MITSUBISHI

Mitsubishi Safety Programmable Controller



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.

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 - (b) trains, railway systems, airplanes, airline operations, other transportation systems,
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 - (d) amusement equipments,
 - (e) incineration and fuel devices,
 - (f) handling of nuclear or hazardous materials or chemicals,
 - (g) mining and drilling,
 - (h) and other applications where the level of risk to human life, health or property are elevated.

REVISIONS

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Japanese Manual Version SH-080610-D

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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

Read the following manual before designing and constructing a safety system.

| 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 | SH-080613ENG |
| system. | (13JR90) |
| (Sold separately) | |

Related Manuals

The manuals related to this product are listed below.

Please place an order as needed.

| Manual Name | Manual Number (Model Code) |
|--|-------------------------------|
| QSCPU User's Manual (Hardware Design, Maintenance and Inspection) | SH-080626ENG |
| Explains the specifications of the QSCPU, safety power supply module, and safety base unit. | (13JR92) |
| (Sold separately) | (1001102) |
| QSCPU User's Manual (Function Explanation, Program Fundamentals) | SH-080627ENG |
| Explains the functions, programming methods, devices and others that are necessary to create programs with the QSCPU. | (13JR93) |
| (Sold separately) | (1001100) |
| CC-Link Safety System Master Module User's Manual | |
| Explains the specifications, procedures and settings before operation, parameter settings, and troubleshooting of the | SH-080600ENG |
| QS0J61BT12 CC-Link Safety system master module. | (13JR88) |
| (Sold separately) | |
| CC-Link Safety System Remote I/O Module User's Manual | |
| Explains the specifications, procedures and settings before operation, parameter settings, and troubleshooting of the CC-Link | SH-080612ENG |
| Safety system remote I/O modules. | (13JR89) |
| (Sold separately) | |
| MELSEC-QS CC-Link IE Field Network Master/Local Module User's Manual | |
| Explains the system configuration, performance specifications, functions, handling, wiring, and troubleshooting of the CC-Link | SH-080969ENG |
| IE Field Network master/local module (with safety functions). | 13JZ53 |
| (Sold separately) | |
| CC-Link IE Controller Network Reference Manual | |
| Explains the system configuration, specifications, functions, handling, wiring, and troubleshooting of CC-Link IE Controller | SH-080668ENG |
| Network. | (13JV16) |
| (Sold separately) | |
| Q corresponding MELSECNET/H Network System Reference Manual (PLC to PLC network) | _ |
| Explains the specifications, procedures and settings before operation, parameter settings, programming, and troubleshooting | SH-080049 |
| of a MELSECNET/H network system for PLC to PLC network. | (13JF92) |
| (Sold separately) | |
| Q Corresponding Ethernet Interface Module User's Manual (Basic) | |
| Explains the specifications, procedures for data communication with external devices, line connection (open/close), fixed | SH-080009 |
| buffer communication, random access buffer communication, and troubleshooting of the Ethernet module. | (13JL88) |
| (Sold separately) | |

| 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. | SH-080010 (13JL89) |
| (Sold separately) | |
| 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 | SH-080008 |
| and write data of the programmable controller CPU via the serial communication module or Ethernet module. | (13JF89) |
| (Sold separately) | |
| GX Developer Version 8 Operating Manual | CLL 000272F |
| 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) | SH-080576ENG |
| Explains the GX Developer functions added and modified for the compatibility with the safety programmable controller. (Sold separately) | (13JU53) |



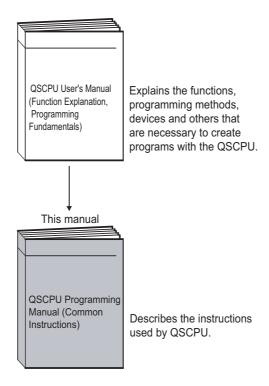
Printed materials are separately available for single item purchase. Order the manual by quoting the manual number on the table above (Model code).



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)

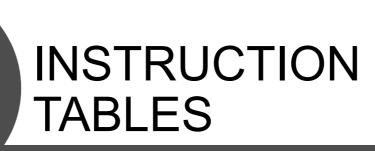


1.2 Generic Terms and Abbreviations

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, CC-Link safety remote I/O module, and CC-Link IE Field Network master/local module (with safety functions). |
| Standard PLC | Generic term of each module for MELSEC-Q series, MELSEC-L 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 |
| 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 the QS0J65BTB2-12DT CC-Link Safety remote I/O module |
| CC-Link Safety remote I/O module | Generic term for the QS0J65BTS2-8D, QS0J65BTS2-4T, and QS0J65BTB2-12DT |
| CC-Link IE Field Network master/local module (with safety functions) | Abbreviation for MELSEC-QS series CC-Link IE Field Network master/ local module |
| 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 Field Network master/local module (with safety functions), CC-Link IE Controller Network module, MELSECNET/H module, and Ethernet module |

| MEMO | | |
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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

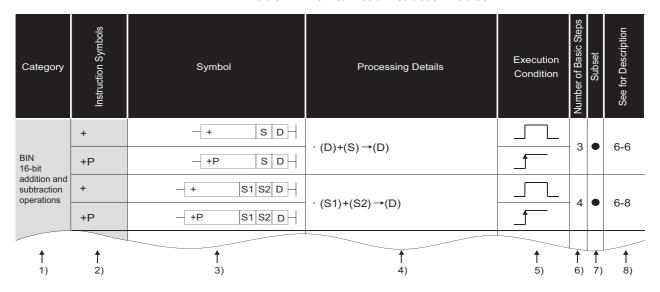
Table 2.1 Types of Instructions

| 1 | ypes of Instructions | Meaning | Reference Chapter |
|-----------------------------------|-----------------------------------|--|----------------------|
| | Contact instruction | Operation start, series connection, parallel connection | |
| | Connection instructions | Ladder block connection, store/read operation results, creation of pulses from operation results | |
| Sequence | Output instruction | Bit device output, output reversal | 5 |
| mstruction | Master control instruction | Master control | |
| | Termination instruction | Program termination | |
| | Other instructions | Instructions such as no operation which do not fit in the above categories | |
| | Comparison operation instruction | Comparisons such as =, >, < | |
| Basic | Arithmetic operation instruction | Addition, subtraction, multiplication or division of BIN | |
| instructions | BCD ←→ BIN conversion instruction | Conversion from BCD to BIN and from BIN to BCD | 6 |
| | Data transfer instruction | Transmits designated data | 1 |
| 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



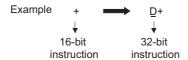
Description

- 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.





3) Shows symbol diagram on the ladder.

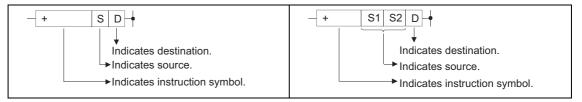


Fig. 2.1 Shows Symbol Diagram on the Ladder

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.

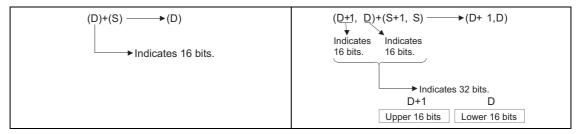


Fig. 2.2 Type of Processing Performed by Individual Instructions

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) $\,\ldots\,$.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 |
|----------|---------------------|----------------------|---|------------------------|-----------------------|--------|---------------------|
| | LD | HF | Starts logic operation (Starts a contact logic operation) | | | | |
| | LDI | HH | Starts logical NOT operation (Starts b contact logic operation) | | | | |
| | AND | \dashv \vdash | Logical product (a contact series connection) | | 1 | | 5-2 |
| | ANI | # | Logical product NOT (b contact series connection) | | , | | 3-2 |
| | OR | ЧН | Logical sum (a contact parallel connection) | | | | |
| Contact | ORI | 4/ | Logical sum NOT (b contact parallel connection) | | | | |
| | LDP | ⊢ ↑ ⊢ | Starts leading edge pulse operation | | | | |
| | LDF | - ↓ - | Starts trailing edge pulse operation | | | | |
| | ANDP | - ↑ - | Leading edge pulse series connection | | 1 | | 5-5 |
| | ANDF | - ↓ | Trailing edge pulse series connection | | ı | | J-J |
| | 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 |
|------------|---------------------|---------|--|------------------------|-----------------------|--------|---------------------|
| | ANB | ANB | AND between logical blocks (Series connection between logical blocks) | | 1 | _ | 5-7 |
| | ORB | | OR between logical blocks (Series connection between logical blocks) | | | - | 5-7 |
| | MPS | | Memory storage of operation results | | | | |
| | MRD | MPS MRD | Read of operation results stored with MPS instruction | _ | 1 | - | 5-9 |
| Connection | MPP | | Read and reset of operation results stored with MPS instruction | | | | |
| Connection | 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 | | ' | | 3-14 |
| | EGP | Vn ↑ | Conversion of operation result to leading edge pulse (Stored at Vn) | | 1 | _ | 5-15 |
| | EGF | Vn | Conversion of operation result to trailing edge pulse (Stored at Vn) | | 2 | - | 0 10 |

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 |
|----------|---------------------|---------------|--|------------------------|-----------------------|--------|------------------------------|
| | OUT | \rightarrow | Device output | | *1 | - | 5-17 5-19 5-23 5-25 |
| | SET | - SET D | Set device | (| *1 | - | 5-27 5-31 |
| Output | 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.

2.3.4 Master control instructions

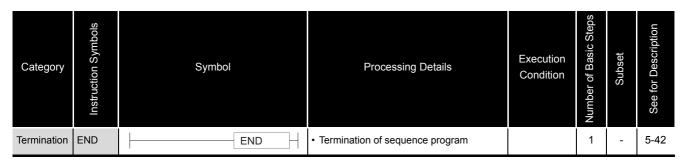
Table 2.6 Master Control Instructions

| Category | Instruction Symbols | Symbol | Processing Details | Execution Condition | Number of Basic Steps | Subset | See for Description |
|----------|---------------------|--------|-----------------------|------------------------|-----------------------|--------|---------------------|
| Master | МС | — MC | Starts master control | | 2 | _ | 5-38 |
| control | MCR | MCR n | Resets master control | | 1 | | 0 00 |

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

2.3.5 Termination instruction

Table 2.7 Termination Instruction



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 |
|--------------|---------------------|--------|--|------------------------|-----------------------|--------|---------------------|
| | NOP | | Ignored (For program deletion or space) | | | | |
| No-operation | NOPLF | NOPLF | Ignored (To change pages during printouts) | | 1 | _ | 5-43 |
| | 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 |
|--------------------|---------------------|--------------------|--|------------------------|-----------------------|--------|---------------------|
| | LD = | <u> </u> = S1 S2 | | | | | |
| | AND = | HH= S1 S2- | Conductive status when (S1) = (S2) Non-conductive status when | | 3 | • | |
| | OR = | = S1 S2 | (S1) ≠ (S2) | | | | |
| | LD<> | <> S1 S2 + - | | | | | |
| | AND<> | HH<>> S1 S2 | Conductive status when (S1) ≠ (S2) Non-conductive status when | | 3 | • | |
| _ | OR<> | <> S1 S2 | (S1) = (S2) | | | | |
| | LD> | > S1 S2 ⊣ ⊢ | | | | | |
| | AND> | HH> S1 S2— | Conductive status when (S1) > (S2) Non-conductive status when | | 3 | • | |
| BIN 16-bit data | OR> | > S1 S2 | (S1) ≦ (S2) | | | | 6-2 |
| comparisons | LD<= | <= S1 S2 H H | | | | | 0.2 |
| | AND<= | H - <= S1 S2 | Conductive status when (S1) ≤ (S2) Non-conductive status when | | 3 | • | |
| | OR<= | <= S1 S2 | (S1) > (S2) | | | | |
| | LD< | ├── < S1 S2 H F | | | | | |
| | AND< | H - | Conductive status when (S1) < (S2) Non-conductive status when | | 3 | • | |
| | OR< | | (S1) ≧ (S2) | | | | |
| | LD>= | ├── >= S1 S2 + | | | | | |
| | AND>= | | Conductive status when (S1) ≥ (S2) Non-conductive status when | | 3 | • | |
| | OR>= | >= S1 S2 | (S1) < (S2) | | | | |

Table 2.9 Comparison Operation Instructions (Continued)

| Category | Instruction Symbols | Symbol | Processing Details | Execution Condition | Number of Basic Steps | Subset | See for Description |
|--------------------|---------------------|------------------------|---|------------------------|-----------------------|--------|---------------------|
| | LDD = | — D= | Conductive status when | | | | |
| | ANDD = | H F D= S1 S2 | (S1+1, S1) = (S2+1, S2) • Non-Conductive status when | | 3 | • | |
| | ORD = | D = S1 S2 | (S1+1, S1) ≠ (S2+1, S2) | | | | |
| | LDD<> | D<> S1 S2 H H | Conductive status when | | | | |
| | ANDD<> | HHD<> S1 S2 | (S1+1, S1) ≠ (S2+1, S2) • Non-Conductive status when | | 3 | • | |
| | ORD<> | | (S1+1, S1) = (S2+1, S2) | | | | |
| | LDD> | D> S1 S2 H H | Conductive status when | | | | |
| | ANDD> | H F D > S1 S2 | $\begin{array}{l} (\text{S1+1,S1}) > (\text{S2+1,S2}) \\ \bullet \text{ Non-Conductive status when} \\ (\text{S1+1,S1}) \leqq (\text{S2+1,S2}) \end{array}$ | | 3 | • | |
| BIN 32-bit data | ORD> | D> S1 S2 | | | | | 6-4 |
| comparisons | LDD<= | D<= S1 S2 H F | Conductive status when | | | | 0 4 |
| | ANDD<= | H D <= S1 S2 | (S1+1, S1) ≦ (S2+1, S2) • Non-Conductive status when | | 3 | • | |
| | ORD<= | | (S1+1, S1) > (S2+1, S2) | | | | |
| | LDD< | D< S1 S2 ⊢ ⊢ | Conductive status when | | | | |
| | ANDD< | H H D < S1 S2 | (S1+1, S1) < (S2+1, S2) • Non-Conductive status when | | 3 | • | |
| | ORD< | D< S1 S2 | (S1+1, S1) ≧ (S2+1, S2) | | | | |
| | LDD>= | D>= S1 S2 H ⊢ | Conductive status when | | | | |
| | ANDD>= | H D >= S1 S2 — | (S1+1, S1) ≧ (S2+1, S2) | | 3 | • | |
| | ORD>= | D>= S1 S2 | • Non-Conductive status when (S1+1, S1) < (S2+1, S2) | | | | |

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 |
|--|---------------------|--|---|------------------------|-----------------------|--------|---------------------|
| | + +P | + S D - +P S D - | • (D) + (S) → (D) | | 3 | • | 6-6 |
| BIN 16-bit | + +P | - + S1 S2 D - +P S1 S2 D - | • (S1) + (S2) → (D) | | 4 | • | 6-8 |
| addition and subtraction operations | - _Р | S D | • (D) — (S) → (D) | | 3 | • | 6-6 |
| - _P | - -P | - S1 S2 D - S1 | • (S1) — (S2) → (D) | | 4 | • | 6-8 |
| | D+ D+P | — D+ S D — — — — — — — — — — — — — — — — — — | • (D+1, D) + (S+1, S) → (D+1, D) | | 3 | • | 6-10 |
| BIN 32-bit | D+ D+P | — D+ S1 S2 D — — D+P S1 S2 D — | • (S1+1, S1) + (S2+1, S2) → (D+1, D) | | 4 | • | 6-12 |
| addition and subtraction operations | D- D-P | D S D D_P S D | • (D+1, D) — (S+1, S) → (D+1, D) | | 3 | • | 6-10 |
| | D- D-P | — D— S1 S2 D— — D—P S1 S2 D— | • (S1+1, S1) — (S2+1, S2) → (D+1, D) | | 4 | • | 6-12 |
| BIN 16-bit | * *P | - * S1 S2 D * P S1 S2 D - | • (S1) × (S2) → (D+1,D) | | 4 | • | 0.44 |
| multiplication and division operations | / D/P | - / S1 S2 D /P S1 S2 D - | (S1) / (S2) → Quotient(D), Remainder (D+1) | | 4 | • | 6-14 |
| BIN 32-bit | D* | — D * S1 S2 D — — — D * P S1 S2 D — | • (S1+1, S1) × (S2+1, S2) → (D+3, D+2, D+1, D) | | 4 | • | |
| multiplication and division operations | D/ D/P | — D/ S1 S2 D — — D/P S1 S2 D — | (S1+1, S1) / (S2+1, S2) → Quotient (D+1, D), Remainder (D+3, D+2) | | 4 | • | 6-16 |

Table 2.10 Arithmetic Operation Instructions (Continued)

| Category | Instruction Symbols | Symbol | Processing Details | Execution Condition | Number of Basic Steps | Subset | See for Description |
|-----------|---------------------|-----------|---------------------------|------------------------|-----------------------|--------|---------------------|
| | 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 |
| BIN data | DINCP | - DINCP D | (011, 0) 11 / (011, 0) | | _ | | 0 20 |
| increment | DEC | - DEC D- | • (D) — 1 → (D) | | 2 | | 6-18 |
| - | DECP | - DECP D | (b) $1 \rightarrow (b)$ | | _ | | 0 10 |
| | DDEC | - DDEC D | | | 2 | | 6-20 |
| | DDECP | - DDECP D | • (D+1, D) — 1 → (D+1, D) | | _ | | 0 20 |

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 | BCD S D | • (S) BCD conversion (D) | | 3 | | |
| BCD | BCDP | BCDP S D | BIN (0 to 9999) | | Ů | | 6-22 |
| conversions | DBCD | - DBCD S D | • $(S+1,S)$ BCD conversion $(D+1,D)$ | | 3 | • | |
| | DBCDP | - DBCDP S D | EIN (0 to 9999999) | <u></u> | | | |
| | BIN | BIN S D | • (S) BIN conversion (D) | | 3 | • | |
| BIN | BINP | - BINP S D | T—— BCD (0 to 9999) | <u></u> | | | 6-24 |
| conversions | DBIN | - DBIN S D | • (S+1, S) BIN conversion (D+1,D) | 3 | • | | |
| | DBINP | - DBINP S D | BCD (0 to 9999999) | | | | |
| | NEG | NEG D | • (D) | | 2 | _ | |
| Complement | NEGP | NEGP D | EIN data | | | | 6-27 |
| to 2 | DNEG | DNEG D | • (<u>D+1, D)</u> → (D+1,D) | | 2 | _ | |
| | DNEGP | DNEGP D | BIN data | | _ | | |

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 | MOV | - MOV SD- | •(S) | | *1 | | |
| transfer | MOVP | - MOVP SD- | | | | | 6-29 |
| 32-bit data | DMOV | - DMOV SD- | • (S+1,S) | | *2 | | 0 20 |
| transfer | DMOVP | - DMOVP S D | (3+1,3) | | _ | | |
| 16-bit data negation | CML | - CML S D | •(S) | | *1 | | |
| transfer | CMLP | - CMLP S D | | | • | | 6-31 |
| 32-bit data negation | DCML | - DCML S D | • (S+1,S) | | *2 | | 0-01 |
| transfer | DCMLP | - DCMLP S D | (011,0) | | _ | | |
| Block | BMOV | - BMOV SDn | (S) (D) | | 4 | | 6-34 |
| transfer | BMOVP | - BMOVP S D n | n | | 7 | | 0-04 |
| Multiple transfers of | FMOV | - FMOV SDn | (D) | | | | |
| same data block | FMOVP | - FMOVP S D n | (S) | | 4 | | 6-36 |

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

| | Device | Number of Steps | |
|--------------------------|-------------------|--------------------|--|
| · Word device: Interna | device | | |
| · Bit device: Devices | 2 | | |
| designa | designation is K4 | | |
| · Constant: No limit | tations | | |
| Devices other than above | 3 | | |

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

| | Number of Steps | |
|------------------|---|---|
| · Word device: | Internal device | |
| · Bit device: | Devices whose device Nos. are multiples of 16 and whose digit | 2 |
| | designation is K8 | 3 |
| · Constant: | No limitations Note 1) | |
| Devices other th | 3 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 |
|-----------------|---------------------|--------------------------|--|------------------------|-----------------------|--------|---------------------|
| | WANDP | - WAND S D - WANDP S D - | \cdot (D) \wedge (S) \rightarrow (D) | | 3 | • | 7-3 |
| | WAND | - WAND S1 S2 D - | | | | | |
| Logical | WANDP | - WANDP S1 S2 D | · (S1) ∧(S2)→(D) | | 4 | • | 7-5 |
| product | DAND | - DAND S D | | | *1 | | |
| | DANDP | DANDP S D | · (D+1,D) ∧ (S+1,S) → (D+1,D) | | 3 | • | 7-3 |
| | DAND | - DAND S1S2D- | · (S1+1,S1) △(S2+1,S2) → (D+1,D) | | *1 | | 7-5 |
| | DANDP | - DANDP S1 S2 D | (6111,61) | | 4 | | |
| | WOR | - WOR SD- | (D) ((C) (D) | | _ 3 | • | 7-8 |
| | WORP | - WORP S D | $(D) \vee (S) \rightarrow (D)$ | | 3 | | |
| | WOR | - WOR S1 S2 D - | - · (S1) ∨ (S2) → (D) | | 4 | | 7-10 |
| Logical | WORP | WORP S1 S2 D | (0:) (02) (0) | | | | |
| sum | DOR | DOR S D | · (D+1,D) √ (S+1,S) → (D+1,D) | | *1 | | 7-8 |
| | DORP | OORP SD | | | 3 | | |
| | DOR | DOR S1 S2 D | · (S1+1,S1) ∨(S2+1,S2)→(D+1,D) | | *1 | • | 7-10 |
| | DORP | - DORP S1 S2 D - | (3111,31) \$ (0211,32) 7(011,0) | | | | |
| | WXOR | - WXOR S D | $\cdot (D) \swarrow (S) \rightarrow (D)$ | | 3 | | 7-12 |
| Exclusive OR | WXORP | WXORP S D | | | | | |
| | WXOR | WXOR S1S2D | · (S1) ∨ (S2) → (D) | | 4 | | 7-14 |
| | WXORP | WXORP S1 S2 D | (0.) (0.2) (0.) | | | | |
| | DXOR | DXOR S D | · (D+1,D) \\((S+1,S) \)→(D+1,D) | | *1 | | 7-12 |
| | DXORP | - DXORP S D | | | 3 | | |
| | DXOR | DXOR S1 S2 D | - · (S1+1,S1) → (S2+1,S2) → (D+1,D) | | *1 | | 7-14 |
| | DXORP | DXORP S1 S2 D | | | 4 | | |

^{*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 |
|----------------|---------------------|---------------|---|------------------------|-----------------------|--------|---------------------|
| | WXNR | WXNR S D | $\cdot \overline{(D)} \overline{\vee} \overline{(S)} \rightarrow (D)$ | | 3 | • | 7-16 |
| | WXNRP | WXNRP S D | | | | | 7 10 |
| | WXNR | WXNR S1 S2 D | $\cdot \overline{(S1)} \rightarrow (D)$ | | 4 | • | 7-18 |
| NON exclusive | WXNRP | WXNRP S1 S2 D | (01) \$ (02) 7(0) | | | | 7-10 |
| logical sum | DXNR | DXNR S D | $\cdot \overline{(D+1,D)} \searrow \overline{(S+1,S)} \rightarrow \overline{(D+1,D)}$ | | *1 3 *1 4 | • | 7-16 |
| | DXNRP | - DXNRP S D | | | | | 7 10 |
| | DXNR | DXNR S1 S2 D | - · (S1+1,S1) \ | | | | 7-18 |
| | DXNRP | DXNRP S1 S2 D | | | | | , 10 |

^{*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.

