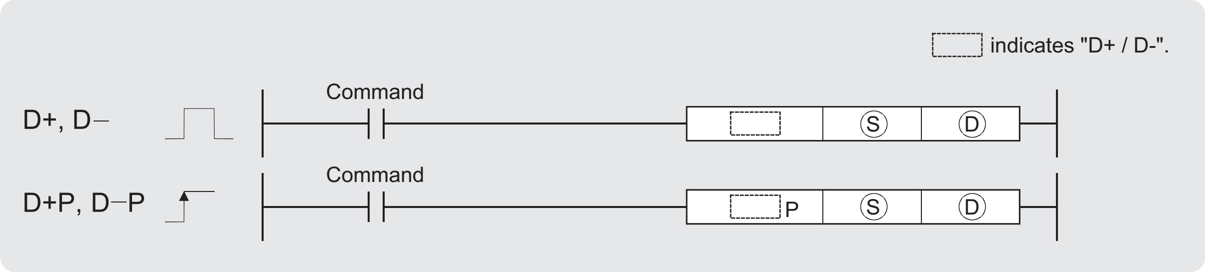
(2) The following program outputs the difference between the set value for timer T3 and its present value in BCD to Y40 to Y53.

[Ladder Mode]



6.2.2 BIN 32-bit addition and subtraction operations (D+(P), D–(P))

1 When two data are set ((Ⓓ + 1, Ⓓ) + (Ⓢ + 1, Ⓢ) → (Ⓓ + 1, Ⓓ),
(Ⓓ +1, Ⓓ) – (Ⓢ + 1, Ⓢ) → (Ⓓ +1, Ⓓ))



Ⓢ : Data for additing/subtracting or start number of the devices where the data for additing/subtracting is stored (BIN 32 bits)

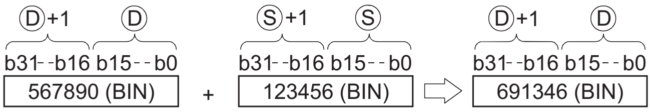
Ⓓ : Start number of the devices where the data to be added to/subtracted from is stored (BIN 32 bits)

Set Data	Internal Devices		Constants K, H	Others
	Bit	Word		
Ⓢ	○		○	—
Ⓓ	○		—	—

Function

D+

(1) Adds 32-bit BIN data designated by Ⓓ to 32-bit BIN data designated by Ⓢ, and stores the result of the addition at the device designated by Ⓓ.



(2) The values for Ⓢ and Ⓓ can be designated at between −2147483648 and 2147483647 (BIN 32 bits).

(3) Judgment of whether the data is positive or negative is made on the basis of the most significant bit (b31).

- 0: Positive
- 1: Negative

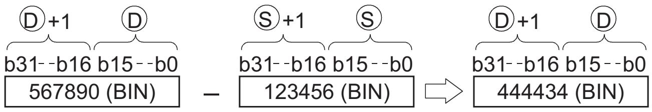
(4) The following will happen when an underflow or overflow is generated in an operation result: The carry flag in this case does not go ON.

· K2147483647 +K2 ——→ K−2147483647 ······Since b31 is "1", the judgment is
(H7FFFFFFF) (H00000002) (H80000001) a negative value.

· K−2147483648 +K−2 ——→ K2147483646 ·········Since b31 value is "0", the judgment is
(H80000000) (HFFFFFFFE) (H7FFFFFFE) a positive value.

D –

(1) Subtracts 32-bit BIN data designated by Ⓓ from 32-bit BIN data designated by Ⓢ and stores the result of the subtraction at the device designated by Ⓓ.



(2) The values for Ⓢ and Ⓓ can be designated at between −2147483648 and 2147483647 (BIN 32 bits).

(3) Judgment of whether the data is positive or negative is made on the basis of the most significant bit (b31).

- 0: Positive
- 1: Negative

(4) The following will happen when an underflow or overflow is generated in an operation result: The carry flag in this case does not go ON.

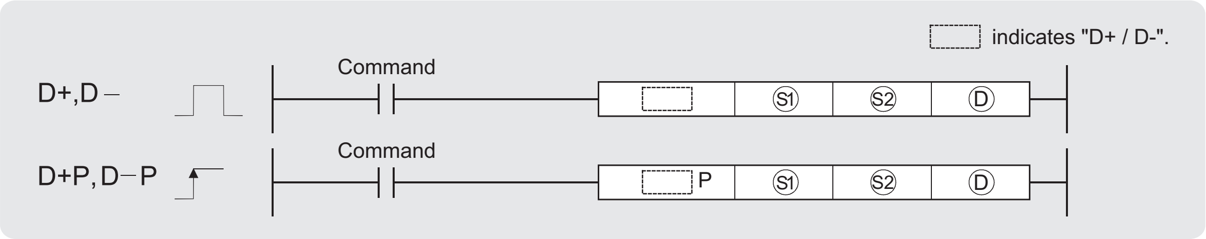
· K−2147483648 − K2 → K2147483646 ········ Since b31 is "0", the judgment is
(H80000000) (H00000002) (H7FFFFFFE) a positive value.

· K2147483647 − K−2 → K−2147483647 ······ Since b31 is "1", the judgment is
(H7FFFFFFF) (HFFFFFFFE) (H80000001) a negative value.

Operation Error

(1) There are no operation errors associated with the +(P) or –(P) instructions.

2 When three data are set ((Ⓢ1 + 1, Ⓢ1) + (Ⓢ2 + 1, Ⓢ2) → (Ⓓ + 1, Ⓓ), (Ⓢ1 + 1, Ⓢ1) – (Ⓢ2 + 1, Ⓢ2) → (Ⓓ +1, Ⓓ))



Ⓢ1 : Data to be added to/subtracted from or start number of the devices where the data to be added to/subtracted from is stored (BIN 32 bits)

Ⓢ2 : Data for additing/subtracting or start number of the devices where the data for additing/subtracting is stored (BIN 32 bits)

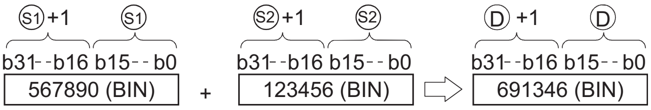
Ⓓ : Start number of the devices where the addition/subtraction operation result will be stored (BIN 32 bits)

Set Data	Internal Devices		Constants K, H	Others
	Bit	Word		
Ⓢ1	○		○	—
Ⓢ2	○		○	—
Ⓓ	○		—	—

Function

D+

(1) Adds 32-bit BIN data designated by Ⓢ1 to 32-bit BIN data designated by Ⓢ2, and stores the result of the addition at the device designated by Ⓓ.



(2) The values for Ⓢ1, Ⓢ2 and Ⓓ can be designated at between −2147483648 and 2147483647 (BIN 32 bits).

(3) Judgment of whether the data is positive or negative is made on the basis of the most significant bit (b31).
- 0: Positive
- 1: Negative

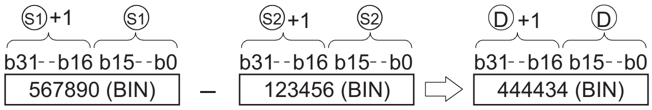
(4) The following will happen when an underflow or overflow is generated in an operation result: The carry flag in this case does not go ON.

```
· K2147483647   +K2 ──────────▶ K−2147483647 ···Since b31 is "1", the judgment is
  (H7FFFFFFF)    (H00000002)     (H80000001)      a negative value.

· K−2147483648  +K− 2 ────────▶ K2147483646 ······Since b31 is "0", the judgment is
  (H80000000)    (HFFFFFFFE)     (H7FFFFFFE)      a positive value.
```

D –

(1) Subtracts 32-bit BIN data designated by S1 from 32-bit BIN data designated by S2 and stores the result of the subtraction at the device designated by D.



(2) The values for S1, S2 and D can be designated at between −2147483648 and 2147483647 (BIN 32 bits).

(3) Judgment of whether the data is positive or negative is made on the basis of the most significant bit (b31).

- 0: Positive
- 1: Negative

(4) The following will happen when an underflow or overflow is generated in an operation result: The carry flag in this case does not go ON.

```
· K−2147483648 −K2 ────────▶ K2147483646······Since b31 is "0", the judgment is
  (H80000000)    (H00000002)  (H7FFFFFFE)      a positive value.

· K2147483647    −K−2 ───────▶ K−2147483647···Since b31 is "1", the judgment is
  (H7FFFFFFF)    (HFFFFFFFE)  (H80000001)      a negative value.
```

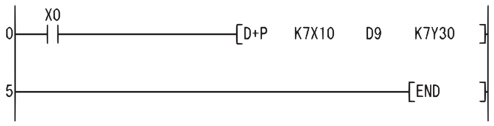
Operation Error

(1) There are no operation errors associated with the +(P) or –(P) instructions.

Program Example

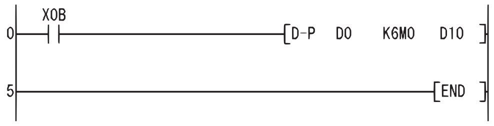
(1) The following program adds 28-bit data from X10 to X2B to the data at D9 and D10 when X0 goes ON, and outputs the result of the operation to Y30 to Y4B.

[Ladder Mode]

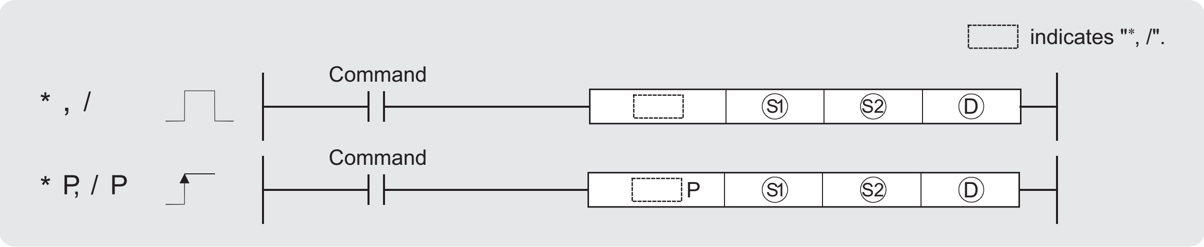


(2) The following program subtracts the data from M0 to M23 from the data at D0 and D1 when XB goes ON, and stores the result at D10 and D11.

[Ladder Mode]



6.2.3 BIN 16-bit multiplication and division operations (*(P), /(P))



Ⓢ1 : Data to be multiplied/divided or start number of the devices where the data to be multiplied/divided is stored (BIN 16 bits)

Ⓢ2 : Data for multiplying/dividing or start number of the devices where the data for multiplying/dividing is stored (BIN 16 bits)

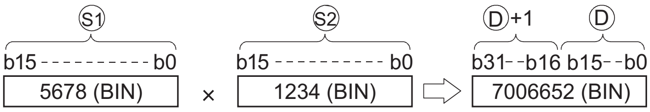
Ⓓ : Start number of the devices where the multiplication/division operation result will be stored (BIN 32 bits)

Set Data	Internal Devices		Constants K, H	Others
	Bit	Word		
Ⓢ1	○		○	—
Ⓢ2	○		○	—
Ⓓ	○		—	—

Function

*

(1) Multiplies BIN 16-bit data designated by Ⓢ1 and BIN 16-bit data designated by Ⓢ2, and stores the result in the device designated by Ⓓ.



(2) If Ⓓ is a bit device, designation is made from the lower bits.

Example

K1........ Lower 4 bits (b0 to b3)
K4........ Lower 16 bits (b0 to b15)
K8........ 32 bits (b0 to b31)

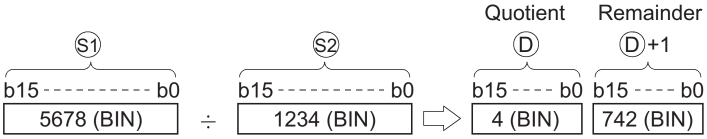
(3) Values for Ⓢ1 and Ⓢ2 can be designated between −32768 and 32767 (BIN, 16 bits).

(4) Judgments whether Ⓢ1, Ⓢ2, and Ⓓ are positive or negative are made on the basis of the most significant bit (b15 for Ⓢ1, and Ⓢ2, for Ⓓ and b31).

- 0: Positive
- 1: Negative

/

(1) Divides BIN 16-bit data designated by S1 and BIN 16-bit data designated by S2, and stores the result in the device designated by D.



(2) If a word device has been used, the result of the division operation is stored as 32 bits, and both the quotient and remainder are stored; if a bit device has been used, 16 bits are used and only the quotient is stored.

Quotient: Stored at the lower 16 bits
Remainder: Stored at the upper 16 bits (Stored only when using a word device)

(3) Values for S1 and S2 can be designated between −32768 and 32767 (BIN, 16 bits).

(4) Judgment whether values for S1, S2, D and D + 1 are positive or negative is made on the basis of the most significant bit (b15). (Sign is attached to both the quotient and remainder.)

- 0: Positive
- 1: Negative

Operation Error

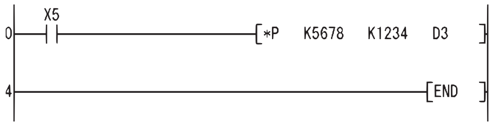
(1) In any of the following cases, an operation error occurs, the error flag (SM0) turns ON, and the corresponding error code is stored into SD0.

- Attempt to divide S2 by 0. (Error code: 4100)

Program Example

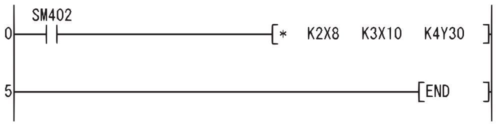
(1) The following program divides "5678" by "1234" when X5 goes ON, and stores the result at D3 and D4.

[Ladder Mode]



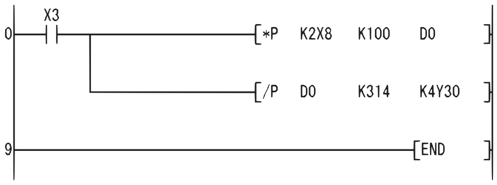
(2) The following program divides BIN data at X8 to XF by BIN data at X10 to X1B, and outputs the result of the division operation to Y30 to Y3F.

[Ladder Mode]

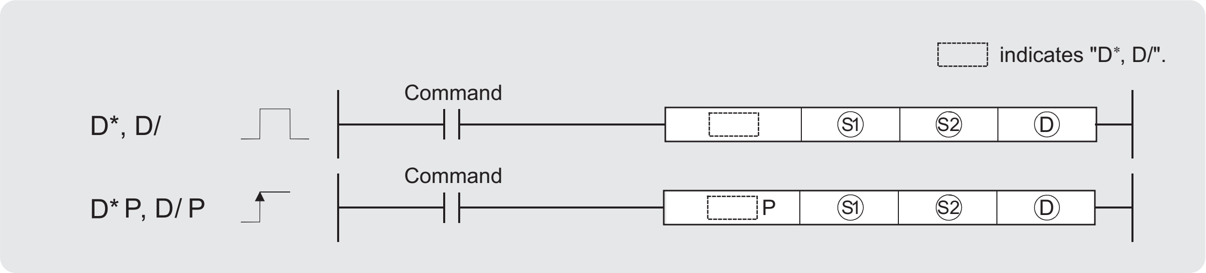


(3) The following program divides, when X3 is turned ON, the data at X8 to XF by 3.14 and outputs the operation result at Y30 to Y3F.

[Ladder Mode]



6.2.4 BIN 32-bit multiplication and division operations (D*(P), D/(P))



Ⓢ1 : Data to be multiplied/divided or start number of the devices where the data to be multiplied/divided is stored (BIN 32 bits)

Ⓢ2 : Data for multiplying/dividing or start number of the devices where the data for multiplying/dividing is stored (BIN 32 bits)

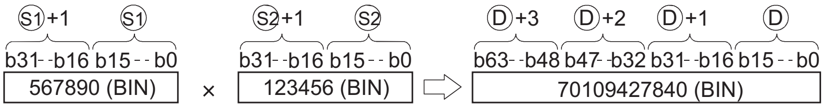
Ⓓ : Start number of the devices where the multiplication/division operation result will be stored (BIN 64 bits)

Set Data	Internal Devices		Constants K, H	Others
	Bit	Word		
Ⓢ1	○		○	—
Ⓢ2	○		○	—
Ⓓ	○		—	—

☆ Function

D*

(1) Multiplies BIN 32-bit data designated by Ⓢ1 and BIN 32-bit data designated by Ⓢ2, and stores the result in the device designated by Ⓓ.



(2) If Ⓓ is a bit device, only the lower 32 bits of the multiplication result will be considered, and the upper 32 bits cannot be designated.

Example

K1........ Lower 4 bits (b0 to b3)
K4........ Lower 16 bits (b0 to b15)
K8........ Lower 32 bits (b0 to b31)

If the upper 32 bits of the bit device are required for the result of the multiplication operation, first temporarily store the data in a word device, then transfer the word device data to the bit device by designating (Ⓓ + 2) and (Ⓓ + 3) data.

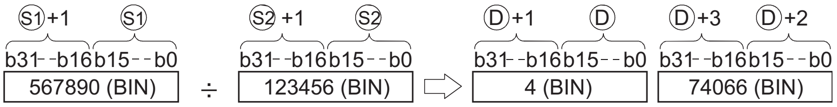
(3) The values for Ⓢ1 and Ⓢ2 can be designated at between −2147483648 and 2147483647 (BIN 32 bits).

(4) Judgments whether Ⓢ1, Ⓢ2, and Ⓓ are positive or negative are made on the basis of the most significant bit (b31 for Ⓢ1 and Ⓢ2, b63 for Ⓓ).

- 0: Positive
- 1: Negative

D/

(1) Divides BIN 32-bit data designated by S1 and BIN 32-bit data designated by S2, and stores the result in the device designated by D.



(2) With a word device, the division operation result is stored in 64 bits and both the quotient and remainder are stored. With a bit device, only the quotient is stored as the operation result in 32 bits.

Quotient: Stored at the lower 32 bits
Remainder: Stored at the upper 32 bits (Stored only when using a word device)

(3) The values for S1 and S2 can be designated at between −2147483648 and 2147483647 (BIN 32 bits).

(4) Judgment whether values for S1, S2, D and D + 2 are positive or negative is made on the basis of the most significant bit (b31).

(Sign is attached to both the quotient and remainder)

- 0: Positive
- 1: Negative

Operation Error

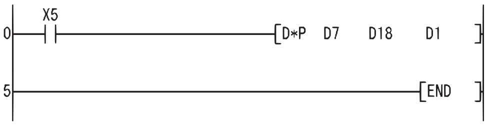
(1) In any of the following cases, an operation error occurs, the error flag (SM0) turns ON, and the corresponding error code is stored into SD0.

- Attempt to divide S2 by 0. (Error code: 4100)

Program Example

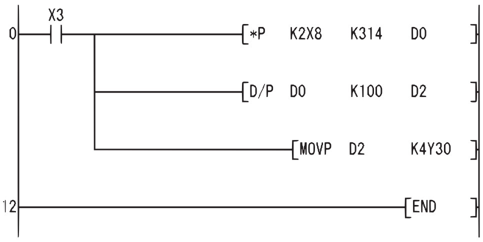
(1) The following program divides the BIN data at D7 and D8 by the BIN data at D18 and D19 when X5 is ON, and stores the result at D1 to D4.

[Ladder Mode]

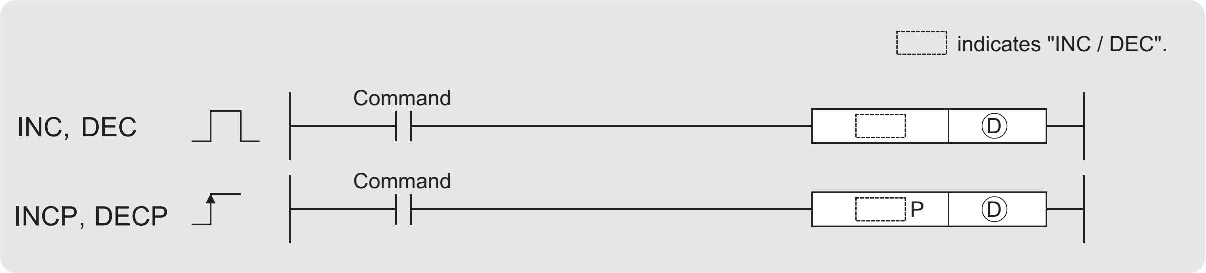


(2) The following program outputs the value resulting when the data at X8 to XF is multiplied by 3.14 to Y30 to Y3F when X3 is ON.

[Ladder Mode]



6.2.5 Incrementing and decrementing 16-bit BIN data (INC(P), DEC(P))



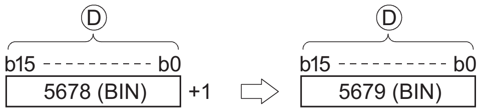
Ⓓ : Start number of devices for INC (+1)/DEC (−1) operation (BIN 16 bits)

Set Data	Internal Devices		Constants	Others
	Bit	Word		
Ⓓ	○		—	

Function

INC

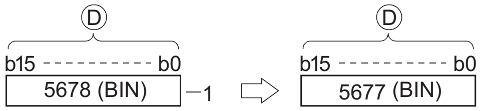
(1) Adds 1 to the device designated by Ⓓ (16-bit data).



(2) When INC/INCP operation is executed for the device designated by Ⓓ, whose content is 32767, the value −32768 is stored at the device designated by Ⓓ.

DEC

(1) Subtracts 1 from the device designated by Ⓓ (16-bit data).



(2) When DEC/DECP operation is executed for the device designated by Ⓓ, whose content is −32768, the value 32767 is stored at the device designated by Ⓓ.

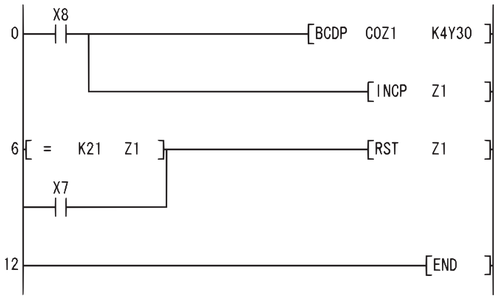
Operation Error

(1) There are no operation errors associated with the INC(P)/DEC(P) instruction.

Program Example

(1) The following program outputs the present value at the counter C0 to C20 to the area Y30 to Y3F in BCD, every time X8 is turned ON. (When present value is less than 9999)

[Ladder Mode]



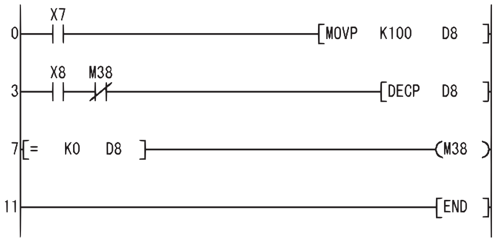
Outputs the present value of C (D+Z1) to Y30 to Y3F.

Executes Z1+1.

Sets 0 to Z1 when Z1=21 or X7 (reset input).

(2) The following is a down counter program.

[Ladder Mode]

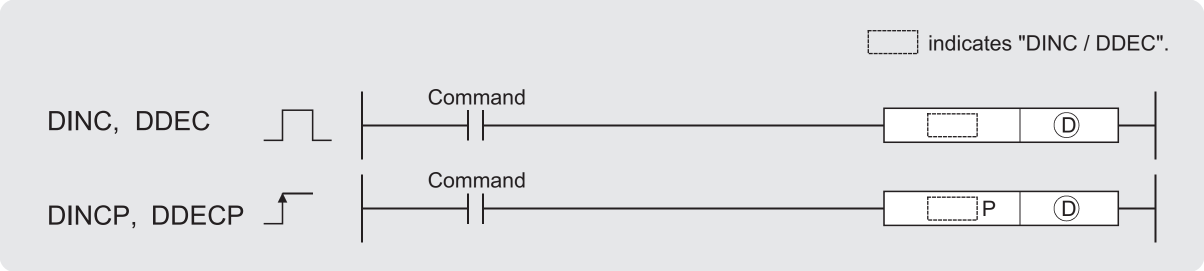


Transfers 100 to D8 when X7 is turned ON.

Turns X8 from OFF to ON
when M38 is OFF, which executes "D8 - 1".

M38 is turned ON when "D8=0".

6.2.6 Incrementing and decrementing 32-bit BIN data (DINC(P), DDEC(P))



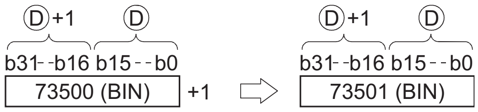
Ⓓ : Start number of devices for DINC(+1) or DDEC(–1) operation (BIN 32 bits)

Set Data	Internal Devices		Constants	Others
	Bit	Word		
Ⓓ	○		—	

Function

DINC

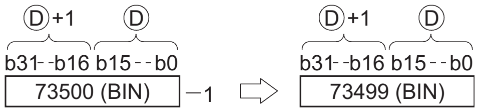
(1) Adds 1 to the device designated by Ⓓ (32-bit data).



(2) When DINC/DINCP operation is executed for the device designated by Ⓓ, whose content is 2147483647, the value −2147483648 is stored at the device designated by Ⓓ.

DDEC

(1) Subtracts 1 from the device designated by Ⓓ (32-bit data).



(2) When DDEC/DDECP operation is executed for the device designated by Ⓓ, whose content is 0, the value −1 is stored at the device designated by Ⓓ.

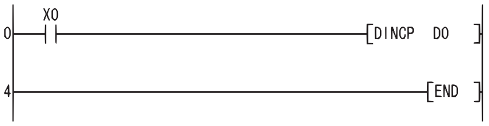
Operation Error

(1) There are no operation errors associated with DINC(P) or DDEC(P).

Program Example

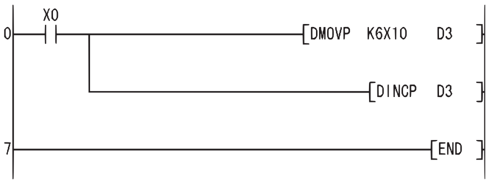
(1) The following program adds 1 to the data at D0 and D1 when X0 is ON.

[Ladder Mode]



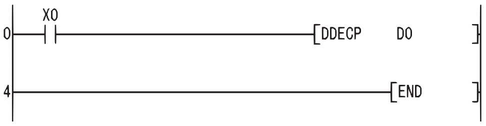
(2) The following program adds 1 to the data set at X10 to X27 when X0 goes ON, and stores the result at D3 and D4.

[Ladder Mode]



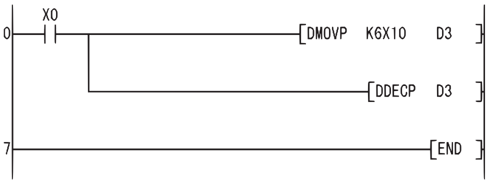
(3) The following program subtracts 1 from the data at D0 and D1 when X0 goes ON.

[Ladder Mode]



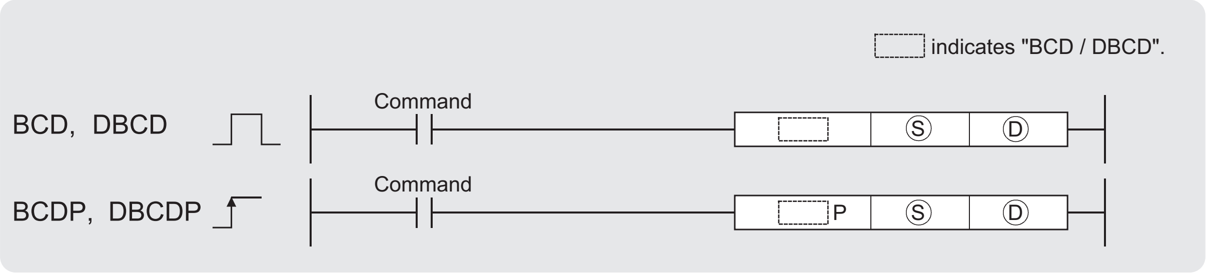
(4) The following program subtracts 1 from the data set at X10 to X27 when X0 goes ON, and stores the result at D3 and D4.

[Ladder Mode]



6.3 Data Conversion Instructions

6.3.1 Conversion from BIN data to 4-digit and 8-digit BCD (BCD(P), DBCD(P))



Ⓢ : BIN data or start number of the devices where the BIN data is stored (BIN 16/32 bits)

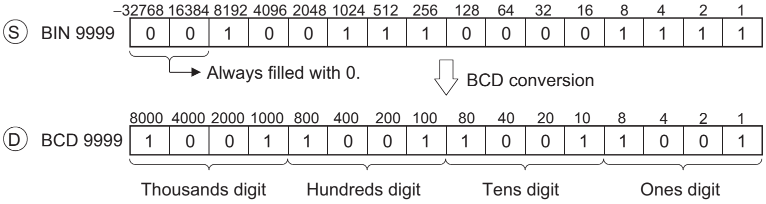
Ⓓ : Start number of the devices where BCD data will be stored (BCD 4/8 digits)

Set Data	Internal Devices		Constants K, H	Others
	Bit	Word		
Ⓢ	○		○	—
Ⓓ	○		—	—

Function

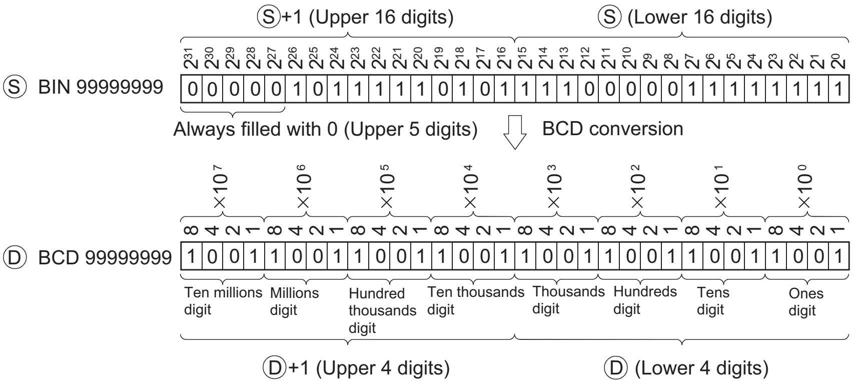
BCD

(1) Converts BIN data (0 to 9999) at the device designated by Ⓢ to BCD data, and stores it at the device designated by Ⓓ.



DBCD

(1) Converts BIN data (0 to 99999999) at the device designated by Ⓢ to BCD data, and stores it at the device designated by Ⓓ.



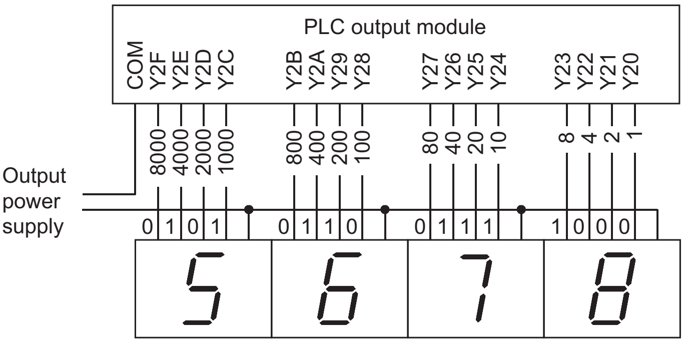
Operation Error

(1) In any of the following cases, an operation error occurs, the error flag (SM0) turns ON, and the corresponding error code is stored into SD0.

- The data of Ⓢ is other than 0 to 9999 at BCD instruction. (Error code: 4100)
- The data of Ⓢ or Ⓢ+1 is other thean 0 to 99999999 at DBCD instruction. (Error code: 4100)

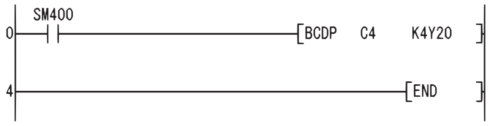
Program Example

(1) The following program outputs the present value of C4 from Y20 to Y2F to the BCD display device.

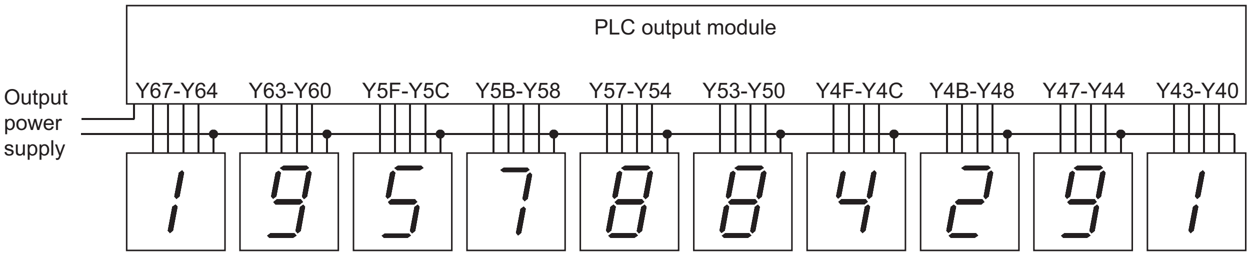


7-segment indicator

[Ladder Mode]

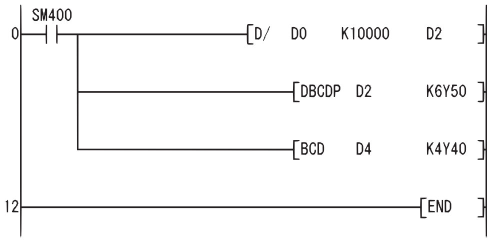


(2) The following program outputs 32-bit data from D0 to D1 to Y40 to Y67.

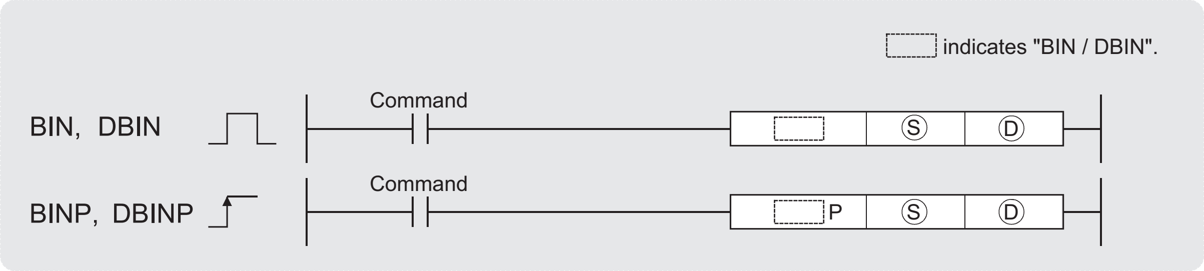


7-segment indicator

[Ladder Mode]



6.3.2 Conversion from BCD 4-digit and 8-digit data to BIN data (BIN(P), DBIN(P))



Ⓢ : BCD data or start number of the devices where the BCD data is stored (BCD 4/8 digits)

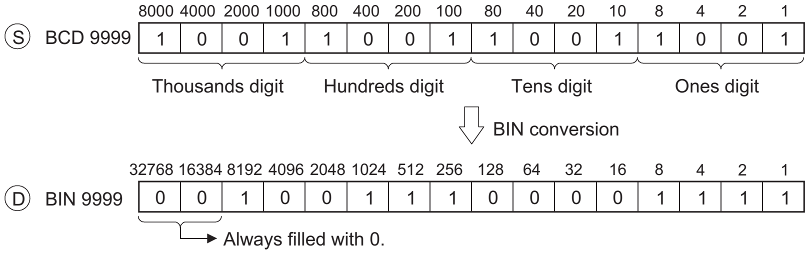
Ⓓ : Start number of the devices where BIN data will be stored (BIN 16/32 bits)

Set Data	Internal Devices		Constants K, H	Others
	Bit	Word		
Ⓢ	○		○	—
Ⓓ	○		—	—

Function

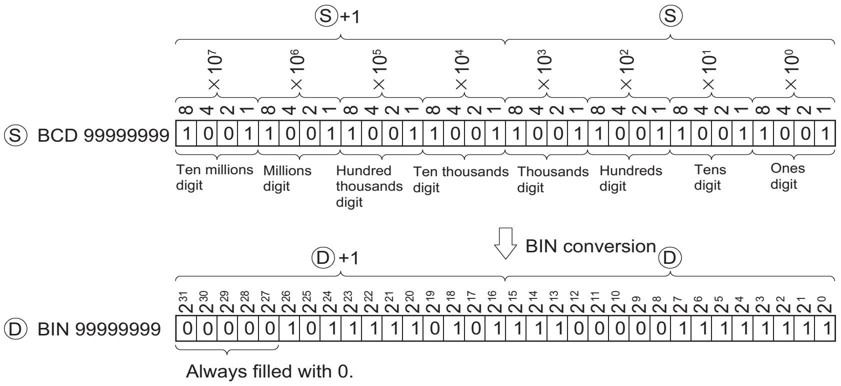
BIN

(1) Converts BCD data (0 to 9999) at device designated by Ⓢ to BIN data, and stores at the device designated by Ⓓ.



DBIN

(1) Converts BCD data (0 to 99999999) at device designated by Ⓢ to BIN data, and stores at the device designated by Ⓓ.



Operation Error

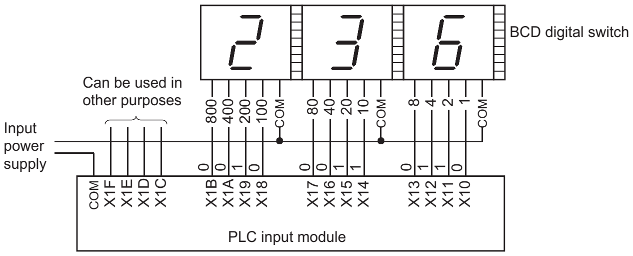
(1) In the following cases, an operation error occurs, the error flag (SM0) turns ON, an error code is stored in SD0, and the instruction is not executed.

- When values other than 0 to 9 are designated to any digits of Ⓢ.(Error code: 4100)

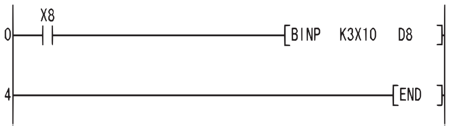
In this regard, however, the error above can be suppressed by turning SM722 ON.
However, the instruction is not executed regardless of whether SM722 is turned ON or OFF if the designated value is out of the available range.
For the BINP/DBINP instruction, the next operation will not be performed until the command (execution condition) is turned from OFF to ON regardless of the presence/absence of an error.

Program Example

(1) The following program converts the BCD data at X10 to X1B to BIN when X8 is ON, and stores it at D8.

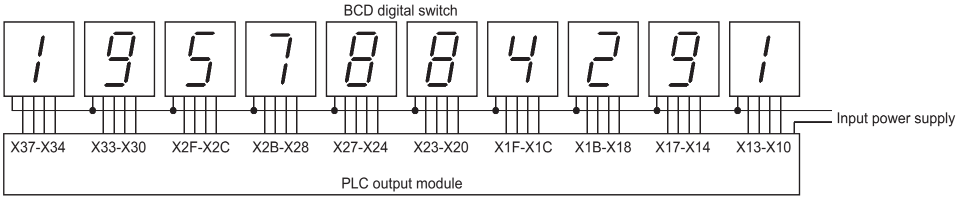


[Ladder Mode]

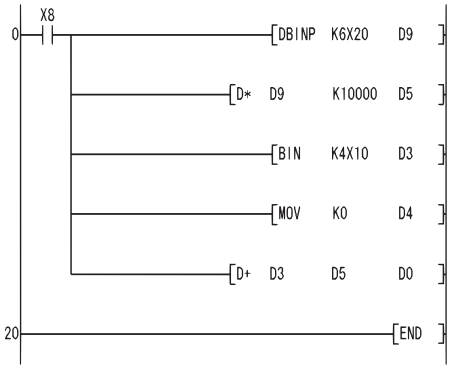


(2) The following program converts the BCD data at X10 to X37 to BIN when X8 is ON, and stores it at D0 and D1.

(Addition of the BIN data converted from BCD at X20 to X37 and the BIN data converted from BCD at X10 to X1F)

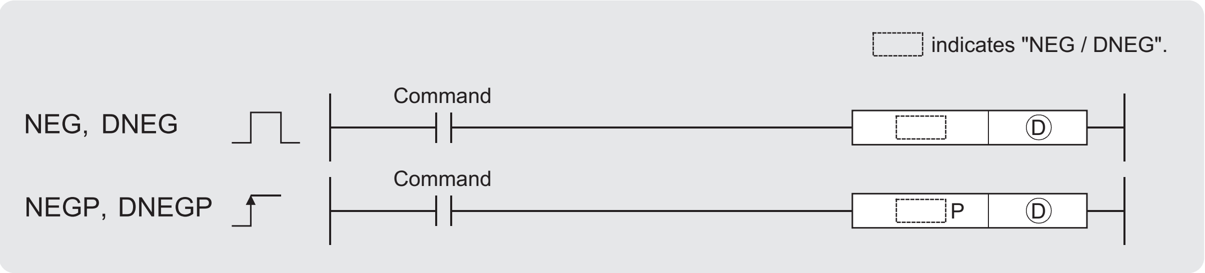


[Ladder Mode]



If the data set at X10 to X37 is a BCD value which exceeds 2147483647, the value at D0 and D1 will be a negative value, because it exceeds the range of numerical values that can be handled by a 32-bit device.

6.3.3 Complement of 2 of BIN 16- and 32-bit data (sign reversal) (NEG(P), DNEG(P))



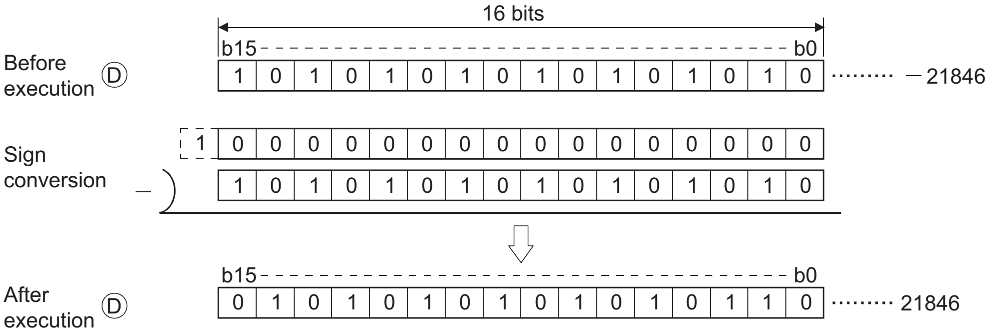
Ⓓ : Start number of the devices where the data for which complement of 2 is performed is stored (BIN 16/32 bits)

Set Data	Internal Devices		Constants	Others
	Bit	Word		
Ⓓ	○		—	

Function

NEG

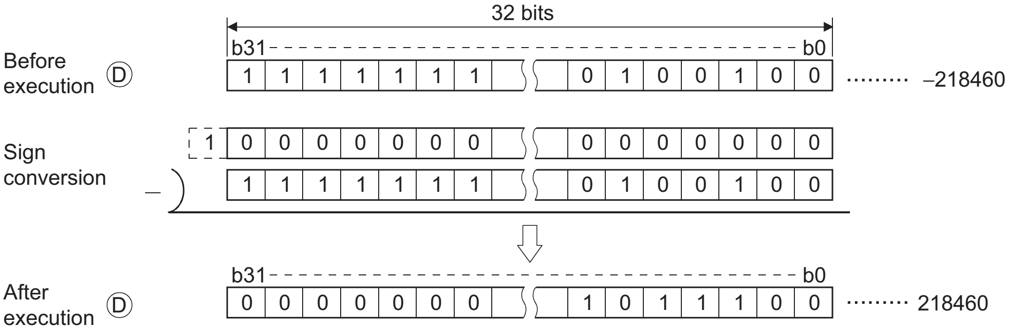
(1) Reverses the sign of the 16-bit device designated by Ⓓ and stores at the device designated by Ⓓ.



(2) Used when reversing positive and negative signs.

DNEG

(1) Reverses the sign of the 32-bit device designated by Ⓓ and stores at the device designated by Ⓓ.



(2) Used when reversing positive and negative signs.

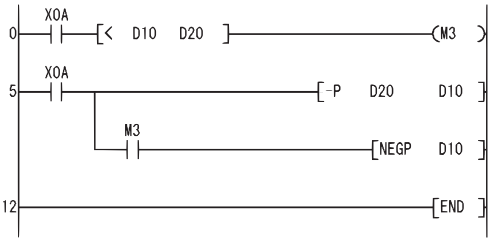
Operation Error

(1) There are no operation errors associated with the NEG(P) or DNEG(P) instructions.

Program Example

(1) The following program calculates a total for the data at D10 through D20 when XA goes ON, and seeks an absolute value if the result is negative.

[Ladder Mode]



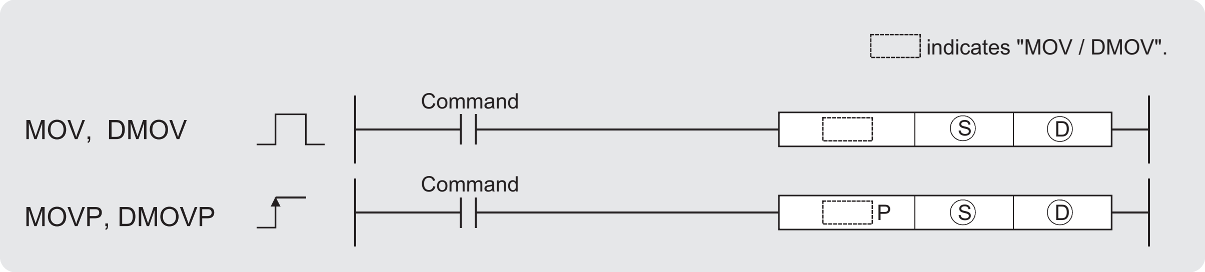
M3 is turned ON when D10<D20.

Executes "D10 – D20".

Calculates the absolute value (complement of 2) when M3 is ON.

6.4 Data Transfer Instructions

6.4.1 16-bit and 32-bit data transfers (MOV(P), DMOV(P))



Ⓢ : Data to be transferred or the number of the device where the data to be transferred is stored (BIN 16/32 bits)

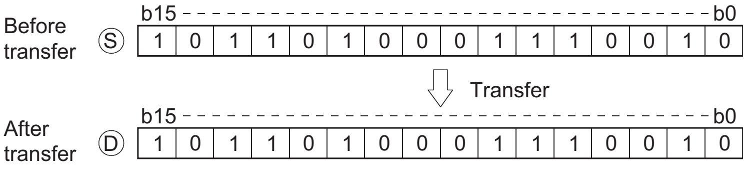
Ⓓ : Number of the device where the data will be transferred (BIN 16/32 bits)

Set Data	Internal Devices		Constants K, H	Others
	Bit	Word		
Ⓢ	○		○	—
Ⓓ	○		—	—

Function

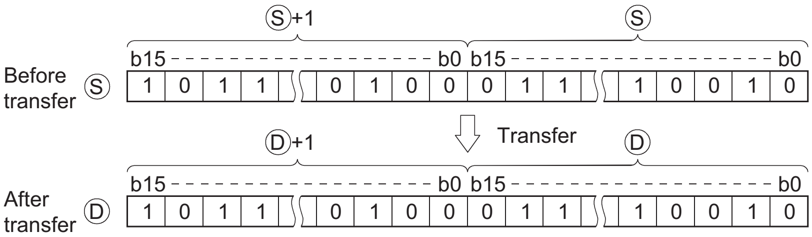
MOV

(1) Transfers the 16-bit data from the device designated by Ⓢ to the device designated by Ⓓ.



DMOV

(1) Transfers 32-bit data at the device designated by Ⓢ to the device designated by Ⓓ.



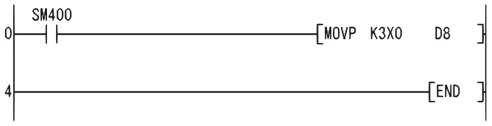
Operation Error

(1) There are no operation errors associated with the MOV(P) or DMOV(P) instructions.

Program Example

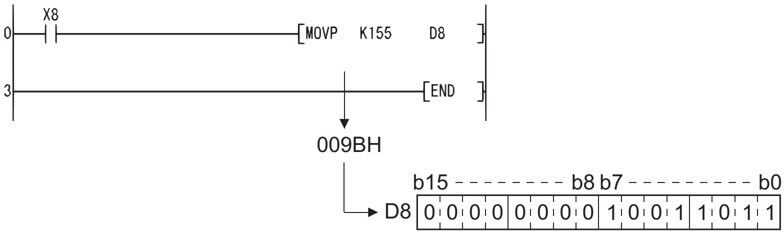
(1) The following program stores input data from X0 to XB at D8.

[Ladder Mode]



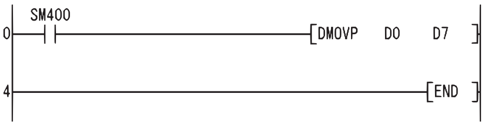
(2) The following program stores the constant K155 at D8 when X8 goes ON.

[Ladder Mode]



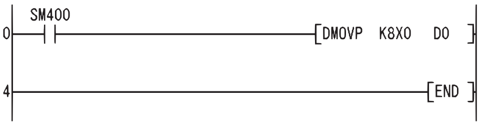
(3) The following program stores the data from D0 and D1 at D7 and D8.

[Ladder Mode]

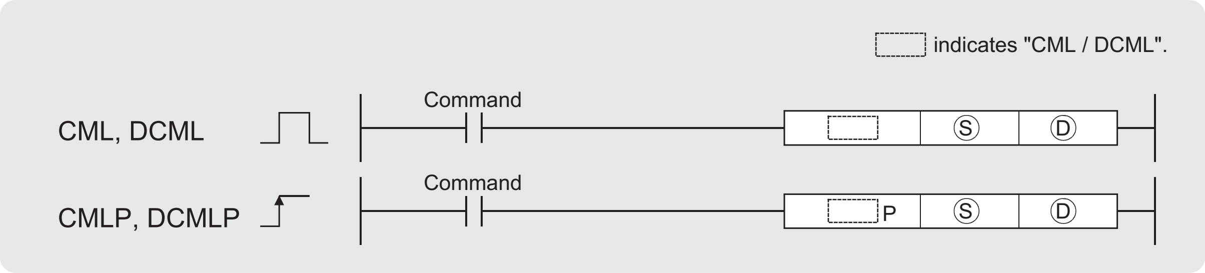


(4) The following program stores the data from X0 to X1F at D0 and D1.

[Ladder Mode]



6.4.2 16-bit and 32-bit negation transfers (CML(P), DCML(P))



Ⓢ : Data to be reversed or the number of the device where data to be reversed is stored (BIN 16/32 bits)

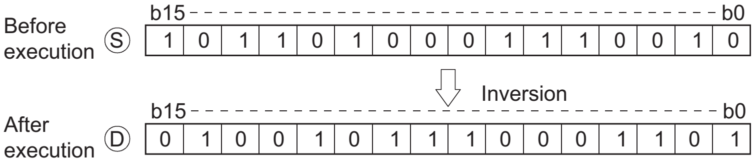
Ⓓ : Number of the device where the reversing result will be stored (BIN 16/32 bits)

Set Data	Internal Devices		Constants K, H	Others
	Bit	Word		
Ⓢ	○		○	—
Ⓓ	○		—	—

Function

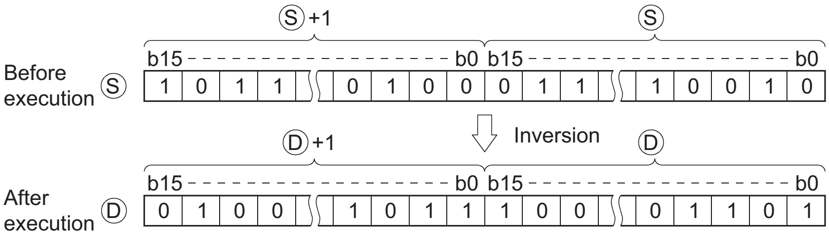
CML

(1) Inverts 16-bit data designated by Ⓢ bit by bit, and transfers the result to the device designated by Ⓓ.



DCML

(1) Inverts 32-bit data designated by Ⓢ bit by bit, and transfers the result to the device designated by Ⓓ.



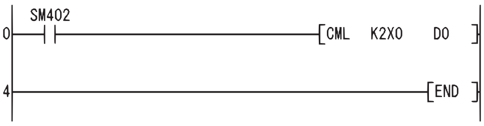
Operation Error

(1) There are no operation errors associated with the CML(P) or DCML(P) instructions.

Program Example

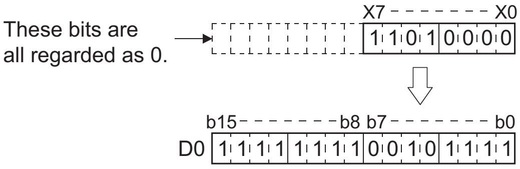
(1) The following program inverts the data from X0 to X7, and transfers result to D0.

[Ladder Mode]



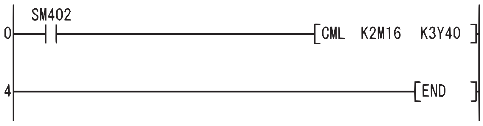
[Operation]

When "Number of bits of (S) < Number of bits of (D)"


These bits are
all regarded as 0.
X7 - - - - - - - X0
1 1 0 1 0 0 0 0
b15 - - - - - - b8 b7 - - - - - - - b0
D0 1 1 1 1 1 1 1 1 0 0 1 0 1 1 1 1

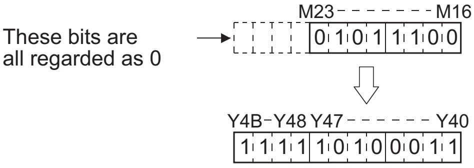
(2) The following program inverts the data at M16 to M23, and transfers the result to Y40 to Y47.

[Ladder Mode]



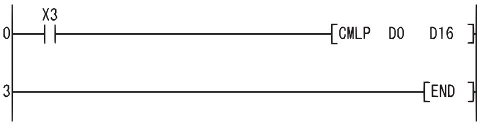
[Operation]

When "Number of bits of (S) < Number of bits of (D)"

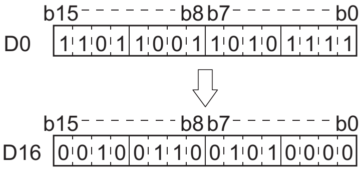


(3) The following program inverts the data at D0 when X3 is ON, and stores the result at D16.

[Ladder Mode]

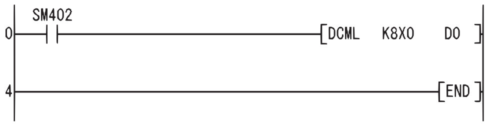


[Operation]


b15 - - - - - - - b8 b7 - - - - - - - b0
D0 1 1 0 1 1 0 0 1 1 0 1 0 1 1 1 1
b15 - - - - - - - b8 b7 - - - - - - - b0
D16 0 0 1 0 0 1 1 0 0 1 0 1 0 0 0 0

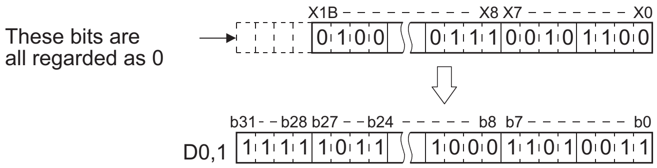
(4) The following program inverts the data at X0 to X1F, and transfers results to D0 and D1.

[Ladder Mode]



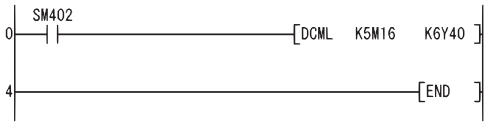
[Operation]

When "Number of bits of (S) < Number of bits of (D)"


These bits are all regarded as 0
X1B - - - - - - - - - X8 X7 - - - - - - - X0
0 1 0 0 0 1 1 1 0 0 1 0 1 1 0 0
b31 - - b28 b27 - - b24 - - - - - b8 b7 - - - - - - - b0
D0,1
1 1 1 1 1 0 1 1 1 0 0 0 1 1 0 1 0 0 1 1

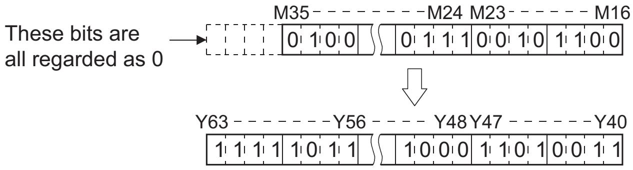
(5) The following program inverts the data at M16 to M35, and transfers it to Y40 to Y63.

[Ladder Mode]



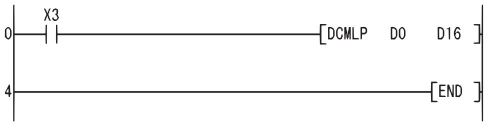
[Operation]

When "Number of bits of (S) < Number of bits of (D)"

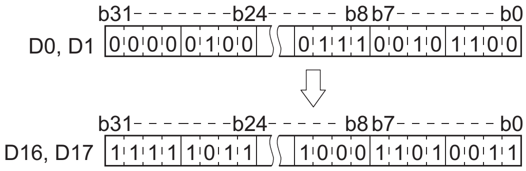

These bits are all regarded as 0
M35 - - - - - - - - M24 M23 - - - - - - M16
0 1 0 0 0 1 1 1 0 0 1 0 1 1 0 0
Y63 - - - - - - - Y56 - - - - Y48 Y47 - - - - - - Y40
1 1 1 1 1 0 1 1 1 0 0 0 1 1 0 1 0 0 1 1

(6) Inverts the data at D0 and D1 when X3 is ON, and stores the result at D16 and D17.

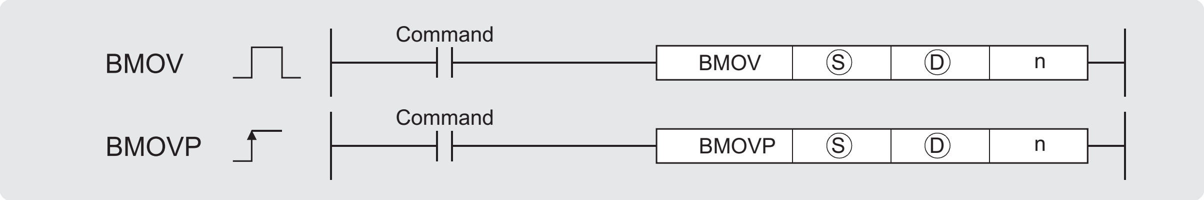
[Ladder Mode]



[Operation]


b31 - - - - - - - b24 - - - - - b8 b7 - - - - - - - b0
D0, D1
0 0 0 0 0 1 0 0 0 1 1 1 0 0 1 0 1 1 0 0
b31 - - - - - - - b24 - - - - - b8 b7 - - - - - - - b0
D16, D17
1 1 1 1 1 0 1 1 1 0 0 0 1 1 0 1 0 0 1 1

6.4.3 Block 16-bit data transfers (BMOV(P))



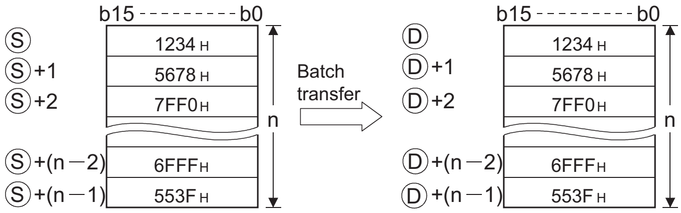
Ⓢ : Start number of the devices where the data to be transferred is stored (BIN 16 bits)

Ⓓ : Start number of the devices of transfer destination (BIN 16 bits)
n : Number of data to be transferred (BIN 16 bits)

Set Data	Internal Devices		Constants K, H	Others
	Bit	Word		
Ⓢ	○		—	—
Ⓓ	○		—	—
n	○		○	—

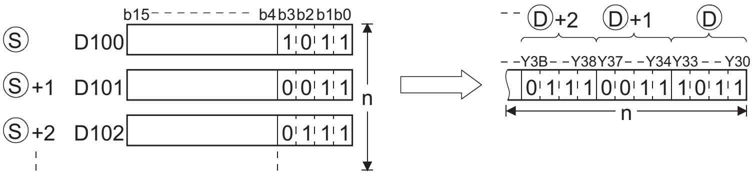
Function

(1) Transfers in batch 16-bit data n-points from the device designated by Ⓢ to location n-points from the device designated by Ⓓ.