3.1 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:

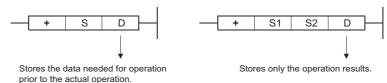
 - Bit devices and word devices Designates the device that stores the data to be used in the operation.

Data must be stored in the designated device until the operation is executed.

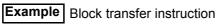
By changing the data stored in a designated device during program execution, the data to be used in the instruction can be changed.

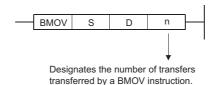
- (2) Destination (D)
 - (a) The destination stores the data after the operation has been conducted. However, some instructions require storing the data to be used in an operation at the destination prior to the operation execution.

Example An addition instruction involving BIN 16-bit data



- (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.

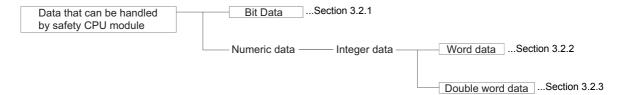




(b) The number of devices or number of transfers can be set between 0 and 32767. However, if the number is 0, the instruction will be a no-operation instruction.

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.

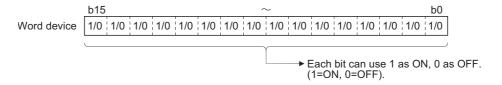
"Bit devices" and "Bit designated word devices" can be used as bit data.

(1) When using bit devices

Bit devices are designated in one-point units.



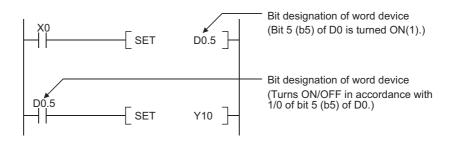
- (2) Using word devices
 - (a) Word devices enable the use of a designated bit number 1/0 as bit data by the designation of that bit number.



(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)



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

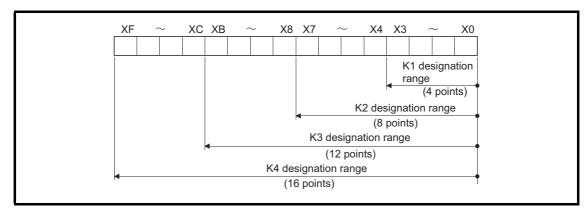


Fig 3.1 Digit Designation Setting Range for 16-Bit Instruction

(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.

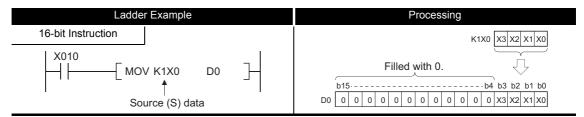


Fig 3.2 Ladder Example and Processing Conducted

(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.

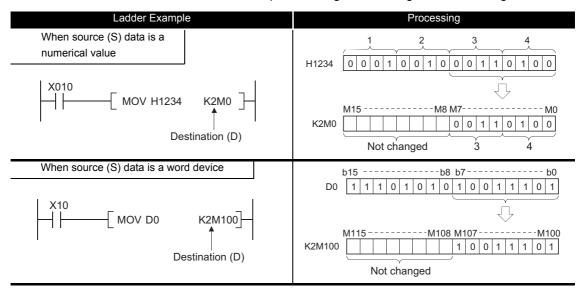
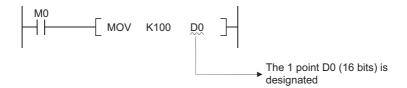


Fig 3.3 Ladder Example and Processing Conducted

(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 HFFFFFFF

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

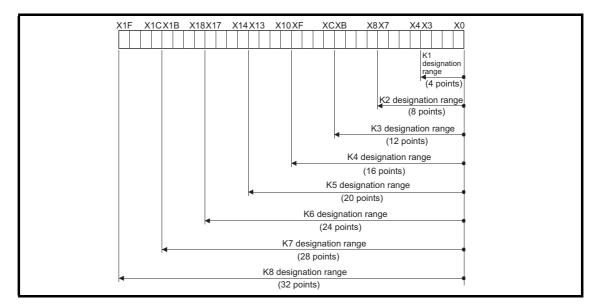


Fig 3.4 Digit Designation Setting Range for 32-Bit Instructions

(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.

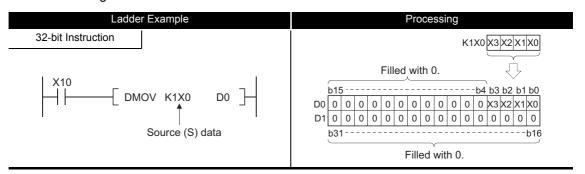


Fig 3.5 Ladder Example and Processing Conducted

(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.

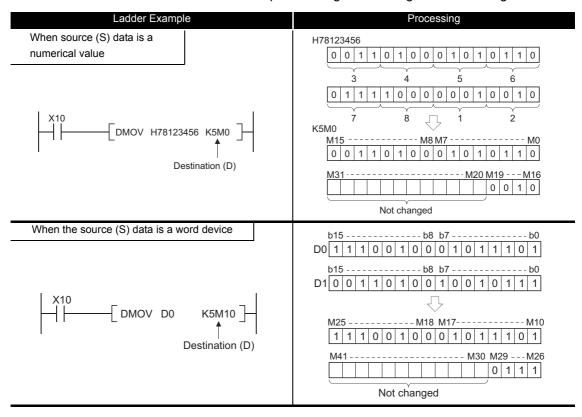


Fig 3.6 Ladder Example and Processing Conducted

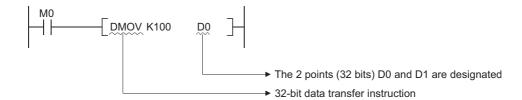
⊠POINT

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).



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 16Only 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 16Only 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.

(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.

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

| | SM |
|--------------|------------------------|
| lead address | Х |
| ixed) | Υ |
| | М |
| | В |
| | 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 |
| | |



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

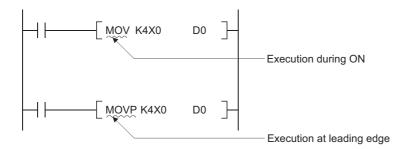
• Executed at trailing edge...... Instructions executed only at the trailing edge of the input condition (when it goes from ON to OFF)

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

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

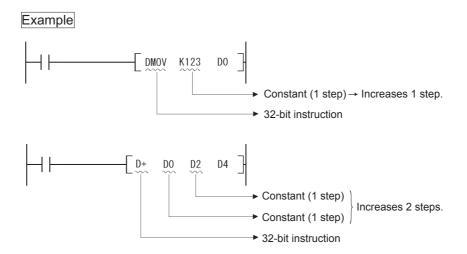
The basic number of steps for basic instructions and application instructions is calculated by adding the device number and 1.

For example, the "+ instruction" would be calculated as follows:

(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.



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.

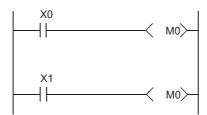
(1) OUT instructions using the same device

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.

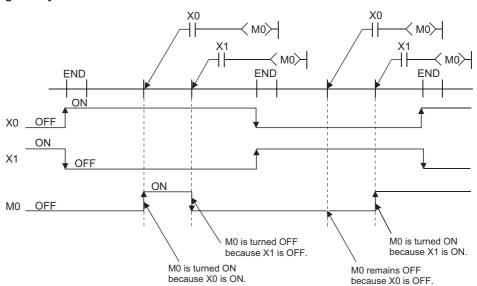
Since turning ON or OFF of the device is determined when each OUT instruction is executed, the device may turn ON and OFF repeatedly during one scan.

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]

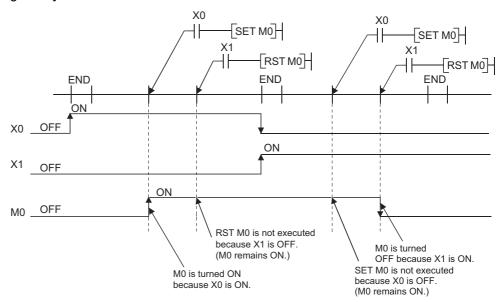


When specifying output (Y) in OUT instruction, the ON/OFF status of the device at the execution of the last OUT instruction in the scan is returned as the output (Y).

- (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]



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).

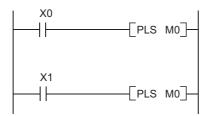
(3) PLS instructions using the same device

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.

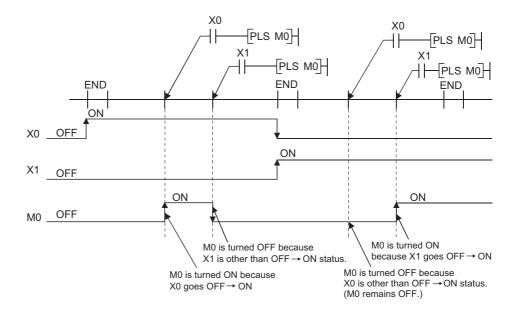
For this reason, if multiple PLS instructions using the same device are executed in a single scan, a device that has been turned ON by a PLS instruction may not be turned ON during one scan.

[Circuit]

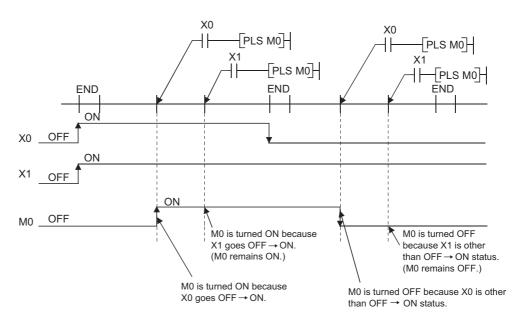


[Timing Chart]

• 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.



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.

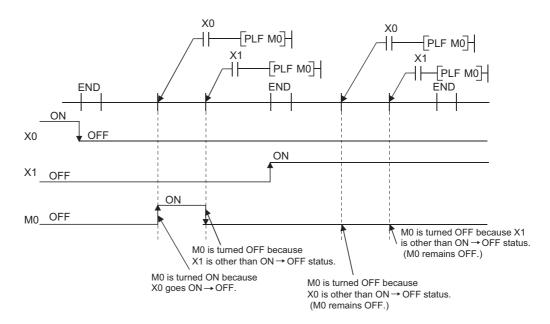
It turns OFF the device at any other time (OFF to OFF, OFF to ON, or ON to ON). If two or more PLF instructions using the same device are executed in one scan, each instruction turns ON the device when the corresponding execution command is turned OFF from ON and turns OFF the device in other cases.

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.

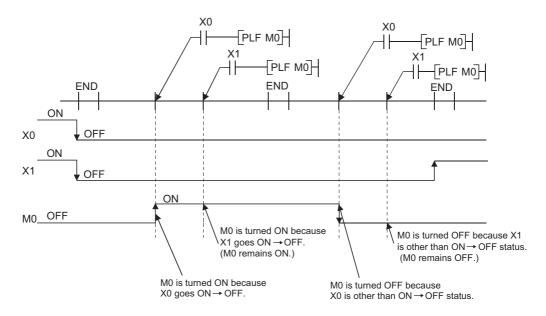
[Circuit]

[Timing Chart]

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



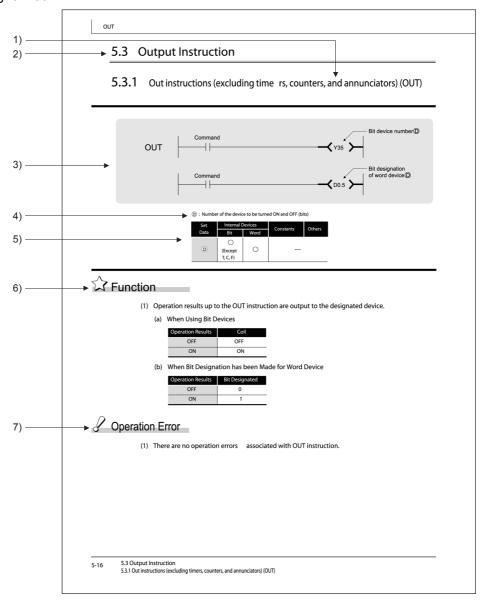
• The X0 and X1 turn OFF from ON at the same time.



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).



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

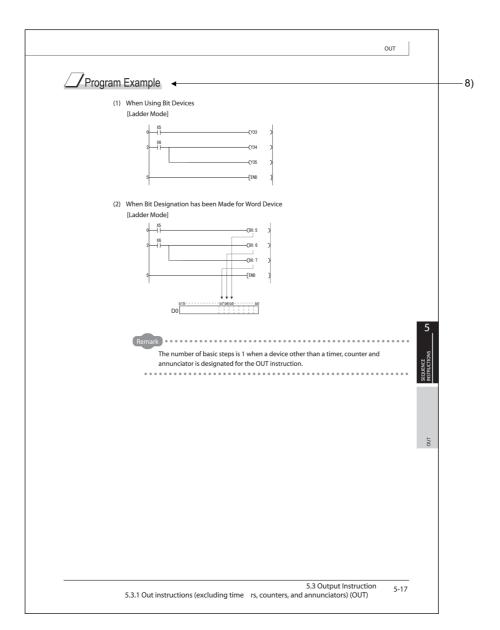


- 1) Code used to write instruction (instruction symbol).
- 2) Section number and general category of instructions being discussed.
- 3) Indicates ladder mode expressions and execution conditions for instructions.

| 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 |



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 | К, Н | 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.

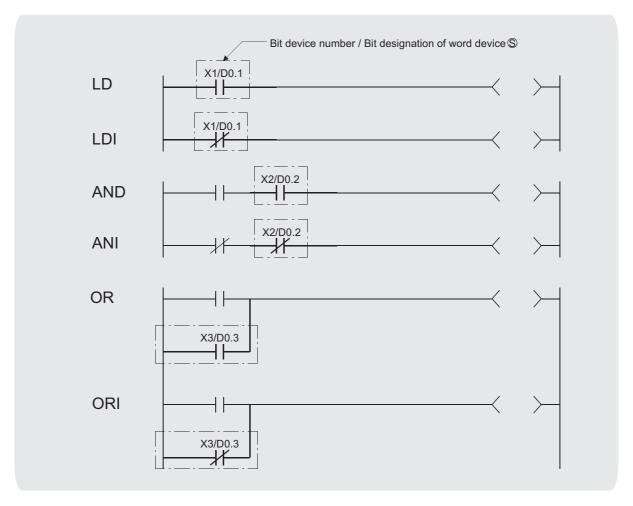
| MEMO | | |
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SEQUENCE INSTRUCTIONS

| 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)



(S): Devices used as contacts (bits)

| Set | Internal | Devices Constants | | Others |
|------|----------|-------------------|-----------|--------|
| Data | Bit | Word | Constants | Others |
| (\$) | 0 | | _ | |



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.

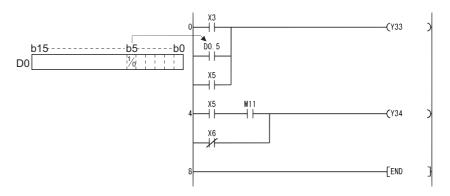
Operation Error

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

Program Example

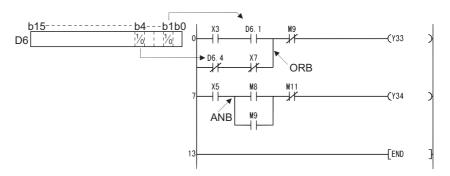
(1) A program using LD, AND, OR, and ORI instructions.

[Ladder Mode]



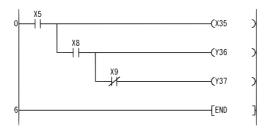
(2) A program linking contact points established through the use of ANB and ORB instructions.

[Ladder Mode]

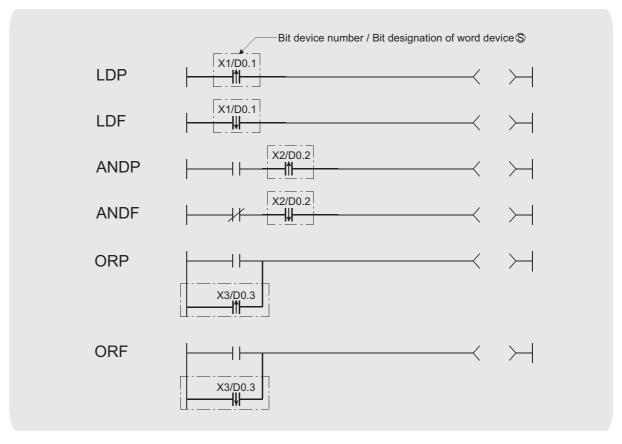


(3) A parallel program with OUT instruction.

[Ladder Mode]



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



(S): Devices used as contacts (bits)

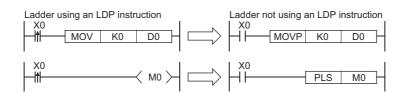
| Set | Internal | Devices | Constants | Others |
|------|----------|---------|-----------|--------|
| Data | Bit | Word | Constants | Others |
| S | 0 | | _ | |



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).



(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 | | |
|------------------|--------------------------------|------------|------------|
| Bit device | Bit designated for word device | ANDP State | ANDF State |
| OFF to ON | 0 to 1 | ON | |
| OFF | 0 | | OFF |
| ON | 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 designat | ed in ORP or ORF | | |
|-----------------|--------------------------------|-----------|-----------|
| Bit device | Bit designated for word device | ORP State | ORF State |
| OFF to ON | 0 to 1 | ON | |
| OFF 0 | | | OFF |
| ON 1 | | OFF | |
| ON to OFF | 1 to 0 | | ON |

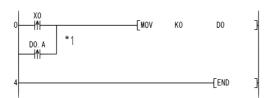
✓ Operation Error

(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:

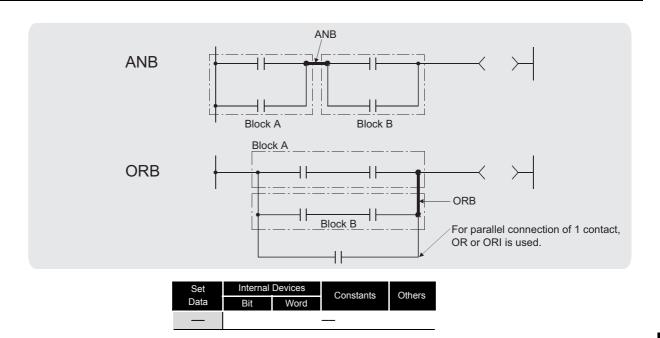
[Ladder Mode]



*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)



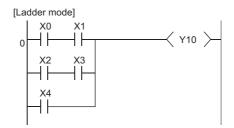


ANB

- (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.



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

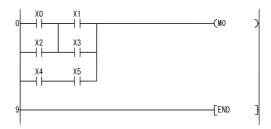
⊘ Operation Error

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

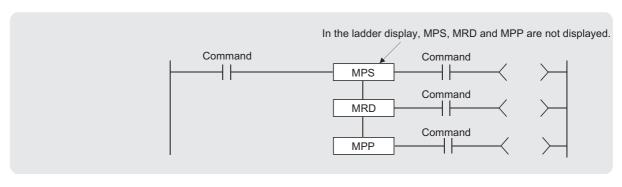
Program Example

(1) A program using ANB and ORB instructions.

[Ladder Mode]



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



| Set | Internal Devices | | Constants | Others |
|------|------------------|------|-------------|--------|
| Data | Bit | Word | Constants | Others |
| _ | | | | |



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

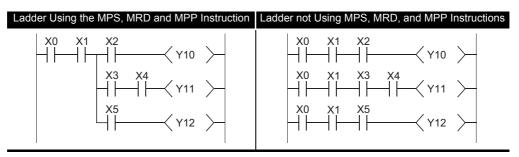
(1) Reads the operation result stored for the MPS instruction, and uses that result to perform the operation in the next step.

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.



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]

```
X1C M8 (Y30 )

(Y31 )

X1D M9 M68 (Y32 )

T0 (Y33 )

(Y34 )

X1E M81 M96 (Y35 )

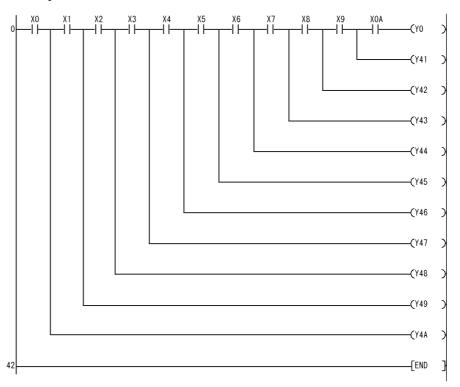
M97 (Y36 )

M98 (Y37 )

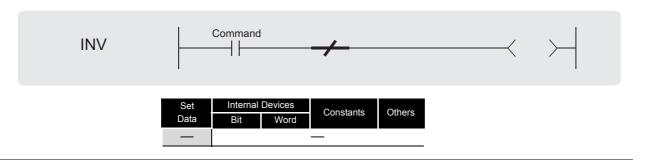
(Y38 )

30 (END ]
```

(2) A program using MPS and MPP instructions successively. [Ladder Mode]



5.2.3 Operation results inversion (INV)





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

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

Operation Error

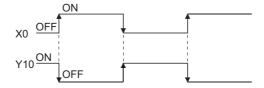
(1) There are no operation errors associated with the INV instruction.

Program Example

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

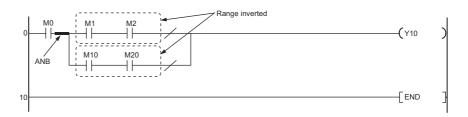


[Timing Chart]



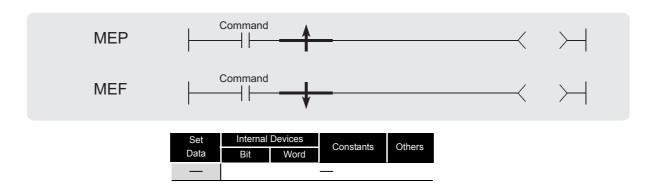
⊠POINT -

- 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)





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.

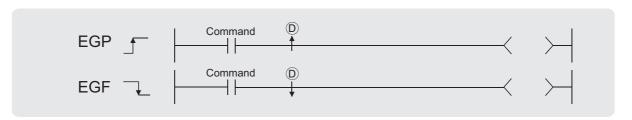
Program Example

(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)



(bits)

| Set | Internal | al Devices Constants | | Others |
|------|----------|-----------------------|-----------|--------|
| Data | Bit | Word | Constants | V |
| (D) | | | | 0 |



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).

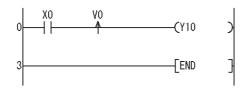
(3) The EGF instruction can be used like an AND instruction.

Operation Error

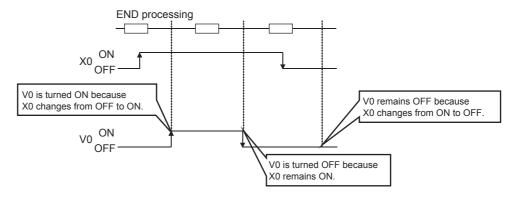
(1) There are no operation errors associated with the EGP or EGF instructions.

Program Example

(1) A program containing a subroutine program using an EGP instruction [Ladder Mode]

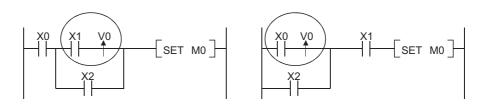


[Operation]



⊠POINT

- 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)



① : Number of the device to be turned ON and OFF (bits)

| Set | Internal | Devices | Constants | Othere | |
|------|------------------|---------|-----------|--------|--|
| Data | Bit | Word | Constants | Others | |
| D | (Except T, C, F) | 0 | _ | | |



- (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

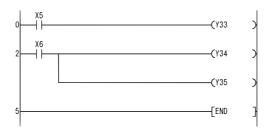
| Operation Results | Bit Designated |
|-------------------|----------------|
| OFF | 0 |
| ON | 1 |



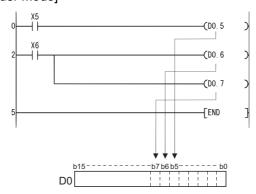
(1) There are no operation errors associated with OUT instruction.

Program Example

(1) When Using Bit Devices [Ladder Mode]



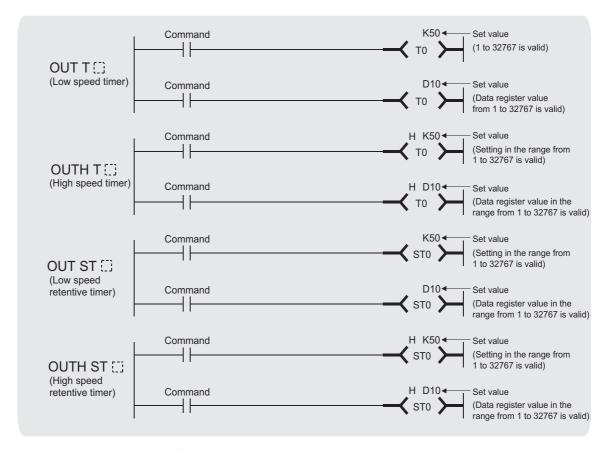
(2) When Bit Designation has been Made for Word Device [Ladder Mode]



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)



① : Timer number (bit)Set value : Value set for timer (BIN 16 bits)

| Set | Internal Devices | | Constants | Others | |
|-----------|------------------|---------------|------------|---------|--|
| Data | Bit | Word | K | Ollicis | |
| (D) | 0 | | | | |
| • | (Only T) | | | | |
| Set value | _ | (Except T, C) | <u></u> *1 | | |

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



(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 | Prior to Time Up | | After Time Up | |
|--------------------------|-----------|------------------|------------------|------------|---------------|------------|
| Type of Times | Timer Con | Timer | A Contact | B Contact | A Contact | B Contact |
| Low speed timer | OFF | 0 | Non- | Continuity | Non- | Continuity |
| High speed timer | OH | O O | continuity | Continuity | continuity | Continuity |
| Low speed | | | | | | |
| retentive timer | OFF | Maintains the | Non- | Continuity | Continuity | Non- |
| High speed | 011 | present value | continuity | Continuity | Continuity | continuity |
| 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.



1. Timer's time limit

Time limit of the timer is set in the PLC system setting of the PLC parameter dialog box.

| | QSCPU | | |
|---|--------------------------------------|-----------------|--|
| Type of Timer | 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.



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



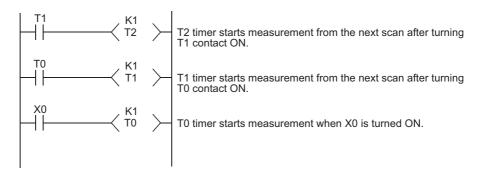
(1) When creating a program in which the operation of the timer contact triggers the operation of other timer, create the program according to the operation order of the timers - create the program for the timer that operates later first.

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

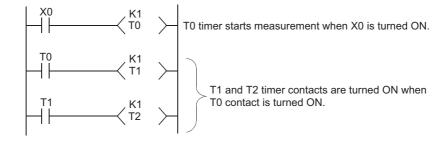
- If the set value is smaller than a scan time.
- If "1" is set.

Example

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

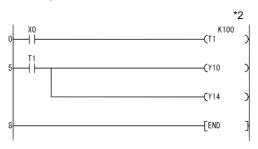


• For timers T0 to T2, the program is created in the order of timer operation.

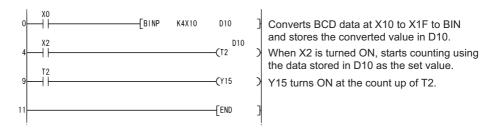


Program Example

(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]

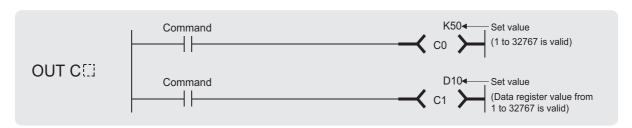


(3) The following program turns Y10 ON 250 m after X0 goes ON. [Ladder Mode]



*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 | Internal | Devices | Constants | Others |
|-----------|----------|------------------|------------|---------|
| Data | Bit | Word | K | Officis |
| D | (Only C) | | _ | _ |
| Set value | _ | (Except T, C) | <u></u> *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.



(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.



- 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.

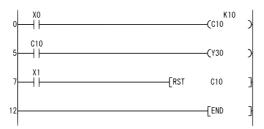
⊘ Operation Error

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

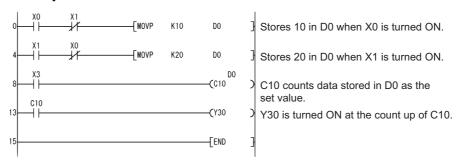
Program Example

(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.



5.3.4 Annunciator output (OUT F)



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

| Set | Internal Devices | | Constants | Othoro |
|------|------------------|------|-----------|--------|
| Data | Bit | Word | Constants | Others |
| D | (Only F) | | | |



- (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.



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



- 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.

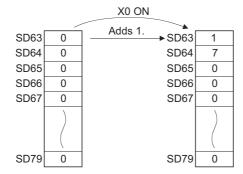
Program Example

(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)



① : Bit device number to be set (ON)/Word device bit designation (bits)

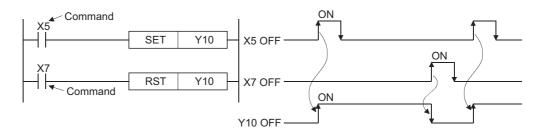
| Set | Internal Devices | | Constants | Others |
|------|------------------|---------------|-----------|--------|
| Data | Bit | Word | Constants | Others |
| (D) | 0 | (Except T, C) | | 0 |



(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

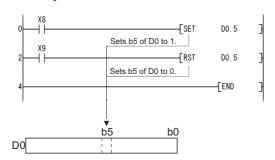
(1) The following program sets Y8B (ON) when X8 goes ON, and resets Y8B (OFF) when X9 goes ON.

[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)

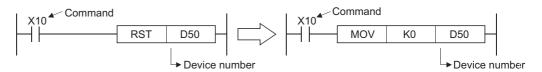
| Set | Internal Devices | | Constants | Others |
|------|------------------|------|-----------|---------|
| Data | Bit | Word | Constants | Officis |
| D | | | _ | |



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

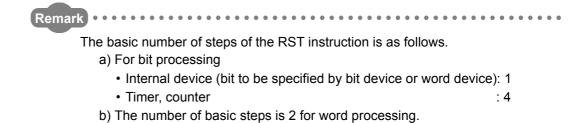
| Device | Device Status |
|--|---|
| Bit device | Turns coils and contacts OFF |
| Timers and counters | Sets the present value to 0, and turns coils and contacts OFF |
| When Bit Designation has been Made for Word Device | Sets value of designated bit to 0 |
| Word devices other than timers and counters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



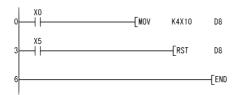
Operation Error

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



Program Example

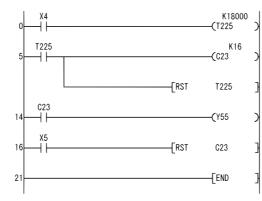
(1) The following program sets the value of the data register to 0. [Ladder Mode]



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 ①: Number of the annunciator to be set (F number) (bits)

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

| Set | Internal Devices | | Constants | Others |
|------|------------------|------|-----------|--------|
| Data | Bit | Word | Constants | Others |
| D | (Only F) | | | |



SET

- (1) The annunciator designated by (a) 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

- (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.

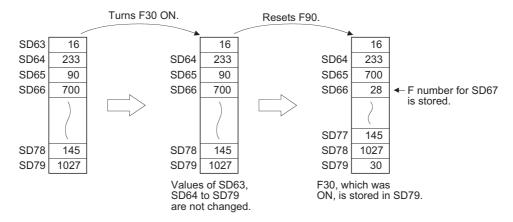


- 1. Refer to the manual below for details of annunciators.
 - QSCPU User's Manual (Function Explanation, Program Fundamentals)
- 2. The number of basic steps for the SET F and RST F instructions is 2.

(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^{\square} or RST F^{\square} instructions.

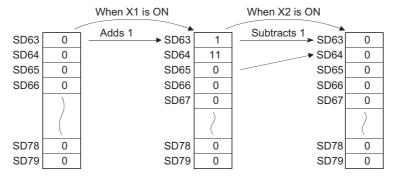
Program Example

(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).

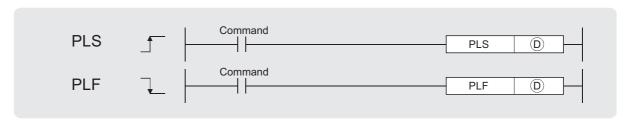
[Ladder Mode]



[Operation]



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



① : Pulse conversion device (bits)

| Set | Internal Devices | | Constants | Others |
|------|------------------|------|-----------|--------|
| Data | Bit | Word | Constants | Others |
| D | 0 | | _ | |

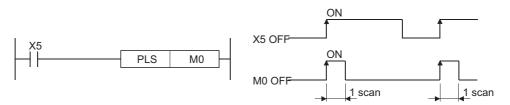


PLS

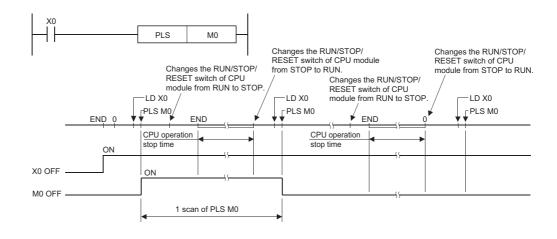
(1) Turns ON the designated device when the execution command is turned OFF \rightarrow ON, and turns OFF the device in any other case the execution command is turned OFF \rightarrow ON (i.e., at ON \rightarrow ON, ON \rightarrow OFF or OFF \rightarrow OFF of the execution command).

When there is one PLS instruction for the device designated by \odot 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.



(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.

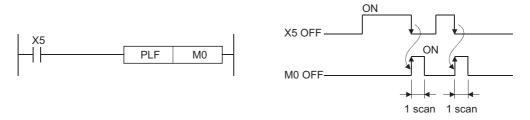
The device turned ON at the first scan after power-ON turns OFF at the next PLS instruction.

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 $_{\textcircled{D}}$ 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.



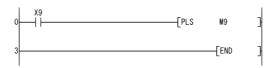
(2) If the RUN/STOP/RESET switch is changed from RUN to STOP after the execution of the PLF instruction, the PLF instruction will not be executed again even if the switch is set back to RUN.

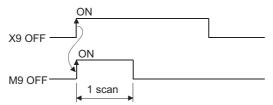
Operation Error

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

Program Example

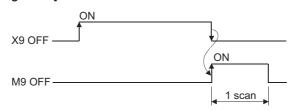
(1) The following program executes the PLS instruction when X9 goes ON. [Ladder Mode]



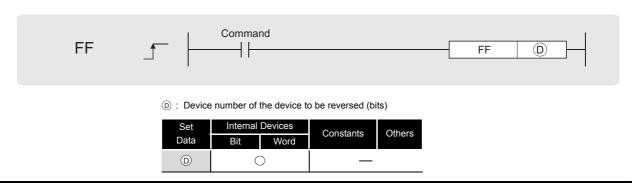


(2) The following program executes the PLF instruction when X9 goes OFF. [Ladder Mode]





5.3.9 Bit device output reverse (FF)





(1) Reverses the output status of the device designated by $_{\textcircled{D}}$ when the execution command is turned OFF $^{\rightarrow}$ ON.

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

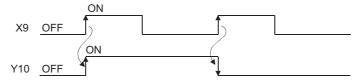
Operation Error

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

Program Example

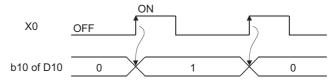
(1) The following program reverses the output of Y10 when X9 goes ON. [Ladder Mode]





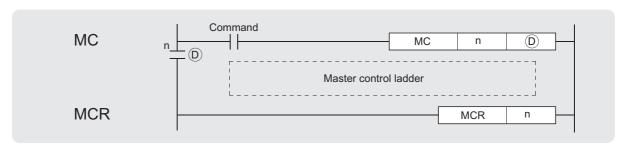
(2) The following program reverses b10 (bit 10) of D10 when X0 goes ON. [Ladder Mode]





5.4 Master Control Instructions

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



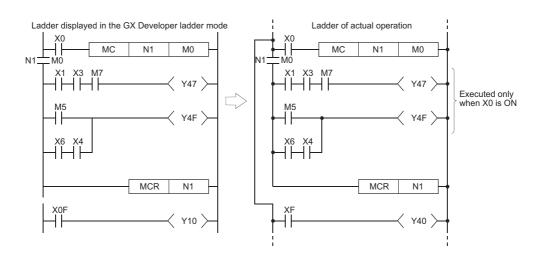
- n : Nesting (N0 to N14) (Nesting)
- D : Number of the device to turn ON (bits)

| Set | Internal Devices | | Constants | Others |
|------|------------------|--|-----------|--------|
| Data | Bit Word | | | Ν |
| n | _ | | | 0 |
| D | 0 | | | |

Function 7

(3) 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:



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.

Remark

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 |
| SET, RST Basic, Application Devices in the following instructions: | 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 ①, the MC instruction can use the same nesting (N) number as often as desired.

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

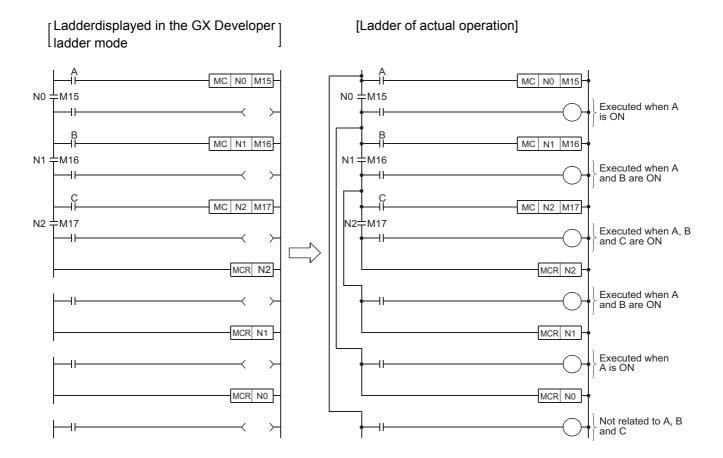
(1) There are no operation errors associated with the MC or MCR instructions.

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:



Cautions when Using Nesting Architecture

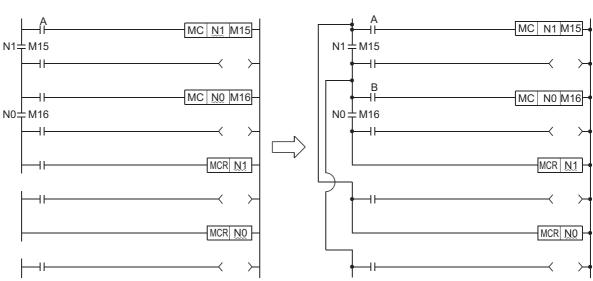
(1) Nesting can be used up to 15 times (N0 to N14)

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.

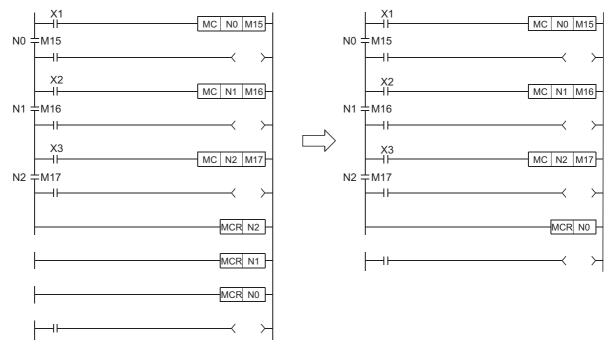
For example, if nesting is designated in the order N1 to N0 by the MC instruction, and also designated in the N1 to N0 order by the MCR instruction, the vertical bus will intersect and a correct master control ladder will not be produced.

Ladder displayed in the GX Developer ladder mode

[Ladder of actual operation]

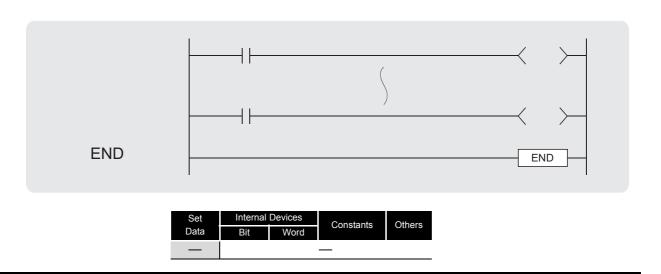


(2) If the nesting architecture results in MCR instructions concentrated in one location, all master controls can be terminated by use of just the lowest nesting number (N).



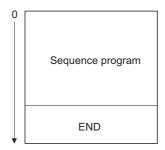
5.5 Termination Instruction

5.5.1 End sequence program (END)





(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.



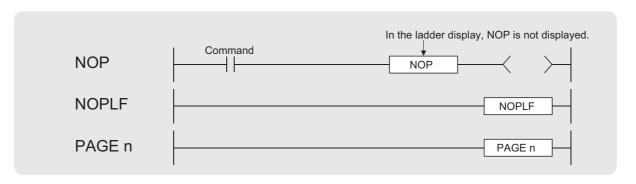
(2) END instruction is automatically set by the GX Developer during programming.



(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 | Internal | Devices | Constants | Others | |
|------|----------|---------|-----------|---------|--|
| Data | Bit | Word | K | Olliels | |
| n | _ | _ | 0 | | |



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.

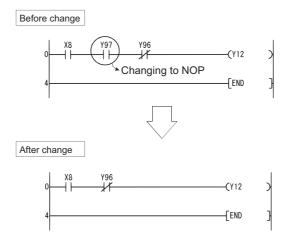
Operation Error

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

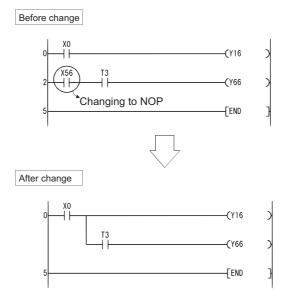
Program Example

NOP

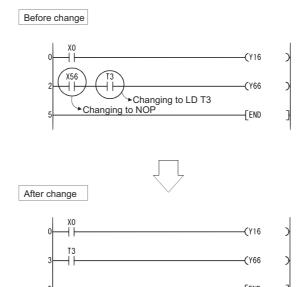
(1) Contact closed....... Deletes AND or ANI instruction. [Ladder Mode]



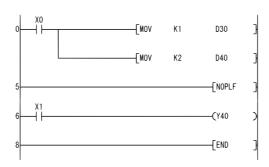
(2) Contact closed....... LD, LDI changed to NOP (Note carefully that changing the LD and LDI instructions to NOP completely changes the nature of the ladder.)



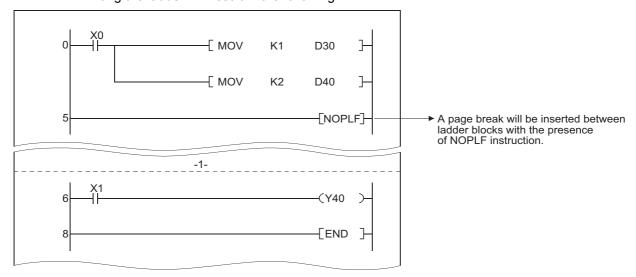
[Ladder Mode]



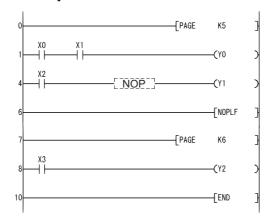
NOPLF



• Printing the ladder will result in the following:



PAGE n

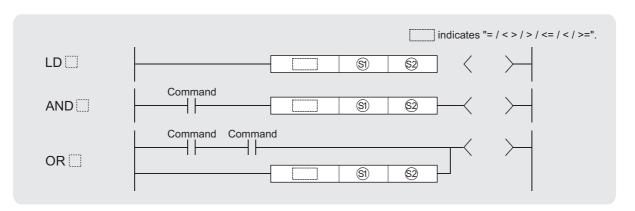


BASIC

| 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 (= , <> , >, <= , <, >=)



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

| Set | Internal Devices | | Constants | Others |
|------------|------------------|------|-----------|---------|
| Data | Bit | Word | K, H | Officis |
| § 1 | 0 | | 0 | _ |
| \$2 | 0 | | 0 | _ |



- (1) Treats BIN 16-bit data from device designated by (s) and BIN 16-bit data from device designated by (s) 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 | | |
|-----------------------|-----------|-----------------------------|-----------------------|-----------|-----------------------------|----------|--|
| = | §2 = §1 | | = | §1) ≠ §2) | | | |
| <> | §1) ≠ §2) | | <> | S2 = S1 | | | |
| > | §1 > §2 | Continuity | > | §1) ≦ §2 | Non-continuity | | |
| <= | §1) ≦ §2 | Continuity | <= | §1 > §2 | 14011-continuity | | |
| < | §) < §2 | | | | < | §1) ≧ §2 | |
| >= | §1) ≧ §2 | | >= | \$1 < \$2 | | | |

(3) When (3) and (2) 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.

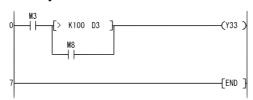
[Ladder Mode]

(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.

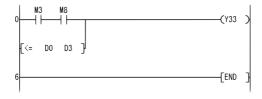
[Ladder Mode]

(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.

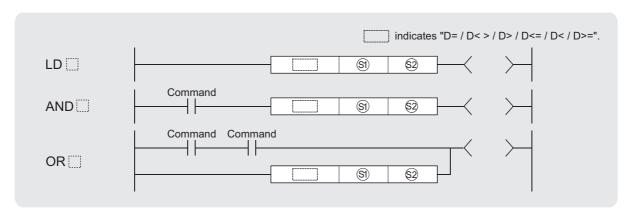
[Ladder Mode]



(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.