(2) Transfers can be accomplished even in cases where there is an overlap between the source and destination device.
In the case of transmission to the smaller device number, transmission is from Ⓢ; for transmission to the larger device number, transmission is from Ⓢ + (n − 1).

(3) When Ⓢ is a word device and Ⓓ is a bit device, the target for the word device is the number of bits designated by the bit device digit specification.
If Ⓓ is designated for K1Y30, the lower four bits of the word device designated by Ⓢ are the target.



(4) If bit device has been designated for Ⓢ and Ⓓ, then Ⓢ and Ⓓ should always have the same number of digits.

Operation Error

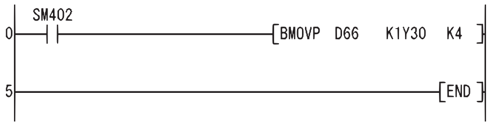
(1) In any of the following cases, an operation error occurs, the error flag (SM0) turns ON, and the corresponding error code is stored into SD0.

- The device range of n-points from Ⓢ or Ⓓ exceeds the corresponding device range.
(Error code: 4101)

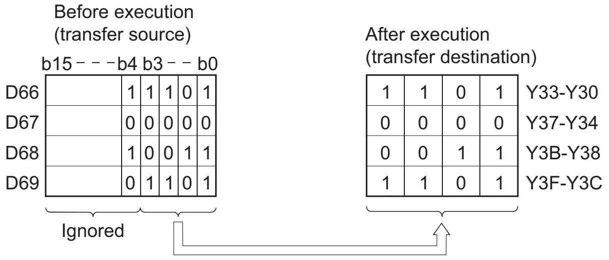
Program Example

(1) The following program outputs the lower 4 bits of data at D66 to D69 to Y30 to Y3F in 4-point units.

[Ladder Mode]



[Operation]

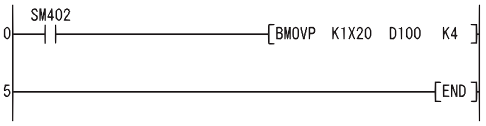


	b15 - - - b4	b4	b3			b0
D66		1	1	1	0	1
D67		0	0	0	0	0
D68		1	0	0	1	1
D69		0	1	1	0	1

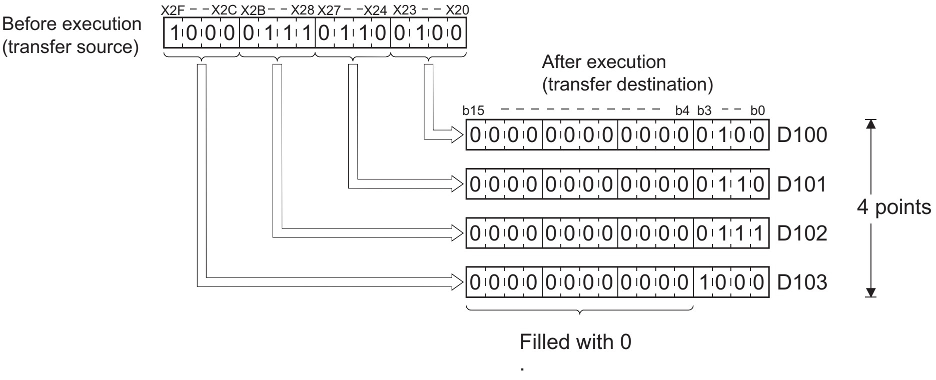
1	1	0	1	Y33-Y30
0	0	0	0	Y37-Y34
0	0	1	1	Y3B-Y38
1	1	0	1	Y3F-Y3C

(2) The following program outputs the data at X20 to X2F to D100 to D103 in 4-point units.

[Ladder Mode]



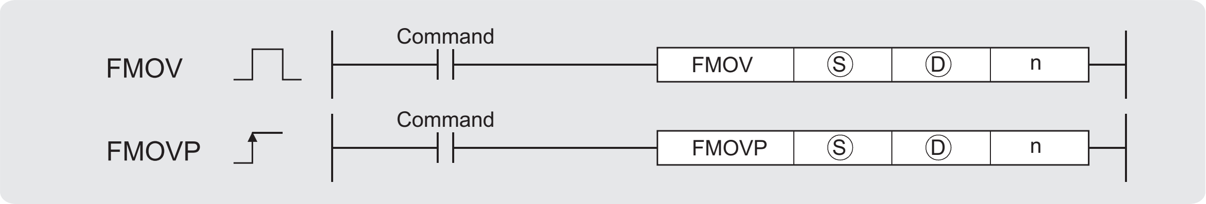
[Operation]



X2F - - X2C	X2B - - X28	X27 - - X24	X23 - - X20
1 0 0 0	0 1 1 1	0 1 1 0	0 1 0 0

0 0 0 0	0 0 0 0	0 0 0 0	0 1 0 0	D100
0 0 0 0	0 0 0 0	0 0 0 0	0 1 1 0	D101
0 0 0 0	0 0 0 0	0 0 0 0	0 1 1 1	D102
0 0 0 0	0 0 0 0	0 0 0 0	1 0 0 0	D103

6.4.4 Identical 16-bit data block transfers (FMOV(P))



Ⓢ : Data to be transferred or the start number of the devices where the data to be transferred is stored (BIN 16 bits)

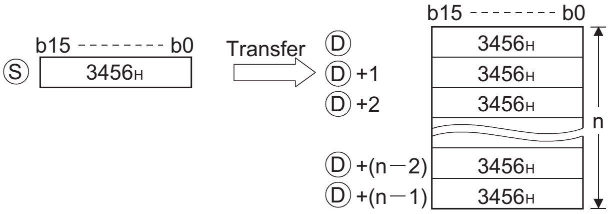
Ⓓ : Start number of the devices of transfer destination (BIN 16 bits)

n : Number of data to be transferred (BIN 16 bits)

Set Data	Internal Devices		Constants K, H	Others
	Bit	Word		
Ⓢ	○		○	—
Ⓓ	○		—	—
n	○		○	—

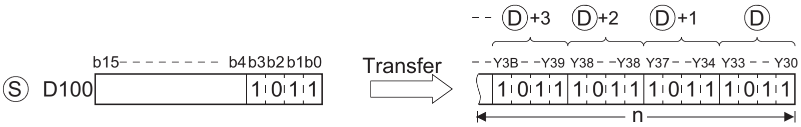
Function

(1) Transfers 16-bit data at the device designated by Ⓢ to n points of devices starting from the one designated by Ⓓ.



(2) When Ⓢ is a word device and Ⓓ is a bit device, the target for the word device Ⓢ is the number of bits designated by the bit device digit specification.

If Ⓓ is designated for K1Y30, the lower 4 bits of the word device designated by Ⓢ are the target.


b15- - - - - - - - b4 b3 b2 b1 b0
Ⓢ D100
1 0 1 1
Transfer
- - Ⓓ+3 Ⓓ+2 Ⓓ+1 Ⓓ
- -Y3B- -Y39 Y38- -Y38 Y37- -Y34 Y33 - - Y30
1 0 1 1 1 0 1 1 1 0 1 1 1 0 1 1
n

(3) If bit device has been designated for Ⓢ and Ⓓ, then Ⓢ and Ⓓ should always have the same number of digits.

Operation Error

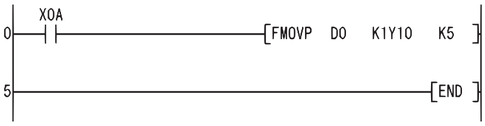
(1) In any of the following cases, an operation error occurs, the error flag (SM0) turns ON, and the corresponding error code is stored into SD0.

- The device range of n-points from Ⓓ or exceeds the corresponding device range. (Error code: 4101)

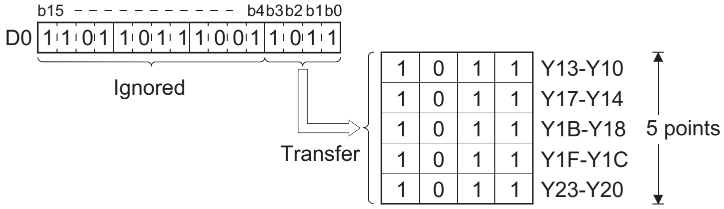
Program Example

(1) The following program outputs the lower 4 bits of D0 when XA goes ON to Y10 to Y23 in 4-bit units.

[Ladder Mode]

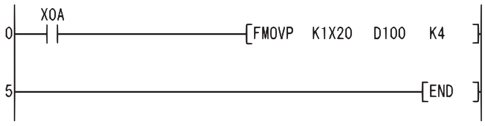


[Operation]

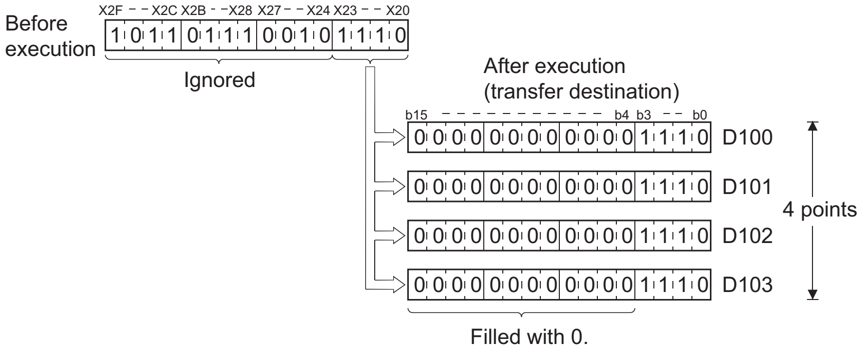


(2) The following program outputs the data at X20 through X23 to D100 through D103 when XA goes ON.

[Ladder Mode]



[Operation]


Before execution
X2F X2C X2B X28 X27 X24 X23 X20
1 0 1 1 0 1 1 1 0 0 1 0 1 1 1 0
Ignored
After execution (transfer destination)
b15 b4 b3 b0
0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 0 D100
0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 0 D101
0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 0 D102
0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 0 D103
4 points
Filled with 0.

MEMO

7 APPLICATION INSTRUCTIONS

Category	Processing Details	Reference section
Logical operation instructions	Logical operations such as logical sum, logical product, etc.	7.1

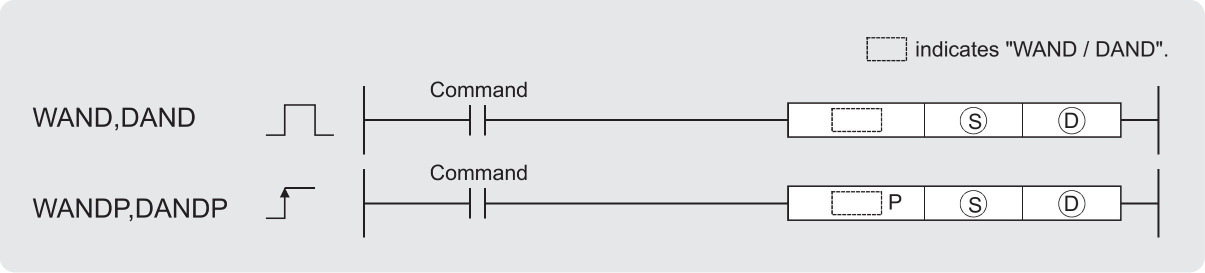
7.1 Logical Operation Instructions

(1) The logical operation instructions perform logical sum, logical product or other logical operations in 1-bit units.

Category	Processing Details	Formula for Operation	Example		
			A	B	Y
Logical product (AND)	Becomes 1 only when both input A and input B are 1; otherwise, is 0	$Y = A * B$	0	0	0
			0	1	0
			1	0	0
			1	1	1
Logical sum (OR)	Becomes 0 only when both input A and input B are 0; otherwise, is 1	$Y = A + B$	0	0	0
			0	1	1
			1	0	1
			1	1	1
Exclusive OR (XOR)	Becomes 0 if input A and input B are equal; otherwise, is 1	$Y = \overline{A} * B + A * \overline{B}$	0	0	0
			0	1	1
			1	0	1
			1	1	0
NON exclusive logical sum (XNR)	Becomes 1 if input A and input B are equal; otherwise, is 0	$Y = (\overline{A} + B)(A + \overline{B})$	0	0	1
			0	1	0
			1	0	0
			1	1	1

7.1.1 Logical products with 16-bit and 32-bit data (WAND(P), DAND(P))

1 When two data are set (Ⓓ ∧ Ⓢ → Ⓓ, (Ⓓ + 1, Ⓓ) ∧ (Ⓢ + 1, Ⓢ) → (Ⓓ + 1, Ⓓ))



Ⓢ : Data for a logical product operation or the start number of the devices where the data is stored (BIN 16/32 bits)

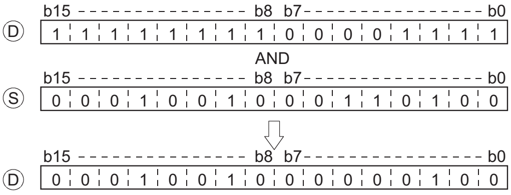
Ⓓ : Start number of the devices where the logical product operation result will be stored (BIN 16/32 bits)

Set Data	Internal Devices		Constants K, H	Others
	Bit	Word		
Ⓢ	○		○	—
Ⓓ	○		—	—

Function

WAND

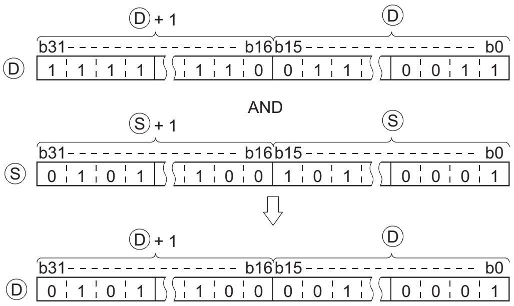
(1) A logical product operation is conducted for each bit of the 16-bit data of the device designated at Ⓓ and the 16-bit data of the device designated at Ⓢ, and the results are stored in the device designated at Ⓓ.



(2) When bit devices are designated, the bit devices below the points designated as digits are regarded as "0" in the operation. (See Program Example (2))

DAND

(1) Conducts a logical product operation on each bit of the 32-bit data for the device designated by Ⓓ and the 32-bit data for the device designated by Ⓢ, and stores the results at the device designated by Ⓓ.



(2) When bit devices are designated, the bit devices below the points designated as digits are regarded as "0" in the operation. (See Program Example (2))

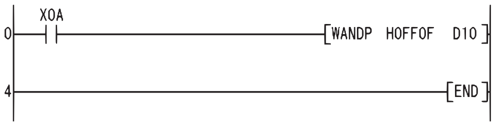
Operation Error

(1) There are no operation errors associated with the WAND(P) or DAND(P) instruction.

Program Example

(1) The following program masks the digit in the 10s place of the 4-digit BCD value at D10 (second digit from the end) to 0 when XA is turned ON.

[Ladder Mode]



[Operation]

	b15							b8	b7							b0
D10 BCD1234	0	0	0	1	0	0	1	0	0	0	1	1	0	1	0	0

AND

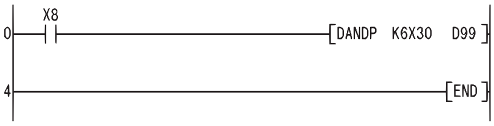
	b15							b8	b7							b0
HFF0F	1	1	1	1	1	1	1	1	0	0	0	0	1	1	1	1

⇩

	b15							b8	b7							b0
D10 BCD1204	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0

(2) The following program performs a logical product operation on the data at D99 and D100, and the 24-bit data between X30 and X47 when X8 is ON, and stores the results at D99 and D100.

[Ladder Mode]



[Operation]

	b31	b30	b29	b28	b27	b26	b25	b24	b23	b22		b3	b2	b1	b0
D100, D99	1	1	1	1	1	1	1	1	1	1		1	1	1	1

AND

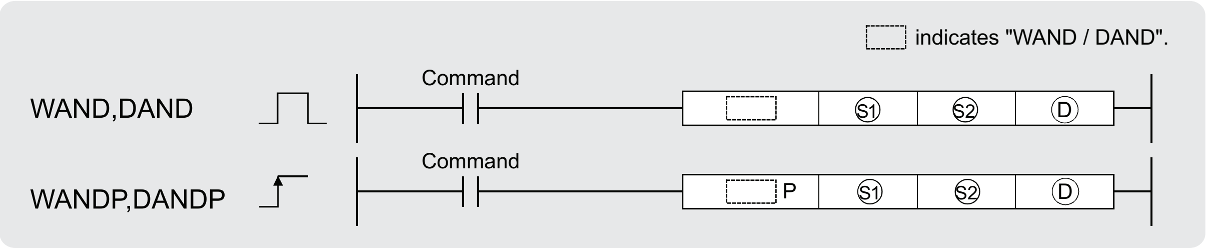
									X47	X46		X33	X32	X31	X30
X47-X30	0	0	0	0	0	0	0	0	1	1		0	1	0	1

Regarded as 0.

⇩

	b31	b30	b29	b28	b27	b26	b25	b24	b23	b22		b3	b2	b1	b0
D100, D99	0	0	0	0	0	0	0	0	1	1		0	1	0	1

2 When three data are set (Ⓢ1 ∧ Ⓢ2 → Ⓓ, (Ⓢ1 + 1, Ⓢ1) ∧ (Ⓢ2+1, Ⓢ2) → (Ⓓ+1, Ⓓ))



Ⓢ1, Ⓢ2 : Data for a logical product operation or the start number of the devices where the data is stored (BIN 16/32 bits)

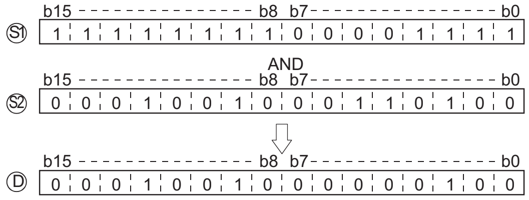
Ⓓ : Start number of the devices where the logical product operation result will be stored (BIN 16/32 bits)

Set Data	Internal Devices		Constants K, H	Others
	Bit	Word		
Ⓢ1	○		○	—
Ⓢ2	○		○	—
Ⓓ	○		—	—

☆ Function

WAND

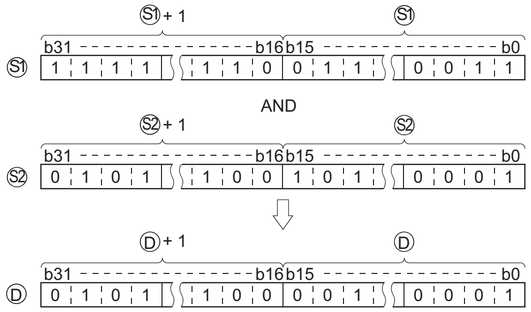
(1) A logical product operation is conducted for each bit of the 16-bit data of the device designated at Ⓢ1 and the 16-bit data of the device designated at Ⓢ2, and the results are stored in the device designated at Ⓓ.


```
     b15 ---------------- b8  b7 ---------------- b0
Ⓢ1   1  1  1  1  1  1  1  1  0  0  0  0  1  1  1  1
                        AND
     b15 ---------------- b8  b7 ---------------- b0
Ⓢ2   0  0  0  1  0  0  1  0  0  0  1  1  0  1  0  0
                         ⇩
     b15 ---------------- b8  b7 ---------------- b0
Ⓓ    0  0  0  1  0  0  1  0  0  0  0  0  0  1  0  0
```

(2) For bit devices, the bit devices below the points designated by digit specification are regarded as "0" in the operation. (See Program Examples (1) and (2))

DAND

(1) Conducts a logical product operation on each bit of the 32-bit data for the device designated by Ⓢ1 and the 32-bit data for the device designated by Ⓢ2, and stores the results at the device designated by Ⓓ.


```
              Ⓢ1 + 1                      Ⓢ1
     b31 -------------------- b16 b15 -------------------- b0
Ⓢ1   1  1  1  1  ⟆  1  1  0 | 0  1  1  ⟆  0  0  1  1
                           AND
              Ⓢ2 + 1                      Ⓢ2
     b31 -------------------- b16 b15 -------------------- b0
Ⓢ2   0  1  0  1  ⟆  1  0  0 | 1  0  1  ⟆  0  0  0  1
                            ⇩
              Ⓓ + 1                       Ⓓ
     b31 -------------------- b16 b15 -------------------- b0
Ⓓ    0  1  0  1  ⟆  1  0  0 | 0  0  1  ⟆  0  0  0  1
```

(2) For bit devices, the bit devices below the points designated by digit specification are regarded as "0" in the operation. (See Program Example (3))

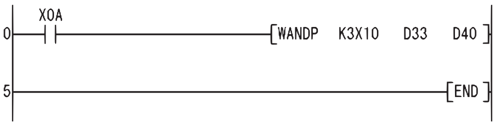
Operation Error

(1) There are no operation errors associated with the WAND(P) or DAND(P) instruction.

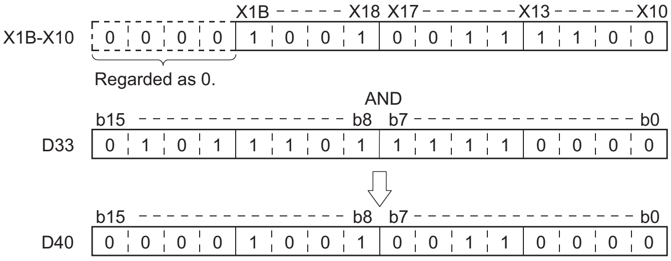
Program Example

(1) The following program performs a logical product operation on the data from X10 to X1B and the data at D33 when XA is ON, and stores the results at D40.

[Ladder Mode]



[Operation]



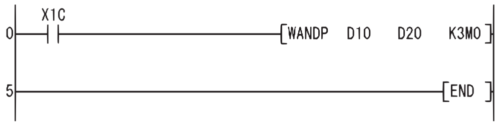
					X1B			X18	X17			X13				X10
X1B-X10	0	0	0	0	1	0	0	1	0	0	1	1	1	1	0	0

	b15							b8	b7							b0
D33	0	1	0	1	1	1	0	1	1	1	1	1	0	0	0	0

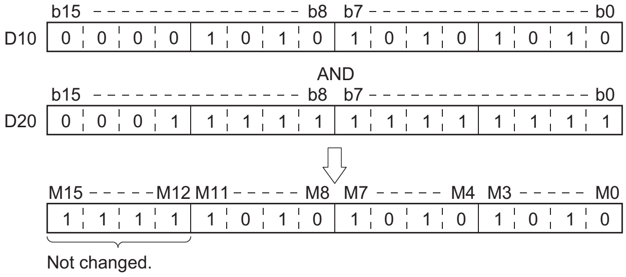
	b15							b8	b7							b0
D40	0	0	0	0	1	0	0	1	0	0	1	1	0	0	0	0

(2) The following program performs a logical product operation on the data at D10 and at D20 when X1C is ON, and stores the results from M0 to M11.

[Ladder Mode]



[Operation]



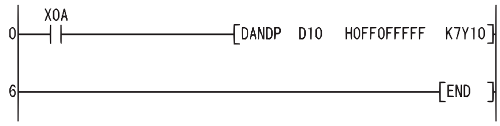
	b15							b8	b7							b0
D10	0	0	0	0	1	0	1	0	1	0	1	0	1	0	1	0

	b15							b8	b7							b0
D20	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1

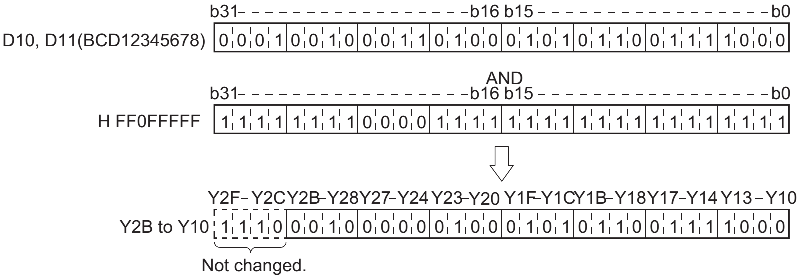
M15			M12	M11			M8	M7			M4	M3			M0
1	1	1	1	1	0	1	0	1	0	1	0	1	0	1	0

(3) The following program masks the digit in the hundred-thousands place of the 8-digit BCD value at D10 and D11 (sixth digit from the end) to 0 when XA is ON, and outputs the results to from Y10 to Y2B.

[Ladder Mode]

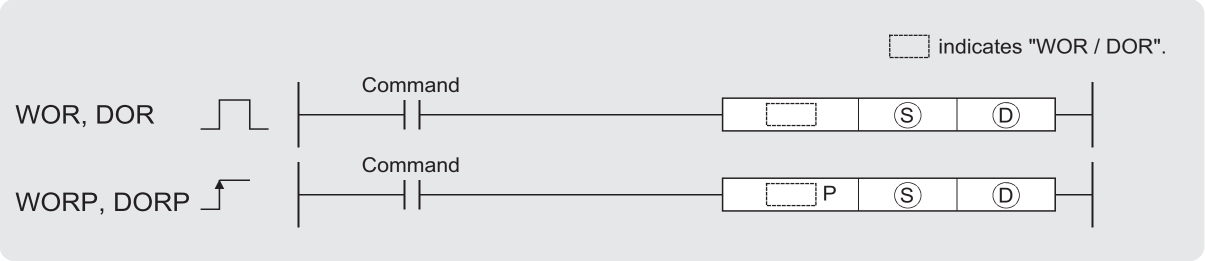


[Operation]



7.1.2 Logical sums of 16-bit and 32-bit data (WOR(P), DOR(P))

1 When two data are set (Ⓓ ∨ Ⓢ → Ⓓ, (Ⓓ+1, Ⓓ) ∨ (Ⓢ+1, Ⓢ) → (Ⓓ+1, Ⓓ))



Ⓢ : Data for a logical sum operation or start number of the devices where the data is stored (BIN 16/32 bits)

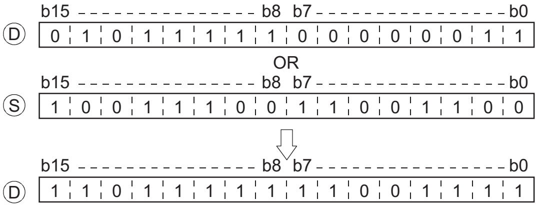
Ⓓ : Start number of the devices where the logical sum operation result will be stored (BIN 16/32 bits)

Set Data	Internal Devices		Constants K, H	Others
	Bit	Word		
Ⓢ	○		○	—
Ⓓ	○		—	—

Function

WOR

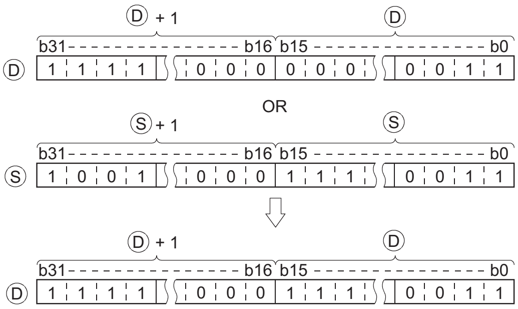
(1) Conducts a logical sum operation on each bit of the 16-bit data of the device designated by Ⓓ and the 16-bit data of the device designated by Ⓢ, and stores the results at the device designated by Ⓓ.



(2) For bit devices, the bit devices below the points designated by digit specification are regarded as "0" in the operation.

DOR

(1) Conducts a logical sum operation on each bit of the 32-bit data of the device designated by Ⓓ and the 32-bit data of the device designated by Ⓢ, and stores the results at the device designated by Ⓓ.



(2) For bit devices, the bit devices below the points designated by digit specification are regarded as "0" in the operation.

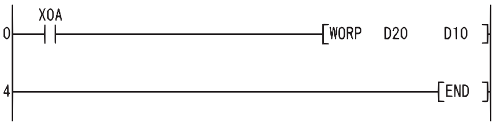
Operation Error

(1) There are no operation errors associated with the WOR(P) or DOR(P) instructions.

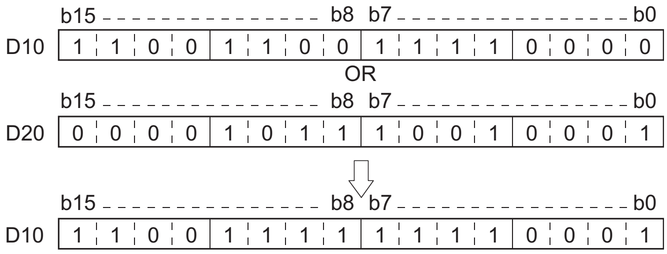
Program Example

(1) The following program performs a logical sum operation on the data at D10 and D20 when XA goes ON, and stores the results at D10.

[Ladder Mode]

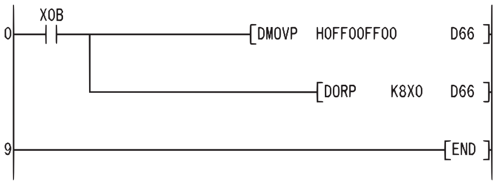


[Operation]

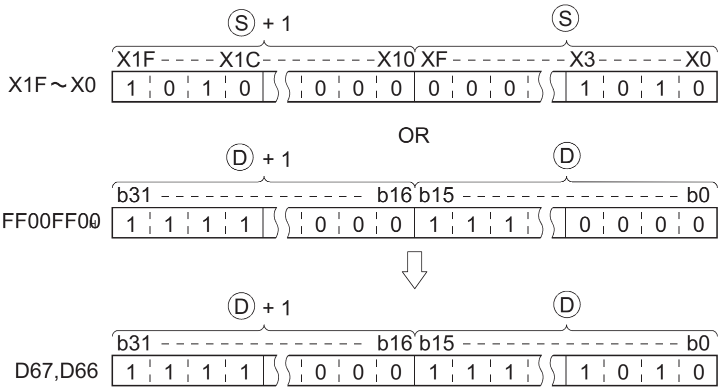

b15 b8 b7 b0
D10 1 1 0 0 1 1 0 0 1 1 1 1 0 0 0 0
OR
b15 b8 b7 b0
D20 0 0 0 0 1 0 1 1 1 0 0 1 0 0 0 1
b15 b8 b7 b0
D10 1 1 0 0 1 1 1 1 1 1 1 1 0 0 0 1

(2) The following program performs a logical sum operation on the 32-bit data from X0 to X1F, and on the hexadecimal value $FF00FF00_H$ when XB goes ON, and stores the results at D66 and D67.