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



§1, §2 : Data for comparison or start number of the devices where the data for comparison is stored (BIN 32 bits)

| Set | Internal Devices | | Constants | Othere |
|-------------|------------------|------|-----------|--------|
| Data | Bit | Word | K, H | Others |
| (S1) | 0 | | 0 | _ |
| \$2 | 0 | | 0 | _ |



- (1) Treats BIN 32-bit data from device designated by (s) and BIN 32-bit data from device designated by (s) 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 | | D = | §1) ≠ §2) | |
| D <> | §1) ≠ §2) | | D <> | §2 = §1 | |
| D > | §1 > §2 | Continuity | D > | §1) ≦ §2 | Non-continuity |
| D <= | §1) ≦ §2 | Continuity | D <= | §1 > §2 | Non-continuity |
| D < | §1 < §2 | | D < | §1) ≧ §2 | |
| D >= | §1) ≧ §2 | | D >= | §1 < §2 | |

- (3) When (s) and (s) 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.



(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]



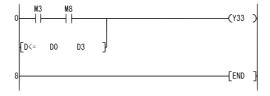
- (2) The following program compares BIN value K38000 to the data at D3, and D4, and establishes continuity if the data in D3 and D4 is something other than 38000.
 - [Ladder Mode]

- (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]

```
0 M3 (Y33 )

M8 (END )
```

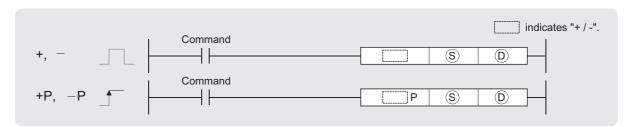
(4) The following program compares the data in D0 and D1 with the data in D3 and D4, and establishes continuity if the data in D0 and D1 is equal to or less than the data in D3 and D4. [Ladder Mode]



6.2 Arithmetic Operation Instructions

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

1 When two data are set (\bigcirc + \bigcirc \rightarrow \bigcirc , \bigcirc - \bigcirc \rightarrow \bigcirc)



- (S): Data for additing/subtracting or start number of the devices where the data for additing/subtracting is stored (BIN 16 bits)
- ① :Start number of the devices where the data to be added to/subtracted from is stored (BIN 16 bits)

| Set | Internal Devices | | Constants | Othera |
|------|------------------|------|-----------|--------|
| Data | Bit | Word | K, H | Others |
| S | 0 | | 0 | _ |
| D | 0 | | _ | _ |



+

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

- (2) Values for (a) and (b) 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.

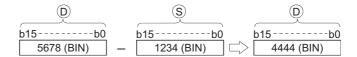
K-32768 +K-2 → K32766 ····· Since b15 is "0", the judgment is (H8000) (HFFFE) (H7FFE) a positive value.
```

(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

.



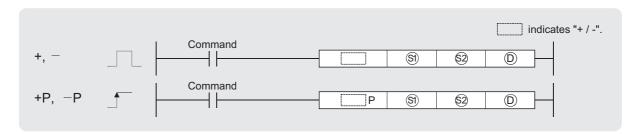
- (2) Values for \odot and \odot can be designated between -32768 and 32767 (BIN, 16 bits).
- (3) The judgment of whether data is positive or negative is made by the most significant bit (b15).
 - 0: Positive
 - 1: Negative
- (4) The following will happen when an underflow or overflow is generated in an operation result: The carry flag in this case does not go ON.



✓ Operation Error

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

$\fbox{2}$ When three data are set (§) + §2 \rightarrow D, §) - §2 \rightarrow D)



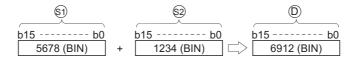
- Data to be added to/subtracted from or start number of the devices where the data to be added to/ subtracted from is stored (BIN 16 bits)
- Data for additing/subtracting or start number of the devices where the data for additing/subtracting is stored (BIN 16 bits)
- (a): Start number of the devices where the addition/subtraction operation result will be stored (BIN 16 bits)

| Set | Internal Devices | | Constants | Others |
|------------|------------------|------|-----------|---------|
| Data | Bit | Word | K, H | Officis |
| § 1 | 0 | | 0 | |
| \$2 | 0 | | 0 | _ |
| D | | | _ | _ |



+

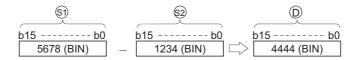
(1) Adds 16-bit BIN data designated by (s) to 16-bit BIN data designated by (s) and stores the result of the addition at the device designated by (D).



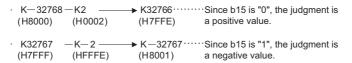
- (2) Values for \S_1 , \S_2 and \S_3 can be designated between -32768 and 32767 (BIN, 16 bits).
- (3) The judgment of whether data is positive or negative is made by the most significant bit (b15).
 - 0: Positive
 - 1: Negative
- (4) The following will happen when an underflow or overflow is generated 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 (s) from 16-bit BIN data designated by (s) and stores the result of the subtraction at the device designated by (a).



- (2) Values for \mathfrak{S}_1 , \mathfrak{S}_2 and \mathfrak{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.



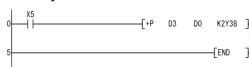
✓ Operation Error

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

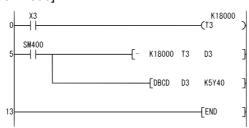
Program Example

(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]

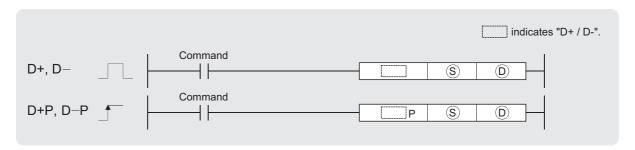


(2) The following program outputs the difference between the set value for timer T3 and its present value in BCD to Y40 to Y53.



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

1 When two data are set ((
$$\bigcirc$$
 + 1, \bigcirc) + (\bigcirc + 1, \bigcirc) \rightarrow (\bigcirc + 1, \bigcirc), (\bigcirc + 1, \bigcirc) – (\bigcirc + 1, \bigcirc))



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

| Set | Internal Devices | | Constants | Others |
|------|------------------|------|-----------|---------|
| Data | Bit | Word | K, H | Officis |
| S | 0 | | 0 | |
| D | 0 | | _ | _ |



D+

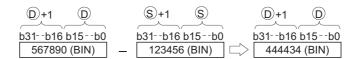
(1) Adds 32-bit BIN data designated by 0 to 32-bit BIN data designated by s, and stores the result of the addition at the device designated by 0.

- (2) The values for \odot and \odot 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 (H7FFFFFF) (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 (a) from 32-bit BIN data designated by (b) and stores the result of the subtraction at the device designated by (b).

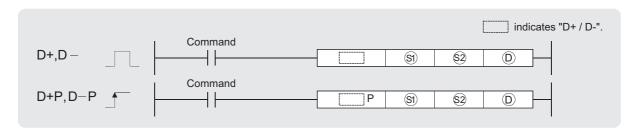


- (2) The values for \odot and \odot can be designated at between -2147483648 and 2147483647 (BIN 32 bits).
- (3) Judgment of whether the data is positive or negative is made on the basis of the most significant bit (b31).
 - 0: Positive
 - 1: Negative
- (4) The following will happen when an underflow or overflow is generated in an operation result: The carry flag in this case does not go ON.

⊘ Operation Error

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

2 When three data are set ((§) + 1, §) + (§) + 1, §)
$$\rightarrow$$
 (\bigcirc + 1, \bigcirc), (§) + 1, \bigcirc) - (\bigcirc + 1, \bigcirc))



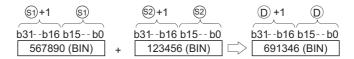
- Data to be added to/subtracted from or start number of the devices where the data to be added to/subtracted from is stored (BIN 32 bits)
- ② : Data for additing/subtracting or start number of the devices where the data for additing/subtracting is stored (BIN 32 bits)
- ① : Start number of the devices where the addition/subtraction operation result will be stored (BIN 32 bits)

| Set Data | Internal Devices | | Constants | Others |
|-------------|------------------|------|-----------|--------|
| Data | Bit | Word | K, H | Others |
| § 1 | | 0 | | _ |
| \$2 | 0 | | 0 | _ |
| D | |) | | _ |



D+

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



- (2) The values for 5, 5 and 5 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.

D –

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



- (2) The values for \S , \S and \circledcirc 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.

Operation Error

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

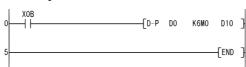
Program Example

(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.

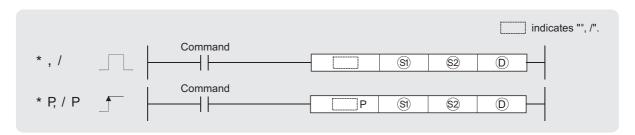
[Ladder Mode]



(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.



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



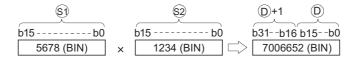
- Si : Data to be multiplied/divided or start number of the devices where the data to be multiplied/divided is stored (BIN 16 bits)
- See : Data for multiplying/dividing or start number of the devices where the data for multiplying/dividing is stored (BIN 16 bits)
- (D): Start number of the devices where the multiplication/division operation result will be stored (BIN 32 bits)

| Set | Internal Devices | | Constants | Others |
|------------|------------------|------|-----------|--------|
| Data | Bit | Word | K, H | Others |
| § 1 | | 0 | | |
| \$2 | 0 | | 0 | |
| D | |) | | _ |



*

(1) Multiplies BIN 16-bit data designated by (s) and BIN 16-bit data designated by (s), and stores the result in the device designated by (n).



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

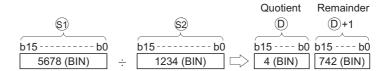
K1...... Lower 4 bits (b0 to b3)

K4...... Lower 16 bits (b0 to b15)

K8...... 32 bits (b0 to b31)

- (3) Values for \mathfrak{S}_1 and \mathfrak{S}_2 can be designated between -32768 and 32767 (BIN, 16 bits).
- (4) Judgments whether [6], [62], and [0] are positive or negative are made on the basis of the most significant bit (b15 for [63], and [62], for [0] and b31).
 - · 0: Positive
 - 1: Negative

(1) Divides BIN 16-bit data designated by (s) and BIN 16-bit data designated by (s), and stores the result in the device designated by (n).



(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 \mathfrak{S}_1 and \mathfrak{S}_2 can be designated between -32768 and 32767 (BIN, 16 bits).
- (4) Judgment whether values for (5), (2), (5) and (5) + 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



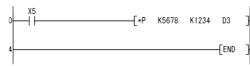
- (1) In any of the following cases, an operation error occurs, the error flag (SM0) turns ON, and the corresponding error code is stored into SD0.
 - Attempt to divide
 by 0.

(Error code: 4100)

Program Example

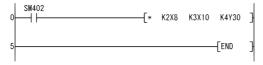
(1) The following program divides "5678" by "1234" when X5 goes ON, and stores the result at D3 and D4.

[Ladder Mode]

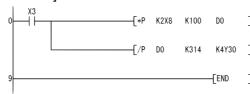


(2) The following program divides BIN data at X8 to XF by BIN data at X10 to X1B, and outputs the result of the division operation to Y30 to Y3F.

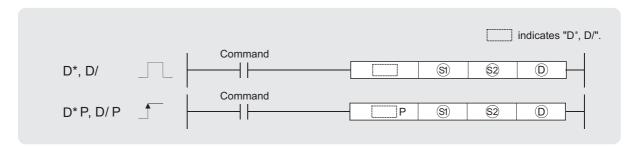
[Ladder Mode]



(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.



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



- Data to be multiplied/divided or start number of the devices where the data to be multiplied/divided is stored (BIN 32 bits)
- Significant in the state of the devices where the data for multiplying/dividing is stored (BIN 32 bits)
- ① : Start number of the devices where the multiplication/division operation result will be stored (BIN 64 bits)

| Set Data | Internal Devices | | Constants | Others |
|-------------|------------------|------|-----------|--------|
| Data | Bit | Word | K, H | Others |
| § 1 | 0 | | 0 | _ |
| \$2 | 0 | | 0 | _ |
| D | |) | _ | |



D*

(1) Multiplies BIN 32-bit data designated by (s) and BIN 32-bit data designated by (s), and stores the result in the device designated by (o).

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

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 $(\bigcirc + 2)$ and $(\bigcirc + 3)$ data.

- (3) The values for 1 and 2 can be designated at between -2147483648 and 2147483647 (BIN 32 bits).
- (4) Judgments whether (a), (a), and (b) are positive or negative are made on the basis of the most significant bit (b31 for (a) and (a), b63 for (b)).
 - 0: Positive
 - 1: Negative

D/

(1) Divides BIN 32-bit data designated by (s) and BIN 32-bit data designated by (s), and stores the result in the device designated by (n).



(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 \S and \S can be designated at between -2147483648 and 2147483647 (BIN 32 bits).
- (4) Judgment whether values for (s), (s), (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.



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



 \odot : Start number of devices for INC (+1)/DEC (- 1) operation (BIN 16 bits)

| Set | Internal Devices | | Constants | Others |
|------|------------------|------|-----------|---------|
| Data | Bit | Word | Constants | Officis |
| D | 0 | | _ | |



INC

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



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

DEC

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



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

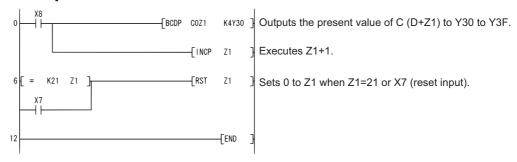
Operation Error

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

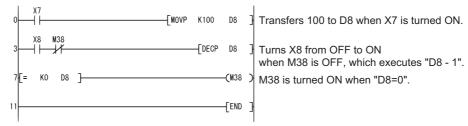
Program Example

(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)

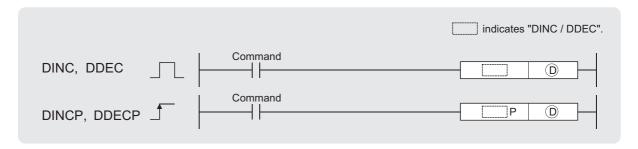
[Ladder Mode]



(2) The following is a down counter program.



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



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

| Set | Internal Devices | | Constants | Others |
|------|------------------|------|-----------|---------|
| Data | Bit | Word | Constants | Olliers |
| D | 0 | | | |



DINC

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



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

DDEC

(1) Subtracts 1 from the device designated by (2) (32-bit data).



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

Operation Error

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

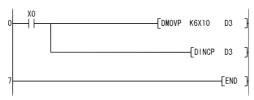
Program Example

(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.

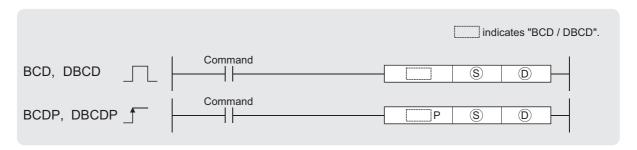
[Ladder Mode]



(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.

6.3 Data Conversion Instructions

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



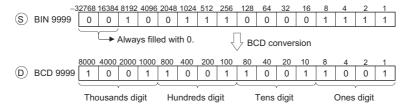
- ③ : BIN data or start number of the devices where the BIN data is stored (BIN 16/32 bits)
- ① : Start number of the devices where BCD data will be stored (BCD 4/8 digits)

| Set | Internal Devices | | Constants | Others |
|------|------------------|------|-----------|---------|
| Data | Bit | Word | K, H | Officis |
| S | 0 | | 0 | _ |
| D | | 0 | | _ |



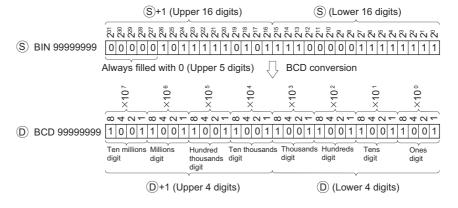
BCD

(1) Converts BIN data (0 to 9999) at the device designated by ③ to BCD data, and stores it at the device designated by ⑤.



DBCD

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



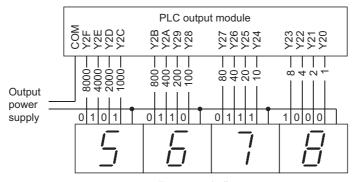


- (1) In any of the following cases, an operation error occurs, the error flag (SM0) turns ON, and the corresponding error code is stored into SD0.
 - The data of ③ is other than 0 to 9999 at BCD instruction. (Error code: 4100)
 - The data of ③ or ③ +1 is other thean 0 to 99999999 at DBCD instruction.

(Error code: 4100)

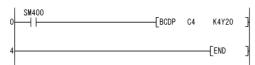
Program Example

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

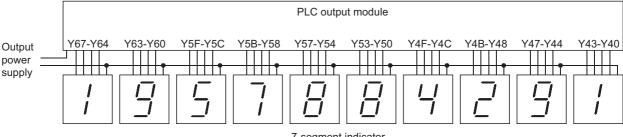


7-segment indicator

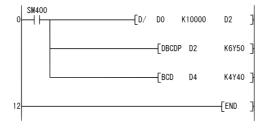
[Ladder Mode]



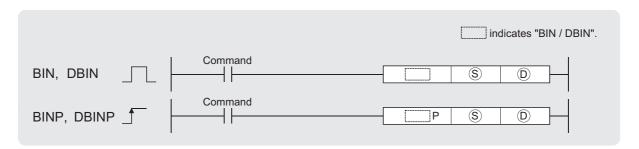
(2) The following program outputs 32-bit data from D0 to D1 to Y40 to Y67.



7-segment indicator



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



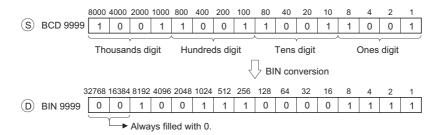
- ③: BCD data or start number of the devices where the BCD data is stored (BCD 4/8 digits)
- ① : Start number of the devices where BIN data will be stored (BIN 16/32 bits)

| Set | Internal Devices | | Constants | Others |
|------|------------------|------|-----------|---------|
| Data | Bit | Word | K, H | Officis |
| (\$) | 0 | | 0 | _ |
| D | 0 | | _ | _ |



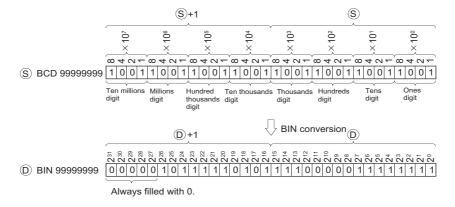
BIN

(1) Converts BCD data (0 to 9999) at device designated by ⑤ to BIN data, and stores at the device designated by ⑥.



DBIN

(1) Converts BCD data (0 to 99999999) at device designated by ③ to BIN data, and stores at the device designated by ⑤.





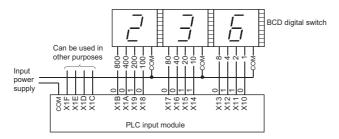
- (1) In the following cases, an operation error occurs, the error flag (SM0) turns ON, an error code is stored in SD0, and the instruction is not executed.
 - When values other than 0 to 9 are designated to any digits of ③ .(Error code: 4100)

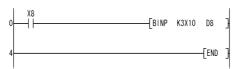
In this regard, however, the error above can be suppressed by turning SM722 ON. However, the instruction is not executed regardless of whether SM722 is turned ON or OFF if the designated value is out of the available range.

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

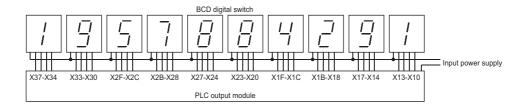
(1) The following program converts the BCD data at X10 to X1B to BIN when X8 is ON, and stores it at D8.



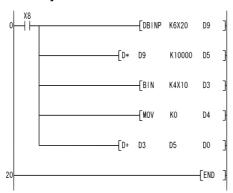


(2) The following program converts the BCD data at X10 to X37 to BIN when X8 is ON, and stores it at D0 and D1.

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

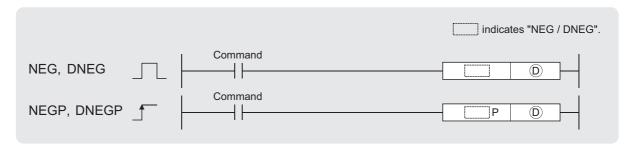


[Ladder Mode]



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))



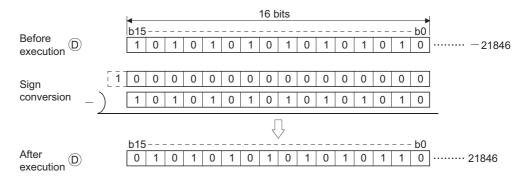
① : Start number of the devices where the data for which complement of 2 is performed is stored (BIN 16/32 bits)

| Set | Internal | Devices | Constants | Others |
|------|----------|---------|-----------|---------|
| Data | Bit | Word | Constants | Officis |
| D | 0 | | | |



NEG

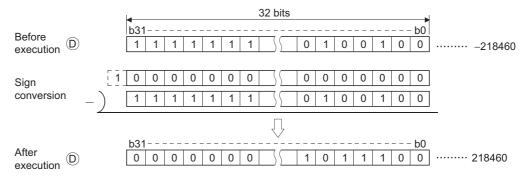
(1) Reverses the sign of the 16-bit device designated by \odot and stores at the device designated by \odot .



(2) Used when reversing positive and negative signs.

DNEG

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



(2) Used when reversing positive and negative signs.



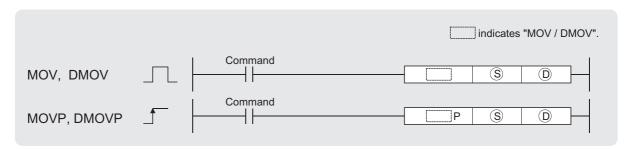
(1) There are no operation errors associated with the NEG(P) or DNEG(P) instructions.

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.

6.4 Data Transfer Instructions

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



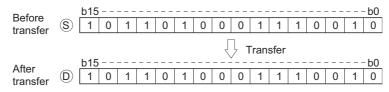
- (S): Data to be transferred or the number of the device where the data to be transferred is stored (BIN 16/32 bits)
- (D): Number of the device where the data will be transferred (BIN 16/32 bits)

| Set | Internal Devices | | Constants | Others |
|------|------------------|------|-----------|---------|
| Data | Bit | Word | K, H | Officis |
| S | 0 | | 0 | |
| (D) | 0 | | | |



MOV

(1) Transfers the 16-bit data from the device designated by (s) to the device designated by (o).



DMOV

(1) Transfers 32-bit data at the device designated by (s) to the device designated by (f).



✓ Operation Error

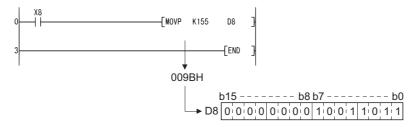
(1) There are no operation errors associated with the MOV(P) or DMOV(P) instructions.

Program Example

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