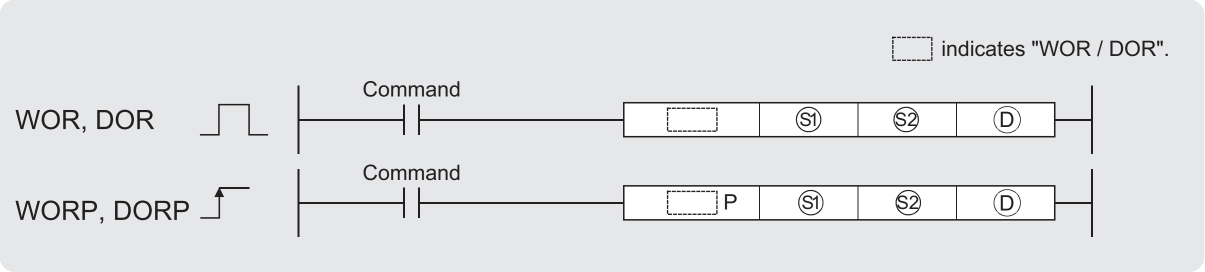
[Ladder Mode]



[Operation]


S + 1
S
X1F X1C X10 XF X3 X0
X1F～X0 1 0 1 0 0 0 0 0 0 0 1 0 1 0
OR
D + 1
D
b31 b16 b15 b0
FF00FF00H 1 1 1 1 0 0 0 1 1 1 0 0 0 0
D + 1
D
b31 b16 b15 b0
D67,D66 1 1 1 1 0 0 0 1 1 1 1 0 1 0

2 When three data are set (Ⓢ1 ⊻ Ⓢ2 → Ⓓ, (Ⓢ1+1, Ⓢ1) ⊻ (Ⓢ2+1, Ⓢ2) → (Ⓓ+1, Ⓓ))



Ⓢ1, Ⓢ2 : Data for a logical sum operation or start number of the devices where the data is stored (BIN 16/32 bits)

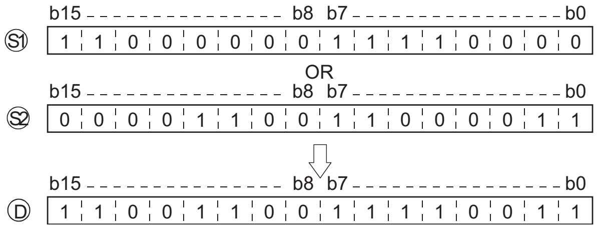
Ⓓ : Start number of the devices where the logical sum operation result will be stored (BIN 16/32 bits)

Set Data	Internal Devices		Constants K, H	Others
	Bit	Word		
Ⓢ1	○		○	—
Ⓢ2	○		○	—
Ⓓ	○		—	—

☆ Function

WOR

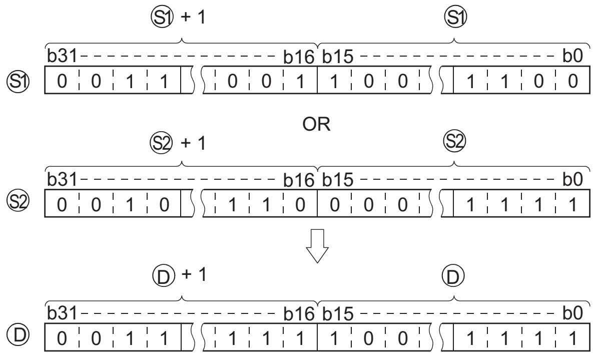
(1) Conducts a logical sum operation on each bit of the 16-bit data of the device designated by Ⓢ1 and the 16-bit data of the device designated by Ⓢ2, and stores the results at the device designated by Ⓓ.



(2) For bit devices, the bit devices below the points designated by digit specification are regarded as "0" in the operation. (See Program Example (1))

DOR

(1) Conducts a logical sum operation on each bit of the 32-bit data of the device designated by Ⓢ1 and the 32-bit data of the device designated by Ⓢ2, and stores the results at the device designated by Ⓓ.



(2) When bit devices are designated, the bit devices below the points designated as digits are regarded as "0" in the operation. (See Program Example (2))

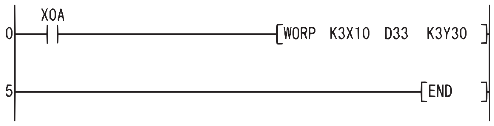
Operation Error

(1) There are no operation errors associated with the WOR(P) or DOR(P) instructions.

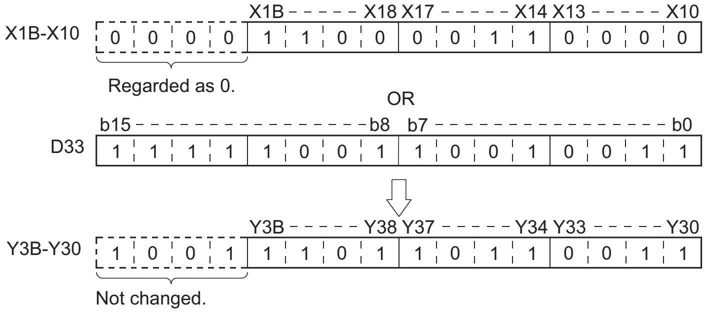
Program Example

(1) The following program performs a logical sum operation on the data from X10 to X1B, and the data at D33, and stores the result at Y30 to Y3B when XA is ON.

[Ladder Mode]

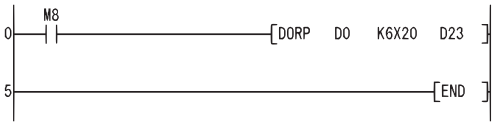


[Operation]

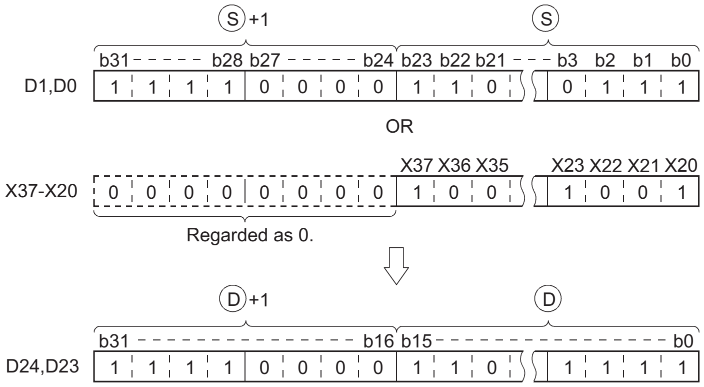

X1B-X10
X1B - - - - - X18 X17 - - - - - X14 X13 - - - - - X10
0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0
Regarded as 0.
OR
b15 - - - - - b8 b7 - - - - - b0
D33
1 1 1 1 1 0 0 1 1 0 0 1 0 0 1 1
Y3B - - - - - Y38 Y37 - - - - - Y34 Y33 - - - - - Y30
Y3B-Y30
1 0 0 1 1 1 0 1 1 0 1 1 0 0 1 1
Not changed.

(2) The following program performs a logical sum operation on the 32-bit data at D0 and D1, and the 24-bit data from X20 to X37, and stores the results at D23 and D24 when M8 is ON.

[Ladder Mode]

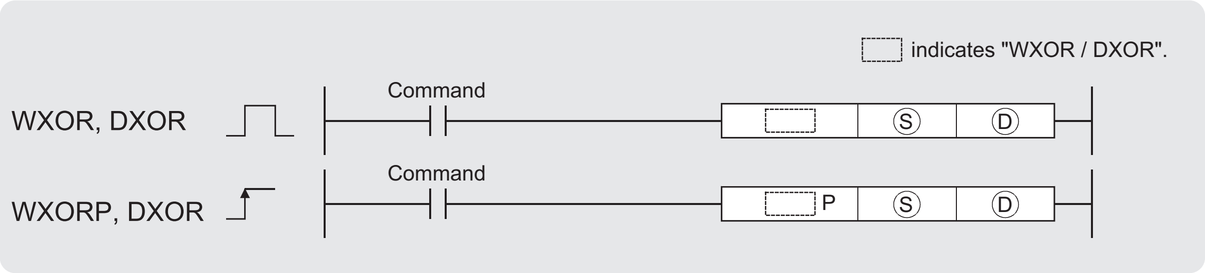


[Operation]



7.1.3 16-bit and 32-bit exclusive OR operations (WXOR(P), DXOR(P))

1 When two data are set (Ⓓ ⊻ Ⓢ → Ⓓ, (Ⓓ+1, Ⓓ) ⊻ (Ⓢ+1, Ⓢ) → (Ⓓ+1, �))



Ⓢ : Data for an exclusive OR operation or start number of the devices where the data is stored (BIN 16/32 bits)

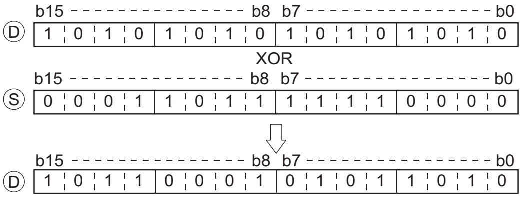
Ⓓ : Start number of the devices where the exclusive OR operation result will be stored (BIN 16/32 bits)

Set Data	Internal Devices		Constants K, H	Others
	Bit	Word		
Ⓢ	○		○	—
Ⓓ	○		—	—

Function

WXOR

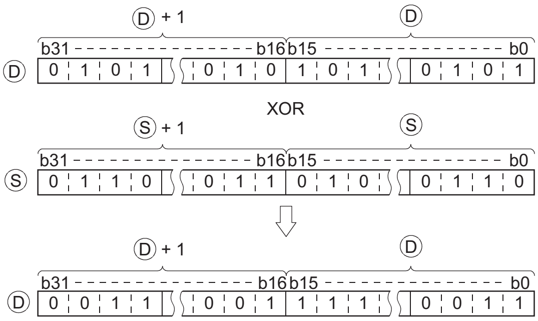
(1) Conducts an exclusive OR operation on each bit of the 16-bit data of the device designated by Ⓓ and the 16-bit data of the device designated by Ⓢ, and stores the results at the device designated by Ⓓ.



(2) For bit devices, the bit devices below the points designated by digit specification are regarded as "0" in the operation.

DXOR

(1) Conducts an exclusive OR operation on each bit of the 32-bit data of the device designated by Ⓓ and the 32-bit data of the device designated by Ⓢ, and stores the results at the device designated by Ⓓ.



(2) For bit devices, the bit devices below the points designated by digit specification are regarded as "0" in the operation.

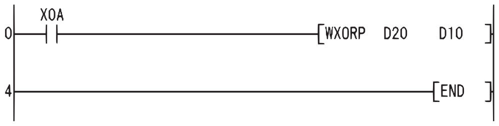
Operation Error

(1) There are no operation errors associated with the WXOR(P) or DXOR(P) instructions.

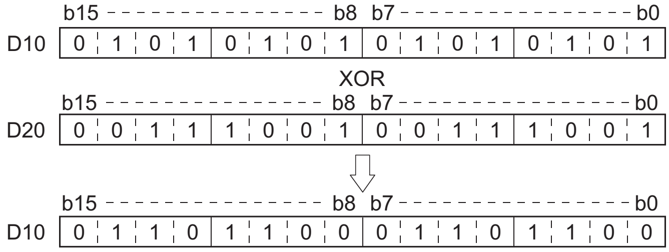
Program Example

(1) The following program performs an exclusive OR operation on the data at D10 and D20 when XA is ON, and stores the result at D10.

[Ladder Mode]

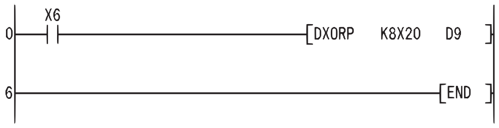


[Operation]

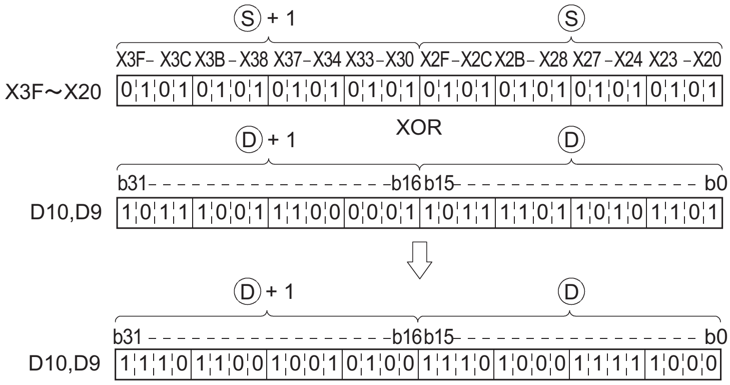


(2) The following program compares the bit pattern of the 32-bit data from X20 to X3F with the bit pattern of the data at D9 and D10 when X6 is ON.

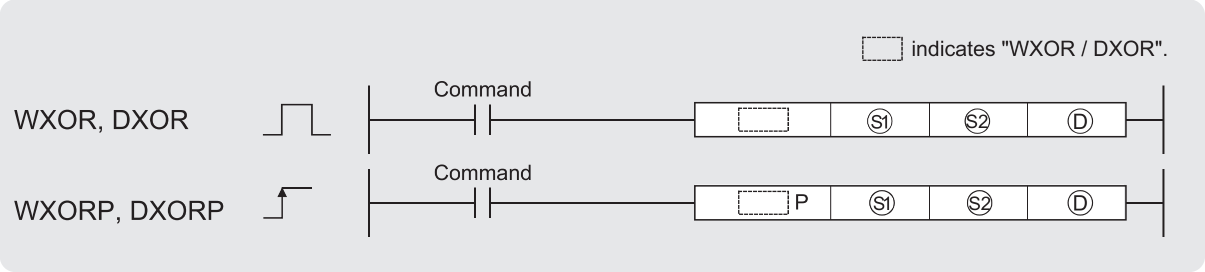
[Ladder Mode]



[Operation]



2 When three data are set (S1 ⊻ S2 → D (S1+1, S1) ⊻ (S2+1, S2) → (D+1, D))



S1, S2: Data for an exclusive OR operation or start number of the devices where the data is stored (BIN 16/32 bits)

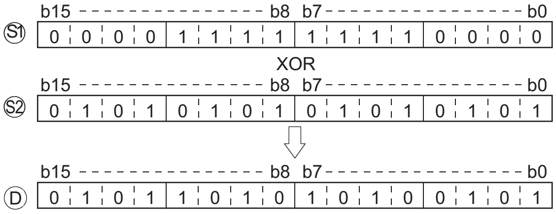
D: Start number of the devices where the exclusive OR operation result will be stored (BIN 16/32 bits)

Set Data	Internal Devices		Constants K, H	Others
	Bit	Word		
S1	○		○	—
S2	○		○	—
D	○		—	—

Function

WXOR

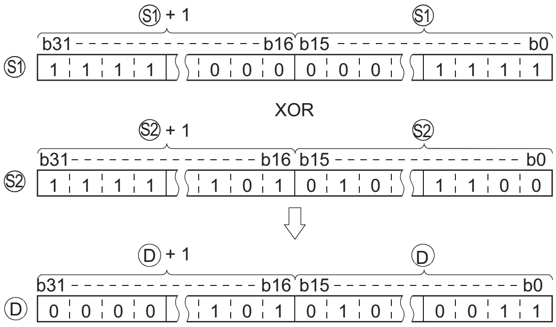
(1) Conducts an exclusive OR operation on each bit of the 16-bit data of the device designated by S1 and the 16-bit data of the device designated by S2, and stores the results at the device designated by D.


b15 b8 b7 b0
S1 0 0 0 0 1 1 1 1 1 1 1 1 0 0 0 0
XOR
b15 b8 b7 b0
S2 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1
b15 b8 b7 b0
D 0 1 0 1 1 0 1 0 1 0 1 0 0 1 0 1

(2) For bit devices, the bit devices below the points designated by digit specification are regarded as "0" in the operation. (See Program Example (1))

DXOR

(1) Conducts an exclusive OR operation on each bit of the 32-bit data of the device designated by S1 and the 32-bit data of the device designated by S2, and stores the results at the device designated by D.


S1 + 1
S1
b31 b16 b15 b0
S1 1 1 1 1 0 0 0 0 0 0 1 1 1 1
XOR
S2 + 1
S2
b31 b16 b15 b0
S2 1 1 1 1 1 0 1 0 1 0 1 1 0 0
D + 1
D
b31 b16 b15 b0
D 0 0 0 0 1 0 1 0 1 0 0 0 1 1

(2) For bit devices, the bit devices below the points designated by digit specification are regarded as "0" in the operation.

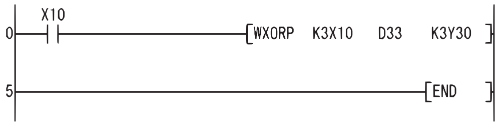
Operation Error

(1) There are no operation errors associated with the WXOR(P) or DXOR(P) instructions.

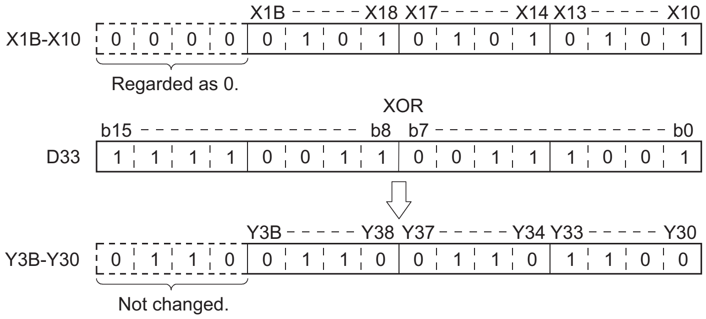
Program Example

(1) The following program conducts an exclusive OR operation on the data from X10 to X1B and the data at D33 when X10 is ON, and outputs the result to from Y30 to Y3B.

[Ladder Mode]

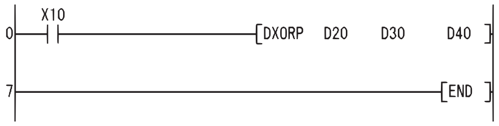


[Operation]

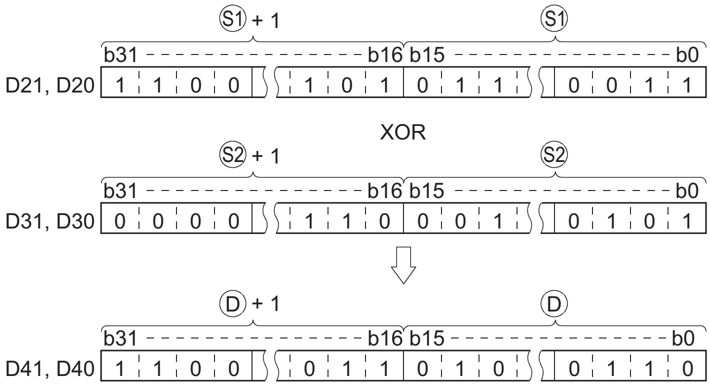


(2) The following program conducts an exclusive OR operation on the data at D20 and D21, and the data at D30 and D31 when X10 goes ON, and stores the results at D40 and D41.

[Ladder Mode]

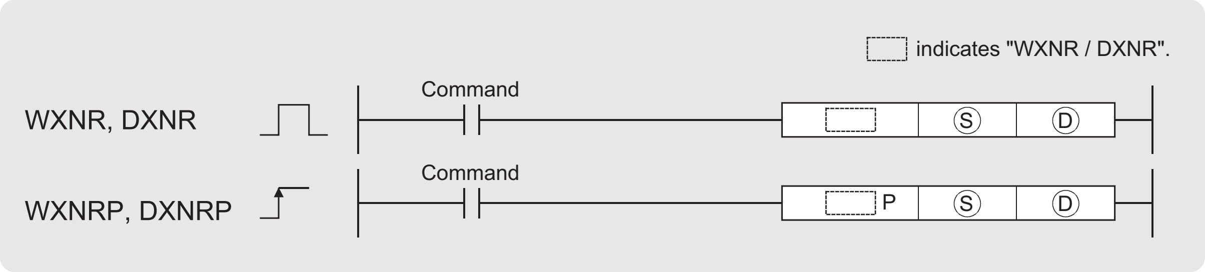


[Operation]



7.1.4 16-bit and 32-bit data exclusive NOR operations (WXNR(P), DXNR(P))

1 When two data are set $(\overline{Ⓓ \veebar Ⓢ} \rightarrow Ⓓ, \overline{(Ⓓ+1, Ⓓ) \veebar (Ⓢ+1, Ⓢ)} \rightarrow (Ⓓ+1, Ⓓ))$



Ⓢ : Data for an exclusive NOR operation or start number of the devices where the data is stored (BIN 16/32 bits)

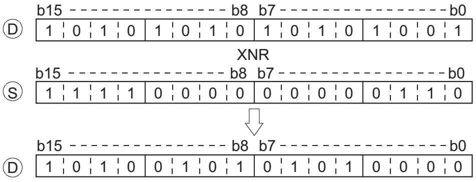
Ⓓ : Start number of the devices where the exclusive NOR operation result will be stored (BIN 16/32 bits)

Set Data	Internal Devices		Constants K, H	Others
	Bit	Word		
Ⓢ	○		○	—
Ⓓ	○		—	—

Function

WXNR

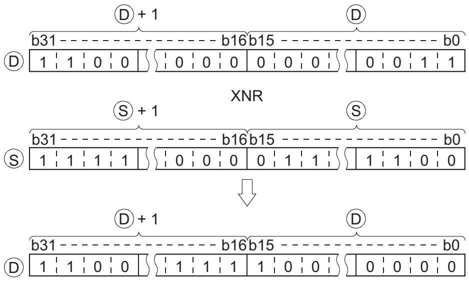
(1) Conducts an exclusive NOR operation on the 16-bit data of the device designated by Ⓓ and the 16-bit data of the device designated by Ⓢ, and stores the results at the device designated by Ⓓ.



(2) For bit devices, the bit devices below the points designated by digit specification are regarded as "0" in the operation.

DXNR

(1) Conducts an exclusive NOR operation on the 32-bit data of the device designated by Ⓓ and the 32-bit data of the device designated by Ⓢ, and stores the results at the device designated by Ⓓ.



(2) For bit devices, the bit devices below the points designated by digit specification are regarded as "0" in the operation.

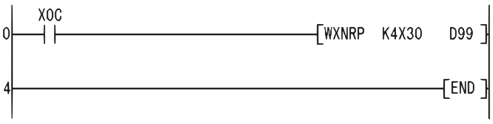
Operation Error

(1) There are no operation errors associated with the WXNR(P) or DXNR(P) instructions.

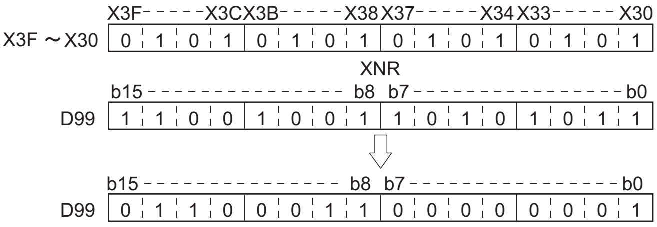
Program Example

(1) The following program compares the bit pattern of the 16-bit data from X30 to X3F with the bit pattern of the 16-bit data at D99 when X6 is ON

[Ladder Mode]



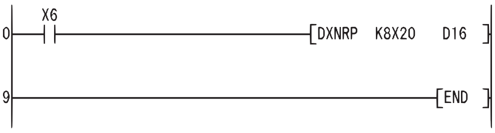
[Operation]


X3F-----X3CX3B-----X38 X37-----X34 X33-----X30
XNR
b15 --------------- b8 b7 ---------------- b0

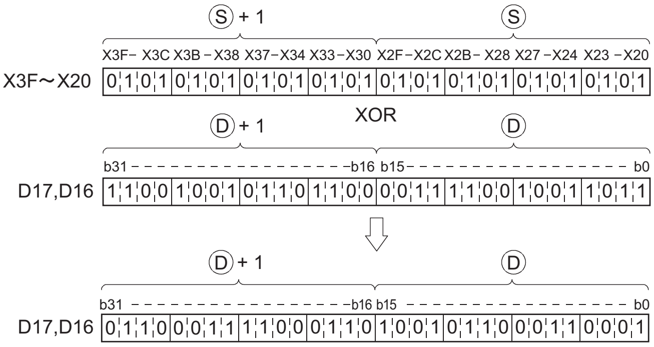
	X3F			X3C	X3B			X38	X37			X34	X33			X30
X3F ～X30	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
D99	1	1	0	0	1	0	0	1	1	0	1	0	1	0	1	1
D99	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0	1

(2) The following program compares the bit pattern of the 32-bit data from X20 to X3F with the bit pattern of the data at D16 and D17 when X6 is ON.

[Ladder Mode]

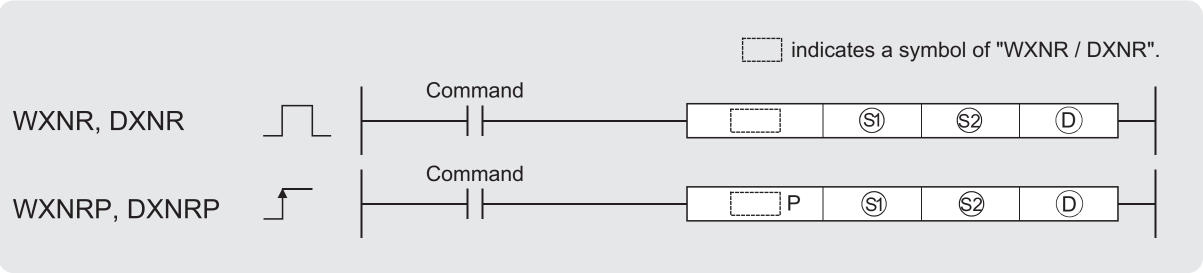


[Operation]


Ⓢ + 1
Ⓢ
X3F– X3C X3B –X38 X37–X34 X33–X30 X2F–X2C X2B– X28 X27 –X24 X23 –X20
XOR
Ⓓ + 1
Ⓓ
b31 ----------------- b16 b15 ------------------ b0
Ⓓ + 1
Ⓓ
b31 ----------------- b16 b15 ------------------ b0

	X3F–X3C	X3B–X38	X37–X34	X33–X30	X2F–X2C	X2B–X28	X27–X24	X23–X20
X3F～X20	0 1 0 1	0 1 0 1	0 1 0 1	0 1 0 1	0 1 0 1	0 1 0 1	0 1 0 1	0 1 0 1
D17,D16	1 1 0 0	1 0 0 1	0 1 1 0	1 1 0 0	0 0 1 1	1 1 0 0	1 0 0 1	1 0 1 1
D17,D16	0 1 1 0	0 0 1 1	1 1 0 0	0 1 1 0	1 0 0 1	0 1 1 0	0 0 1 1	0 0 0 1

$\boxed{2}$ When three data are set ($\overline{\text{S1} \veebar \text{S2}} \rightarrow \text{D}$, $\overline{(\text{S1}+1, \text{S1}) \veebar (\text{S2}+1, \text{S2})} \rightarrow (\text{D}+1, \text{D})$)



S1, S2: Data for an exclusive NOR operation or start number of the devices where the data is stored (BIN 16/32 bits)

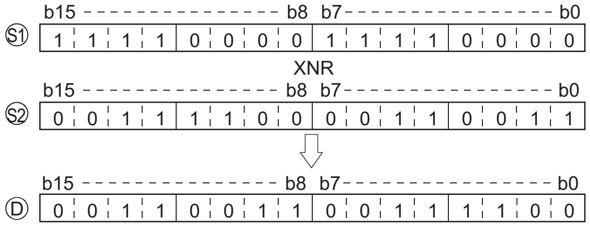
D: Start number of the devices where the exclusive NOR operation result will be stored (BIN 16/32 bits)

Set Data	Internal Devices		Constants K, H	Others
	Bit	Word		
S1	○		○	—
S2	○		○	—
D	○		—	—

Function

WXNR

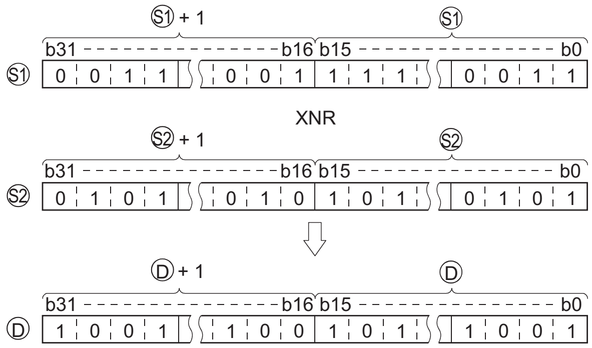
(1) Conducts an exclusive NOR operation on the 16-bit data of the device designated by S1 and the 16-bit data of the device designated by S2, and stores the results at the device designated by D.


b15 b8 b7 b0
S1 1 1 1 1 0 0 0 0 1 1 1 1 0 0 0 0
XNR
b15 b8 b7 b0
S2 0 0 1 1 1 1 0 0 0 0 1 1 0 0 1 1
b15 b8 b7 b0
D 0 0 1 1 0 0 1 1 0 0 1 1 1 1 0 0

(2) For bit devices, the bit devices below the points designated by digit specification are regarded as "0" in the operation.

DXNR

(1) Conducts an exclusive NOR operation on the 32-bit data of the device designated by S1 and the 32-bit data of the device designated by S2, and stores the results at the device designated by D.