```
0 | MOVP K3X0 D8 ]
```

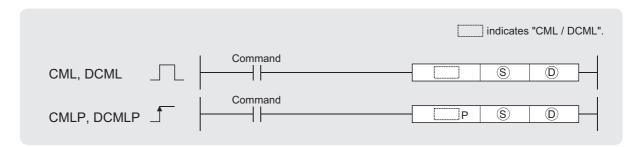
(2) The following program stores the constant K155 at D8 when X8 goes ON. [Ladder Mode]



(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))



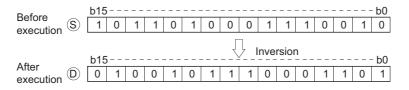
- ③ : Data to be reversed or the number of the device where data to be reversed is stored (BIN 16/32 bits)
- ① : Number of the device where the reversing result will be stored (BIN 16/32 bits)

| Set | Internal Devices | | Constants | Others |
|------|------------------|------|-----------|---------|
| Data | Bit | Word | K, H | Officis |
| S | 0 | | 0 | _ |
| D | 0 | | | |



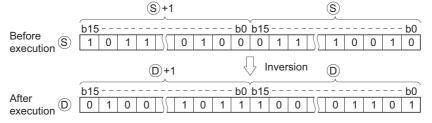
CML

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



DCML

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



✓ 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)"

(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]

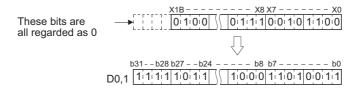


(4) The following program inverts the data at X0 to X1F, and transfers results to D0 and D1. [Ladder Mode]



[Operation]

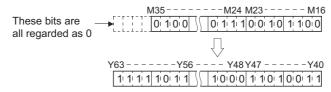
When "Number of bits of (S) < Number of bits of (D)"



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

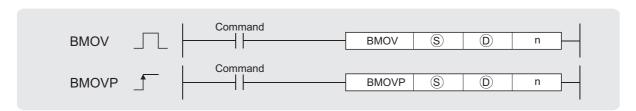
[Operation]

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



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

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

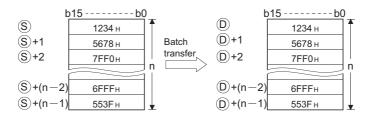


- (\$): Start number of the devices where the data to be transferred is stored (BIN 16 bits)
- (D): Start number of the devices of transfer destination (BIN 16 bits)
- n: Number of data to be transferred (BIN 16 bits)

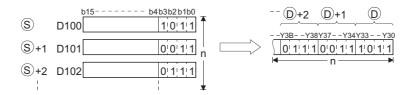
| Set Data | Internal Devices | | Constants | Others |
|-------------|------------------|------|-----------|---------|
| Data | Bit | Word | K, H | Olliers |
| S | | 0 | | _ |
| D | 0 | | | _ |
| n | | | 0 | _ |



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



- (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 \S ; for transmission to the larger device number, transmission is from \S + (n-1).
- (3) When s is a word device and b 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 \S and \lozenge , then \S and \lozenge should always have the same number of digits.



- (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 \circ or \circ exceeds the corresponding device range. (Error code: 4101)

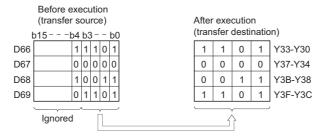
Program Example

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

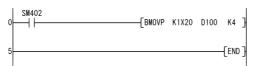
[Ladder Mode]

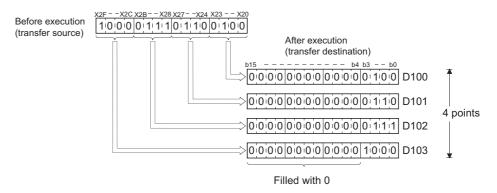


[Operation]

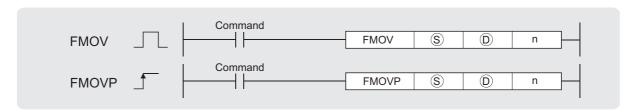


(2) The following program outputs the data at X20 to X2F to D100 to D103 in 4-point units. [Ladder Mode]





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

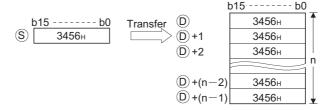


- S : Data to be transferred or the start number of the devices where the data to be transferred is stored (BIN 16 bits)
- $\textcircled{\scriptsize 0}$: Start number of the devices of transfer destination (BIN 16 bits)
- n : Number of data to be transferred (BIN 16 bits)

| Set | Internal Devices | | Constants | Others |
|------|------------------|------|-----------|--------|
| Data | Bit | Word | K, H | Others |
| S | |) | 0 | _ |
| D | 0 | | | _ |
| n | |) | 0 | _ |

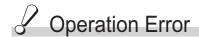


(1) Transfers 16-bit data at the device designated by (s) to n points of devices starting from the one designated by (n).



- (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 \odot is designated for K1Y30, the lower 4 bits of the word device designated by \odot are the target.

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



- (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)

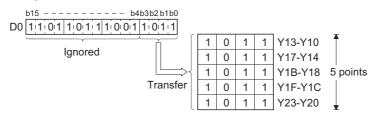
Program Example

(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]

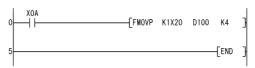


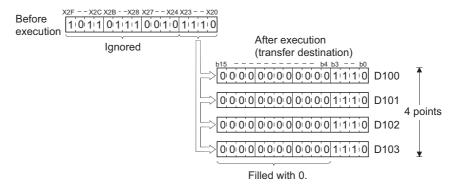
[Operation]



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

[Ladder Mode]





MEMO



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

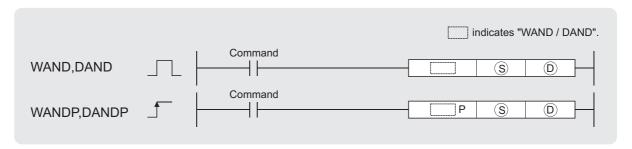
7.1 Logical Operation Instructions

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

| Category | Processing Details | Formula for | Example | | |
|------------------------------|---|--|---------|---|---|
| Category | i Tocessing Details | Operation | Α | В | Υ |
| | | | 0 | 0 | 0 |
| Logical product | Becomes 1 only when both input A and input B are 1; otherwise, is 0 | Y = A * B | 0 | 1 | 0 |
| (AND) | | | 1 | 0 | 0 |
| | | | 1 | 1 | 1 |
| | | $V = \Delta + R$ | 0 | 0 | 0 |
| Logical sum | Becomes 0 only when both input A and input B are 0; otherwise, is 1 | | 0 | 1 | 1 |
| (OR) | | | 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 |
| Exclusive OR | | | 0 | 1 | 1 |
| (XOR) | | | 1 | 0 | 1 |
| | | | 1 | 1 | 0 |
| NON evelueine | Becomes 1 if input A and input B are equal; otherwise, is 0 | $Y = (\overline{A} + B)(A + \overline{B})$ | 0 | 0 | 1 |
| NON exclusive logical sum | | | 0 | 1 | 0 |
| (XNR) | | | 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 (\bigcirc \land \bigcirc \rightarrow \bigcirc , (\bigcirc + 1, \bigcirc) \land (\bigcirc + 1, \bigcirc) \rightarrow (\bigcirc + 1, \bigcirc))



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

| Set | Internal Devices | | Constants | Othera | |
|------|------------------|------|-----------|--------|--|
| Data | Bit | Word | K, H | Others | |
| S | 0 | | 0 | | |
| D | 0 | | | | |



WAND

(1) A logical product operation is conducted for each bit of the 16-bit data of the device designated at

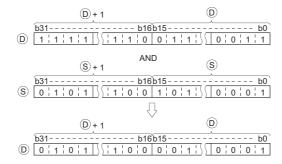
and the 16-bit data of the device designated at

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



(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]

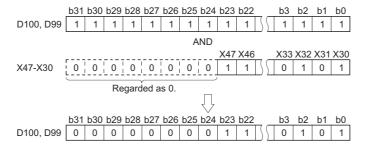


[Operation]

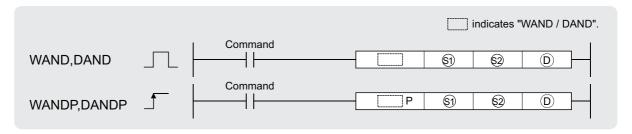
(2) The following program performs a logical product operation on the data at D99 and D100, and the 24-bit data between X30 and X47 when X8 is ON, and stores the results at D99 and D100.

[Ladder Mode]





 $\fbox{2}$ When three data are set (§) \land §2 \rightarrow 0, (§) + 1, 9) \land (§2 + 1, 9) \rightarrow (0 + 1, 0))



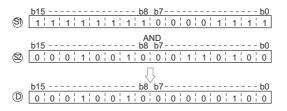
- (s) , (s) : Data for a logical product operation or the start number of the devices where the data is stored (BIN 16/32 bits)
- ① : Start number of the devices where the logical product operation result will be stored (BIN 16/32 bits)

| Set Data | Internal Devices | | Constants | Others |
|-------------|------------------|------|-----------|---------|
| Data | Bit | Word | K, H | Olliers |
| § 1 | 0 | | 0 | |
| <u>\$2</u> | 0 | | 0 | |
| D | 0 | | | |



WAND

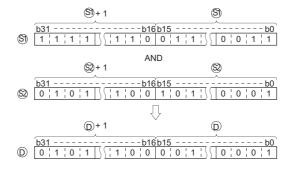
(1) A logical product operation is conducted for each bit of the 16-bit data of the device designated at (s) and the 16-bit data of the device designated at (s), and the results are stored in the device designated at (D).



(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 (s) and the 32-bit data for the device designated by (s), and stores the results at the device designated by (D).



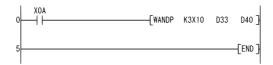
(2) For bit devices, the bit devices below the points designated by digit specification are regarded as "0" in the operation. (See Program Example (3))

Operation Error

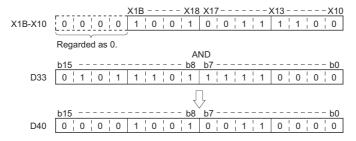
(1) There are no operation errors associated with the WAND(P) or DAND(P) instruction.

Program Example

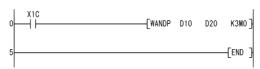
(1) The following program performs a logical product operation on the data from X10 to X1B and the data at D33 when XA is ON, and stores the results at D40. [Ladder Mode]

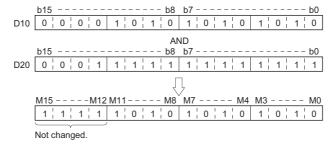


[Operation]



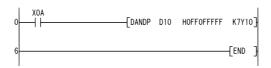
(2) The following program performs a logical product operation on the data at D10 and at D20 when X1C is ON, and stores the results from M0 to M11.
[Ladder Mode]

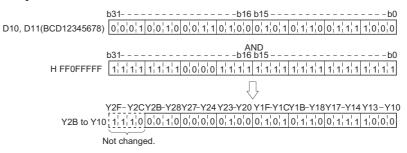




(3) The following program masks the digit in the hundred-thousands place of the 8-digit BCD value at D10 and D11 (sixth digit from the end) to 0 when XA is ON, and outputs the results to from Y10 to Y2B.

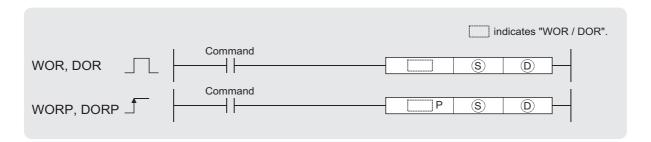
[Ladder Mode]





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

1 When two data are set $(\textcircled{\tiny } \lor \textcircled{\tiny }) \rightarrow \textcircled{\tiny })$, $(\textcircled{\tiny } +1, \textcircled{\tiny }) \lor (\textcircled{\tiny } +1, \textcircled{\tiny }) \rightarrow (\textcircled{\tiny } +1, \textcircled{\tiny }))$



- (S): Data for a logical sum operation or start number of the devices where the data is stored (BIN 16/32 bits)
- ① : Start number of the devices where the logical sum operation result will be stored (BIN 16/32 bits)

| Set | Internal Devices | | Constants | Others |
|------|------------------|------|-----------|--------|
| Data | Bit | Word | K, H | Others |
| S | 0 | | 0 | _ |
| D | 0 | | | _ |



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

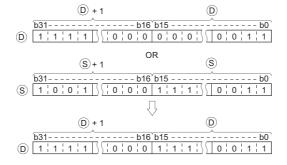
 , and stores the results at the device designated by

 .

(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 .





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

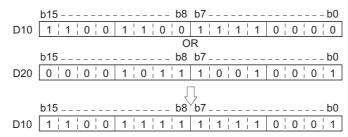
Program Example

(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]

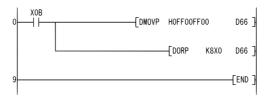


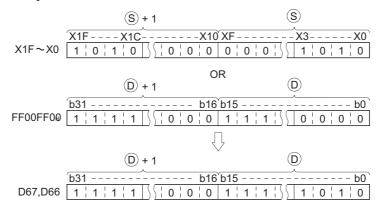
[Operation]



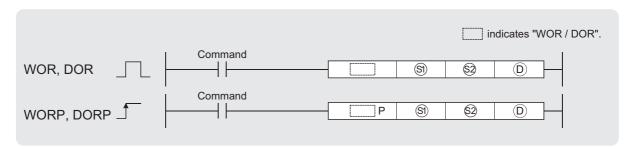
(2) The following program performs a logical sum operation on the 32-bit data from X0 to X1F, and on the hexadecimal value FF00FF00_H when XB goes ON, and stores the results at D66 and D67.

[Ladder Mode]





2 When three data are set (§) \vee §2 \rightarrow ©, (§) +1, §) \vee (§2 +1, §2) \rightarrow (© +1, ©))



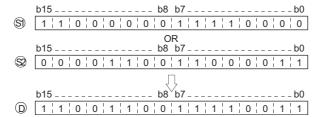
§), ⊚ : Data for a logical sum operation or start number of the devices where the data is stored (BIN 16/32 bits)

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

| Set | Internal Devices | | Internal Devices | | Constants | Others |
|------------|------------------|------|------------------|--------|-----------|--------|
| Data | Bit | Word | K, H | Others | | |
| § 1 | 0 | | 0 | | | |
| \$2 | 0 | | 0 | _ | | |
| D | 0 | | | _ | | |



WOR

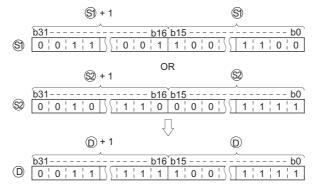


(2) For bit devices, the bit devices below the points designated by digit specification are regarded as "0" in the operation. (See Program Example (1))

DOR

(1) Conducts a logical sum operation on each bit of the 32-bit data of the device designated by

 and the 32-bit data of the device designated by
 , and stores the results at the device designated by
 .



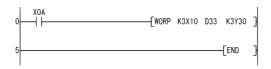
(2) When bit devices are designated, the bit devices below the points designated as digits are regarded as "0" in the operation. (See Program Example (2))



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

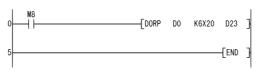
Program Example

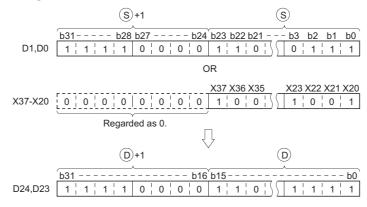
(1) The following program performs a logical sum operation on the data from X10 to X1B, and the data at D33, and stores the result at Y30 to Y3B when XA is ON. [Ladder Mode]



[Operation]

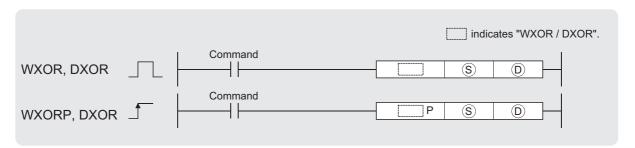
(2) The following program performs a logical sum operation on the 32-bit data at D0 and D1, and the 24-bit data from X20 to X37, and stores the results at D23 and D24 when M8 is ON. [Ladder Mode]





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

1 When two data are set (\bigcirc \lor \bigcirc \rightarrow \bigcirc , (\bigcirc +1, \bigcirc) \lor (\bigcirc +1, \bigcirc) \rightarrow (\bigcirc +1, \bigcirc))



- ③ : Data for an exclusive OR operation or start number of the devices where the data is stored (BIN 16/32 bits)
- ① : Start number of the devices where the exclusive OR operation result will be stored (BIN 16/32 bits)

| Set | Internal Devices Bit Word | | Internal Devices | | Constants | Others |
|------|---------------------------|--|------------------|--------|-----------|--------|
| Data | | | K, H | Others | | |
| S | 0 | | 0 | _ | | |
| D | 0 | | | | | |

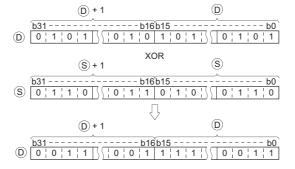


WXOR

(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 \odot and the 32-bit data of the device designated by \odot , and stores the results at the device designated by \odot .





(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.

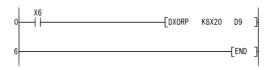
[Ladder Mode]

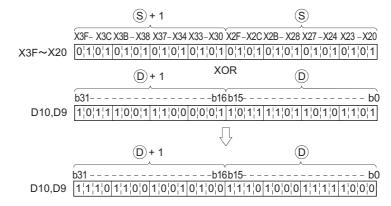


[Operation]

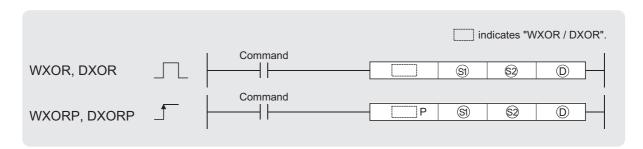
(2) The following program compares the bit pattern of the 32-bit data from X20 to X3F with the bit pattern of the data at D9 and D10 when X6 is ON.

[Ladder Mode]





 $\fbox{2}$ When three data are set (§) \lor 2 \rightarrow 0 (§) +1, 9) \lor (2 +1, 2) \rightarrow (0 +1, 0))



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

| Set Data | Internal Devices | | Internal Devices | | Constants | Others |
|-------------|------------------|------|------------------|---------|-----------|--------|
| Data | Bit | Word | K, H | Officis | | |
| § 1 | 0 | | 0 | | | |
| \$2 | 0 | | 0 | _ | | |
| D | 0 | | | _ | | |



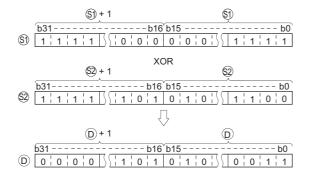
WXOR

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

(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 ⑤ and the 32-bit data of the device designated by ⑥, and stores the results at the device designated by ⑥.





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

Program Example

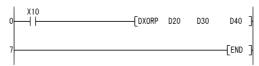
(1) The following program conducts an exclusive OR operation on the data from X10 to X1B and the data at D33 when X10 is ON, and outputs the result to from Y30 to Y3B.

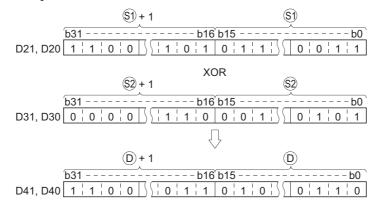
[Ladder Mode]

[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.

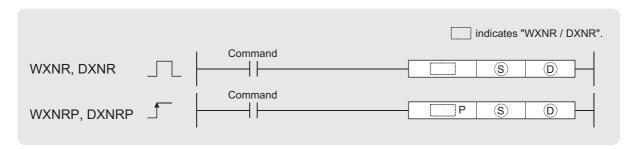
[Ladder Mode]





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

1 When two data are set $(\overline{\bigcirc \lor \bigcirc \lor} \to \bigcirc, \overline{(\bigcirc +1, \bigcirc) \lor (\bigcirc +1, \bigcirc)} \to (\bigcirc +1, \bigcirc)$



- (BIN 16/32 bits)
- ① : Start number of the devices where the exclusive NOR operation result will be stored (BIN 16/32 bits)

| Set | Internal Devices Bit Word | | Internal Devices | | Constants | Others |
|------|---------------------------|--|------------------|--------|-----------|--------|
| Data | | | K, H | Others | | |
| S | 0 | | 0 | _ | | |
| D | 0 | | | _ | | |



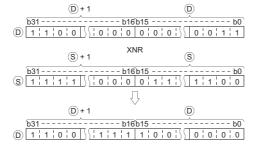
WXNR

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

(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 $_{\odot}$ and the 32-bit data of the device designated by $_{\odot}$, and stores the results at the device designated by $_{\odot}$.





(1) There are no operation errors associated with the WXNR(P) or DXNR(P) instructions.

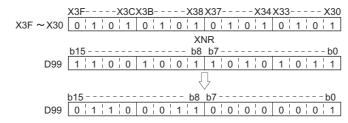
Program Example

(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]

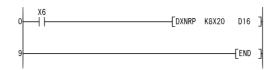


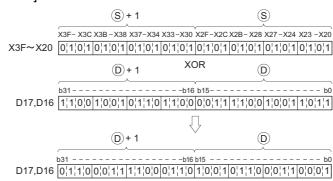
[Operation]

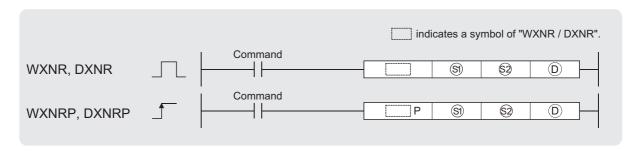


(2) The following program compares the bit pattern of the 32-bit data from X20 to X3F with the bit pattern of the data at D16 and D17 when X6 is ON.

[Ladder Mode]







- (§), (§): Data for an exclusive NOR operation or start number of the devices where the data is stored (BIN 16/32 bits)
- ①: Start number of the devices where the exclusive NOR operation result will be stored (BIN 16/32 bits)

| Set Data | Internal Devices | | Internal Devices | | Constants | Others |
|-------------|------------------|------|------------------|--------|-----------|--------|
| Data | Bit | Word | K, H | Others | | |
| § 1 | 0 | | 0 | | | |
| \$2 | 0 | | 0 | _ | | |
| D | 0 | | _ | _ | | |



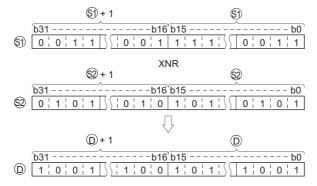
WXNR

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

(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 (s) and the 32-bit data of the device designated by (s), and stores the results at the device designated by (D).





(1) There are no operation errors associated with the WXNR(P) or DXNR(P) instructions.

Program Example

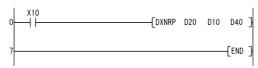
(1) The following program performs an exclusive NOR operation on the 16-bit data from X30 to X3F and the data at D99 when X0 is turned ON, and stores the results to D7.

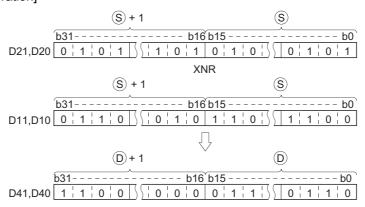
[Ladder Mode]

[Operation]

(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]





MEMO



| Category | Processing Details | Reference section |
|---------------------------------|---------------------|-------------------|
| Forced control stop instruction | Forced control stop | 8.1 |

8.1 Forced Control Stop Instruction (S.QSABORT)

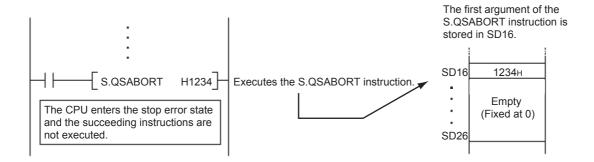


S : Data to be stored in SD16 as the abort code, or the number of the device where the data is stored (BIN 16 bits).

| Set | Internal | Devices | Constants | Others | |
|------|----------|---------|-----------|--------|--|
| Data | Bit Word | | K, H | Others | |
| S | 0 | | 0 | | |



- (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)



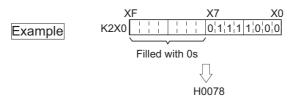
(2) Details of the program error are stored in the common information (SD5 to SD15).

| Device | Meaning | | | | | |
|--------|--|----------------------------------|--|--|--|--|
| SD5 | | | | | | |
| SD6 | File name (ASCII code: 8 characters) | | | | | |
| SD7 | | | | | | |
| SD8 | | | | | | |
| SD9 | Extension (ASCII code: 3 characters) | 2EH(.) | | | | |
| SD10 | Extension (Acon code. 5 characters) | | | | | |
| SD11 | Fixed to 0 | | | | | |
| SD12 | 0 (Bloo | ck No.) | | | | |
| SD13 | 0 (Step No. / S | 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 | |
| SD18 | |
| SD19 | |
| SD20 | |
| SD21 | Empty (Fixed at 0) |
| SD22 | Empty (Fixed at 0) |
| 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.



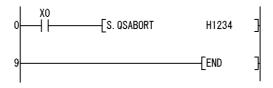


- (1) In any of the following cases, an operation error occurs, the error flag (SM0) turns ON, and the corresponding error code is stored into SD0.
 - The designated instruction name is incorrect. (Error code: 4002)
 - The number of the arguments used in the instruction is incorrect. (Error code: 4003)
 - 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]



| MEMO | | |
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9.1 Error Code List

If an error occurs under one of the following conditions, the QS series CPU module uses the selfdiagnostic function to display error information (LED indication) and stores it in the special relay (SM) and special register (SD):

- the programmable controller is powered on
- the programmable controller is reset
- the programmable controller is switched from STOP to RUN
- · the programmable controller 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 $(4000_{\rm H}\ to\ 4FFF_{\rm H})$ to the request source.

The following describes the description of errors which occur in the CPU module and the corrective actions for the errors.

- 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 CPUQS: 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 the following table.

Table 9.1 The relation between the error detection pattern, error detection location and error code

| 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 |
| | CPU module | 4000н to 4FFFн | QSCPU User's Manual (Hardware Design, Maintenance and Inspection) |
| | CC-Link Safety master module | B000н to BFFFн | CC-Link Safety System Master Module User's Manual |
| | Ethernet module | C000н to CFFFн | Ethernet Interface Module UserAfs Manual |
| Detection at communication with CPU module | CC-Link IE Field Network master/local module (with safety functions) | D000н to DFFFн | MELSEC-QS CC-Link IE Field Network Master/Local Module User's Manual |
| | CC-Link IE Controller Network module | E000н to EFFFн | CC-Link IE Controller Network Reference Manual |
| | MELSECNET/H module | F000н to FFFFн | 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, information such as the error code and error message for troubleshooting can be read using GX Developer.

To read error codes, follow the instructions described below.

- 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.

For details, refer to the following.

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.

Table9.2 Error code

| Error Code | Error Message | Common Information | Individual Information | LED S | Status ERROR | CPU Operation Status | Diagnostic Timing | |
|------------------------------|--------------------|--------------------|---------------------------|-------|-----------------|----------------------------|-----------------------------------|--|
| (SD0) | | (SD5 to 15) | (SD16 to 26) | | On/ Flash | Status | | |
| 1001 | | | | | On | | | |
| 1002 1003 1004 1006 | MAIN CPU DOWN | - | _ | Off | | Stop | Always | |
| 1009 | | | | | Flash | | | |
| 1010 | END NOT EXECUTE | _ | _ | Off | Flash | Stop | When an END instruction executed. | |
| 1030 | MAIN COLL | | F | | | | | |
| 1031 | MAIN CPU DOWN | - | Error information | Off | Flash | Stop | Always | |

^{*1} BAT.ALM LED is displayed at BATTERY ERROR.

| Erro Cod (SD0 | e Error Contents and Cause | Corrective Action | Corresponding CPU | |
|------------------------------|--|--|----------------------|--|
| 1000 1001 1002 1003 | Runaway or failure of the 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.) | | |
| 1004 1006 | | | QS | |
| 1009 | The power supply module detected an incorrect power waveform. A failure is detected on the power supply module, CPU module, or base unit. | Correct the power waveform applied to the power supply module. 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 | |

| Error | Error | Common | Individual Information | LED | Status | CPU | Diagnostic | |