S1 + 1
S1
b31 b16 b15 b0
S1 0 0 1 1 0 0 1 1 1 1 0 0 1 1
XNR
S2 + 1
S2
b31 b16 b15 b0
S2 0 1 0 1 0 1 0 1 0 1 0 1 0 1
D + 1
D
b31 b16 b15 b0
D 1 0 0 1 1 0 0 1 0 1 1 0 0 1

(2) For bit devices, the bit devices below the points designated by digit specification are regarded as "0" in the operation.

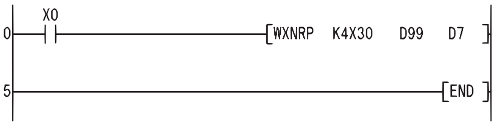
Operation Error

(1) There are no operation errors associated with the WXNR(P) or DXNR(P) instructions.

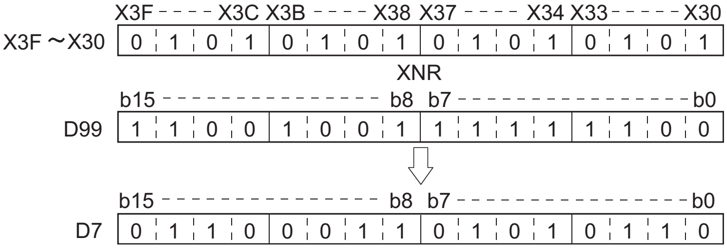
Program Example

(1) The following program performs an exclusive NOR operation on the 16-bit data from X30 to X3F and the data at D99 when X0 is turned ON, and stores the results to D7.

[Ladder Mode]

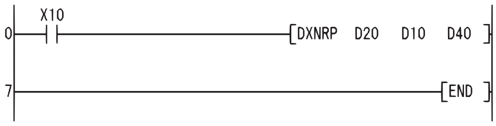


[Operation]

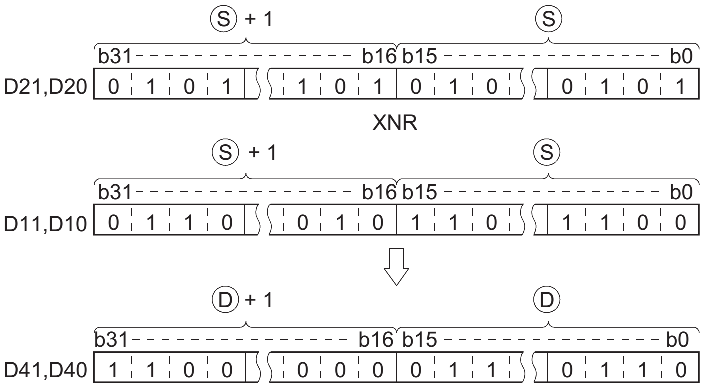

X3F - - - - X3C X3B - - - - X38 X37 - - - - X34 X33 - - - - - X30
X3F ～X30
0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1
XNR
b15 - - - - - - - - - - - - - - - b8 b7 - - - - - - - - - - - - - - - - b0
D99
1 1 0 0 1 0 0 1 1 1 1 1 1 1 0 0
b15 - - - - - - - - - - - - - - - b8 b7 - - - - - - - - - - - - - - - - b0
D7
0 1 1 0 0 0 1 1 0 1 0 1 0 1 1 0

(2) The following program performs an exclusive NOR operation on the 32-bit data at D20 and D21 and the data at D10 and D11 when X10 is turned ON, and stores the result to D40 and D41.

[Ladder Mode]



[Operation]


S + 1
S
b31 - - - - - - - - - - - - - - - b16 b15 - - - - - - - - - - - - - - - b0
D21,D20
0 1 0 1 1 0 1 0 1 0 0 1 0 1
XNR
S + 1
S
b31 - - - - - - - - - - - - - - - b16 b15 - - - - - - - - - - - - - - - b0
D11,D10
0 1 1 0 0 1 0 1 1 0 1 1 0 0
D + 1
D
b31 - - - - - - - - - - - - - - - b16 b15 - - - - - - - - - - - - - - - b0
D41,D40
1 1 0 0 0 0 0 0 1 1 0 1 1 0

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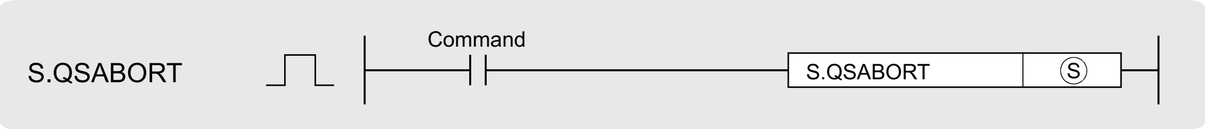
8 QSCPU DEDICATED INSTRUCTIONS

Category	Processing Details	Reference section
Forced control stop instruction	Forced control stop	8.1

8.1 Forced Control Stop Instruction (S.QSABORT)



Ⓢ : Data to be stored in SD16 as the abort code, or the number of the device where the data is stored (BIN 16 bits).

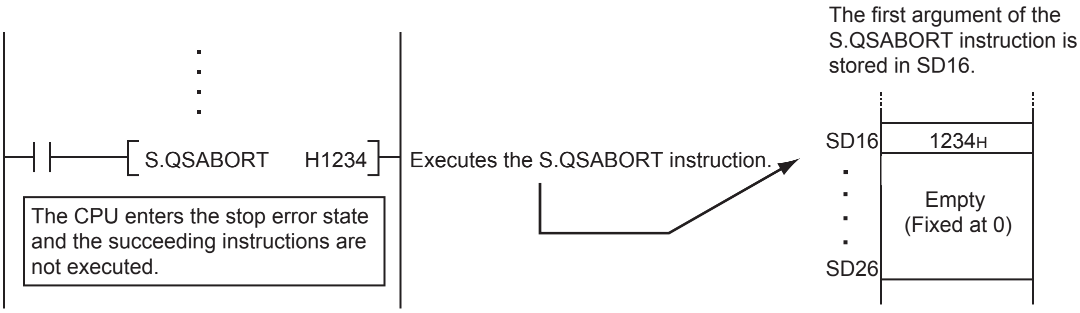
Set Data	Internal Devices		Constants K, H	Others
	Bit	Word		
Ⓢ	○		○	—

Function

(1) Execution of the S.QSABORT instruction stops program execution and brings the safety CPU module into the stop error status (error code: 4700).[*1]

SM0 (diagnostics error) turns ON to store the error information in SD0 to SD26. In this case, however, SM1 (self-diagnostics error) does not turn ON.

[*1]: For the CPU operation at a stop error, refer to the following manual
- QSCPU User's Manual (Function Explanation, Program Fundamentals)


The first argument of the S.QSABORT instruction is stored in SD16.
S.QSABORT
H1234
Executes the S.QSABORT instruction.
The CPU enters the stop error state and the succeeding instructions are not executed.
SD16
1234H
Empty (Fixed at 0)
SD26

(2) Details of the program error are stored in the common information (SD5 to SD15).

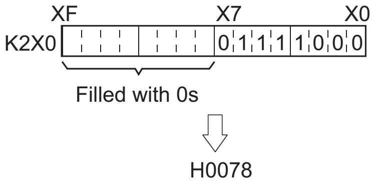
Device	Meaning	
SD5	File name (ASCII code: 8 characters)	
SD6		
SD7		
SD8		
SD9	Extension (ASCII code: 3 characters)	2EH(.)
SD10		
SD11	Fixed to 0	
SD12	0 (Block No.)	
SD13	0 (Step No. / Shift conditions)	
SD14	Sequence step No. (L) where the S.QSABORT instruction was executed	
SD15	Sequence step No. (H) where the S.QSABORT instruction was executed	

(3) Program abort information is stored in the individual information (SD16 to SD26).

Device	Meaning
SD16	Abort code (The first argument of the S.QSABORT instruction is stored.)
SD17	Empty (Fixed at 0)
SD18	
SD19	
SD20	
SD21	
SD22	
SD23	
SD24	
SD25	
SD26	

(4) If the abort code is designated using digit designation of a bit device, the data of the designated digit in the designated bit device is obtained from the device memory as abort code. If the designated number of bits is less than 16 bits, empty bits are filled with 0.

Example



Operation Error

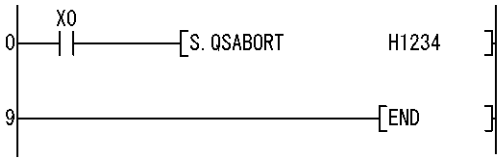
(1) In any of the following cases, an operation error occurs, the error flag (SM0) turns ON, and the corresponding error code is stored into SD0.

- The designated instruction name is incorrect. (Error code: 4002)
- The number of the arguments used in the instruction is incorrect. (Error code: 4003)
- A device that cannot be used in an argument is designated. (Error code: 4004)

Program Example

(1) The program below shows that, when X0 turns ON, the CPU module enters the stop error state and the abort code is stored in SD16.

[Ladder Mode]



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9 ERROR CODE

9.1 Error Code List

The QS series CPU module uses the self diagnostics function to display error information (LED indication) and stores the information into the special relay SM and special register SD, when an error occurs in the following situations:

- When the PLC is powered ON.
- When the CPU module is reset.
- When the CPU module is switched from STOP to RUN.
- While the CPU module is running.

If an error occurs when a communication request is issued from GX Developer, intelligent function module or network system to the CPU module, the CPU module returns the error code (4000_H to $4FFF_H$) to the request source.

The following describes the description of errors which occur in the CPU module and the corrective actions for the errors.

(1) How to read the error code list

The following describes how to read Section 9.1.3 Error code list (1000 to 1999) to Section 9.1.8 Error code list (8000 to 9000).

(a) Error code, common information and individual information

Alphanumeric characters in the parentheses of the titles indicate the special register numbers where each information is stored.

(b) Compatible CPU

QS: Compatible with the QSCPU.

9.1.1 Error codes

Errors are detected by the self diagnostic function of the CPU module or detected during communication with the CPU module.

The relation between the error detection pattern, error detection location and error code is shown in Table9.1.

Table9.1 Reference destination

Error detection pattern	Error detection location	Error code	Reference
Detection by the self diagnostics function of CPU module	CPU module	1000 to 9000[*1]	Section 9.1.3 to 9.1.8
Detection at communication with CPU module	CPU module	4000_H to $4FFF_H$	QSCPU User's Manual (Hardware Design, Maintenance and Inspection)
	CC-Link Safety master module	$B000_H$ to $BFFF_H$	CC-Link Safety System Master Module User's Manual
	Ethernet module	$C000_H$ to $CFFF_H$	Ethernet Interface Module User's Manual
	CC-Link IE controller network module	$E000_H$ to $EFFF_H$	CC-Link IE Controller Network Reference Manual
	MELSECNET/H module	$F000_H$ to $FFFF_H$	MELSECNET/H Network System Reference Manual

*1: CPU module error codes are classified into minor, moderate, major errors as shown below.

- Minor error:Errors that may allow the CPU module to continue the operation, e.g., battery error. (Error code: 1300 to 9000)
- Moderate error:Errors that may cause the CPU module to stop the operation, e.g., WDT error. (Error code: 1300 to 9000)
- Major error:Errors that may cause the CPU module to stop the operation, e.g., RAM error. (Error code: 1000 to 1299)

"Errors that may allow the CPU module to continue the operation" and "Errors that may cause the CPU module to stop the operation" can be distinguished using "Operating Statuses of CPU" of Section 9.1.3 to 9.1.8 Error code list.

9.1.2 Reading an error code

If an error occurs, the error code, error message and others to perform the troubleshooting can be read with GX Developer.

1) Start GX Developer.
2) Connect the CPU module to the personal computer that started GX Developer.
3) On GX Developer, choose the [Online] → [Read from PLC] menu and read the project from the CPU module.
4) Choose the [Diagnostic] → [PLC diagnostic] menu.
5) Click the "Current error" button in the PLC diagnostic dialog box to display the error code and error message.
6) Choose the [Help] → [CPU error] menu and check details of the corresponding error code.

Refer to the following manual for details of the GX Developer operating method.
→ GX Developer Operating Manual

9.1.3 Error code list (1000 to 1999)

The following shows the error messages from the error code 1000 to 1999, the contents and causes of the errors, and the corrective actions for the errors.

Error Code (SD0)	Error Message	Common Information (SD5 to 15)	Individual Information (SD16 to 26)	LED Status		CPU Operation Status	Diagnostic Timing
				RUN	ERROR		
1000	MAIN CPU DOWN	–	–	Off	On/ Flicker	Stop	Always
1001					On		
1002					Flicker		
1003							
1004							
1006							
1009							
1010	END NOT EXECUTE	–	–	Off	Flicker	Stop	When an END instruction executed.
1030	MAIN CPU DOWN	–	Error information	Off	Flicker	Stop	Always
1031							

*1 BAT.ALM LED is displayed at BATTERY ERROR.

Error Code (SD0)	Error Contents and Cause	Corrective Action	Corresponding CPU
1000	Run mode suspended or failure of main CPU • Malfunctioning due to noise or other reason • Hardware fault	• Take noise reduction measures. • Reset the CPU module and RUN it again.If the same error is displayed again, this suggests a CPU module hardware fault.(Contact your local Mitsubishi representative.)	QS
1001			
1002			
1003			
1004			
1006			
1009	• A failure is detected on the power supply module, CPU module, or base unit.	Reset the CPU module and RUN it again.If the same error is detected again, it is considered that the power supply module, CPU module, or base unit is failure. (Contact your local Mitsubishi representative.)	
1010	Entire program was executed without the execution of an END instruction. • When the END instruction is executed it is read as another instruction code, e.g. due to noise. • The END instruction has been changed to another instruction code somehow.	• Take noise reduction measures. • Reset the CPU module and RUN it again. If the same error is displayed again, this suggests a CPU module hardware fault. (Contact your local Mitsubishi representative.)	QS
1030	Run mode suspended or failure of main CPU • Malfunctioning due to noise or other reason • Hardware fault	• Take noise reduction measures. • Reset the CPU module and RUN it again. If the same error is displayed again, this suggests a CPU module hardware fault. (Contact your local Mitsubishi representative.)	QS
1031			

Error Code (SD0)	Error Message	Common Information (SD5 to 15)	Individual Information (SD16 to 26)	LED Status		CPU Operation Status	Diagnostic Timing
				RUN	ERROR		
1131	RAM ERROR	–	Error information	Off	Flicker	Stop	At power-ON/ At reset
1132							
1133							
1136							
1137							
1141							Always
1142							
1143							
1146							
1210	OPERATION CIRCUIT ERROR	–	Error information	Off	Flicker	Stop	At power-ON/ At reset/When an END instruction executed
1311	I/O INTERRUPT ERROR	–	–	Off	Flicker	Stop	During interrupt
1401	INTELLIGENT FUNCTION MODULE DOWN	Module No.	–	Off	Flicker	Stop	At power ON/ At reset/When intelligent function module is accessed.
1403	INTELLIGENT FUNCTION MODULE DOWN	Module No.	–	Off	Flicker	Stop	When an END instruction executed.
1404	INTELLIGENT FUNCTION MODULE DOWN	Module No.	–	Off	Flicker	Stop	When an END instruction executed.

*1 BAT.ALM LED is displayed at BATTERY ERROR.

Error Code (SD0)	Error Contents and Cause	Corrective Action	Corresponding CPU
1131 1132 1133 1136 1137 1141 1142 1143 1146	A fault was detected in the internal memory of the CPU module.	Hardware error of the CPU module. (Please consult your local Mitsubishi Service or representative.)	QS
1210	The operation circuit for sequence processing in the CPU module does not operate normally.	Hardware error of the CPU module. (Please consult your local Mitsubishi Service or representative.)	QS
1311	An interrupt request from the module where interrupt pointer setting has not been made in the PLC parameter dialog box was detected.	Hardware error of either of the CPU module or base unit. (Please consult your local Mitsubishi Service or representative.)	QS
1401	• There was no response from the intelligent function module in the initial processing. • The size of the buffer memory of the intelligent function module is invalid.	Hardware error of the intelligent function module, CPU module or base unit is expecting a hardware fault. (Please consult your local Mitsubishi Service or representative.)	QS
1403	• The hardware test of the module installed in the slot indicated by module number has completed. • There was no response from the intelligent function module when the END instruction is executed. • An error is detected at the intelligent function module. • The intelligent function module being accessed is broken down.	• Confirm if the setting of hardware test of the module installed in the slot indicated by the module number has been set or not. • Hardware error of the access target intelligent function module. (Please consult your local Mitsubishi Service or representative.)	QS
1404	An intelligent function module response data error was detected.	Reset the CPU module and RUN it again. If the same error is displayed again, the intelligent function module, CPU module or base unit is faulty. (Contact your local Mitsubishi representative.)	QS

Error Code (SD0)	Error Message	Common Information (SD5 to 15)	Individual Information (SD16 to 26)	LED Status		CPU Operation Status	Diagnostic Timing	
				RUN	ERROR			
1411	CONTROL-BUS ERROR	Module No.	–	Off	Flicker	Stop	At power ON/ At reset	
1413	CONTROL-BUS ERROR	–	–	Off	Flicker	Stop	Always	
1414	CONTROL-BUS ERROR	–	–	Off	Flicker	Stop	When an END instruction executed.	
1415	CONTROL-BUS ERROR	Base No.	–	Off	Flicker	Stop	When an END instruction executed.	
1500	AC/DC DOWN	–	–	On	Off	Continue	Always	
1600	BATTERY ERROR[*1]	Drive Name	–	On	Off	Continue	Always	
1610	EXCEED MAX FLASH ROM REWRIT. ERR.	–	–	On	On	Continue	When an END instruction executed.	

*1 BAT.ALM LED is displayed at BATTERY ERROR.

	Error Code (SD0)	Error Contents and Cause	Corrective Action	Corresponding CPU
	1411	When performing a parameter I/O allocation the intelligent function module could not be accessed during initial communications. (On error occurring, the head I/O number of the corresponding intelligent function module is stored in the common information.)	Reset the CPU module and RUN it again. If the same error is displayed again, the intelligent function module, CPU module or base unit is faulty. (Contact your local Mitsubishi representative.)	QS
	1413	An error was detected on the system bus.	The intelligent function module, CPU module or base unit is faulty. (Contact your local Mitsubishi representative.)	QS
	1414	An error was detected on the system bus.	The intelligent function module, CPU module or base unit is faulty. (Contact your local Mitsubishi representative.)	QS
	1415	Fault of the base unit was detected.	The intelligent function module, CPU module or base unit is faulty. (Contact your local Mitsubishi representative.)	QS
	1500	• A momentary power supply interruption has occurred. • The power supply went off.	Check the power supply.	QS
	1600	• The battery voltage in the CPU module has dropped below stipulated level. • The lead connector of the CPU module battery is not connected.	• Change the battery. • Install a lead connector of the battery.	QS
	1610	The number of writing to the standard RAM exceeded one hundred thousand times. (Number of writing>100,000 times)	Replace the CPU modules.	QS

9.1.4 Error code list (2000 to 2999)

The following shows the error messages from the error code 2000 to 2999, the contents and causes of the errors, and the corrective actions for the errors.

Error Code (SD0)	Error Message	Common Information (SD5 to 15)	Individual Information (SD16 to 26)	LED Status		CPU Operation Status	Diagnostic Timing	
				RUN	ERROR			
2000	MODULE VERIFY ERROR	Module No.	–	Off	Flicker	Stop	When an END instruction executed.	
2100	MODULE LAYOUT ERROR	Module No.	–	Off	Flicker	Stop	At power ON/ At reset	
2106	MODULE LAYOUT ERROR	Module No.	–	Off	Flicker	Stop	At power ON/ At reset	
2107	MODULE LAYOUT ERROR	Module No.	–	Off	Flicker	Stop	At power ON/ At reset	

	Error Code (SD0)	Error Contents and Cause	Corrective Action	Corresponding CPU
	2000	• Intelligent function module information at power ON are changed. • During operation, Intelligent function module are not installed properly or installed on the base unit.	Read the common information of the error using the GX Developer, and check and/or change the module that corresponds to the numerical values (module number) there. Alternatively, monitor the special registers SD 150 to SD 153 at a GX Developer, and change the fuse at the output module whose bit has a value of "1".	QS
	2100	• In the parameter I/O allocation settings, an Inteli (intelligent function module) was allocated to a location reserved for an I/O module. • In the I/O assignment setting of the PLC parameter dialog box, the number of points assigned to the intelligent function module is less than the number of points of the mounted module.	Reset the parameter I/O allocation setting to conform to the actual status of the intelligent function module.	QS
	2106	• More than three CC-Link Safety master modules are mounted. • More than two CC-Link IE controller network modules are mounted. • More than two MELSECNET/H modules are mounted. • More than two Ethernet modules are mounted. • A module that the Safety CPU module cannot recognize has been mounted.	• Mount two or less CC-Link Safety master modules. • Mount either only one CC-Link IE controller network module or MESECNET/H module. • Mount only one Ethernet module. • Mount a module supported in the Safety CPU module.	QS
	2107	The start X/Y set in the PLC parameter’s I/O assignment settings is overlapped with the one for another module.	Make the PLC parameter’s I/O assignment setting again so it is consistent with the actual status of the intelligent function module.	QS

Error Code (SD0)	Error Message	Common Information (SD5 to 15)	Individual Information (SD16 to 26)	LED Status		CPU Operation Status	Diagnostic Timing	
				RUN	ERROR			
2112	INTELLIGENT FUNCTION MODULE ERR.	Module No.	Program error location	Off	Flicker	Stop	At an execution of instruction	
2124	MODULE LAYOUT ERROR	Module No.	–	Off	Flicker	Stop	At power ON/ At reset	
2125	MODULE LAYOUT ERROR	Module No.	–	Off	Flicker	Stop	At power ON/ At reset	
2200	MISSING PARAMETER	Drive No.	–	Off	Flicker	Stop	At power ON/ At reset	
2210	BOOT ERROR	Drive No.	–	Off	Flicker	Stop	At power ON/ At reset	
2500	CAN'T EXECUTE PROGRAM	File name/ Drive No.	–	Off	Flicker	Stop	At power ON/ At reset/ STOP→RUN	
2501								
2502								
2503								

Error Code (SD0)	Error Contents and Cause	Corrective Action	Corresponding CPU
2112	• The module other than intelligent function module is specified by the intelligent function module dedicated instruction. Or, it is not the corresponding intelligent function module. • There is no network No. specified by the network dedicated instruction. Or the relay target network does not exit.	Read the individual information of the error using GX Developer, check and correct the intelligent function module dedicated instruction corresponding to its value (program error location).	QS
2124	• A module is installed to the actual I/O points or greater. • A module is installed to the slot whose assigned I/O range includes the limit of actual I/O points.	• Remove the module installed to the actual I/O points or greater. • Reset the I/O assignment setting of the parameter so as not to exceed the actual I/O points.	QS
2125	• A module that the safety CPU module cannot recognize has been mounted. • There was no response from the intelligent function module.	• Mount a module supported in the safety CPU module. • The intelligent function module is experiencing a hardware fault. (Contact your local Mitsubishi representative.)	QS
2200	There is no parameter file at the program memory.	Set the parameter file to the program memory.	QS
2210	The contents of the boot file are incorrect.	Check the boot setting.	QS
2500	• There is a program file that uses a device that is out of the range set in the PLC parameter device setting.	Read the common information of the error using the GX Developer, check to be sure that the parameter device allocation setting and the program file device allocation correspond to the numerical values there (file name), and correct if necessary.	QS
2501	• More than two program files exist for one drive. • The program name differs from the program contents.	• Delete unnecessary program files. • Match the program name with the program contents.	QS
2502	The program file is incorrect. Alternatively, the file contents are not those of a sequence program.	Check whether the program version is＊＊＊.QPG, and check the file contents to be sure they are for a sequence program.	QS
2503	There are no program files at all. (A drive No. is only displayed on the common information.)	• Check program configuration. • Check parameters and program configuration.	QS

9.1.5 Error code list (3000 to 3999)

The following shows the error messages from the error code 3000 to 3999, the contents and causes of the errors, and the corrective actions for the errors.

Error Code (SD0)	Error Message	Common Information (SD5 to 15)	Individual Information (SD16 to 26)	LED Status		CPU Operation Status	Diagnostic Timing	
				RUN	ERROR			
3000	PARAMETER ERROR	File name/ Drive No.	Parameter number	Off	Flicker	Stop	At power ON/ At reset	
3001								
3003	PARAMETER ERROR	File name/ Drive No.	Parameter number	Off	Flicker	Stop	At power ON/ At reset	
3004	PARAMETER ERROR	File name/ Drive No.	Parameter number	Off	Flicker	Stop	At power ON/ At reset	
3008	PARAMETER ERROR	File name/ Drive No.	Parameter number	Off	Flicker	Stop	When CC-Link Safety remote station return	

Error Code (SD0)	Error Contents and Cause	Corrective Action	Corresponding CPU
3000	The PLC parameter settings for timer time limit setting, the RUN-PAUSE contact and number of vacant slots is outside the range that can be used by the CPU module.	Read the detailed information of the error using the GX Developer, check the parameter items corresponding to those numerical values (parameter numbers), and correct when necessary.	QS
3001	The parameter settings are corrupted.		
3003	The number of devices set at the PLC parameter device settings exceeds the possible CPU module range.	Read the detailed information of the error using the GX Developer, check the parameter items corresponding to those numerical values (parameter numbers), and correct when necessary.	QS
3004	The parameter file is incorrect. Alternatively, the contents of the file are not parameters.	Check whether the parameter file version is＊＊＊.QPA, and check the file contents to be sure they are parameters.	QS
3008	The system power is not restarted or the CPU module is not reset after writing the parameter to the CPU module.When the remote I/O station returns while the system power is restarted or the CPU module is reset after writing the PLC parameter into CPU module, this error occurs.	Restart the power or reset the CPU module.	QS

Error Code (SD0)	Error Message	Common Information (SD5 to 15)	Individual Information (SD16 to 26)	LED Status		CPU Operation Status	Diagnostic Timing	
				RUN	ERROR			
3100	NETWORK PARAMETER ERROR	File name/ Drive No.	Parameter number	Off	Flicker	Stop	At power ON/ At reset	

Error Code (SD0)	Error Contents and Cause	Corrective Action	Corresponding CPU
3100	• The number of modules actually mounted is different from that is set in Network parameter for CC-Link IE controller network. • The start I/O number of the module actually mounted is different from that is set in Network parameter for CC-Link IE controller network. • Some data in the parameters are not supported. • The station type for a CC-Link IE controller network has been changed while the power is ON. (RESET→RUN is required for changing the station type.)	• Check the setting in Network parameter and actual mounting status, and if they differ, correct either the setting or mounting status so that they become the same. If the parameter setting is corrected, write Network parameter to the CPU module. • If an error occurs even after correction, a hardware failure is considered. (Please consult your local Mitsubishi representative.)	QS
	• The number of modules actually mounted is different from that is set in Network parameter for MELSECNET/H. • The start I/O number of the module actually mounted is different from that is set in Network parameter for MELSECNET/H. • Some data in the parameters are not supported. • The station type for a MELSECNET/H has been changed while the power is ON. (RESET→RUN is required for changing the station type.) • The mode switches of MELSECNET/H module are out of the setting range.	• Check the setting in Network parameter and actual mounting status, and if they differ, correct either the setting or mounting status so that they become the same. If the parameter setting is corrected, write Network parameter to the CPU module. • If an error occurs even after correction, a hardware failure is considered. (Please consult your local Mitsubishi representative.) • Set the mode switches of MELSECNET/H module within the setting range.	

*3 : MELSECNET/H modules whose serial number (first five digits) is “08102” or higher are targeted.

Error Code (SD0)	Error Message	Common Information (SD5 to 15)	Individual Information (SD16 to 26)	LED Status		CPU Operation Status	Diagnostic Timing	
				RUN	ERROR			
3101	NETWORK PARAMETER ERROR	File name/ Drive No.	Parameter number	Off	Flicker	Stop	At power ON/ At reset	
3102	NETWORK PARAMETER ERROR	File name/ Drive No.	Parameter number	Off	Flicker	Stop	At power ON/ At reset	
3103	NETWORK PARAMETER ERROR	File name/ Drive No.	Parameter number	Off	Flicker	Stop	At power ON/ At reset	

Error Code (SD0)	Error Contents and Cause	Corrective Action	Corresponding CPU
3101	The refresh parameter for CC-Link IE controller network is out of the setting range.	Check the setting in Network parameter and actual mounting status, and if they differ, correct either the setting or mounting status so that they become the same. If the parameter setting is corrected, write Network parameter to the CPU module.	QS
	• The start I/O number of the module actually mounted is different from that is set in Network parameter. • The refresh parameter for MELSECNET/H is out of the setting range.		
3102	• The network module detected an error in Network parameter. • The MELSECNET/H inherent parameter setting is incorrect.	• Correct the parameter setting and write Network parameter to the CPU If an error occurs even after correction, a hardware failure is considered. (Please consult your local Mitsubishi representative.)	QS
3103	• The number of modules actually mounted is different from that is set in Network parameter for Ethernet. • The start I/O number of the module actually mounted is different from that is set in Network parameter for Ethernet.	• Check the setting in Network parameter and actual mounting status, and if they differ, correct either the setting or mounting status so that they become the same. If the parameter setting is corrected, write Network parameter to the CPU module. • If an error occurs even after correction, a hardware failure is considered. (Please consult your local Mitsubishi representative.)	QS

Error Code (SD0)	Error Message	Common Information (SD5 to 15)	Individual Information (SD16 to 26)	LED Status		CPU Operation Status	Diagnostic Timing	
				RUN	ERROR			
3104	NETWORK PARAMETER ERROR	File name/ Drive No.	Parameter number	Off	Flicker	Stop	At power ON/ At reset	
3105	CC-LINK PARAMETER ERROR	File name/ Drive No.	Parameter number	Off	Flicker	Stop	At power ON/ At reset	
3106	CC-LINK PARAMETER ERROR	File name/ Drive No.	Parameter number	Off	Flicker	Stop	At power ON/ At reset	
3107	CC-LINK PARAMETER ERROR	File name/ Drive No.	Parameter number	Off	Flicker	Stop	At power ON/ At reset	
3400	REMOTE PASSWORD ERROR	–	–	Off	Flicker	Stop	At power ON/ At reset	
3401	REMOTE PASSWORD ERROR	–	–	Off	Flicker	Stop	At power ON/ At reset	

	Error Code (SD0)	Error Contents and Cause	Corrective Action	Corresponding CPU
	3104	• The same network number is used for Ethernet, CC-Link IE controller network, and MELSECNET/H. • The network number, station number, and/or group number set in Network parameter are out of the setting range. • The specified I/O number is outside the range of the used CPU module. • The Ethernet inherent parameter setting is incorrect.	• Correct the parameter setting and write Network parameter to the CPU module. • If an error occurs even after correction, a hardware failure is considered. (Please consult your local Mitsubishi representative.)	QS
	3105	• Though the number of CC-Link modules set in the network parameters is one or more, the number of actually mounted modules is zero. • The start I/O number in the common parameters is different from that of the actually mounted module. • The station type of the CC-Link module count setting parameters is different from that of the actually mounted station.	• Correct and write the network parameters. • If the error occurs after correction, it suggests a hardware fault. (Contact your local Mitsubishi representative.)	QS
	3106	• The network refresh parameter for CC-Link is out of range. • Although the safety remote station set in the network parameter does not support the safety data monitoring time, it is set for the station.	• Check the parameter setting. • Check the [Model name] and [Module technical version] of the safety remote station settings, or delete the setting of the safety data monitoring time.	QS
		The safety data monitoring time has been set.	Delete the setting of the safety data monitoring time.	QS[*1]
	3107	The CC-Link parameter setting is incorrect.	Check the parameter setting.	QS
	3400	The start I/O number of the target module in Remote password is set to other than 0H to 3E0H.	Change the start I/O number of the target module to the number within 0H to 3E0H.	QS
	3401	Ethernet module of function version B or later is not mounted on the slot specified for the start I/O number of Remote password.	Mount the Ethernet module of function version B or later on the slot specified for the start I/O number of Remote password.	QS

*1 :For the module whose first five digits of serial number are “10031” or earlier.

9.1.6 Error code list (4000 to 4999)

The following shows the error messages from the error code 4000 to 4999, the contents and causes of the errors, and the corrective actions for the errors.

Error Code (SD0)	Error Message	Common Information (SD5 to 15)	Individual Information (SD16 to 26)	LED Status		CPU Operation Status	Diagnostic Timing	
				RUN	ERROR			
4000	INSTRUCTION CODE ERROR	Program error location	–	Off	Flicker	Stop	At power ON/ At reset/ STOP→RUN	
4002	INSTRUCTION CODE ERROR	Program error location	–	Off	Flicker	Stop	At power ON/ At reset/ STOP→RUN	
4003	INSTRUCTION CODE ERROR	Program error location	–	Off	Flicker	Stop	At power ON/ At reset/ STOP→RUN	
4004	INSTRUCTION CODE ERROR	Program error location	–	Off	Flicker	Stop	At power ON/ At reset/ STOP→RUN	
4010	MISSING END INSTRUCTION	Program error location	–	Off	Flicker	Stop	At power ON/ At reset/ STOP→RUN	
4100	OPERATION ERROR	Program error location	–	Off/ On	Flicker	Stop	When instruction executed.	

Error Code (SD0)	Error Contents and Cause	Corrective Action	Corresponding CPU
4000	• The program contains an instruction code that cannot be decoded. • An unusable instruction is included in the program.	Read the common information of the error using GX Developer, check and correct the error step corresponding to its value (program error location).	QS
4002	• The name of dedicated instruction specified in the program is incorrect. • The dedicated instruction specified in the program cannot be executed by the specified module. • An unsupported instruction exists.		QS
4003	The number of devices for the dedicated instruction specified in the program is incorrect.		QS
4004	The device, which cannot be used by the dedicated instruction specified in the program, is specified.		QS
4010	There is no END instruction in the program.		QS
4100	The instruction cannot process the contained data.	Read the common information of the error using the GX Developer, check error step corresponding to its numerical value (program error location), and correct the problem.	QS

Error Code (SD0)	Error Message	Common Information (SD5 to 15)	Individual Information (SD16 to 26)	LED Status		CPU Operation Status	Diagnostic Timing	
				RUN	ERROR			
4101	OPERATION ERROR	Program error location	–	Off/ On	Flicker	Stop	When instruction executed.	
4102	OPERATION ERROR	Program error location	–	Off	Flicker	Stop	At an execution of instruction	
4700	PROGRAM ABORT EXECUTED	Program error location	Aborted program information	Off	Flicker	Stop	When executing the S.QSABORT instructions.	

	Error Code (SD0)	Error Contents and Cause	Corrective Action	Corresponding CPU
	4101	• The designated device number for data processed by the instruction exceeds the usable range. • Alternatively, the stored data or constants for the devices designated by the instruction exceeds the usable range.	Read the common information of the error using GX Developer, check and correct the error step corresponding to its value (program error location).	QS
	4102	• The network number and/or station number specified by the dedicated instruction are incorrect. • The module number, network number, and/or number of character strings specified by the dedicated instruction exceed the allowable range.	Read the common information of the error using GX Developer, check and correct the error step corresponding to its value (program error location).	QS
	4700	The S.QSABORT instruction was executed, and the program was forcefully stopped.	Remove the cause before executing the S.QSABORT instruction.	QS

9.1.7 Error code list (5000 to 5999)

The following shows the error messages from the error code 5000 to 5999, the contents and causes of the errors, and the corrective actions for the errors.

Error Code (SD0)	Error Message	Common Information (SD5 to 15)	Individual Information (SD16 to 26)	LED Status		CPU Operation Status	Diagnostic Timing	
				RUN	ERROR			
5001	WDT ERROR	Time (value set)	Time (value actually measured)	Off	Flicker	Stop	Always	
5010	PROGRAM SCAN TIME OVER	Time (value set)	Time (value actually measured)	On	On	Continue	Always	

	Error Code (SD0)	Error Contents and Cause	Corrective Action	Corresponding CPU
	5001	The program scan time exceeded the WDT value specified in the PLC RAS setting of the PLC parameter dialog box.	Read the individual information of the error with the GX Developer, check its value (time), and shorten the scan time.	QS
	5010	The program scan time exceeded the constant scan time specified in the PLC RAS setting of the PLC parameter dialog box.	Review the constant scan time in the PLC parameter so that the margin time of constant scan may be fully reserved.	QS

9.1.8 Error code list (8000 to 9000)

The following shows the error messages from the error code 8000 to 9000, the contents and causes of the errors, and the corrective actions for the errors.

Error Code (SD0)	Error Message	Common Information (SD5 to 15)	Individual Information (SD16 to 26)	LED Status		CPU Operation Status	Diagnostic Timing	
				RUN	ERROR			
8000	INTERNAL REGISTER ERROR	–	Error information	Off	Flicker	Stop	At power ON/ At reset/When an END instruction executed.	
8010	INTERNAL BUS ERROR	–	Error information	Off	Flicker	Stop	At power ON/ At reset/When an END instruction executed.	
8020	CPU A & B CAN'T BE SYNCHRO-NIZED	–	Error information	Off	Flicker	Stop	Always	
8021							When an END instruction executed.	
8031	INCORRECT FILE	–	Diagnostics file information	Off	Flicker	Stop	At power ON/ At reset	
8032	INCORRECT FILE	–	Diagnostics file information	Off	Flicker	Stop	When an END instruction executed.	
8050	SAFETY OUTPUT VERIFY ERROR	Module No./ Station No.	–	Off	On	Stop	When an END instruction executed.	
8060	INCORRECT FIRMWARE	–	Error information	Off	Flicker	Stop	At power ON/ At reset/When an END instruction executed.	

*1 The operating status of a CPU module in case of an error can be set in the "Operation settings during remote station error" of "Parameter". The default is set to "Stop" (The LED indication changes according to the status).

*2 At occurrence of "F****", a USER LED lights up.

	Error Code (SD0)	Error Contents and Cause	Corrective Action	Corresponding CPU
	8000	Error is detected by the inside register diagnostics built in the CPU module.	This suggests a CPU module hardware fault. (Contact your local Mitsubishi representative.)	QS
	8010	Error is detected inside the bus of the CPU module.	This suggests a CPU module hardware fault. (Contact your local Mitsubishi representative.)	QS
	8020	Mismatch has occurred in the execution status of CPU A and CPU B.	• Take measure against noise. • Reset it and run it again. If the same error is displayed again, this suggests a CPU module hardware fault. (Contact your local Mitsubishi representative.)	QS
	8021	Mismatch of program execution times is detected between CPU A and CPU B.		
	8031	Error of a file stored in the program memory or the standard ROM is detected.	The file indicated by the individual information SD17~SD22 is written into the individual information SD16, and turn the CPU power is turned OFF→ON or reset→reset canceling.If the same error is displayed again, this suggests a CPU module hardware fault. (Contact your local Mitsubishi representative.)	QS
	8032			
	8050	The verification of safety outputs between the CPU A and CPU B in a CPU module resulted in a mismatch.	• Check if the program for outputing safety outputs is correct. • Take measure against noise. • Reset it and run it again. If the same error is displayed again, this suggests a CPU module hardware fault. (Contact your local Mitsubishi representative.)	QS
	8060	Error of system programs is detected.	• Take measure against noise. • Reset it and run it again. If the same error is displayed again, this suggests a CPU module hardware fault. (Contact your local Mitsubishi representative.)	QS

Error Code (SD0)	Error Message	Common Information (SD5 to 15)	Individual Information (SD16 to 26)	LED Status		CPU Operation Status	Diagnostic Timing	
				RUN	ERROR			
8070	INTERNAL CPU COMMUNI-CATION ERROR	–	Error information	Off	Flicker	Stop	At power ON/ At reset	
8071								
8072								
8073							When an END instruction executed.	
8074								
8080	POWER SUPPLY ERROR	–	Error information	Off	Off/On	Stop	Always	
8090	VOLTAGE DIAGNOSIS ERROR	–	Error information	Off	Flicker	Stop	When an END instruction executed.	
8100	TEST MODE TIME EXCEEDED	–	–	On	On	Continues	When an END instruction executed.	
8120	WDT CLOCK CHECK ERROR	–	–	Off	Flicker	Stop	Always	
8300	CC-LINK REMOTE DETECTION ERROR	CC-Link Safety information	CC-Link Safety information	Off/On*1	Flicker/ On*1	Stop/ Continues *1	Always	

*1 The operating status of a CPU module in case of an error can be set in the "Operation settings during remote station error" of "Parameter". The default is set to "Stop" (The LED indication changes according to the status).

*2 At occurrence of "F****", a USER LED lights up.

Error Code (SD0)	Error Contents and Cause	Corrective Action	Corresponding CPU
8070	The initial communication between CPU A and CPU B was unsuccessful.	• Take measure against noise. • Reset it and run it again. If the same error is displayed again, this suggests a CPU module hardware fault. (Contact your local Mitsubishi representative.)	QS
8071	CPU A and CPU B cannot send data to each other.		
8072	CPU A and CPU B cannot receive data from each other.		
8073	CPU A and CPU B cannot send data to each other.		
8074	CPU A and CPU B cannot receive data from each other.		
8080	Power supply voltage error has been detected in a CPU module.	• Take measure against noise. • Reset it and run it again. If the same error is displayed again, this suggests a CPU module hardware fault. (Contact your local Mitsubishi representative.)	QS
8090	The error of line voltage monitoring circuit is detected.	• Take measure against noise. • Reset it and run it again. If the same error is displayed again, this suggests a CPU module hardware fault. (Contact your local Mitsubishi representative.)	QS
8100	The continuous operation time on TEST MODE exceeds the TEST MODE continuous operation time set by the parameter.	Confirm that the safety CPU operation mode can be switched to the SAFETY MODE, and start operation after switching the TEST MODE to the SAFETY MODE.	QS
8120	Clock stop of the WDT is detected.	• Take measure against noise. • Reset it and run it again. If the same error is displayed again, this suggests a CPU module hardware fault. (Contact your local Mitsubishi representative.)	QS
8300	Error information is received from CC-Link Safety remote station.	Confirm the error code of the relevant CC-Link Safety remote station. (Refer to the manual of the CC-Link Safety remote module for the confirmation.)	QS

Error Code (SD0)	Error Message	Common Information (SD5 to 15)	Individual Information (SD16 to 26)	LED Status		CPU Operation Status	Diagnostic Timing	
				RUN	ERROR			
8310	CC-LINK PRODUCT INFO. MISMATCH	CC-Link Safety information	CC-Link Safety information	Off/On*1	Flicker/ On*1	Stop/ Continues *1	Always	
8320	CC-LINK DATA RECEPTION TIMEOUT	CC-Link Safety information	CC-Link Safety information	Off/On*1	Flicker/ On*1	Stop/ Continues *1	While initializing remote station	
8321							Always	
8322							When receiving remote station's error information	

*1 The operating status of a CPU module in case of an error can be set in the "Operation settings during remote station error" of "Parameter". The default is set to "Stop" (The LED indication changes according to the status).

*2 At occurrence of "F****", a USER LED lights up.

	Error Code (SD0)	Error Contents and Cause	Corrective Action	Corresponding CPU
	8310	The installed product is different from the specified one by network parameter.	Check that [Model name], [Module technical version] or [Production information] of the CC-Link Safety remote station set in the network parameter matches the product information of the relevant CC-Link Safety remote station.(Refer to the manual of the CC-Link Safety remote module for the confirmation.)	QS
	8320	The response data cannot be received during the initial processing of CC-Link Safety remote station.	• Check that the following operations are not executed. (1)Switching the operation mode (5)Writing the program memory to ROM (6)Registration/change of the CPU access password (7)Initialization of PLC memory (If executed, this error may occur due to the increase of the interval between data communications of CC-Link Safety.) • When instantaneous power failure occurs to the supply power, change to the asynchronous mode or slow down the speed. • Execute the link test to check the soundness of transmission path. • Check the setting of transmission speed. • Check if the setting value of the Safety refresh monitoring timer is appropriate. • Check if the setting value of the Safety data monitoring timer is appropriate.	QS
	8321	The response data cannot be received during the normal communication with CC-Link Safety remote station.		QS
	8322	The response data cannot be received during processing error information from CC-Link Safety remote station.		QS

Error Code (SD0)	Error Message	Common Information (SD5 to 15)	Individual Information (SD16 to 26)	LED Status		CPU Operation Status	Diagnostic Timing	
				RUN	ERROR			
8330	CC-LINK RECEIVED DATA ERROR	CC-Link Safety information	CC-Link Safety information	Off/On*1	Flicker/ On*1	Stop/ Continues *1	Always	
8331								
8332								
8333								
8334								
9000	F**** *2	Program error location	Annunciator number	On	Off	Continue	When instruction executed.	

*1 The operating status of a CPU module in case of an error can be set in the "Operation settings during remote station error" of "Parameter". The default is set to "Stop" (The LED indication changes according to the status).

*2 At occurrence of "F****", a USER LED lights up.

	Error Code (SD0)	Error Contents and Cause	Corrective Action	Corresponding CPU
	8330	The received command differs from the expected value.	• Check the cable status visually or by a line test. • Hardware error of the CC-Link Safety master module or the relevant CC-Link Safety remote module (Contact your local Mitsubishi representative.)	QS
	8331	Lapse in separated receiving data has occurred.		QS
	8332	The link ID in receiving data is different from the expected value.	• Check if the link ID setting of the relevant remote station and the link ID that has been set in the network parameter are identical. • Hardware error of the CC-Link Safety master module or the relevant CC-Link Safety remote module (Contact your local Mitsubishi representative.)	QS
	8333	The running No. in receiving data is different from the expected value.	• Check if the setting value of the Safety refresh monitoring time is appropriate. • Hardware error of the CC-Link Safety master module or the relevant CC-Link Safety remote module (Contact your local Mitsubishi representative.)	QS
	8334	The CC-Link Safety master station cannot recognize the separated data.	• Check the cable status visually or by a line test. • Hardware error of the CC-Link Safety master module or the relevant CC-Link Safety remote module (Contact your local Mitsubishi representative.)	QS
	9000	Annunciator (F) was set ON (**** in the error message indicates the detected annunciator number.)	Read the individual information of the error using the GX Developer, and check the program corresponding to the numerical value (annunciator number).	QS

9.2 Canceling Errors

CPU module can perform the cancel operation for errors only when the errors allow the CPU module to continue its operation.

To cancel the errors, follow the steps shown below.

1) Read the special register SD81 with GX Developer and confirm the cause of the continuation error that currently occurs in the CPU module.
2) Eliminate the cause of the error.
3) Store the error code to be canceled in the special register SD50.
4) Energize the special relay SM50 (OFF → ON).
5) Read the special register SD81 with GX Developer again and confirm that the bit corresponding to the canceled continuation error is turned OFF.
6) Turn the special relay SM50 OFF.

After the CPU module is reset by the canceling of the error, the special relays, special registers, and LEDs associated with the error are returned to the status under which the error occurred.
If the same error occurs again after the cancellation of the error, it will be registered again in the error history.

When multiple enunciators(F) detected are canceled, the first one with No. F only is canceled.

If the canceling of errors is performed when multiple continuation errors are occurring, the LED indication and error information of the CPU module operate as follows.

Error Canceling Status	LED Indication *1 ("ERR." LED, "BAT." LED, "USER" LED)	Error Information (SM0, SM1, SM5, SM16, SD0 to 26)
Before canceling errors	On	The error information of the continuation error that occurred last is stored.
	↓	
The error which occurred last is cancelled. (The continuation error that is not canceled remains.)	On	Returned to the status without error.
Errors other than the continuation error that occurred last are cancelled. (The continuation error that is not canceled remains.)	On	No change (The error information that occurred last is retained.)
	↓	
All the continuation errors are cancelled.	Off	No error

*1: 1) Error code: When 1600 (BATTERY ERROR) occurs, only "BAT." LED turns on.
Error code: When canceling the error code 1600, "BAT." LED turns off.
2) Error code: When 9000 (F****) occurs, only "USER" LED turns on.
Error code: When canceling the error code 9000, "USER" LED turns off.

Refer to the following manual for details of error canceling.
→ QSCPU User's Manual (Function Explanation, Program Fundamentals)

POINT

1. When the error is canceled with the error code to be canceled stored in the SD50, the lower one digit of the code is neglected.
   (Example)
   If error codes 2100 and 2106 occur, and error code 2100 to cancel error code 2106.
   If error codes 2100 and 2125 occur, error code 2125 is not canceled even if error code 2100 is canceled.
2. Errors developed due to trouble in other than the CPU module are not canceled even if the special relay (SM50) and special register (SD50) are used to cancel the error.
   (Example)
   Since "INTELLIGENT FUNCTION MODULE DOWN" is the error that occurred in the base unit, intelligent function module, etc. the error cause cannot be removed even if the error is canceled by the special relay (SM50) and special register (SD50).
   Refer to the error code list and remove the error cause.

MEMO

A APPENDICIES

Appendix 1 OPERATION PROCESSING TIME

Appendix 1.1 Definition

(1) Processing time taken by the QSCPU is the total of the following processing times.

- Total of each instruction processing time
- END processing time
- I/O refresh time
- Service processing time

(2) Instruction processing time
This is the total of processing time of each instruction shown in Appendix 1.2.

(3) END processing time
END instruction processing time is the total of the following processing times.

- END instruction processing time shown in Appendix 1.2
- CC-Link IE controller network and MELSECNET/H refresh time
- Auto refresh time of CC-Link Safety*1
- MELSECNET/H refresh time*2
- Communication processing time with GX Developer *3

*1: For details CC-Link IE controller network and MELSECNET/H refresh time, refer to the following manual.
- QSCPU User's Manual (Function Explanation, Program Fundamentals)

*2: For details the auto refresh time of CC-Link Safety., refer to the following manual.
- CC-Link Safety System Master Module User's Manual

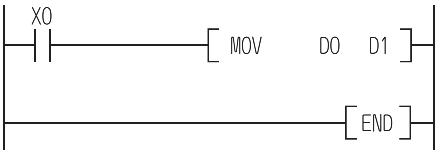
*3: Also refer to the following manual for the communication processing time with the GX Developer.
- QSCPU User's Manual (Function Explanation, Program Fundamentals)

(4) I/O refresh time can be calculated using the equation below.
I/O refresh time (μs) = Number of I/O points × 0.224 + 310 (μs)

(5) For details of service processing time, refer to the following manual.

- QSCPU User's Manual (Function Explanation, Program Fundamentals)

(6) Calculation of processing time
The total of the processing time when executed by the QSCPU is calculated as follows:

Ladder Example	Processing Time
	[Instruction processing time] LD X0 . . . . 0.10μs MOV D0 D1 . . . . 0.35μs → 0.10(μs) + 0.35(μs) = 0.45(μs) [END processing time] END instruction . . . . 8200μs [I/O refresh time] I/O refresh time . . . . 310μs TOTAL 0.45(μs) + 8200(μs) + 310(μs) = 8510.45(μs)

Appendix 1.2 Operation Processing Time

The processing times for the individual instructions are shown in the table on the following pages.

Operation processing times can vary substantially depending on the nature of the sources and destinations of the instructions, and the values contained in the following tables should therefore be taken as a set of general guidelines to processing times rather than as being strictly accurate.

(1) Sequence instruction

Instruction	Conditions (Device)		Processing Time (μs)
LD LDI AND ANI OR ORI	X0		0.10
	D0.0		0.15
LDP LDF ANDP ANDF ORP ORF	X0		0.15
	D0.0		
ANB ORB MPS MRD MPP	—		0.10
INV	When not executed		0.10
	When executed		
MEP MEF	When not executed		0.15
	When executed		
EGP	When not executed	(OFF→OFF) (ON→ON)	0.10
	When executed	(OFF→ON) (ON→OFF)	
EGF	When not executed	(OFF→OFF)	11
		(ON→ON)	14
	When executed	(OFF→ON)	14
		(ON→OFF)	16

Instruction		Conditions (Device)			Processing Time (μs)
OUT	Y	When not changed	(OFF→OFF) (ON→ON)		0.10
		When changed	(OFF→ON) (ON→OFF)		
	D0.0	When not changed	(OFF→OFF) (ON→ON)		0.20
		When changed	(OFF→ON) (ON→OFF)		
	F	When OFF			18
		When ON	When displayed		370
			Display completed		240
	T	When not executed			0.55
		When executed	After Time Up		0.55
			When added	K	0.55
				D	0.60
	C	When not executed			0.55
		When executed	After Time Up		0.55
			When added	K	0.55
				D	0.60
OUTH	T	When not executed			0.55
		When executed	After Time Up		0.55
			When added	K	0.55
				D	0.60
SET	Y	When not executed			0.10
		When executed	When not changed (ON→ON)		0.10
			When changed (OFF→ON)		0.10
	D0.0	When not executed			0.20
		When executed	When not changed (ON→ON)		0.20
			When changed (OFF→ON)		0.20
	F	When not executed			0.25
		When executed	When displayed		365
			Display completed		235

Instruction		Conditions (Device)		Processing Time (μs)
RST	Y	When not executed		0.10
		When executed	When not changed (OFF→OFF)	0.10
			When changed (ON→OFF)	0.10
	D0.0	When not executed		0.20
		When executed	When not changed (ON→ON)	0.20
			When changed (OFF→ON)	0.20
	SM	When not executed		0.10
		When executed		0.10
	F	When not executed		0.25
		When executed	When displayed	115
			Display completed	87
	T, C	When not executed		0.40
		When executed		0.50
	D	When not executed		0.20
		When executed		0.30
PLS		—		7.1
PLF		—		7.1
FF	Y	When not executed		0.25
		When executed		4.9
MC		M0		0.20
		D0.0		0.30
MCR		—		0.10
END		Performs error check		8200
NOP		—		0.10
NOPLF PAGE		—		0.10

(2) Basic instructions

The processing time when the instruction is not executed is calculated as follows:
0.10 × (Number of steps of each instruction +1) μs

Instruction	Conditions (Device)		Processing Time (μs)
LD =	When continuity established		0.40
	When no continuity		0.40
AND =	When not executed		0.35
	When executed	When continuity established	0.40
		When no continuity	0.40
OR =	When not executed		0.35
	When executed	When continuity established	0.40
		When no continuity	0.40
LD < >	When continuity established		0.40
	When no continuity		0.40
AND < >	When not executed		0.35
	When executed	When continuity established	0.40
		When no continuity	0.40
OR < >	When not executed		0.35
	When executed	When continuity established	0.40
		When no continuity	0.40
LD >	When continuity established		0.40
	When no continuity		0.40
AND >	When not executed		0.35
	When executed	When continuity established	0.40
		When no continuity	0.40
OR >	When not executed		0.35
	When executed	When continuity established	0.40
		When no continuity	0.40
LD < =	When continuity established		0.40
	When no continuity		0.40

Instruction	Conditions (Device)		Processing Time (μs)
AND < =	When not executed		0.35
	When executed	When continuity established	0.40
		When no continuity	0.40
OR < =	When not executed		0.35
	When executed	When continuity established	0.40
		When no continuity	0.40
LD <	When continuity established		0.40
	When no continuity		0.40
AND <	When not executed		0.35
	When executed	When continuity established	0.40
		When no continuity	0.40
OR <	When not executed		0.35
	When executed	When continuity established	0.40
		When no continuity	0.40
LD > =	When continuity established		0.40
	When no continuity		0.40
AND > =	When not executed		0.35
	When executed	When continuity established	0.40
		When no continuity	0.40
OR > =	When not executed		0.35
	When executed	When continuity established	0.40
		When no continuity	0.40
LDD =	When continuity established		0.50
	When no continuity		0.50
ANDD =	When not executed		0.40
	When executed	When continuity established	0.50
		When no continuity	0.50
ORD =	When not executed		0.40
	When executed	When continuity established	0.50
		When no continuity	0.50
LDD < >	When continuity established		0.50
	When no continuity		0.50
ANDD < >	When not executed		0.40
	When executed	When continuity established	0.50
		When no continuity	0.50
ORD < >	When not executed		0.40
	When executed	When continuity established	0.50
		When no continuity	0.50
LDD >	When continuity established		0.50
	When no continuity		0.50
ANDD >	When not executed		0.40
	When executed	When continuity established	0.50
		When no continuity	0.50
ORD >	When not executed		0.40
	When executed	When continuity established	0.50
		When no continuity	0.50
LDD < =	When continuity established		0.50
	When no continuity		0.50

Instruction	Conditions (Device)		Processing Time (µs)
ANDD < =	When not executed		0.40
	When executed	When continuity established	0.50
		When no continuity	0.50
ORD < =	When not executed		0.40
	When executed	When continuity established	0.50
		When no continuity	0.50
LDD <	When continuity established		0.50
	When no continuity		0.50
ANDD <	When not executed		0.40
	When executed	When continuity established	0.50
		When no continuity	0.50
ORD <	When not executed		0.40
	When executed	When continuity established	0.50
		When no continuity	0.50
LDD > =	When continuity established		0.50
	When no continuity		0.50
ANDD > =	When not executed		0.40
	When executed	When continuity established	0.50
		When no continuity	0.50
ORD > =	When not executed		0.40
	When executed	When continuity established	0.50
		When no continuity	0.50
+ Ⓢ Ⓓ +P Ⓢ Ⓓ	When executed		0.50
+ S1 S2 Ⓓ +P S1 S2 Ⓓ	When executed		0.60
+ Ⓢ Ⓓ - P Ⓢ Ⓓ	When executed		0.50
+ S1 S2 Ⓓ - P S1 S2 Ⓓ	When executed		0.60
D+ Ⓢ Ⓓ D+P Ⓢ Ⓓ	When executed		0.65
D+ S1 S2 Ⓓ D+P S1 S2 Ⓓ	When executed		0.75
D – Ⓢ Ⓓ D – P Ⓢ Ⓓ	When executed		0.65
D – S1 S2 Ⓓ D – P S1 S2 Ⓓ	When executed		0.75
* S1 S2 Ⓓ * P S1 S2 Ⓓ	When executed		0.55
/ S1 S2 Ⓓ /P S1 S2 Ⓓ	—		14
D * S1 S2 Ⓓ D * P S1 S2 Ⓓ	—		42
D/ S1 S2 Ⓓ D/P S1 S2 Ⓓ	—		25

Instruction	Conditions (Device)	Processing Time (μs)
INC INCP	—	0.35
DINC DINCP	—	0.45
DEC DECP	—	0.35
DDEC DDECP	—	0.45
BCD BCDP	—	16
DBCD DBCDP	—	23
BIN BINP	—	15
DBIN DBINP	—	18
NEG NEGP	—	14
DNEG DNEGP	—	15
MOV MOVP	Ⓢ = D0, Ⓓ = D1	0.35
DMOV DMOVP	Ⓢ = D0, Ⓓ = D1	0.45
CML CMLP	—	0.35
DCML DCMLP	—	0.45
BMOV Ⓢ Ⓓ n	n = 1	35
BMOVP Ⓢ Ⓓ n	n = 96	67
FMOV Ⓢ Ⓓ n	n = 1	30
FMOVP Ⓢ Ⓓ n	n = 96	48

(3) Application instructions

The processing time when the instruction is not executed is calculated as follows:
0.10 × (Number of steps of each instruction +1) μs

Instruction	Conditions (Device)	Processing Time (μs)
WAND S D WANDP S D	When executed	0.50
WAND S1 S2 D WANDP S1 S2 D	When executed	0.60
DAND S D DANDP S D	When executed	0.65
DAND S1 S2 D DANDP S1 S2 D	When executed	0.75
WOR S D WORP S D	When executed	0.50
WOR S1 S2 D WORP S1 S2 D	When executed	0.60
DOR S D DORP S D	When executed	0.65
DOR S1 S2 D DORP S1 S2 D	When executed	0.75
WXOR S D WXORP S D	When executed	0.50
WXOR S1 S2 D WXORP S1 S2 D	When executed	0.60
DXOR S D DXORP S D	When executed	0.65
DXOR S1 S2 D DXORP S1 S2 D	When executed	0.75
WXNR S D WXNRP S D	When executed	0.50
WXNR S1 S2 D WXNRP S1 S2 D	When executed	0.60
DXNR S D DXNRP S D	When executed	0.65
DXNR S1 S2 D DXNRP S1 S2 D	When executed	0.75

(4) QSCPU dedicated instruction

Instruction	Conditions (Device)	Processing Time (μs)
S.QSABORT S	When executed (K1234)	344
	When not executed	34

Appendix 2 SPECIAL RELAY LIST

Special relays, SM, are internal relays whose applications are fixed in the Programmable Controller.
For this reason, they cannot be used by sequence programs in the same way as the normal internal relays.
However, they can be turned ON or OFF as needed in order to control the CPU module and remote I/O modules.
The heading descriptions in the following special relay lists are shown in TableApp.2.1.