|--------------------------------------|---|----------------------------|-----------------------------|-----|----------------------|---------------------|--|--|
| Code (SD0) | Message | Information (SD5 to 15) | Information (SD16 to 26) | RUN | ERROR | Operation Status | Timing | |
| 1131 1132 1133 1136 1137 | RAM ERROR | _ | Error information | Off | Flash | Stop | At power-ON/ At reset | |
| 1141 1142 1143 1146 | | | | | Always At power-ON/ | | | |
| 1210 | OPERATION CIRCUIT ERROR | - | Error information | Off | Flash | Stop | At reset/When an END instruction executed | |
| 1311 | I/O INTERRUPT ERROR | - | - | Off | Flash | Stop | During interrupt | |
| 1401 | INTELLIGENT FUNCTION MODULE DOWN | Module No. | - | Off | Flash | Stop | At power ON/ At reset/When intelligent function module is accessed. | |
| 1403 | INTELLIGENT FUNCTION MODULE DOWN | Module No. | _ | Off | Flash | Stop | When an END instruction executed. | |
| 1404 | INTELLIGENT FUNCTION MODULE DOWN | Module No. | - | Off | Flash | 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 | | | |
| 1133 | | | |
| 1136 | A fault was detected in the internal | Hardware error of the CPU module. | |
| 1137 | memory of the CPU module. | (Please consult your local Mitsubishi | QS |
| 1141 | Themory of the Cr o module. | Service or representative.) | |
| 1142 | | | |
| 1143 | | | |
| 1146 | | | |
| 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 | Error | Common | Individual | LED S | Status | CPU | Diagnostic | |
|---------------|--|----------------------------|-----------------------------|-------|--------|---------------------|-----------------------------------|--|
| Code (SD0) | Message | Information (SD5 to 15) | Information (SD16 to 26) | RUN | ERROR | Operation Status | Timing | |
| 1411 | CONTROL- BUS ERROR | Module No. | - | Off | Flash | Stop | At power ON/ At reset | |
| 1413 | CONTROL- BUS ERROR | - | - | Off | Flash | Stop | Always | |
| 1414 | CONTROL- BUS ERROR | - | - | Off | Flash | Stop | When an END instruction executed. | |
| 1415 | CONTROL- BUS ERROR | Base No. | ı | Off | Flash | 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. The lead connector of the CPU module battery is not securely engaged. | Change the battery. Install a lead connector of the battery. Check the lead connector of the CPU module for looseness. Firmly engage the connector if it is loose. | QS |
| 1610 | The number of writing to the standard ROM 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.

Table9.3 Error code

| Error | | Common | LED Status | | CPU | | | |
|---------------|---------------------------|----------------------------|---|-----|-------|---------------------|-----------------------------------|--|
| Code (SD0) | Error Message | Information (SD5 to 15) | Individual Information (SD16 to 26) | RUN | ERROR | Operation Status | Diagnostic Timing | |
| 2000 | MODULE VERIFY ERROR | Module No. | _ | Off | Flash | Stop | When an END instruction executed. | |
| 2100 | MODULE LAYOUT ERROR | Module No. | _ | Off | Flash | Stop | At power ON/ At reset | |
| 2106 | MODULE LAYOUT ERROR | Module No. | _ | Off | Flash | Stop | At power ON/ At reset | |
| 2107 | MODULE LAYOUT ERROR | Module No. | _ | Off | Flash | 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. More than two CC-Link IE Field Network master/local modules (with safety functions) are 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. Mount only one CC-Link IE Field Network master/local module (with safety functions). | 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 | Error | Common | Individual | LED : | Status | CPU | Diagnostic | |
|---------------|---|----------------------------|-----------------------------|-------|--------|---------------------|--------------------------------|--|
| Code (SD0) | Message | Information (SD5 to 15) | Information (SD16 to 26) | RUN | ERROR | Operation Status | Timing | |
| 2112 | INTELLIGENT FUNCTION MODULE ERR. | Module No. | Program error location | Off | Flash | Stop | At an execution of instruction | |
| 2124 | MODULE LAYOUT ERROR | Module No. | _ | Off | Flash | Stop | At power ON/ At reset | |
| 2125 | MODULE LAYOUT ERROR | Module No. | 1 | Off | Flash | Stop | At power ON/ At reset | |
| 2200 | MISSING PARAMETER | Drive No. | - | Off | Flash | Stop | At power ON/ At reset | |
| 2210 | BOOT ERROR | Drive No. | _ | Off | Flash | Stop | At power ON/ At reset | |

| 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 |

| Error | Error | Common Information (SD5 to 15) | Individual | LED S | Status | CPU | Diagnostic | |
|---------------|-----------------------------|--------------------------------------|-----------------------------|-------|--------|---------------------|---------------------------------------|--|
| Code (SD0) | Message | | Information (SD16 to 26) | RUN | ERROR | Operation Status | Timing | |
| 2500 | | | | | | | | |
| 2501 | CAN'T EXECUTE PROGRAM | File name/ Drive No. | _ | Off | Flash | Stop | At power ON/ At reset/ STOP→RUN | |
| 2502 | | | | | | | | |
| 2503 | | | | | | | | |

| Error Code (SD0) | Error Contents and Cause | Corrective Action | Corresponding CPU |
|------------------------|---|---|-------------------|
| 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.

Table9.4 Error code

| Error | | Error | Common | Individual | LED S | Status | CPU | Diagnostic | |
|-------|---------------|-------------------------------|----------------------------|-----------------------------|-------|--------|---------------------|---|--|
| | Code (SD0) | Message | Information (SD5 to 15) | Information (SD16 to 26) | RUN | ERROR | Operation Status | Timing | |
| | 3000 | PARAMETER ERROR | File name/ Drive No. | Parameter number | Off | Flash | Stop | At power ON/ At reset | |
| | 3003 | PARAMETER ERROR | File name/ Drive No. | Parameter number | Off | Flash | Stop | At power ON/ At reset | |
| | 3004 | PARAMETER ERROR | File name/ Drive No. | Parameter number | Off | Flash | Stop | At power ON/ At reset | |
| | 3008 | PARAMETER ERROR | File name/ Drive No. | Parameter number | Off | Flash | Stop | When CC-Link Safety remote station return | |
| | 3100 | NETWORK PARAMETER ERROR | File name/ Drive No. | Parameter number | Off | Flash | Stop | At power ON/ At reset | |

| 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. The parameter settings are corrupted. | 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 |
| 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 |
| 3100 | The number of modules actually mounted is different from that is set in Network parameter for CC-Link IE Field Network. The start I/O number of the module actually mounted is different from that is set in Network parameter for CC-Link IE Field Network. Some data in the parameters are not supported. | 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 ^{*3} |

^{*1} This applies when the serial number (first five digits) of the MELSECNET/H module is "08102" or later.

^{*2} This applies when the serial number (first five digits) of the CPU module is "10031" or earlier.

^{*3} This applies when the serial number (first five digits) of the CPU module is "13042" or later.

| Error | | Error | Common | Individual | LED Status | | CPU | Diagnostic | |
|-------|--------------|-------------------------------|----------------------------|-----------------------------|------------|-------|---------------------|--------------------------|--|
| | Code SD0) | Message | Information (SD5 to 15) | Information (SD16 to 26) | RUN | ERROR | Operation Status | Timing | |
| 310 | | NETWORK PARAMETER ERROR | File name/ Drive No. | Parameter number | Off | Flash | Stop | At power ON/ At reset | |

| Error Code (SD0) | Error Contents and Cause | Corrective Action | Corresponding CPU |
|------------------------|--|---|-------------------|
| | 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 CCLink 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 to change 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 |
| 3100 | 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 thatis 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 to change the station type.) The mode switches of MELSECNET/H module*1 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*1 within the setting range. | QS |

^{*1} This applies when the serial number (first five digits) of the MELSECNET/H module is "08102" or later.

^{*2} This applies when the serial number (first five digits) of the CPU module is "10031" or earlier.

^{*3} This applies when the serial number (first five digits) of the CPU module is "13042" or later.

| Error | Error | Common Information (SD5 to 15) | Individual Information (SD16 to 26) | LED Status | | CPU | Diagnostic | |
|---------------|-------------------------------|--------------------------------------|---|------------|-------|---------------------|--------------------------|--|
| Code (SD0) | Message | | | RUN | ERROR | Operation Status | Timing | |
| 3101 | NETWORK PARAMETER ERROR | File name/ Drive No. | Parameter number | Off | Flash | Stop | At power ON/ At reset | |
| 3102 | NETWORK PARAMETER ERROR | File name/ Drive No. | Parameter number | Off | Flash | Stop | At power ON/ At reset | |
| 3103 | NETWORK PARAMETER ERROR | File name/ Drive No. | Parameter number | Off | Flash | 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. • The refresh parameter for CC-Link IE Field Network is out of the setting range. • The refresh parameter for CC-Link IE Field Network is overlapped with the refresh parameter or the I/O assignment setting for other networks. • 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. | 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 |
| 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 |

^{*1} This applies when the serial number (first five digits) of the MELSECNET/H module is "08102" or later.

^{*2} This applies when the serial number (first five digits) of the CPU module is "10031" or earlier.

^{*3} This applies when the serial number (first five digits) of the CPU module is "13042" or later.

| Error Code (SD0) | Error Message | Common Information (SD5 to 15) | Individual Information (SD16 to 26) | LED S | Status ERROR | CPU Operation Status | Diagnostic Timing | |
|------------------------|-------------------------------|--------------------------------------|---|-------|-----------------|----------------------------|--------------------------|--|
| 3104 | NETWORK PARAMETER ERROR | File name/ Drive No. | Parameter number | Off | Flash | Stop | At power ON/ At reset | |
| 3105 | CC-LINK PARAMETER ERROR | File name/ Drive No. | Parameter number | Off | Flash | Stop | At power ON/ At reset | |
| 3106 | CC-LINK PARAMETER ERROR | File name/ Drive No. | Parameter number | Off | Flash | 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. The refresh parameter for CC-Link IE Field Network is overlapped with the refresh parameter or the I/O assignment setting for other networks. | Check the [Model name] and [Module technical version] of the safety remote station settings, or delete the setting of the safety data monitoring time. Correct and write the network parameters. If the error occurs after correction, it suggests a hardware fault. (Contact your local Mitsubishi representative.) | QS |
| | The safety data monitoring time has been set. | Delete the setting of the safety data monitoring time. | QS ^{*2} |

^{*1} This applies when the serial number (first five digits) of the MELSECNET/H module is "08102" or later.

^{*2} This applies when the serial number (first five digits) of the CPU module is "10031" or earlier.

^{*3} This applies when the serial number (first five digits) of the CPU module is "13042" or later.

| Error | Error | Common | Individual | LED : | Status | CPU | Diagnostic | |
|---------------|-------------------------------|----------------------------|---|-------|--------|---------------------|--------------------------|--|
| Code (SD0) | Message | Information (SD5 to 15) | Information (SD16 to 26) | RUN | ERROR | Operation Status | Timing | |
| 3107 | CC-LINK PARAMETER ERROR | File name/ Drive No. | Parameter number | Off | Flash | Stop | At power ON/ At reset | |
| 3150 | DUPLICAT.NE T.NO. | File name/ Drive No. | Parameter number (A block No. of the switch setting is stored.) | Off | Flash | Stop | At power ON/ At reset | |
| 3400 | REMOTE PASSWORD ERROR | | | Off | Flash | Stop | At power ON/ At reset | |
| 3401 | REMOTE PASSWORD ERROR | | | Off | Flash | Stop | At power ON/ At reset | |

| Error Code (SD0) | Error Contents and Cause | Corrective Action | Corresponding CPU |
|------------------------|--|--|-------------------|
| 3107 | The CC-Link parameter setting is incorrect. | Correct and write the network parameters. If the error occurs after correction, it suggests a hardware fault. (Contact your local Mitsubishi representative.) | QS |
| 3150 | The network No. set in Network parameter for CC-Link IE Field Network is overlapped with the one set for another network module. | Check the parameter setting. | QS ^{*3} |
| 3400 | The start I/O number of the target module in Remote password is set to other than 0н to 3E0н. | Change the start I/O number of the target module to the number within 0н to 3E0н. | 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} This applies when the serial number (first five digits) of the MELSECNET/H module is "08102" or later.

^{*2} This applies when the serial number (first five digits) of the CPU module is "10031" or earlier.

^{*3} This applies when the serial number (first five digits) of the CPU module is "13042" or later.

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.

Table9.5 Error code

| Error | Error | Common | Individual | LED S | Status | CPU | Diagnostic | |
|---------------|----------------------------|----------------------------|-----------------------------|------------|--------|---------------------|---------------------------------------|--|
| Code (SD0) | Message | Information (SD5 to 15) | Information (SD16 to 26) | RUN | ERROR | Operation Status | Timing | |
| 4000 | INSTRUCTION CODE ERROR | Program error location | _ | Off | Flash | Stop | At power ON/ At reset/ STOP→RUN | |
| 4002 | INSTRUCTION CODE ERROR | Program error location | I | Off | Flash | Stop | At power ON/ At reset/ STOP→RUN | |
| 4003 | INSTRUCTION CODE ERROR | Program error location | - | Off | Flash | Stop | At power ON/ At reset/ STOP→RUN | |
| 4004 | INSTRUCTION CODE ERROR | Program error location | - | Off | Flash | Stop | At power ON/ At reset/ STOP→RUN | |
| 4010 | MISSING END INSTRUCTION | Program error location | - | Off | Flash | Stop | At power ON/ At reset/ STOP→RUN | |
| 4100 | OPERATION ERROR | Program error location | - | Off/ On | Flash | Stop | When instruction executed. | |
| 4101 | OPERATION ERROR | Program error location | - | Off/ On | Flash | 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. An unusable safety FB is included in the program. | | 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. | Read the common information of the error using a GX Developer, check error step corresponding to its numerical value (program error location), and | QS | |
| 4003 | The number of devices for the dedicated instruction specified in the program is incorrect. | correct the problem. | Q.O | |
| 4004 | The device, which cannot be used by the dedicated instruction specified in the program, is specified. | | | |
| 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 | |
| 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 the GX Developer, check error step corresponding to its numerical value (program error location), and correct the problem. | QS | |

| | Error | Error | Common | Individual | rmation RIIN ERROR Op | | CPU | Diagnostic | |
|---|---------------|------------------------------|----------------------------|-----------------------------|-----------------------|-------|---------------------|--|--|
| | Code (SD0) | Message | Information (SD5 to 15) | Information (SD16 to 26) | | | Operation Status | Timing | |
| 4 | 102 | OPERATION ERROR | Program error location | - | Off | Flash | Stop | At an execution of instruction | |
| 4 | 700 | PROGRAM ABORT EXECUTED | Program error location | Aborted program information | Off | Flash | Stop | When executing the S.QSABORT instructions. | |

| Error Code (SD0) | Error Contents and Cause | Corrective Action | Corresponding CPU |
|------------------------|--|---|-------------------|
| 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 the GX Developer, check error step corresponding to its numerical value (program error location), and correct the problem. | 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.

Table9.6 Error code

| Error | Error Message | Common | Individual | LED S | Status | CPU | Diagnostic | |
|---------------|------------------------------|----------------------------|--------------------------------------|-------|--------|---------------------|------------|--|
| Code (SD0) | | Information (SD5 to 15) | Information (SD16 to 26) | RUN | ERROR | Operation Status | Timing | |
| 5001 | WDT ERROR | Time (value set) | Time (value actually measured) | Off | Flash | 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.

Table9.7 Error code

| | Tables. First code | | | | | | | | |
|---------------|-------------------------------------|----------------------------|------------------------------|-------|--------|---------------------|---|--|--|
| Error | Error | Common | Individual | LED S | Status | CPU | Diagnostic | | |
| Code (SD0) | Message | Information (SD5 to 15) | Information (SD16 to 26) | RUN | ERROR | Operation Status | Timing | | |
| 8000 | INTERNAL REGISTER ERROR | _ | Error information | Off | Flash | Stop | At power ON/ At reset/When an END instruction executed. | | |
| 8010 | INTERNAL BUS ERROR | _ | Error information | Off | Flash | Stop | At power ON/ At reset/When an END instruction executed. | | |
| 8020 | CPU A & B | | | | | | Always | | |
| 8021 | CAN'T BE SYNCHRO- NIZED | _ | Error information | Off | Flash | Stop | When an END instruction executed. | | |
| 8031 | INCORRECT FILE | - | Diagnostics file information | Off | Flash | Stop | At power ON/ At reset | | |
| 8032 | INCORRECT FILE | - | Diagnostics file information | Off | Flash | Stop | When an END instruction executed. | | |
| 8050 | SAFETY OUTPUT VERIFY ERROR | Module No./ Station No. | _ | Off | Flash | Stop | 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****", the "USER" LED turns on.

| 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. | |
| 8021 | Mismatch of program execution times is detected between CPU A and CPU B. | If the same error is displayed again, this suggests a CPU module hardware fault. (Contact your local Mitsubishi representative.) | QS |
| 8031 | | The file indicated by the individual information SD17~SD22 is written into | |
| 8032 | Error of a file stored in the program memory or the standard ROM is detected. | 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 |
| 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 |

 $^{^{\}star}3$ This applies when the serial number (first five digits) of the CPU module is "13042" or later.

| Error | Error | Common | Individual | LED \$ | Status | CPU | Diagnostic | |
|---------------|---|----------------------------|-----------------------------|----------|----------------------------|--------------------------|---|--|
| Code (SD0) | Message Message | Information (SD5 to 15) | Information (SD16 to 26) | RUN | ERROR | Operation Status | Diagnostic Timing | |
| 8060 | INCORRECT FIRMWARE | _ | Error information | Off | Flash | Stop | At power ON/ At reset/When an END instruction executed. | |
| 8070 | | | | | | | | |
| 8071 | INTERNAL CPU | | | | | | At power ON/ At reset | |
| 8072 | COMMUNI- CATION | _ | Error information | Off | Flash | Stop | | |
| 8073 | ERROR | | | | | | When an END instruction | |
| 8074 | | | | | | | executed. | |
| 8080 | POWER SUPPLY ERROR | _ | Error information | Off | Off/On | Stop | Always | |
| 8090 | VOLTAGE DIAGNOSIS ERROR | - | Error information | Off | Flash | 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 | Flash | Stop | Always | |
| 8300 | CC-LINK REMOTE DETECTION ERROR | CC-Link Safety information | CC-Link Safety information | Off/On*1 | Flash/ 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****", the "USER" LED turns on.

| Error Code (SD0) | Error Contents and Cause | Corrective Action | Corresponding CPU |
|------------------------|--|--|-------------------|
| 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 |
| 8070 | The initial communication between CPU A and CPU B was unsuccessful. | | |
| 8071 | CPU A and CPU B cannot send data to each other. | Take measure against noise.Reset it and run it again. | |
| 8072 | CPU A and CPU B cannot receive data from each other. | If the same error is displayed again, this suggests a CPU module hardware fault. | QS |
| 8073 | CPU A and CPU B cannot send data to each other. | (Contact your local Mitsubishi representative.) | |
| 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 |

 $^{^{\}star}3$ This applies when the serial number (first five digits) of the CPU module is "13042" or later.

| Error Code | Error Message | Common Information (SD5 to 15) | Individual Information (SD16 to 26) | LED S | Status ERROR | CPU Operation Status | Diagnostic Timing | |
|------------------------|---|--------------------------------------|---|----------|----------------------------|----------------------------|---|--|
| (SD0) 8310 | CC-LINK PRODUCT INFO. MISMATCH | CC-Link Safety information | CC-Link Safety information | Off/On*1 | Flash/ On ^{*1} | Stop/ Continues *1 | Always | |
| 8320 | | | | | | | While initializing remote station | |
| 8321 | | | | | | | Always | |
| 8322 | CC-LINK DATA RECEPTION TIMEOUT | CC-Link Safety information | CC-Link Safety information | Off/On*1 | Flash/ On ^{*1} | Stop/ Continues *1 | 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****", the "USER" LED turns on.

| 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 | QS |
| 8321 | The response data cannot be received during the normal communication with CC-Link Safety remote station. | (2)Writing the program memory to ROM (3)Registration/change of the CPU | QS |
| 8322 | The response data cannot be received during processing error information from CC-Link Safety remote station. | access password (4)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 time is appropriate. • Check if the setting value of the Safety data monitoring timer is appropriate. | QS |

 $^{^{\}star}3$ This applies when the serial number (first five digits) of the CPU module is "13042" or later.

| Error Code | Error | Common Information | Individual Information | | Status | CPU Operation | Diagnostic | |
|---------------|---|--|--|----------|------------------|--------------------------|--|--|
| (SD0) | Message | (SD5 to 15) | (SD16 to 26) | RUN | ERROR | Status | Timing | |
| 8330 | ' | | | | | 1 | | |
| 8331 | | | | | | | | |
| 8332 | CC-LINK RECEIVED DATA ERROR | RECEIVED CC-Link Safety CC-Li | CC-Link Safety information | Off/On*1 | 1 Flash/ On*1 | Stop/ Continues *1 | Always | |
| 8333 | | | | | | | | |
| 8334 | | | | | | | | |
| 8400 | CC IE ANOTHER MODULE DETECT ERR. | Error classification, error item, network No., station No. | CC-Link IE Field Network information | On | On | Continue | Always | |
| 8410 | CC IE PRODUCT INFO. MISMATCH | Network No., station No. | CC-Link IE Field Network information | On | On | Continue | When connection with safety stations established | |

 ^{*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****", the "USER" LED turns on.

| 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. | QS |
| 8331 | Lapse in separated receiving data has occurred. | Hardware error of the CC-Link Safety master module or the relevant CC- Link Safety remote module (Contact your local Mitsubishi representative.) | 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 received 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 |
| 8400 | Safety communication target station detection error (Error information is received from a safety communication target station on CC-Link IE Field Network.) | Check the error code of the communication target station on CC-Link IE Field Network. | QS ^{*3} |
| 8410 | Safety station product information mismatch ("Model name" or "Production information" of a safety station is incorrect.) | It may be malfunction due to noise. Check the soundness of transmission path by performing the CC-Link IE Field Network diagnostics. Check the distance between power lines and communication cables, and the installation status of each device as well. | QS ^{*3} |

 $^{^{\}star}3$ This applies when the serial number (first five digits) of the CPU module is "13042" or later.

| Error | Error | Common | Individual | LED | Status | CPU | Diagnostic | |
|---------------|------------------------------------|-----------------------------|--|-----|--------|---------------------|------------------|--|
| Code (SD0) | Message | Information (SD5 to 15) | Information (SD16 to 26) | RUN | ERROR | Operation Status | Timing | |
| | | | | | | | When | |
| 8420 | | | | | | | connection | |
| 0.20 | | | | | | | established with | |
| | | | | | | | safety stations | |
| 8421 | | | | | | | Always | |
| | | | | | | | When an error | |
| 8422 | | | | | | | received from a | |
| | | | | | | | safety station | |
| 8423 | | | | | | | | |
| 8424 | CC IE DATA RECEPTION TIMEOUT | Network No., station No. | CC-Link IE Field Network information | On | On | Continue | 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****", the "USER" LED turns on.

| Error Code (SD0) | Error Contents and Cause | Corrective Action | Corresponding CPU | | | |
|------------------------|---|---|----------------------|--|--|--|
| 8420 | | Check that the following operations are not performed. 1) Switching the operation mode 2) Writing the program memory to | | | | |
| 8421 | | ROM | | | | |
| 8422 | | Registration/change of the CPU access password Initialization of PLC memory | | | | |
| 8423 | | 5) Monitoring, diagnostics | | | | |
| 8424 | Safety monitoring timeout error (A timeout error occurred during safety communication.) | (If executed, this error may occur due to the increase of the interval between data communications of CC-Link IE Field.) It may be malfunction due to noise. Check the soundness of transmission path by performing the CC-Link IE Field Network diagnostics. Check the distance between power lines and communication cables, and the installation status of each device as well. | QS ^{*3} | | | |

 $^{^{\}star}3$ This applies when the serial number (first five digits) of the CPU module is "13042" or later.

| Error Code | Error | Common Information | Individual Information | LED S | Status ERROR | CPU Operation | Diagnostic | |
|---------------|------------------------------|--------------------------|--------------------------------------|-------|-----------------|------------------|------------|--|
| (SD0) 8425 | CC IE DATA RECEPTION TIMEOUT | Network No., station No. | CC-Link IE Field Network information | On | On | Continue | Timing | |

 ^{*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****, the "USER" LED turns on.

| Error Code (SD0) | Error Contents and Cause | Corrective Action | Corresponding CPU |
|------------------------|---|---|----------------------|
| 8425 | Safety monitoring timeout error (A timeout error occurred during safety communication.) | Check that the following operations are not performed. 1) Switching the operation mode 2) Writing the program memory to ROM 3) Registration/change of the CPU access password 4) Initialization of PLC memory 5) Monitoring, diagnostics (If executed, this error may occur due to the increase of the interval between data communications of CC-Link IE Field.) Check that the transmission interval monitoring time for the target station is correctly set. It may be malfunction due to noise. Check the soundness of transmission path by performing the CC-Link IE Field Network diagnostics. Check the distance between power lines and communication cables, and the installation status of each device as well. | QS ^{*3} |

 $^{^{\}star}3$ This applies when the serial number (first five digits) of the CPU module is "13042" or later.

| Error Code (SD0) | Error Message | Common Information (SD5 to 15) | Individual Information (SD16 to 26) | LED S | Status ERROR | CPU Operation Status | Diagnostic Timing | |
|------------------------|--|--------------------------------------|--|-------|-----------------|----------------------------|----------------------------|--|
| 8426 | CC IE DATA RECEPTION TIMEOUT | Network No., station No. | CC-Link IE Field Network information | On | On | Continue | Always | |
| 8431 8432 | CC IE RECEIVED DATA ERROR | Network No., station No. | CC-Link IE Field Network information | On | On | Continue | Always | |
| 8440 | CC IE CONNECTIO N SETTING ERROR | Network No., station No. | CC-Link IE Field Network information | On | On | Continue | Always | |
| 9000 | F*** *2 | Program error location | Annunciator number | On | Off | Continue | When instruction executed. | |

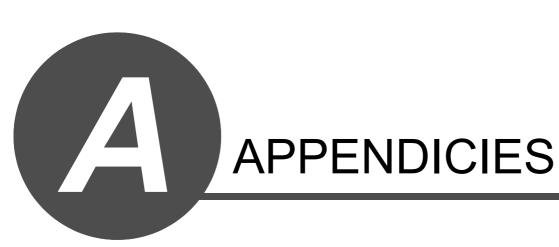
The operating status of a CPU module in case of an error can be set in the "Operation settings during remote station error" of "Parameter". The default is set to "Stop" (The LED indication changes according to the status).

*2 At occurrence of "F****", the "USER" LED turns on.

| Error Code (SD0) | Error Contents and Cause | Corrective Action | Corresponding CPU |
|------------------------|---|--|-------------------|
| 8426 | Safety monitoring timeout error (A timeout error occurred during safety communication.) | Check that the following operations are not performed. Switching the operation mode Writing the program memory to ROM Registration/change of the CPU access password Initialization of PLC memory Monitoring, diagnostics (If executed, this error may occur due to the increase of the interval between data communications of CC-Link IE Field.) Set the larger value for the safety refresh monitoring time. Or set the smaller value for the transmission interval monitoring time. It may be malfunction due to noise. Check the soundness of transmission path by performing the CC-Link IE Field Network diagnostics. Check the distance between power lines and communication cables, and the installation status of each device as well. | QS*3 |
| 8430 | | It may be malfunction due to noise. | |
| 8431 8432 | Safety station reception data error (Incorrect data is received.) | Check the soundness of transmission path by performing the CC-Link IE Field Network diagnostics. Check the distance between power lines and communication cables, and the installation status of each device as well. | QS*3 |
| 8440 | Safety connection setting error (Incorrect CID is received.) | Check that safety connection is correctly set for own station. | QS ^{*3} |
| 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 |

^{*3} This applies when the serial number (first five digits) of the CPU module is "13042" or later.

| Memo | | | |
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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

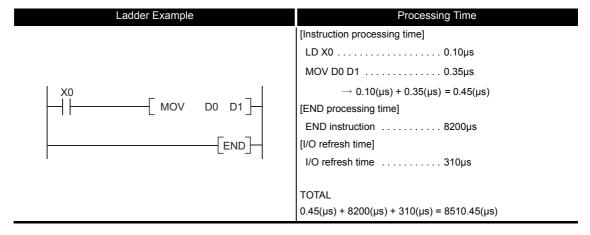
END instruction processing time is the total of the following processing times.

- END instruction processing time shown in Appendix 1.2
- CC-Link IE Field Network, 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 Field Network, 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 (μ s) = Number of I/O points \times 0.224 + 310 (μ s)

- (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:



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 | X0 | | 0.10 |
| ANI OR ORI | DO | 0.0 | 0.15 |
| LDP LDF ANDP | хо | | 0.15 |
| ANDF ORP ORF | D0.0 | | 0.10 |
| ANB ORB MPS MRD MPP | _ | | 0.10 |
| INV | | executed | 0.10 |
| MEP MEF | When not executed When executed | | 0.15 |
| EGP | When not executed When executed | $(OFF \rightarrow OFF)$ $(ON \rightarrow ON)$ $(OFF \rightarrow ON)$ $(ON \rightarrow OFF)$ | 0.10 |
| | When not | (OFF→OFF) | 11 |
| EGF | executed | (ON→ON) | 14 |
| LGI | When | (OFF→ON) | 14 |
| | executed | (ON→OFF) | 16 |

| Instruction | | C | onditions (Device) | | Processing Time (µs) |
|-------------|------|-------------------------------|-------------------------------|---|----------------------|
| | | When no | | | |
| | Y | change | | | |
| | | When | (OFF→ON) | | 0.10 |
| | | changed (ON→OFF) | | | |
| | | When no | (, | | |
| | | changed $(ON \rightarrow ON)$ | | | |
| | D0.0 | When | (OFF→ON) | | 0.20 |
| | | change | , | | |
| | | onango | When OFF | | 18 |
| OUT | F | When | When displayed | | 370 |
| | | ON | Display completed | | 240 |
| | | | /hen not executed | | 0.55 |
| | | | After Time Up | | 0.55 |
| | Т | When | | K | 0.55 |
| | | executed | When added | D | 0.60 |
| | | W | /hen not executed | | 0.55 |
| | | 100 | After Time Up | | 0.55 |
| | С | When executed | When added | K | 0.55 |
| | | executed | when added | D | 0.60 |
| | | W | hen not executed | | 0.55 |
| OUTH | Т | When | After Time Up | | 0.55 |
| 00111 | | executed | When added | K | 0.55 |
| | | | | D | 0.60 |
| | | W | /hen not executed | | 0.10 |
| | | | When not changed | i | 0.10 |
| | Y | When | (ON→ON) | | |
| | | executed | When changed | | 0.10 |
| | | | (OFF→ON) | | 0.00 |
| OFT | | W | /hen not executed | | 0.20 |
| SET | D0 0 | \ | When not changed | 1 | 0.20 |
| | D0.0 | When executed | (ON→ON) | | |
| | | executed | When changed | | 0.20 |
| | | 10 | (OFF→ON) /hen not executed | | 0.25 |
| | F | When | When displayed | | 365 |
| | | executed | Display completed | | 235 |
| | | CACCUICU | Display Completed | | 200 |

| Instruction | | Co | onditions (Device) | Processing Time (µs) |
|---------------|------|----------------------|---------------------------|----------------------|
| | | W | hen not executed | 0.10 |
| | | | When not changed | 0.10 |
| | Υ | When | $(OFF {\rightarrow} OFF)$ | 0.10 |
| | | executed | When changed | 0.10 |
| | | | $(ON \rightarrow OFF)$ | |
| | | W | hen not executed | 0.20 |
| | | | When not changed | 0.20 |
| | D0.0 | When | (ON→ON) | 0.20 |
| | | executed | When changed | 0.20 |
| RST | | | (OFF→ON) | |
| | SM | | hen not executed | 0.10 |
| | | | When executed | 0.10 |
| | | When not executed | | 0.25 |
| | F | When | When displayed | 115 |
| | | executed | 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 | Υ | | /hen not executed | 0.25 |
| | | When executed | | 4.9 |
| MC | | MO | | 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 \times (Number of steps of each instruction +1) μs

| Instruction | Condition | Processing Time (µs) | |
|-------------|-----------------------------|-----------------------------|------|
| LD = | When continu | 0.40 | |
| LD = | When no | continuity | 0.40 |
| | When no | t executed | 0.35 |
| AND = | When executed | When continuity established | 0.40 |
| | vviien executed | When no continuity | 0.40 |
| | When no | t executed | 0.35 |
| OR = | When executed | When continuity established | 0.40 |
| | vviien executed | When no continuity | 0.40 |
| LD <> | When continu | uity established | 0.40 |
| LD < > | When no | continuity | 0.40 |
| | When no | 0.35 | |
| AND <> | When executed | When continuity established | 0.40 |
| | | When no continuity | 0.40 |
| | When no | 0.35 | |
| OR <> | When executed | When continuity established | 0.40 |
| | | When no continuity | 0.40 |
| LD> | When continu | 0.40 | |
| LU / | When no | 0.40 | |
| | When no | 0.35 | |
| AND > | When executed | When continuity established | 0.40 |
| | vvnen executed | When no continuity | 0.40 |
| OR > | When no | 0.35 | |
| | When executed | When continuity established | 0.40 |
| | vvnen executed | When no continuity | 0.40 |
| LD <= | When continuity established | | 0.40 |
| LD \ = | When no | 0.40 | |

| Instruction | Condition | ons (Device) | Processing Time (µs) |
|-------------|-------------------|-----------------------------|----------------------|
| | | not executed | 0.35 |
| AND < = | | When continuity established | 0.40 |
| | When executed | When no continuity | 0.40 |
| | When r | not executed | 0.35 |
| OR < = | \M/han avagutad | When continuity established | 0.40 |
| | When executed | When no continuity | 0.40 |
| LD < | When conti | nuity established | 0.40 |
| LU | When r | no continuity | 0.40 |
| | When r | not executed | 0.35 |
| AND < | When executed | When continuity established | 0.40 |
| | When executed | When no continuity | 0.40 |
| | When r | not executed | 0.35 |
| OR < | When executed | When continuity established | 0.40 |
| | When executed | When no continuity | 0.40 |
| LD > = | When conti | nuity established | 0.40 |
| LU / - | When r | no continuity | 0.40 |
| | When r | not executed | 0.35 |
| AND > = | When executed | When continuity established | 0.40 |
| | Wileit executed | When no continuity | 0.40 |
| | When r | 0.35 | |
| OR > = | When executed | When continuity established | 0.40 |
| | | When no continuity | 0.40 |
| LDD = | When conti | nuity established | 0.50 |
| LDD = | When r | 0.50 | |
| | When r | 0.40 | |
| ANDD = | When executed | When continuity established | 0.50 |
| | | When no continuity | 0.50 |
| | When r | not executed | 0.40 |
| ORD = | When executed | When continuity established | 0.50 |
| | | When no continuity | 0.50 |
| LDD <> | When conti | nuity established | 0.50 |
| | When r | no continuity | 0.50 |
| | When not executed | | 0.40 |
| ANDD <> | When executed | When continuity established | 0.50 |
| | | When no continuity | 0.50 |
| | When r | not executed | 0.40 |
| ORD <> | When executed | When continuity established | 0.50 |
| | | When no continuity | 0.50 |
| LDD > | | nuity established | 0.50 |
| | | no continuity | 0.50 |
| | When r | not executed | 0.40 |
| ANDD > | When executed | When continuity established | 0.50 |
| | | When no continuity | 0.50 |
| | When r | 0.40 | |
| ORD > | When executed | When continuity established | 0.50 |
| | | When no continuity | 0.50 |
| LDD < = | | nuity established | 0.50 |
| | When r | 0.50 | |

| Instruction | Condition | is (Device) | Processing Time (µs) |
|---------------|------------------------|-----------------------------|----------------------|
| | | t executed | 0.40 |
| ANDD < = | | When continuity established | 0.50 |
| | When executed | When no continuity | 0.50 |
| | When no | t executed | 0.40 |
| ORD < = | | When continuity established | 0.50 |
| | When executed | When no continuity | 0.50 |
| | When continu | ity established | 0.50 |
| LDD < | When no | continuity | 0.50 |
| | When no | t executed | 0.40 |
| ANDD < | VA/In a series out and | When continuity established | 0.50 |
| | When executed | When no continuity | 0.50 |
| | When no | t executed | 0.40 |
| ORD < | When executed | When continuity established | 0.50 |
| | When executed | When no continuity | 0.50 |
| LDD > - | When continu | ity established | 0.50 |
| LDD > = | When no | continuity | 0.50 |
| | When no | t executed | 0.40 |
| ANDD > = | When executed | When continuity established | 0.50 |
| | when executed | When no continuity | 0.50 |
| | When no | t executed | 0.40 |
| ORD > = | When executed | When continuity established | 0.50 |
| | when executed | When no continuity | 0.50 |
| + (S) (D) | When | executed | 0.50 |
| +P (S) (D) | VVIIGIT | executed | 0.50 |
| + S1 S2 D | | | |
| +P S1 S2 D | When e | executed | 0.60 |
| + (S) (D) | | | |
| - P S D | When executed | | 0.50 |
| + (5) (2) (D) | | | |
| | When e | 0.60 | |
| - P §1 §2 D | | | |
| D+ (S) (D) | When e | 0.65 | |
| D+P S D | | | |
| D+ \$1 \$2 D | When e | executed | 0.75 |
| D+P \$1 \$2 D | | | |
| D - (S) (D) | Whon | executed | 0.65 |
| D-PSD | VVIIGH | skeculeu | 0.03 |
| D - S1 S2 D | | | |
| D-P \$1 \$2 D | When 6 | executed | 0.75 |
| * \$1 \$2 D | | | |
| * P \$1 \$2 D | When e | 0.55 | |
| | | | |
| / §1) §2) D | - | | 14 |
| /P §) §2 D | | | |
| D * \$1 \$2 D | _ | 42 | |
| D*P \$1 \$2 D | | | |
| D/ S1 S2 D | | 25 | |
| D/P §1 §2 D | · | | 25 |
| | | | • |

| Instruction | Conditions (Device) | Processing Time (µs) |
|-------------|---------------------------------|----------------------|
| INC | _ | 0.35 |
| INCP | _ | 0.55 |
| DINC | _ | 0.45 |
| DINCP | | 0.40 |
| DEC | _ | 0.35 |
| DECP | | |
| DDEC | _ | 0.45 |
| DDECP | | |
| BCD | _ | 16 |
| BCDP | | - |
| DBCD | _ | 23 |
| DBCDP | | |
| BIN | _ | 15 |
| BINP | | |
| DBIN | _ | 18 |
| DBINP | | |
| NEG | _ | 14 |
| NEGP | | |
| DNEG | _ | 15 |
| DNEGP | | |
| MOV | (S) = D0, (D) = D1 | 0.35 |
| MOVP | <u> </u> | |
| DMOV | □ □ □ □ □ □ □ | 0.45 |
| DMOVP | (§) = D0, (D) = D1 | 0.10 |
| CML | _ | 0.35 |
| CMLP | _ | 0.55 |
| DCML | _ | 0.45 |
| DCMLP | | 0.40 |
| BMOV S D n | n = 1 | 35 |
| BMOVP ® D n | n = 96 | 67 |
| FMOV S D n | n = 1 | 30 |
| FMOVP S D n | n = 96 | 48 |

(3) Application instructions

The processing time when the instruction is not executed is calculated as follows: $0.10 \times (Number \ of \ steps \ of \ each \ instruction \ +1) \ \mu s$

| Instruction | Conditions (Device) | Processing Time (µs) |
|-------------------------------------|---------------------|----------------------|
| WAND S D WANDP S D | When executed | 0.50 |
| WAND SI SI D WANDP SI SI D | When executed | 0.60 |
| DAND S D DANDP S D | When executed | 0.65 |
| DAND (S) (S) (D) DANDP (S) (S) (D) | When executed | 0.75 |
| WOR S D WORP S D | When executed | 0.50 |
| WOR (§) (§) (D) WORP (§) (§) (D) | When executed | 0.60 |
| DOR S D DORP S D | When executed | 0.65 |
| DOR (S) (S) (D) DORP (S) (S) (D) | When executed | 0.75 |
| WXOR S D WXORP S D | When executed | 0.50 |
| WXOR \$1 \$2 D WXORP \$1 \$2 D | When executed | 0.60 |
| DXOR S D DXORP S D | When executed | 0.65 |
| DXOR \$1 \$2 (D) DXORP \$1 \$2 (D) | When executed | 0.75 |
| WXNR ® D WXNRP ® D | When executed | 0.50 |
| WXNR \$1 \$2 D WXNRP \$1 \$2 D | When executed | 0.60 |
| DXNR S D DXNRP S D | When executed | 0.65 |
| DXNR (S) (S) (D) DXNRP (S) (S) (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 | f special register | | | |
| Meaning | Indicates contents | s of special register | | | |
| Explanation | Discusses conten | Discusses contents of special register in more detail | | | |
| Set by (When set) | <set by=""> S: Set by s U: Set by u S/U: Set by b <when set=""> Indicated only for r Every END Initial Status change Error</when></set> | the relay is set by the system or user, and, if it is set by the system, when setting is performed. ystem ser (sequence programs or test operations from GX Developer) oth system and user egisters set by system : Set during every END processing : Set only during initial processing (when power supply is turned ON, or when going from STOP to RUN) : Set only when there is a change in status : Set when error occurs on: Set when instruction is executed : 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) | |
| 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) | QS |
| 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) | |
| 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. | C | |
| 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) | QS |
| 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 | ON ————OFF | Normally is ON | S (Every END) | |
| SM401 | Always OFF | ON OFF — | Normally is OFF | S (Every END) | |
| SM402 | After RUN, ON for 1 scan only | ON 1 scan | After RUN, ON for 1 scan only. | S (Every END) | |
| SM403 | After RUN, OFF for 1 scan only | ON 1 scan | After RUN, OFF for 1 scan only. | S (Every END) | |
| SM410 | 0.1 second clock | 0.05s 0.05s | | | QS |
| SM411 | 0.2 second clock | 0.1s 0.1s | Repeatedly changes between ON and OFF at each designated time interval. When programmable controller power supply | S (Status change) | |
| SM412 | 1 second clock | 0.5s 0.5s | is turned ON or a CPU module reset is performed, goes from OFF to start. | S (Status change) | |
| SM413 | 2 second clock | 1s 1s | | | |
| SM414 | 2n second clock | ns ns | This relay alternates between ON and OFF at intervals of the time (unit: s) specified in SD414. When programmable controller power supply is turned ON 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) | 39 |