TableApp.2.1 Descriptions of the special relay lists headings

Item	Function of Item
Number	• Indicates special register number
Name	• Indicates name of special register
Meaning	• Indicates contents of special register
Explanation	• Discusses contents of special register in more detail
Set by (When set)	• Indicates whether the relay is set by the system or user, and, if it is set by the system, when setting is performed. <Set by> S : Set by system U : Set by user (sequence programs or test operations from GX Developer) S/U : Set by both system and user <When set> Indicated only for registers set by system Every END : Set during every END processing Initial : Set only during initial processing (when power supply is turned ON, or when going from STOP to RUN) Status change : Set only when there is a change in status Error : Set when error occurs Instruction execution : Set when instruction is executed Request : Set only when there is a user request (through SM, etc.)

For details on the following items, refer to the following manuals:
- Networks → Manuals of each network module

☒POINT

In the program that achieves the safety function, only SM1000 to SM1299 can be used.
Special relay other than SM1000 to SM1299 cannot be used in the program that achieves the safety function.

(1) Diagnostic Information

TableApp.2.2 Descriptions of the special relay headings

Number	Name	Meaning	Explanation	Set by (When Set)	Corresponding CPU
SM0	Diagnostic errors	OFF : No error ON : Error	• Turns ON when an error is detected by diagnostics (Includes when an annunciator is ON) • Remains ON if the condition is restored to normal thereafter.	S (Error)	QS
SM1	Self-diagnosis error	OFF : No self-diagnosis errors ON : Self-diagnosis	• Turns ON when an error is detected by self-diagnostics (Does not include when an annunciator is ON) • Remains ON if the condition is restored to normal thereafter.	S (Error)	
SM5	Error common information	OFF : No error common information ON : Error common information	• When SM0 is ON, ON if there is error common information	S (Error)	
SM16	Error individual information	OFF : No error individual information ON : Error individual information	• When SM0 is ON, ON if there is error individual information	S (Error)	
SM50	Error reset	OFF→ON: Error reset	• Conducts error reset operation	U	
SM51	Battery low latch	OFF : Normal ON : Battery low	• ON if battery voltage at CPU module or memory card drops below rated value. • Remains ON if the battery voltage returns to normal thereafter. • Synchronous with BAT. LED	S (Error)	
SM52	Battery low	OFF : Normal ON : Battery low	• Same as SM51, but goes OFF subsequently when battery voltage returns to normal.	S (Error)	
SM53	AC DOWN detection	OFF : AC DOWN not detected ON : AC DOWN detected	• Turns ON if an instantaneous power failure of within 20ms occurs during use of the AC power supply module. Reset when the power supply is switched OFF, then ON.	S (Error)	
SM56	Operation error	OFF : Normal ON : Operation error	• ON when operation error is generated • Remains ON if the condition is restored to normal thereafter.	S (Error)	
SM61	I/O module verify error	OFF : Normal ON : Error	• Turns ON if the I/O module differs from the status registered at power on. • Remains ON if the condition is restored to normal thereafter.	S (Error)	
SM62	Annunciator detection	OFF : Not detected ON : Detected	• Goes ON if even one annunciator F goes ON.	S (Instruction execution)	

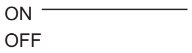
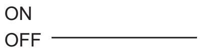
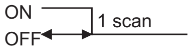
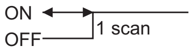
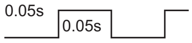
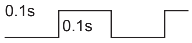
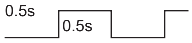
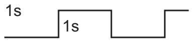
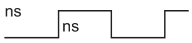
(2) System information

TableApp.2.3 Special relay

Number	Name	Meaning	Explanation	Set by (When Set)	Corresponding CPU
SM203	STOP contact	STOP status	• Turns ON when the CPU is in STOP status.	S (Status change)	QS
SM210	Clock data set request	OFF : Ignored ON : Set request	• Writes clock data stored in SD210 to SD213 to the CPU module after the END instruction of the scan where the relay changes OFF to ON has been executed.	U	
SM211	Clock data error	OFF : No error ON : Error	• Turns ON when an error is detected in the clock data (SD210 to SD213) and turns OFF if no error is detected.	S (Request)	
SM213	Clock data read request	OFF : Ignored ON : Read request	• Reads clock data to SD210 to SD213 in BCD value when the relay is ON.	U	
SM232	Number of writes to ROM	OFF : Within the number of writes ON : Over the number of writes	• Turns ON when the number of writes to ROM exceeds 100,000.	S (Error)	

(3) System clocks/counters

TableApp.2.4 Special relay

Number	Name	Meaning	Explanation	Set by (When Set)	Corresponding CPU
SM400	Always ON		• Normally is ON	S (Every END)	QS
SM401	Always OFF		• Normally is OFF	S (Every END)	
SM402	After RUN, ON for 1 scan only		• After RUN, ON for 1 scan only.	S (Every END)	
SM403	After RUN, OFF for 1 scan only		• After RUN, OFF for 1 scan only.	S (Every END)	
SM410	0.1 second clock		• Repeatedly changes between ON and OFF at each designated time interval. • When PLC power supply is turned OFF or a CPU module reset is performed, goes from OFF to start.	S (Status change)	
SM411	0.2 second clock				
SM412	1 second clock				
SM413	2 second clock				
SM414	2n second clock		• This relay alternates between ON and OFF at intervals of the time (unit: s) specified in SD414. • When PLC power supply is turned OFF or a CPU module reset is performed, goes from OFF to start.	S (Status change)	

(4) Safety CPU

TableApp.2.5 Special relay

Number	Name	Meaning	Explanation	Set by (When Set)	Corresponding CPU
SM560	TEST MODE flag	OFF : Other than TEST MODE ON : TEST MODE	• Turns ON when operating on the TEST MODE. • Turns OFF when operating on the other mode (SAFETY MODE, SAFETY MODE (wait-for-restart)).	S (Status change)	QS
SM561	Continuous RUN of tolerance time setting for the TEST MODE	OFF : Within the setting time ON : Over the setting time	• Turns ON when the continuous RUN of tolerance time set for the TEST MODE in the parameter is exceeded.	S (Error)	

(5) Boot operation

TableApp.2.6 Special relay

Number	Name	Meaning	Explanation	Set by (When Set)	Corresponding CPU
SM660	Boot operation	OFF : Program memory execution ON : During boot operation	(On the TEST MODE) • Turns ON during the boot operation from standard ROM. • Turns OFF when the boot operation from standard ROM is not run. (On the SAFETY MODE) • Always ON	S (Initial)	QS

(6) Instruction-Related Special Relays

TableApp.2.7 Special relay

Number	Name	Meaning	Explanation	Set by (When Set)	Corresponding CPU
SM722	BIN/DBIN instruction error disabling flag	OFF : Error detection performed ON : Error detection not performed	• Turned ON when "OPERATION ERROR" is suppressed for BIN or DBIN instruction.	U	QS

(7) CC-Link Safety

TableApp.2.8 Special relay

Number	Name	Meaning	Explanation	Set by (When Set)	Corresponding CPU
SM1004	Safety station refresh communication status (Safety master module 1)	OFF : Nomal ON : Communication error	The safety station refresh communication atatus is stored. (The status of each station are stored in SD1004 to SD1007.)	S (Status change)	QS
SM1204	Safety station refresh communication status (Safety master module 2)	OFF : Nomal ON : Communication error	The safety station refresh communication status is stored. (The status of each station are stored in SD1204 to SD1207.)	S (Status change)	

Appendix 3 SPECIAL REGISTER LIST

Special relays, SM, are internal relays whose applications are fixed in the Programmable Controller.
For this reason, it is not possible to use these registers in sequence programs in the same way that normal registers are used.
However, data can be written as needed in order to control the CPU modules and remote I/O modules.
Data stored in the special registers are stored as BIN values if no special designation has been made to the contrary.

The heading descriptions in the following special register lists are shown in TableApp.3.1.

TableApp.3.1 Descriptions of the special register list headings

Item	Function of Item
Number	• Indicates special register number
Name	• Indicates name of special register
Meaning	• Indicates contents of special register
Explanation	• Discusses contents of special register in more detail
Set by (When set)	• Indicates whether the relay is set by the system or user, and, if it is set by the system, when setting is performed. <Set by> S : Set by system U : Set by user (sequence programs or test operations from GX Developer) S/U : Set by both system and user <When set> Indicated only for registers set by system Every END : Set during every END processing Initial : Set only during initial processing (when power supply is turned ON, or when going from STOP to RUN) Status change : Set only when there is a change in status Error : Set when error occurs Instruction execution : Set when instruction is executed Request : Set only when there is a user request (through SM, etc.) Writing to ROM : Set when writing to ROM

For details on the following items, refer to the following manuals:

- Networks → Manuals of each network module

POINT

In the program that achieves the safety function, only SD1000 to SD1299 can be used.
Special register other than SD1000 to SD1299 cannot be used in the program that achieves the safety function.

(1) Diagnostic Information

TableApp.3.2 Special register

Number	Name	Meaning	Explanation	Set by (When set)	Corresponding CPU
SD0	Diagnostic errors	Diagnosis error code	• Error codes for errors detected by diagnostics are stored as BIN data. • Contents identical to latest fault history information.	S (Error)	QS
SD1	Clock time for diagnosis error occurrence	Clock time for diagnosis error occurrence	• Stores the year (last two digits) and month when SD0 data was updated as BCD 2-digit code. b15 to b8 b7 to b0 Year (0 to 99) Month (1 to 12) (Example) September, 2006 H0609	S (Error)	
SD2			• Stores the day and hour when SD0 data was updated as BCD 2-digit code. b15 to b8 b7 to b0 Day (1 to 31) Hour (0 to 23) (Example) 10 a.m. on 25th H2510		
SD3			• Stores the minute and second when SD0 data was updated as BCD 2-digit code. b15 to b8 b7 to b0 Minutes (0 to 59) Seconds (0 to 59) (Example) 35 min. 48 sec. H3548		
SD4	Error information categories	Error information category code	Category codes to identify what type of error information is stored in the common information (SD5 to SD15) or in the individual information (SD16 to SD26). b15 to b8 b7 to b0 Individual information category codes Common information category codes • The common information category codes store the following codes: 0 : No error 1: Module No./Base No. 2: File name/Drive name 3: Time (value set) 4: Program error location 9: CC-Link Safety information 10: Module No./Station No. • The individual information category codes store the following codes: 0: No error 2: File name/Drive name 3: Time (value actually measured) 4: Program error location 5: Parameter number 6: Annunciator (F) number 9: Error information 10: CC-Link Safety information 11: Program abort information 12: File diagnostics information	S (Error)	

TableApp.3.2 Special register

<table>
<tr><th>Number</th><th>Name</th><th>Meaning</th><th>Explanation</th><th>Set by
(When set)</th><th>Corresponding CPU</th></tr>
<tr><td>SD5</td><td rowspan="11">Error common information</td><td rowspan="11">Error common information</td><td rowspan="11">• Common information corresponding to the error codes (SD0) is stored here.
• The following six types of information are stored here:
1) Module No./Base No.
<table>
<tr><th>Number</th><th>Meaning</th></tr>
<tr><td>SD5</td><td>Slot No./Base No. ∗1</td></tr>
<tr><td>SD6</td><td>I/O No.∗2</td></tr>
<tr><td>SD7</td><td rowspan="9">(Empty)</td></tr>
<tr><td>SD8</td></tr>
<tr><td>SD9</td></tr>
<tr><td>SD10</td></tr>
<tr><td>SD11</td></tr>
<tr><td>SD12</td></tr>
<tr><td>SD13</td></tr>
<tr><td>SD14</td></tr>
<tr><td>SD15</td></tr>
</table>
*1: The storing value "255" in SD5 (Slot No.) indicates that the slot number for a module specified by an instruction cannot be identified.
When storing the base number to SD5, store 0 (main base unit).
*2: The storing value "FFFFH" in SD6 (I/O No.) indicates that the I/O number cannot be identified on the I/O assignment setting tab of PLC parameter due to overlapping of I/O numbers or that the I/O number cannot be identified from the network number specified by an instruction. In this case, the error location can be identified in SD5.
2) File name/Drive name
<table>
<tr><th>Number</th><th colspan="2">Meaning</th></tr>
<tr><td>SD5</td><td colspan="2">Drive</td></tr>
<tr><td>SD6</td><td colspan="2" rowspan="4">File name
(ASCII code: 8 characters)</td></tr>
<tr><td>SD7</td></tr>
<tr><td>SD8</td></tr>
<tr><td>SD9</td></tr>
<tr><td>SD10</td><td>Extension ∗3</td><td>2EH(.)</td></tr>
<tr><td>SD11</td><td colspan="2">(ASCII code: 3 characters)</td></tr>
<tr><td>SD12</td><td colspan="2" rowspan="4">(Empty)</td></tr>
<tr><td>SD13</td></tr>
<tr><td>SD14</td></tr>
<tr><td>SD15</td></tr>
</table>
(Example) File name =
MAIN.QPG
<table>
<tr><th>b15 to b8</th><th>b7 to b0</th></tr>
<tr><td>41H(A)</td><td>40H(M)</td></tr>
<tr><td>43H(N)</td><td>49H(I)</td></tr>
<tr><td>20H(SP)</td><td>20x(SP)</td></tr>
<tr><td>20H(SP)</td><td>20H(SP)</td></tr>
<tr><td>51H(Q)</td><td>2EH(.)</td></tr>
<tr><td>47H(G)</td><td>50H(P)</td></tr>
</table>
</td><td rowspan="11">S (Error)</td><td rowspan="11">QS</td></tr>
<tr><td>SD6</td></tr>
<tr><td>SD7</td></tr>
<tr><td>SD8</td></tr>
<tr><td>SD9</td></tr>
<tr><td>SD10</td></tr>
<tr><td>SD11</td></tr>
<tr><td>SD12</td></tr>
<tr><td>SD13</td></tr>
<tr><td>SD14</td></tr>
<tr><td>SD15</td></tr>
</table>

Remark

*3 : Extensions are shown in TableApp.3.3.

TableApp.3.3Extension name

SDn	SDn+1		Extension name	File type
Higher 8 bits	Lower 8 bits	Higher 8 bits		
51H	50H	41H	QPA	Parameters
51H	50H	47H	QPG	Sequence program
51H	43H	44H	QCD	Device comment

TableApp.3.2 Special register

<table>
<tr><th>Number</th><th>Name</th><th>Meaning</th><th>Explanation</th><th>Set by
(When set)</th><th>Corresponding
CPU</th></tr>
<tr><td>SD5</td><td rowspan="11">Error common information</td><td rowspan="11">Error common information</td><td rowspan="11">
3) Time (value set)
<table>
<tr><th>Number</th><th>Meaning</th></tr>
<tr><td>SD5</td><td>Time : 1μs units (0 to 999μs)</td></tr>
<tr><td>SD6</td><td>Time : 1ms units (0 to 65535ms)</td></tr>
<tr><td>SD7</td><td rowspan="9">(Empty)</td></tr>
<tr><td>SD8</td></tr>
<tr><td>SD9</td></tr>
<tr><td>SD10</td></tr>
<tr><td>SD11</td></tr>
<tr><td>SD12</td></tr>
<tr><td>SD13</td></tr>
<tr><td>SD14</td></tr>
<tr><td>SD15</td></tr>
</table>
4) Program error location
<table>
<tr><th>Number</th><th colspan="2">Meaning</th></tr>
<tr><td>SD5</td><td colspan="2" rowspan="4">File name
(ASCII code: 8 characters)</td></tr>
<tr><td>SD6</td></tr>
<tr><td>SD7</td></tr>
<tr><td>SD8</td></tr>
<tr><td>SD9</td><td>Extension ∗3</td><td>2EH(.)</td></tr>
<tr><td>SD10</td><td colspan="2">(ASCII code: 3 characters)</td></tr>
<tr><td>SD11</td><td colspan="2">(Empty)</td></tr>
<tr><td>SD12</td><td colspan="2">Block No.∗4</td></tr>
<tr><td>SD13</td><td colspan="2">Step No. ∗4</td></tr>
<tr><td>SD14</td><td colspan="2" rowspan="2">Sequence step No. (L)
Sequence step No. (H)</td></tr>
<tr><td>SD15</td></tr>
</table>
*4: "0" is stored to the block number and the step number.
9) CC-Link Safety information
<table>
<tr><th>Number</th><th>Meaning</th></tr>
<tr><td>SD5</td><td>Error classification∗5</td></tr>
<tr><td>SD6</td><td>Error item∗5</td></tr>
<tr><td>SD7</td><td>Link ID</td></tr>
<tr><td>SD8</td><td>Station No.</td></tr>
<tr><td>SD9</td><td>System area 1</td></tr>
<tr><td>SD10</td><td>System area 2</td></tr>
<tr><td>SD11</td><td>System area 3</td></tr>
<tr><td>SD12</td><td>System area 4</td></tr>
<tr><td>SD13</td><td>System area 5</td></tr>
<tr><td>SD14</td><td>System area 6</td></tr>
<tr><td>SD15</td><td>System area 7</td></tr>
<tr><td>SD16</td><td>System area 8</td></tr>
</table>
*5: The error classification and error item are stored only when the error code is 8300 (CC-LINK REMOTE DETECTION ERROR).
0 is stored when the error coad is other than 8300.
10) Module No./Station No.
<table>
<tr><th>Number</th><th>Meaning</th></tr>
<tr><td>SD5</td><td>Slot No.</td></tr>
<tr><td>SD6</td><td>I/O No.</td></tr>
<tr><td>SD7</td><td>Station No.</td></tr>
<tr><td>SD8
SD9
SD10
SD11
SD12
SD13
SD14
SD15</td><td>(Empty)</td></tr>
</table>
</td><td rowspan="11">S (Error)</td><td rowspan="11">QS</td></tr>
<tr><td>SD6</td></tr>
<tr><td>SD7</td></tr>
<tr><td>SD8</td></tr>
<tr><td>SD9</td></tr>
<tr><td>SD10</td></tr>
<tr><td>SD11</td></tr>
<tr><td>SD12</td></tr>
<tr><td>SD13</td></tr>
<tr><td>SD14</td></tr>
<tr><td>SD15</td></tr>
</table>

TableApp.3.2 Special register

<table>
<tr><th>Number</th><th>Name</th><th>Meaning</th><th>Explanation</th><th>Set by
(When set)</th><th>Corresponding
CPU</th></tr>
<tr><td>SD16</td><td rowspan="11">Error individual information</td><td rowspan="11">Error individual information</td><td rowspan="11">

- Individual information corresponding to error codes (SD0) is stored here.
- There are the following nine different types of information are stored.

2) File name/Drive name

<table>
<tr><th>Number</th><th colspan="2">Meaning</th></tr>
<tr><td>SD16</td><td colspan="2">Drive</td></tr>
<tr><td>SD17</td><td colspan="2" rowspan="4">File name
(ASCII code: 8 characters)</td></tr>
<tr><td>SD18</td></tr>
<tr><td>SD19</td></tr>
<tr><td>SD20</td></tr>
<tr><td>SD21</td><td>Extension *3</td><td>2EH(.)</td></tr>
<tr><td>SD22</td><td colspan="2">(ASCII code: 3 characters)</td></tr>
<tr><td>SD23</td><td colspan="2" rowspan="4">(Empty)</td></tr>
<tr><td>SD24</td></tr>
<tr><td>SD25</td></tr>
<tr><td>SD26</td></tr>
</table>

(Example) File name = MAIN.QPG

<table>
<tr><th>b15 to b8</th><th>b7 to b0</th></tr>
<tr><td>41H(A)</td><td>40H(M)</td></tr>
<tr><td>43H(N)</td><td>49H(I)</td></tr>
<tr><td>20H(SP)</td><td>20x(SP)</td></tr>
<tr><td>20H(SP)</td><td>20H(SP)</td></tr>
<tr><td>51H(Q)</td><td>2EH(.)</td></tr>
<tr><td>47H(G)</td><td>50H(P)</td></tr>
</table>

3) Time (value Actually measured)

<table>
<tr><th>Number</th><th>Meaning</th></tr>
<tr><td>SD16</td><td>Time : 1μs units (0 to 999μs)</td></tr>
<tr><td>SD17</td><td>Time : 1ms units (0 to 65535ms)</td></tr>
<tr><td>SD18</td><td rowspan="9">(Empty)</td></tr>
<tr><td>SD19</td></tr>
<tr><td>SD20</td></tr>
<tr><td>SD21</td></tr>
<tr><td>SD22</td></tr>
<tr><td>SD23</td></tr>
<tr><td>SD24</td></tr>
<tr><td>SD25</td></tr>
<tr><td>SD26</td></tr>
</table>

4) Program error location

<table>
<tr><th>Number</th><th colspan="2">Meaning</th></tr>
<tr><td>SD16</td><td colspan="2" rowspan="4">File name
(ASCII code: 8 characters)</td></tr>
<tr><td>SD17</td></tr>
<tr><td>SD18</td></tr>
<tr><td>SD19</td></tr>
<tr><td>SD20</td><td>Extension *3</td><td>2EH(.)</td></tr>
<tr><td>SD21</td><td colspan="2">(ASCII code: 3 characters)</td></tr>
<tr><td>SD22</td><td colspan="2">(Empty)</td></tr>
<tr><td>SD23</td><td colspan="2">Block No.*6</td></tr>
<tr><td>SD24</td><td colspan="2">Step No.*6</td></tr>
<tr><td>SD25</td><td colspan="2">Sequence step No. (L)</td></tr>
<tr><td>SD26</td><td colspan="2">Sequence step No. (H)</td></tr>
</table>

*6: "0" is stored to the block number and the step number.

5) Parameter No.

<table>
<tr><th>Number</th><th>Meaning</th></tr>
<tr><td>SD16</td><td>Parameter No.</td></tr>
<tr><td>SD17</td><td rowspan="10">(Empty)</td></tr>
<tr><td>SD18</td></tr>
<tr><td>SD19</td></tr>
<tr><td>SD20</td></tr>
<tr><td>SD21</td></tr>
<tr><td>SD22</td></tr>
<tr><td>SD23</td></tr>
<tr><td>SD24</td></tr>
<tr><td>SD25</td></tr>
<tr><td>SD26</td></tr>
</table>

6) Annunciator number

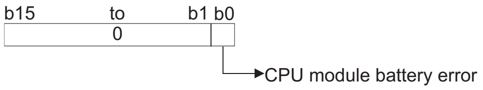
<table>
<tr><th>Number</th><th>Meaning</th></tr>
<tr><td>SD16</td><td>No.</td></tr>
<tr><td>SD17</td><td rowspan="10">(Empty)</td></tr>
<tr><td>SD18</td></tr>
<tr><td>SD19</td></tr>
<tr><td>SD20</td></tr>
<tr><td>SD21</td></tr>
<tr><td>SD22</td></tr>
<tr><td>SD23</td></tr>
<tr><td>SD24</td></tr>
<tr><td>SD25</td></tr>
<tr><td>SD26</td></tr>
</table>

9) Error information

<table>
<tr><th>Number</th><th>Meaning</th></tr>
<tr><td>SD16</td><td>Error information 1</td></tr>
<tr><td>SD17</td><td>Error information 2</td></tr>
<tr><td>SD18</td><td>Error information 3</td></tr>
<tr><td>SD19</td><td>Error information 4</td></tr>
<tr><td>SD20</td><td>Error information 5</td></tr>
<tr><td>SD21</td><td>Error information 6</td></tr>
<tr><td>SD22</td><td>Error information 7</td></tr>
<tr><td>SD23</td><td>Error information 8</td></tr>
<tr><td>SD24</td><td>Error information 9</td></tr>
<tr><td>SD25</td><td>Error information 10</td></tr>
<tr><td>SD26</td><td>Error information 11</td></tr>
</table>

</td><td rowspan="11">S (Error)</td><td rowspan="11">QS</td></tr>
<tr><td>SD17</td></tr>
<tr><td>SD18</td></tr>
<tr><td>SD19</td></tr>
<tr><td>SD20</td></tr>
<tr><td>SD21</td></tr>
<tr><td>SD22</td></tr>
<tr><td>SD23</td></tr>
<tr><td>SD24</td></tr>
<tr><td>SD25</td></tr>
<tr><td>SD26</td></tr>
</table>

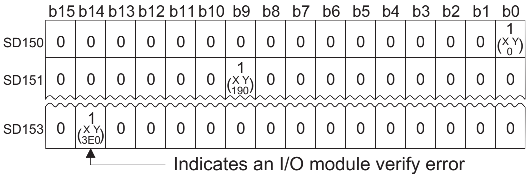
TableApp.3.2 Special register

<table>
<tr><th>Number</th><th>Name</th><th>Meaning</th><th>Explanation</th><th>Set by
(When set)</th><th>Corresponding CPU</th></tr>
<tr><td>SD16</td><td rowspan="11">Error individual information</td><td rowspan="11">Error individual information</td><td rowspan="11">
10) CC-Link Safety information
<table>
<tr><th>Number</th><th>Meaning</th></tr>
<tr><td>SD16</td><td>Number of items for individual information</td></tr>
<tr><td>SD17</td><td>individual information 1</td></tr>
<tr><td>SD18</td><td>individual information 2</td></tr>
<tr><td>SD19</td><td>individual information 3</td></tr>
<tr><td>SD20</td><td>individual information 4</td></tr>
<tr><td>SD21</td><td>individual information 5</td></tr>
<tr><td>SD22</td><td>individual information 6</td></tr>
<tr><td>SD23</td><td>individual information 7</td></tr>
<tr><td>SD24</td><td>individual information 8</td></tr>
<tr><td>SD25</td><td>individual information 9</td></tr>
<tr><td>SD26</td><td>individual information 10</td></tr>
</table>
11) Program abort information
<table>
<tr><th>Number</th><th>Meaning</th></tr>
<tr><td>SD16</td><td>Abort code ∗5</td></tr>
<tr><td>SD17</td><td rowspan="10">(Empty)</td></tr>
<tr><td>SD18</td></tr>
<tr><td>SD19</td></tr>
<tr><td>SD20</td></tr>
<tr><td>SD21</td></tr>
<tr><td>SD22</td></tr>
<tr><td>SD23</td></tr>
<tr><td>SD24</td></tr>
<tr><td>SD25</td></tr>
<tr><td>SD26</td></tr>
</table>
*5 : The specified abort code is stored by the S.QSABORT instruction.
12) File diagostics information
<table>
<tr><th>Number</th><th colspan="2">Meaning</th></tr>
<tr><td>SD16</td><td>Error information</td><td>Drive No.</td></tr>
<tr><td>SD17</td><td colspan="2" rowspan="4">File name
(ASCII code: 8 characters)</td></tr>
<tr><td>SD18</td></tr>
<tr><td>SD19</td></tr>
<tr><td>SD20</td></tr>
<tr><td>SD21</td><td rowspan="2">Extension ∗3
(ASCII code: 3 characters)</td><td>2EH(.)</td></tr>
<tr><td>SD22</td><td></td></tr>
<tr><td>SD23</td><td colspan="2" rowspan="2">Error information 2</td></tr>
<tr><td>SD24</td></tr>
<tr><td>SD25</td><td colspan="2" rowspan="2">Error information 3</td></tr>
<tr><td>SD26</td></tr>
</table>
(Example) File name = MAIN.QPG
<table>
<tr><th>b15 to b8</th><th>b7 to b0</th></tr>
<tr><td>41H(A)</td><td>40H(M)</td></tr>
<tr><td>43H(N)</td><td>49H(I)</td></tr>
<tr><td>20H(SP)</td><td>20x(SP)</td></tr>
<tr><td>20H(SP)</td><td>20H(SP)</td></tr>
<tr><td>51H(Q)</td><td>2EH(.)</td></tr>
<tr><td>47H(G)</td><td>50H(P)</td></tr>
</table>
</td><td rowspan="11">S (Error)</td><td rowspan="16">QS</td></tr>
<tr><td>SD17</td></tr>
<tr><td>SD18</td></tr>
<tr><td>SD19</td></tr>
<tr><td>SD20</td></tr>
<tr><td>SD21</td></tr>
<tr><td>SD22</td></tr>
<tr><td>SD23</td></tr>
<tr><td>SD24</td></tr>
<tr><td>SD25</td></tr>
<tr><td>SD26</td></tr>
<tr><td>SD27</td><td>Diagnostics error CPU identifier</td><td>CPU identifier (CPU A/CPU B)</td><td>• The CPU identifier which the CPU issues diagnostics error SD0 to SD26 is stored
0001H : CPU A
0002H : CPU B</td><td>S (Error)</td></tr>
<tr><td>SD50</td><td>Error reset</td><td>Error number that performs error reset</td><td>• Stores error number that performs error reset</td><td>U</td></tr>
<tr><td>SD51</td><td>Battery low latch</td><td>Bit pattern indicating where battery voltage drop occurred</td><td>• All corresponding bits go 1(ON) when battery voltage drops.
• Subsequently, these remain 1(ON) even after battery voltage has been returned to normal.
 </td><td>S (Error)</td></tr>
<tr><td>SD52</td><td>Battery low</td><td>Bit pattern indicating where battery voltage drop occurred</td><td>• Same configuration as SD51 above
• Turns to 0 (OFF) when the battery voltage returns to normal thereafter.</td><td>S (Error)</td></tr>
<tr><td>SD53</td><td>AC DOWN detection</td><td>Number of times for AC DOWN detection</td><td>• Every time the input voltage falls to or below 85% (AC power) of the rating during calculation of the CPU module, the value is incremented by 1 and stored in BIN code.</td><td>S (Error)</td></tr>
</table>

TableApp.3.2 Special register

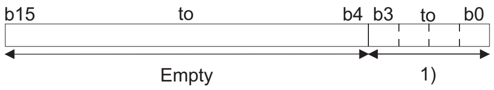
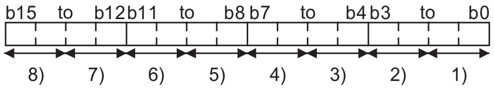
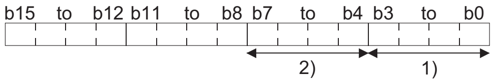
<table>
<tr><th>Number</th><th>Name</th><th>Meaning</th><th>Explanation</th><th>Set by
(When set)</th><th>Corresponding
CPU</th></tr>
<tr><td>SD61</td><td>I/O module verify error number</td><td>I/O module verify error module number</td><td>• The lowest I/O number of the module where the I/O module verification number took place.</td><td>S (Error)</td><td rowspan="20">QS</td></tr>
<tr><td>SD62</td><td>Annunciator number</td><td>Annunciator number</td><td>• The first annunciator number (F number) to be detected is stored here.</td><td>S (Instruction execution)</td></tr>
<tr><td>SD63</td><td>Number of annunciators</td><td>Number of annunciators</td><td>• Stores the number of annunciators searched.</td><td>S (Instruction execution)</td></tr>
<tr><td>SD64
SD65
SD66
SD67
SD68
SD69
SD70
SD71
SD72
SD73
SD74
SD75
SD76
SD77
SD78
SD79</td><td>Table of detected annunciator numbers</td><td>Annunciator detection number</td><td>
• When F goes ON due to OUT F or SET F, the F numbers which go progressively ON from SD64 through SD79 are registered.
• The F numbers turned OFF by RST F are deleted from SD64 - SD79, and the F numbers stored after the deleted F numbers are shifted to the preceding registers.
After 16 annunciators have been detected, detection of the 17th will not be stored from SD64 through SD79.
<table>
<tr><th></th><th></th><th>SET
F50</th><th>SET
F25</th><th>SET
F99</th><th>RST
F25</th><th>SET
F15</th><th>SET
F70</th><th>SET
F65</th><th>SET
F38</th><th>SET
F110</th><th>SET
F151</th><th>SET
F210</th><th>RST
F50</th><th></th></tr>
<tr><td>SD62</td><td>0</td><td>50</td><td>50</td><td>50</td><td>50</td><td>50</td><td>50</td><td>50</td><td>50</td><td>50</td><td>50</td><td>50</td><td>99</td><td>(Number detected)</td></tr>
<tr><td>SD63</td><td>0</td><td>1</td><td>2</td><td>3</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>8</td><td>(Number of annunciators detected)</td></tr>
<tr><td>SD64</td><td>0</td><td>50</td><td>50</td><td>50</td><td>50</td><td>50</td><td>50</td><td>50</td><td>50</td><td>50</td><td>50</td><td>50</td><td>99</td><td rowspan="16">(Number detected)</td></tr>
<tr><td>SD65</td><td>0</td><td>0</td><td>25</td><td>25</td><td>99</td><td>99</td><td>99</td><td>99</td><td>99</td><td>99</td><td>99</td><td>99</td><td>15</td></tr>
<tr><td>SD66</td><td>0</td><td>0</td><td>0</td><td>99</td><td>0</td><td>15</td><td>15</td><td>15</td><td>15</td><td>15</td><td>15</td><td>15</td><td>70</td></tr>
<tr><td>SD67</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>70</td><td>70</td><td>70</td><td>70</td><td>70</td><td>70</td><td>65</td></tr>
<tr><td>SD68</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>65</td><td>65</td><td>65</td><td>65</td><td>65</td><td>38</td></tr>
<tr><td>SD69</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>38</td><td>38</td><td>38</td><td>38</td><td>110</td></tr>
<tr><td>SD70</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>110</td><td>110</td><td>110</td><td>151</td></tr>
<tr><td>SD71</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>151</td><td>151</td><td>210</td></tr>
<tr><td>SD72</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>210</td><td>0</td></tr>
<tr><td>SD73</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>SD74</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>SD75</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>SD76</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>SD77</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>SD78</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>SD79</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
</table>
</td><td>S (Instruction execution)</td></tr>
<tr><td>SD81</td><td>Cause of error</td><td>Cause of error</td><td>
• When a continuation error occurs, the corresponding bits are all set to ON.
• Canceling the error, starting up the safety PLC power or canceling the safety CPU module reset after eliminating the cause of the error makes the bits go OFF.
<table>
<tr><th>Bit No.</th><th>Name of the cause</th></tr>
<tr><td>0</td><td>Instantaneous power failure</td></tr>
<tr><td>1</td><td>Battery low</td></tr>
<tr><td>2</td><td>Standard ROM write count excess</td></tr>
<tr><td>3</td><td>TEST MODE continuous RUN tolerance timeout</td></tr>
<tr><td>4</td><td>Scan timeout</td></tr>
<tr><td>5</td><td>Annunciator ON</td></tr>
<tr><td>6</td><td>Safety remote station detection error</td></tr>
<tr><td>7</td><td>Safety remote station product information mismatch</td></tr>
<tr><td>8</td><td>Initial monitoring timeout error
Safety monitoring timeout error
Error monitoring timeout error</td></tr>
<tr><td>9</td><td>Safety remote station data split error
Safety remote command error
Safety remote station link ID error
Safety remote station running number error
Safety remote station reception data error</td></tr>
<tr><td>10 to 15</td><td>Empty (fixed to 0)</td></tr>
</table>
</td><td>S (Error)</td></tr>
</table>

TableApp.3.2 Special register

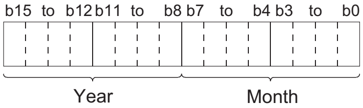
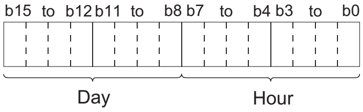
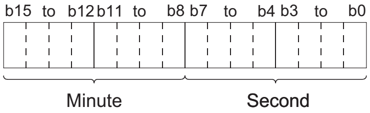
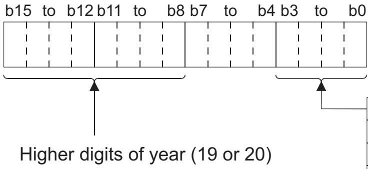
Number	Name	Meaning	Explanation	Set by (When set)	Corresponding CPU
SD150	I/O module verify error	Bit pattern, in units of 16 points, indicating the modules with verify errors. 0: No I/O verify errors 1: I/O verify error present	• When I/O modules, of which data are different from those entered at power-on, have been detected, the I/O module numbers (in units of 16 points) are entered in bit pattern. (Preset I/O module numbers set in parmeters when parameter setting has been performed.)  • Not cleared even if the blown fuse is replaced with a new one. This flag is cleared by error resetting operation.	S (Error)	QS
SD151					
SD152					
SD153					

(2) System information

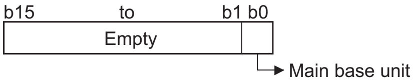
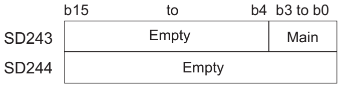
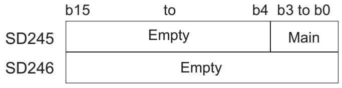
TableApp.3.4 Special register

Number	Name	Meaning	Explanation	Set by (When set)	Corresponding CPU
SD200	Status of switch	Status of CPU switch	• The CPU switch status is stored in the following format.  1): CPU switch status 0: RUN 1: STOP 2: RESET	S (Every END)	QS
SD201	LED status	Status of CPU-LED	• The following bit patterns are used to store the statuses of the LEDs on the CPU module: • 0 is off, 1 is on, and 2 is flicker.  1): RUN 5): Empty 2): ERR. 6): Empty 3): USER 7): TEST 4): BAT. 8): Empty	S (Status change)	
SD203	Operating status of CPU	Operating status of CPU	• The CPU operating status is stored as indicated in the following figure:  1): Operating status of CPU 0: RUN 2: STOP 2): STOP cause 0: Instruction in remote operation program from RUN/STOP/RESET switch 1: Remote contact 2: Remote operation from GX Developer/ serial communication, etc. 4: Error Note stores the above-mentioned factors from the smallest number in priority to the largest one. However, "4:error" is treated as the highest priority.	S (Every END)	

TableApp.3.4 Special register

Number	Name	Meaning	Explanation	Set by (When set)	Corresponding CPU
SD210	Clock data	Clock data (year, month)	• The year (last two digits) and month are stored as BCD code at SD210 as shown below:  Example: September, 2006 0609H	S (Request)/U	QS
SD211	Clock data	Clock data (day, hour)	• The day and hour are stored as BCD code at SD211 as shown below:  Example: 25st, 10 a.m. 2510H		
SD212	Clock data	Clock data (minute, second)	• The minutes and seconds (after the hour) are stored as BCD code at SD212 as shown below:  Example: 35 min., 48 sec. 3548H		
SD213	Clock data	Clock data (later digits of year, day of week)	• Stores the year (two digits) and the day of the week in SD213 in the BCD code format as shown below.  b15 to b12 b11 to b8 b7 to b4 b3 to b0 Higher digits of year (19 or 20) Example: 2006, Monday 2001H Day of the week 0 Sunday 1 Monday 2 Tuesday 3 Wednesday 4 Thursday 5 Friday 6 Saturday		
SD232 SD233	ROM write count	ROM write count up to now	• Store the ROM write count up to now.	S (Writing to ROM)	
SD240	Base mode	0: Automatic mode	• Stores the base mode.(0 fixed)	S (Initial)	
SD241	Extension stage number	0: Main base only	• Stores the maximum number of the extension bases being installed. (0 fixed)	S (Initial)	

TableApp.3.4 Special register

Number	Name	Meaning	Explanation	Set by (When set)	Corresponding CPU
SD242	Installed Q base presence/ absence	Base type differentiation 0: Base not installed 1: QS**B is installed		S (Initial)	QS
SD243	No. of base slots (Operation status)	No. of base slots	 b15 to b4 b3 to b0 SD243 Empty Main SD244 Empty • As shown above, each area stores the number of slots being installed. (Number of set slots when parameter setting has been made)	S (Initial)	
SD244					
SD245	No. of base slots (Mounting status)	No. of base slots	 b15 to b4 b3 to b0 SD245 Empty Main SD246 Empty • As shown above, each area stores the numbers of module-mounted slots of the base unit (actual number of slots of the installed base unit).	S (Initial)	
SD246					
SD250	Loaded maximum I/O	Loaded maximum I/O No.	• The upper 2 digits of the final I/O number plus 1 of the modules loaded are stored as BIN values.	S (Initial)	
SD254	CC-Link IE controller network, MELSECNET /H information	Number of modules mounted	• Indicates the number of mounted CC-Link IE controller network or MELSECNET/H modules.	S (Initial)	
SD255		I/O number	• Indicates the I/O number of mounted CC-Link IE controller network or MELSECNET/H module.		
SD256		Network number	• Indicates the network number of mounted CC-Link IE controller network or MELSECNET/H module.		
SD257		Group number	• Indicates the group number of mounted CC-Link IE controller network or MELSECNET/H module.		
SD258		Station number	• Indicates the station number of mounted CC-Link IE controller network or MELSECNET/H module.		
SD290	Device assignment (Same as the parameter setting)	Number of points assigned for X	• Stores the number of points currently set for X devices	S (Initial)	
SD291		Number of points assigned for Y	• Stores the number of points currently set for Y devices		
SD292		Number of points assigned for M	• Stores the number of points currently set for M devices		
SD294		Number of points assigned for B	• Stores the number of points currently set for B devices		
SD295		Number of points assigned for F	• Stores the number of points currently set for F devices		
SD296		Number of points assigned for SB	• Stores the number of points currently set for SB devices		
SD297		Number of points assigned for V	• Stores the number of points currently set for V devices		
SD299		Number of points assigned for T	• Stores the number of points currently set for T devices		

Number	Name	Meaning	Explanation	Set by (When set)	Corresponding CPU
SD300	Device assignment (Same as the parameter setting)	Number of points assigned for ST	• Stores the number of points currently set for ST devices	S (Initial)	QS
SD301		Number of points assigned for C	• Stores the number of points currently set for C devices		
SD302		Number of points assigned for D	• Stores the number of points currently set for D devices		
SD303		Number of points assigned for W	• Stores the number of points currently set for W devices		
SD304		Number of points assigned for SW	• Stores the number of points currently set for SW devices		
SD340	Ethernet information	Number of modules mounted	• Indicates the number of mounted Ethernet modules.	S (Initial)	
SD341		I/O number	• Indicates the I/O number of mounted Ethernet module.		
SD342		Network number	• Indicates the network number of mounted Ethernet module.		
SD343		Group number	• Indicates the group number of mounted Ethernet module.		
SD344		Station number	• Indicates the station number of mounted Ethernet module.		

(3) System clocks/counters

TableApp.3.5 Special register

Number	Name	Meaning	Explanation	Set by (When set)	Corresponding CPU
SD412	1 second counter	Number of counts in 1-second units	• Following programmable controller CPU module RUN, 1 is added each second • Count repeats from 0 to 32767 to -32768 to 0	S (Status change)	QS
SD414	2n second clock setting	2n second clock units	• Stores value n of 2n second clock (Default is 30) • Setting can be made between 1 to 32767	U	
SD420	Scan counter	Number of counts in each scan	• Incremented by 1 for each scan execution after the CPU module is set to RUN. • Count repeats from 0 to 32767 to -32768 to 0	S (Every END)	

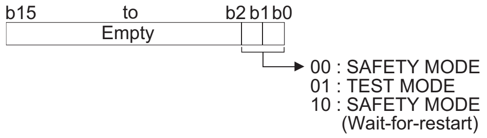
(4) Scan information

TableApp.3.6 Special register

Number	Name	Meaning	Explanation	Set by (When set)	Corresponding CPU
SD520	Current scan time	Current scan time (in 1 ms units)	• The current scan time is stored into SD520 and SD521. (Measurement is made in 100 μs units.) SD520: Stores the value of ms. (Storage range: 0 to 6553) SD521: Stores the value of μs. (Storage range: 0 to 900) (Example) When the current scan time is 23.6ms, the following values are stored. SD520 = 23 SD521 = 600 • The accuracy of processing time of scantime is ±0.1ms.	S (Every END)	QS
SD521		Current scan time (in 100 μs units)			
SD524	Minimum scan time	Minimum scan time (in 1 ms units)	• Stores the minimum value of the scan time into SD524 and SD525. (Measurement is made in 100 μs units.) SD524: Stores the ms place. (Storage range: 0 to 6553) SD525: Stores the μs place. (Storage range: 0 to 900) • The accuracy of processing time of scantime is μ 0.1ms.	S (Every END)	
SD525		Minimum scan time (in 100 μs units)			
SD526	Maximum scan time	Maximum scan time (in 1 ms units)	• Stores the maximum value of the scan time into SD526 and SD527. (Measurement is made in 100 μs units.) SD526: Stores the ms place. (Storage range: 0 to 6553) SD527: Stores the μs place. (Storage range: 0 to 900) • The accuracy of processing time of scantime is ±0.1ms.	S (Every END)	
SD527		Maximum scan time (in 100 μs units)			
SD540	END processing time	END processing time (in 1 ms units)	• Stores the time from when the scan program ends until the next scan starts into SD540 and SD541. (Measurement is made in 100 μs units.) SD540: Stores the ms place. (Storage range: 0 to 6553) SD541: Stores the μs place. (Storage range: 0 to 900) • The accuracy of NED processing time is ±0.1ms.	S (Every END)	
SD541		END processing time (in 100 μs units)			
SD542	Constant scan wait time	Constant scan wait time (in 1 ms units)	• Stores the wait time for constant scan setting into SD542 and SD543. (Measurement is made in 100 μs units.) SD542: Stores the ms place. (Storage range: 0 to 6553) SD543: Stores the μs place. (Storage range: 0 to 900) • The accuracy of constant scan wait time is ±0.1ms.	S (Every END)	
SD543		Constant scan wait time (in 100 μs units)			
SD548	Scan program execution time	Scan program execution time (in 1 ms units)	• Stores the execution time of a scan program during one scan into SD548 and SD549. (Measurement is made in 100 μs units.) SD548: Stores the ms place. (Storage range: 0 to 6553) SD549: Stores the μs place. (Storage range: 0 to 900) • Stored every scan. • The accuracy of scan program execution time is ±0.1ms.	S (Every END)	
SD549		Scan program execution time (in 100 μs units)			

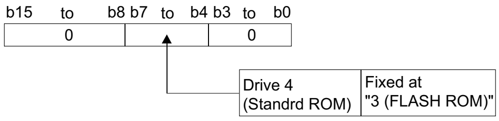
(5) Safety CPU

TableApp.3.7 Special register

Number	Name	Meaning	Explanation	Set by (When set)	Corresponding CPU
SD560	Safety CPU operation mode	Safety CPU operation mode	• Stores the safety CPU operation mode.  b15 to b2 b1 b0 Empty 00 : SAFETY MODE 01 : TEST MODE 10 : SAFETY MODE (Wait-for-restart)	S (Status change)	QS
SD561	TEST MODE continuous RUN time	TEST MODE continuous RUN time (seconds)	• Stores the TEST MODE continuous RUN time. (Measured in seconds) (RUN time in TEST MODE. Start measurement when STOP & RUN (Time when operation is STOP is not included.) • Stores the measurment valve with the range of 1 to 2147483647.	S (Every END)	
SD562					

(6) Memory card

TableApp.3.8 Special register

Number	Name	Meaning	Explanation	Set by (When set)	Corresponding CPU
SD620	Memory type	Memory type	• Indicates the type of built-in memory.  b15 to b8 b7 to b4 b3 to b0 0 0 Drive 4 (Standrd ROM) Fixed at "3 (FLASH ROM)"	S (Initial)	QS
SD623	Drive 4 (ROM) capacity	Drive 4 capacity	• Drive 4 capacity is stored in 1 kbyte units.	S (Initial)	

(7) CC-Link Safety

TableApp.3.9 Special register

<table>
<tr><th>Number</th><th>Name</th><th>Meaning</th><th>Explanation</th><th>Set by
(When set)</th><th>Corresponding
CPU</th></tr>
<tr><td>SD1000
to
SD1003</td><td>Safety remote station specification (CC-Link Safety master module 1)</td><td>0: No safety remote station specification
1: Safety remote station specification</td><td>• The specified status of safety remote station is stored.
• "0" is stored for the standard remote station.
<table>
<tr><th></th><th>b15</th><th>b14</th><th>-</th><th>b1</th><th>b0</th></tr>
<tr><td>SD1000</td><td>16</td><td>15</td><td>to</td><td>2</td><td>1</td></tr>
<tr><td>SD1001</td><td>32</td><td>31</td><td>to</td><td>18</td><td>17</td></tr>
<tr><td>SD1002</td><td>48</td><td>47</td><td>to</td><td>34</td><td>33</td></tr>
<tr><td>SD1003</td><td>64</td><td>63</td><td>to</td><td>50</td><td>49</td></tr>
</table>
1 to 64 in the table indicate station numbers.</td><td>S (Initial)</td><td rowspan="4">QS</td></tr>
<tr><td>SD1004
to
SD1007</td><td>Safety station refresh communication status (CC-Link Safety master module 1)</td><td>0: Normal, Reserved station specified, Unused, Standard remote station
1: Safety station communication error</td><td>• The refresh communication status of safety remote station is stored.
• "0" is stored for the standard remote station.
<table>
<tr><th></th><th>b15</th><th>b14</th><th>-</th><th>b1</th><th>b0</th></tr>
<tr><td>SD1004</td><td>16</td><td>15</td><td>to</td><td>2</td><td>1</td></tr>
<tr><td>SD1005</td><td>32</td><td>31</td><td>to</td><td>18</td><td>17</td></tr>
<tr><td>SD1006</td><td>48</td><td>47</td><td>to</td><td>34</td><td>33</td></tr>
<tr><td>SD1007</td><td>64</td><td>63</td><td>to</td><td>50</td><td>49</td></tr>
</table>
1 to 64 in the table indicate station numbers.</td><td>S (Status changel)</td></tr>
<tr><td>SD1008
to
SD1071</td><td>Safety station communication status (CC-Link Safety master module 1)</td><td>The status of communication with safety station is stored.</td><td>• The status of communication with each safety remote station is stored.
• SD1008: Station number 1 to SD1071: Station number 64 (0 fixed in the case of standard remote station, reserved station specified, or without connection)
0: At normal communication
10: At initial
20: During internal information access
30: Link error
8300: Link error (Safety remote station detection error)
8310: Link error (Product information mismatch)
8320: Link error (Initial monitor timeout)
8321: Link error (Safety monitor timeout)
8322: Link error (Error monitor timeout)
8330: Link error (Command error)
8331: Link error (Data numbering error)
8332: Link error (Link ID error)
8333: Link error (Running number error)
8334: Link error (Received data error)</td><td>S (Status changel)</td></tr>
<tr><td>SD1072
to
SD1075</td><td>Safety station interlock status (CC-Link Safety master module 1)</td><td>0: Interlock is not executed
1: During interlock</td><td>Bit corresponding to the station number turns 1 when the master station goes to the interlock status after the error was detected at the master station.
<table>
<tr><th></th><th>b15</th><th>b14</th><th>-</th><th>b1</th><th>b0</th></tr>
<tr><td>SD1072</td><td>16</td><td>15</td><td>to</td><td>2</td><td>1</td></tr>
<tr><td>SD1073</td><td>32</td><td>31</td><td>to</td><td>18</td><td>17</td></tr>
<tr><td>SD1074</td><td>48</td><td>47</td><td>to</td><td>34</td><td>33</td></tr>
<tr><td>SD1075</td><td>64</td><td>63</td><td>to</td><td>50</td><td>49</td></tr>
</table>
1 to 64 in the table indicate station numbers.</td><td>S (Status changel)</td></tr>
</table>

TableApp.3.9 Special register

<table>
<tr><th>Number</th><th>Name</th><th>Meaning</th><th>Explanation</th><th>Set by
(When set)</th><th>Corresponding CPU</th></tr>
<tr><td>SD1076
to
SD1079</td><td>Safety station interlock cancel request (CC-Link Safety master module 1)</td><td>0: Not cancel the I/O interlock of safety station
1: Cancel the I/O interlock of safety station</td><td>Cancel the I/O interlock of safety station by changing the bit of register from 0 to 1.
<table>
<tr><th></th><th>b15</th><th>b14</th><th>-</th><th>b1</th><th>b0</th></tr>
<tr><td>SD1076</td><td>16</td><td>15</td><td>to</td><td>2</td><td>1</td></tr>
<tr><td>SD1077</td><td>32</td><td>31</td><td>to</td><td>18</td><td>17</td></tr>
<tr><td>SD1078</td><td>48</td><td>47</td><td>to</td><td>34</td><td>33</td></tr>
<tr><td>SD1079</td><td>64</td><td>63</td><td>to</td><td>50</td><td>49</td></tr>
</table>
1 to 64 in the table indicate station numbers.</td><td>U (Request)</td><td rowspan="4">QS</td></tr>
<tr><td>SD1200
to
SD1203</td><td>Safety remote station specification (CC-Link Safety master module 2)</td><td>0: No safety remote station specification
1: Safety remote station specification</td><td>• The specified status of safety remote station is stored.
• "0" is stored for the standard remote station.
<table>
<tr><th></th><th>b15</th><th>b14</th><th>-</th><th>b1</th><th>b0</th></tr>
<tr><td>SD1000</td><td>16</td><td>15</td><td>to</td><td>2</td><td>1</td></tr>
<tr><td>SD1001</td><td>32</td><td>31</td><td>to</td><td>18</td><td>17</td></tr>
<tr><td>SD1002</td><td>48</td><td>47</td><td>to</td><td>34</td><td>33</td></tr>
<tr><td>SD1003</td><td>64</td><td>63</td><td>to</td><td>50</td><td>49</td></tr>
</table>
1 to 64 in the table indicate station numbers.</td><td>S (Initial)</td></tr>
<tr><td>SD1204
to
SD1207</td><td>Safety station refresh communication status (CC-Link Safety master module 2)</td><td>0: Normal, Reserved station specified, Unused, Standard remote station
1: Safety station communication error</td><td>• The refresh communication status of safety remote station is stored.
• "0" is stored for the standard remote station.
<table>
<tr><th></th><th>b15</th><th>b14</th><th>-</th><th>b1</th><th>b0</th></tr>
<tr><td>SD1204</td><td>16</td><td>15</td><td>to</td><td>2</td><td>1</td></tr>
<tr><td>SD1205</td><td>32</td><td>31</td><td>to</td><td>18</td><td>17</td></tr>
<tr><td>SD1206</td><td>48</td><td>47</td><td>to</td><td>34</td><td>33</td></tr>
<tr><td>SD1207</td><td>64</td><td>63</td><td>to</td><td>50</td><td>49</td></tr>
</table>
1 to 64 in the table indicate station numbers.</td><td>S (Status changel)</td></tr>
<tr><td>SD1208
to
SD1271</td><td>Safety station communication status (CC-Link Safety master module 2)</td><td>The status of communication with safety station is stored.</td><td>• The status of communication with each safety remote station is stored.
• SD1208: Station number 1 to SD1271: Station number 64 (0 fixed in the case of standard remote station, reserved station specified, or without connection)
0: At normal communication
10: At initial
20: During internal information access
30: Link error
8300: Link error (Safety remote station detection error)
8310: Link error (Product information mismatch)
8320: Link error (Initial monitor timeout)
8321: Link error (Safety monitor timeout)
8322: Link error (Error monitor timeout)
8330: Link error (Command error)
8331: Link error (Data numbering error)
8332: Link error (Link ID error)
8333: Link error (Running number error)
8334: Link error (Received data error)</td><td>S (Status changel)</td></tr>
</table>

TableApp.3.9 Special register

<table>
<tr><th>Number</th><th>Name</th><th>Meaning</th><th>Explanation</th><th>Set by (When set)</th><th>Corresponding CPU</th></tr>
<tr><td>SD1272 to SD1275</td><td>Safety station interlock status (CC-Link Safety master module 2)</td><td>0: Interlock is not executed
1: During interlock</td><td>Bit corresponding to the station number turns 1 when the master station goes to the interlock status after the error was detected at the master station.
<table>
<tr><th></th><th>b15</th><th>b14</th><th>-</th><th>b1</th><th>b0</th></tr>
<tr><td>SD1272</td><td>16</td><td>15</td><td>to</td><td>2</td><td>1</td></tr>
<tr><td>SD1273</td><td>32</td><td>31</td><td>to</td><td>18</td><td>17</td></tr>
<tr><td>SD1274</td><td>48</td><td>47</td><td>to</td><td>34</td><td>33</td></tr>
<tr><td>SD1275</td><td>64</td><td>63</td><td>to</td><td>50</td><td>49</td></tr>
</table>
1 to 64 in the table indicate station numbers.</td><td>S (Status changel)</td><td rowspan="2">QS</td></tr>
<tr><td>SD1276 to SD1279</td><td>Safety station interlock cancel request (CC-Link Safety master module 2)</td><td>0: Not cancel the I/O interlock of safety station
1: Cancel the I/O interlock of safety station</td><td>Cancel the I/O interlock of safety station by changing the bit of register from 0 to 1.
<table>
<tr><th></th><th>b15</th><th>b14</th><th>-</th><th>b1</th><th>b0</th></tr>
<tr><td>SD1276</td><td>16</td><td>15</td><td>to</td><td>2</td><td>1</td></tr>
<tr><td>SD1277</td><td>32</td><td>31</td><td>to</td><td>18</td><td>17</td></tr>
<tr><td>SD1278</td><td>48</td><td>47</td><td>to</td><td>34</td><td>33</td></tr>
<tr><td>SD1279</td><td>64</td><td>63</td><td>to</td><td>50</td><td>49</td></tr>
</table>
1 to 64 in the table indicate station numbers.</td><td>S (Request)</td></tr>
</table>

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MEMO

WARRANTY

Please confirm the following product warranty details before using this product.

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a. Mitsubishi Electric Company ("MELCO") warrants that for a period of eighteen (18) months after date of delivery from the point of manufacture or one year from date of Customer's purchase, whichever is less, Mitsubishi MELSEC Safety programmable logic controllers (the "Products") will be free from defects in material and workmanship.

b. At MELCO's option, for those Products MELCO determines are not as warranted, MELCO shall either repair or replace them or issue a credit or return the purchase price paid for them.

c. For this warranty to apply:

(1) Customer shall give MELCO (i) notice of a warranty claim to MELCO and the authorized dealer or distributor from whom the Products were purchased, (ii) the notice shall describe in reasonable details the warranty problem, (iii) the notice shall be provided promptly and in no event later than thirty (30) days after the Customer knows or has reason to believe that Products are not as warranted, and (iv) in any event, the notice must given within the warranty period;

(2) Customer shall cooperate with MELCO and MELCO's representatives in MELCO's investigation of the warranty claim, including preserving evidence of the claim and its causes, meaningfully responding to MELCO's questions and investigation of the problem, grant MELCO access to witnesses, personnel, documents, physical evidence and records concerning the warranty problem, and allow MELCO to examine and test the Products in question offsite or at the premises where they are installed or used; and

(3) If MELCO requests, Customer shall remove Products it claims are defective and ship them to MELCO or MELCO's authorized representative for examination and, if found defective, for repair or replacement. The costs of removal, shipment to and from MELCO's designated examination point, and reinstallation of repaired or replaced Products shall be at Customer's expense.

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c. MELCO shall not be liable for any damage to or loss of the Products or any delay in or failure to deliver, service, repair or replace the Products arising from shortage of raw materials, failure of suppliers to make timely delivery, labor difficulties of any kind, earthquake, fire, windstorm, flood, theft, criminal or terrorist acts, war, embargoes, governmental acts or rulings, loss or damage or delays in carriage, acts of God, vandals or any other circumstances reasonably beyond MELCO's control.

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Mitsubishi Safety
Programmable Controller MELSEC QS series

QSCPU
Programming Manual
(Common Instructions)

MODEL	QSCPU-P-KY-E
MODEL CODE	13JW01
SH(NA)-080628ENG-C(0804)MEE	

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