(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 refresh communication status of each safety remote station (Safety master module 1) | OFF : Normal ON : Communication error | The safety station refresh communication status is stored. (The status of each station are stored in SD1004 to SD1007.) | S (Status change) | QS | |
| SM1204 | Safety refresh communication status of each safety remote station (Safety master module 2) | OFF : Normal 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) | QO | |

(8) CC-Link IE Field Network

TableApp.2.9 Special relay

| Number | Name | Meaning | Explanation | Set by (When Set) | Corresponding CPU |
|--------|--|--|--|----------------------|-------------------|
| SM1400 | Setting status of safety communication with master station | OFF: Not set ON: Set | The setting status of safety communication with the master station is stored. | S (Initial) | |
| SM1420 | Safety refresh communication status of each safety station | OFF: Normal (excluding safety refresh communication with the master station) ON: Communication error | The safety refresh communication status with each safety station (excluding the master station) is stored. (The status of each safety station is stored in SD1420 to SD1427.) | | |
| SM1421 | Safety refresh communication status of safety master station | OFF: Normal or safety communication with master station on CC-Link IE Field Network not set ON: Safety refresh communication error | The safety refresh communication status with the master station is stored. When safety communication with the master station is not set in parameter or own station is the master station, this bit turns OFF. | S (Status change) | QS*1 |
| SM1700 | Safety master station interlock status | OFF: Not interlocked ON: Interlocked | When an error is detected and an interlock is activated, this bit turns ON. | | |
| SM1720 | Safety master station interlock release request | OFF: I/O interlock of safety station on CC-Link IE Field Network not released ON: I/O interlock of safety station on CC-Link IE Field Network released | The safety station interlock status is released by changing this bit from OFF to ON. | U | |

 $^{^{\}star}$ 1: This applies when the serial number (first five digits) of the CPU module is "13042" or later.

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

| Function of Item | | | | | | |
|--|--|--|--|--|--|--|
| Indicates special region | Indicates special register number | | | | | |
| Indicates name of sp | ecial register | | | | | |
| Indicates contents of | special register | | | | | |
| Discusses contents of | f special register in more detail | | | | | |
| Discusses contents of special register in more detail 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 RUStatus 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.) | | | | | | |
| | Indicates name of sp Indicates contents of Discusses contents of Discusses contents of Indicates whether the Set by> S: Set by syste U: Set by user S/U: Set by both When set> Indicated only for regist Every END Initial Status change Error | | | | | |

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.

(9) 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) | |
| SD1 | | | Stores the year (last two digits) and month when SD0 data was updated as BCD 2-digit code. b15 to b8 b7 to b0 (Example) September, 2006 Year (0 to 99) Month (1 to 12) H0609 | | |
| SD2 | Clock time for diagnosis error occurrence | Clock time for diagnosis error occurrence | Stores the day and hour when SD0 data was updated as BCD 2-digit code. b15 to b8 b7 to b0 (Example) 10 a.m. on 25th Day (1 to 31) Hour (0 to 23) H2510 | S (Error) | |
| SD3 | | | Stores the minute and second when SD0 data was updated as BCD 2-digit code. b15 to b8 b7 to b0 (Example) 35 min. 48 sec. Minutes (0 to 59) Seconds (0 to 59) 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 | S (Error) | QS |

TableApp.3.2 Special register

| Number | Name | Meaning | Explanation | Set by (When set) | Corresponding CPU |
|--------|--------------------------------|--------------------------|--|----------------------|----------------------|
| SD5 | | | Common information corresponding to the error codes (SD0) is stored here. | | |
| SD6 | | | The following seven types of information are stored here: Module No./Base No. | | |
| SD7 | | | Number Meaning | | |
| SD8 | | | SD10 SD11 SD12 SD13 SD14 | | |
| SD9 | | | *1: The storing value "255" in SD5 (Slot No.) indicates that the slot number for a module specified by an instruction cannot | | |
| SD10 | Error common information | Error common information | 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 | S (Error) | QS |
| SD11 | | | 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 | or | |
| SD12 | | | location can be identified in SD5. 2) File name/Drive name Number Meaning (Example) File name = | | |
| SD13 | | | SD5 Drive MAIN.QPG b15 to b8 b7 to b0 | | |
| SD14 | | | SD10 Extension *3 2EH(.) SD11 (ASCII code: 3 characters) SD12 SD13 (Empty) SD14 (Empty) SD14 SD14 SD14 SD14 SD14 SD14 SD15 SD16 SD16 SD17 SD17 SD17 SD18 SD18 | | |
| SD15 | | | SD14 SD15 | | |

Remark

*3 : Extensions are shown in TableApp.3.3.

TableApp.3.3Extension name

| SDn | SDI | n+1 | Extension | File type | |
|---------------|--------------|---------------|-----------|------------------|--|
| Higher 8 bits | Lower 8 bits | Higher 8 bits | name | i lie type | |
| 51H | 50H | 41H | QPA | Parameters | |
| 51H | 50H | 47H | QPG | Sequence program | |
| 51H | 43H | 44H | QCD | Device comment | |

TableApp.3.2 Special register

| Number | Name | Meaning | Explanation | Set by (When set) | Corresponding CPU |
|--------|-------------|--------------|---|----------------------|-------------------|
| | | | 3) Time (value set) | | |
| | | | Number Meaning | | |
| SD5 | | | SD5 Time : 1µs units (0 to 999µs) | | |
| ODO | | | SD6 Time : 1ms units (0 to 65535ms) | | |
| | | | SD7 | | |
| | | | SD9 | | |
| | | | SD10 | | |
| | | | SD11 (Empty) | | |
| SD6 | | | SD12 SD13 | | |
| | | | SD14 | | |
| | | | SD15 | | |
| | 1 | | 4) Program error location | | |
| | | | Number Meaning | | |
| | | | SD5 | | |
| SD7 | | | SD6 File name SD7 (ASCII code: 8 characters) | | |
| | | | SD8 | | |
| | | | SD9 Extension *3 2EH(.) | | |
| | 1 | | SD10 (ASCII code: 3 characters) | | |
| | | | SD11 (Empty) SD12 Block No.*4 | | |
| 000 | | | SD12 Block No.**4 | | |
| SD8 | | | SD14 Sequence step No. (L) | | |
| | | | SD15 Sequence step No. (H) | | |
| | | | *4: "0" is stored to the block number and the step number. 9) CC-Link Safety information | | |
| | | | Number Meaning | | |
| SD9 | | | SD5 Error classification*5 | | |
| 020 | | | SD6 Error item*5 SD7 Link ID | | |
| | | | SD8 Station No. | | |
| | 1 | | SD9 System area 1 | | |
| | | | SD10 System area 2 | | |
| | Error | | SD11 System area 3 SD12 System area 4 | | |
| SD10 | common | Error common | SD13 System area 5 | S (Error) | QS |
| | information | information | SD14 System area 6 | | |
| | | | SD15 System area 7 | | |
| | 1 | | *5: For details on the error classification and error item, refer to | | |
| | | | the manuals for the connected devices. | | |
| | | | 10) Module No./Station No. | | |
| SD11 | | | Number Meaning | | |
| | | | SD5 Slot No. | | |
| | | | SD6 I/O No. SD7 Station No. | | |
| | | | SD8 | | |
| | | | SD9 | | |
| SD12 | | | SD10 | | |
| 0012 | | | SD11 (Empty) SD12 | | |
| | | | SD13 | | |
| | | | SD14 | | |
| | | | SD15 | | |
| | | | 11) CC-Link IE Field Network information | | |
| SD13 | | | Number Meaning | | |
| | | | SD5 Error classification*6 SD6 Error item*6 | | |
| | | | SD7 Network No. | | |
| | 1 | | SD8 Station No. | | |
| | | | SD9 System area 1 | | |
| 00 | | | SD10 System area 2 SD11 System area 3 | | |
| SD14 | | | SD12 System area 4 | | |
| | | | SD13 System area 5 | | |
| | | | SD14 System area 6 SD15 System area 7 | | |
| | 1 | | · | | |
| | | | *6: For details on the error classification and error item, refer to | | |
| SD15 | | | the manuals for the connected devices. If the QSCPU is connected, "350" is stored as the error | | |
| 3013 | | | classification and the error code of the transfer target is | | |
| | | | stored as the error item. | | |
| | | | · | | |

TableApp.3.2 Special register

| Number | Name | Meaning | Explanation | Set by (When set) | Corresponding CPU |
|--------|------------------------------------|------------------------------|---|----------------------|----------------------|
| SD16 | | | Individual information corresponding to error codes (SD0) is stored here. There are the following ten different types of information are stored. | (Wileli Set) | GPU |
| SD17 | | | 2) File name/Drive name Number | | |
| SD18 | | | SD20 SD21 Extension *3 ZEH(.) SD22 (ASCII code: 3 characters) SD23 SD24 SD25 SD26 (Empty) SD26 (Empty) SD26 SD26 SD26 SD26 | | |
| SD19 | | | 3) Time (value Actually measured) Number Meaning SD16 Time : 1 μs units (0 to 999 μs) SD17 Time : 1ms units (0 to 65535ms) SD18 SD19 SD20 | | |
| SD20 | | | SD21 SD22 SD23 SD24 SD25 SD26 | | |
| SD21 | Error individual information | Error individual information | 4) Program error location Number | S (Error) | QS |
| SD22 | | | SD20 Extension *3 2EH(.) SD21 (ASCII code: 3 characters) SD22 (Empty) SD23 Block No. *6 SD24 Step No. *6 SD25 Sequence step No. (L) SD26 Sequence step No. (H) | | |
| SD23 | | | *6: "0" is stored to the block number and the step number. 5) Parameter No. 6) Annunciator number Number | | |
| SD24 | | | SD19 SD19 SD20 SD20 SD21 (Empty) SD22 (Empty) SD22 (Empty) SD23 SD23 SD24 SD24 SD25 SD26 SD26 | | |
| SD25 | | | 9) Error information Number | | |
| SD26 | | | SD19 Error information 4 SD20 Error information 5 SD21 Error information 6 SD22 Error information 7 SD23 Error information 8 SD24 Error information 9 SD25 Error information 10 SD26 Error information 11 | | |

TableApp.3.2 Special register

| Number | Name | Meaning | Explanation | Set by (When set) | Corresponding CPU | | | | |
|--------|---|--------------------------------|---|----------------------|--|--|---|--|--|
| SD16 | 1 | 10) CC-Link Safety information | | | | | | | |
| 3510 | | | Number Meaning SD16 Number of items for individual information | | | | | | |
| | | | | | | | SD17 individual information 1 SD18 individual information 2 | | |
| SD17 | SD19 individual information 3 SD20 individual information 4 | | | | | | | | |
| | | | SD21 individual information 5 SD22 individual information 6 | | | | | | |
| SD18 | | | SD23 individual information 7 | | | | | | |
| | | | SD24 individual information 8 SD25 individual information 9 | | | | | | |
| SD19 | | | SD26 individual information 10 11) Program abort information | | | | | | |
| | | | Number Meaning | | | | | | |
| CD20 | | | SD16 Abort code *5 SD17 | | | | | | |
| SD20 | | | SD18 | | | | | | |
| | | | SD19 SD20 | | | | | | |
| SD21 | | | SD21 SD22 (Empty) | | | | | | |
| | | | SD23 SD24 | | | | | | |
| SD22 | | | SD25 SD26 | | | | | | |
| | Error | Francis dividual | Error individual | Error individual *5 | *5 : The specified abort code is stored by the S.QSABORT | | l | | |
| SD23 | individual information | information | instruction. 12) File diagnostics information | S (Error) | QS | | | | |
| | illioillation | | Number Meaning (Example) File name = | | | | | | |
| 0004 | | | SD16 Error Drive No. MAIN.QPG b15 to b8 b7 to b0 | | | | | | |
| SD24 | | | SD17 SD18 File name 41H(A) 4DH(M) 4EH(N) 43H(I) 43H(I) | | | | | | |
| | | | SD19 (ASCII code: 8 characters) 20H(SP) 20H(SP) 20H(SP) 20H(SP) | | | | | | |
| SD25 | | | SD21 Extension *3 2EH(.) 51H(Q) 2EH(.) | | | | | | |
| | | | SD22 (ASCII code: 3 characters) SD23 Error information 2 | | | | | | |
| | | | SD25 Error information 3 | | | | | | |
| | | | 13) CC-Link IE Field Network information | | | | | | |
| | | | Number Meaning | | | | | | |
| | | | SD16 Number of items for individual information SD17 individual information 1 | | | | | | |
| SD26 | | | SD18 individual information 2 SD19 individual information 3 | | | | | | |
| | | | SD20 individual information 4 | | | | | | |
| | | | SD21 individual information 5 SD22 individual information 6 | | | | | | |
| | | | SD23 individual information 7 | | | | | | |
| | | | SD24 individual information 8 SD25 individual information 9 | | | | | | |
| | | | SD26 individual information 10 | | | | | | |
| | | | | | | | | | |

TableApp.3.2 Special register

| Number | Name | Meaning | Explanation | Set by (When set) | Corresponding CPU |
|--------|--|--|---|---------------------------|-------------------|
| SD27 | Diagnostics error CPU identifier | CPU identifier (CPU A/CPU B) | The identifier of the CPU module that issued the diagnostics error (SD0 to SD26) is stored. 0001H: CPU A 0002H: CPU B | S (Error) | |
| SD50 | Error reset | Error code to be cleared | An error code to be cleared is stored. | U | |
| SD51 | Battery low latch | Bit pattern indicating where battery voltage drop occurred | All corresponding bits go 1(ON) when battery voltage drops. Subsequently, these remain 1(ON) even after battery voltage has been returned to normal. b15 to b1 b0 O CPU module battery error | S (Error) | |
| SD52 | Battery low | Bit pattern indicating where battery voltage drop occurred | Same configuration as SD51 above Turns to 0 (OFF) when the battery voltage returns to normal thereafter. | S (Error) | |
| SD53 | AC DOWN detection | Number of times for AC DOWN detection | 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. | S (Error) | |
| SD61 | I/O module verify error number | I/O module verify error module number | The lowest I/O number of the module where the I/O module verification error took place. | S (Error) | |
| SD62 | Annunciator number | Annunciator number | The first annunciator number (F number) to be detected is stored here. | S (Instruction execution) | |
| SD63 | Number of annunciators | Number of annunciators | Stores the number of annunciators searched. | S (Instruction execution) | QS |
| SD64 | | | • When F goes ON due to OUTF or SETF, the F numbers | , | |
| SD65 | | | which go progressively ON from SD64 through SD79 are registered. | | |
| SD66 | | | The F numbers turned OFF by RSTF are deleted from SD64 - SD79, and the F numbers stored after the deleted F | | |
| SD67 | | | numbers are shifted to the preceding registers. | | |
| SD68 | | | After 16 annunciators have been detected, detection of the 17th will not be stored from SD64 through SD79. | | |
| SD69 | | | SET SET SET RST SET SET SET SET SET RST F50 F25 F99 F25 F15 F70 F65 F38 F110 F151 F210 F50 | | |
| SD70 | | | SD62 0 50 50 50 50 50 50 50 50 50 50 50 99 (Number | | |
| SD71 | Table of detected | Annunciator | SD63 0 1 2 3 2 3 4 5 6 7 8 9 8 (Number of | S (Instruction | |
| SD72 | annunciator | detection number | annunciators detected) | execution) | |
| SD73 | numbers | | SD64 0 50 50 50 50 50 50 50 50 50 50 50 50 5 | | |
| SD74 | | | SD66 0 0 0 99 0 15 15 15 15 15 70 SD67 0 0 0 0 0 0 0 70 70 70 70 70 65 SD68 0 0 0 0 0 65 65 65 65 65 38 | | |
| SD75 | | | SD69 0 0 0 0 0 0 0 0 0 38 38 38 38 110 SD70 0 0 0 0 0 0 0 0 0 0 110110110110151 | | |
| SD76 | | | SD71 0 0 0 0 0 0 0 0 0 0 0 151 151210 (Number detected) | | |
| SD77 | | | SD73 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 SD74 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | | |
| SD78 |] | | SD75 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | | |
| SD79 | | | SD77 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 SD78 0 0 0 0 0 0 0 0 0 0 0 0 0 0 SD79 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | | |

TableApp.3.2 Special register

| Number | Name | Meaning | Explanation | Set by (When set) | Corresponding CPU |
|--------|----------------------------|--|---|----------------------|----------------------|
| SD81 | Cause of error | Cause of error | 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. Bit No. | S (Error) | QS |
| SD150 | | | When an I/O module whose information is different from the one registered at power-on is detected, the corresponding I/O module number (in units of 16 points) is stored. (The I/O module number set in parameter is stored if it is set.) | | |
| SD151 | | Bit pattern, in | b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0 | | |
| SD152 | | units of 16 points, | SD150 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | | |
| SD153 | I/O module verify error | indicating the modules with verify errors. 0: No I/O verify errors 1: I/O verify error present | SD151 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | S (Error) | QS . |

(10) 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. b15 to b4 b3 to b0 Empty 1) CPU switch status 1: STOP 2: RESET | S (Every END) | |
| SD201 | LED status | Status of CPU-LED | The following bit patterns are used to store the statuses of the LEDs on the CPU module: or is off, 1 is on, and 2 is flicker. b15 to b12b11 to b8 b7 to b4 b3 to b0 | S (Status change) | QS |
| SD203 | Operating status of CPU | Operating status of CPU | The CPU operating status is stored as indicated in the following figure: b15 to b12 b11 to b8 b7 to b4 b3 to b0 2) 1) 1): Operating status 0: RUN of CPU 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 4: Error 5: SAFETY MODE (wait-for-restart) 6: "Write to PLC" was executed. 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: b15 to b12b11 to b8 b7 to b4 b3 to b0 Example: September, 2006 0609н Year Month | | |
| SD211 | Clock data | Clock data (day, hour) | The day and hour are stored as BCD code at SD211 as shown below: b15 to b12b11 to b8 b7 to b4 b3 to b0 Example: 25st, 10 a.m. Day Hour | | |
| SD212 | Clock data | Clock data (minute, second) | The minutes and seconds (after the hour) are stored as BCD code at SD212 as shown below: b15 to b12b11 to b8 b7 to b4 b3 to b0 Example: 35 min., 48 sec. 3548H Minute Second | S (Request)/U | QS |
| 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 b12b11 to b8 b7 to b4 b3 to b0 Example: 2006, Monday 2001H Higher digits of year (19 or 20) Day of the week 0 Sunday 1 Monday 2 Tuesday 3 Wednesday 4 Thursday 5 Friday 6 Saturday Stores the year (two digits) and the day of the week in SD213 in the BCD code in SD2 | | |
| SD232 | ROM write | ROM write | • Store the POM write count up to now | S (Writing to | |
| SD233 | count | count up to now | Store the ROM write count up to now. | 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 | b15 to b1 b0 Empty Main base unit | S (Initial) | |
| SD243 SD244 | No. of base slots (Operation status) | No. of base slots | SD243 Empty Main SD244 Empty • As shown above, each area stores the number of slots being installed. | S (Initial) | |
| SD245 SD246 | No. of base slots (Mounting status) | No. of base slots | (Number of set slots when parameter setting has been made) b15 | S (Initial) | |
| SD250 | Loaded maximum I/O | Loaded maximum I/O No. | installed base unit). The upper 2 digits of the final I/O number plus 1 of the modules loaded are stored as BIN values. | S (Initial) | |
| SD254 | | Number of modules mounted | Indicates the number of mounted CC-Link IE Controller Network or MELSECNET/H modules. | | |
| SD255 | CC-Link IE Controller | I/O number | Indicates the I/O number of mounted CC-Link IE Controller Network or MELSECNET/H module. | | QS |
| SD256 | Network, MELSECNET | Network number | Indicates the network number of mounted CC-Link IE Controller Network or MELSECNET/H module. | S (Initial) | |
| SD257 | /H information | 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 | | Number of points assigned for X | Stores the number of points currently set for X devices | | |
| SD291 | | Number of points assigned for Y | Stores the number of points currently set for Y devices | | |
| SD292 | Device | Number of points assigned for M | Stores the number of points currently set for M devices | | |
| SD294 | assignment (Same as the | Number of points assigned for B | Stores the number of points currently set for B devices | S (Initial) | |
| SD295 | parameter setting) | Number of points assigned for F Number of points | Stores the number of points currently set for F devices | | |
| SD296 | | assigned for SB Number of points | Stores the number of points currently set for SB devices | | |
| SD297 | | 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 | | Number of points assigned for ST | Stores the number of points currently set for ST devices | | |
| SD301 | Device | Number of points assigned for C | Stores the number of points currently set for C devices | | |
| SD302 | assignment (Same as the parameter | Number of points assigned for D | Stores the number of points currently set for D devices | S (Initial) | QS |
| SD303 | setting) | 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 | | Number of modules mounted | Indicates the number of mounted Ethernet modules. | | |
| SD341 | Ethernet | I/O number | Indicates the I/O number of mounted Ethernet module. | C (Initial) | 1 |
| SD342 | information | Network number | Indicates the network number of mounted Ethernet module. | S (Initial) | |
| SD343 | | Group number | Indicates the group number of mounted Ethernet module. |] | |
| SD344 | | Station number | Indicates the station number of mounted Ethernet module. | | |

(11) 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) | |
| 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 | QS |
| 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) | |

(12) Scan information

TableApp.3.6 Special register

| Number | Name | Meaning | Explanation | Set by (When set) | Corresponding CPU |
|--------|-------------------|--|--|----------------------|-------------------|
| SD520 | Current scan | 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) | S (Every END) | |
| SD521 | time | Current scan time (in 100 μs units) | (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. | O (EVOITY EIND) | |
| SD524 | Minimum | Minimum scan time (in 1 ms units) | • Stores the minimum value of the scan time into SD524 and SD525. (Measurement is made in 100 μ s units.) SD524: Stores the ms place. (Storage range: 0 to 6553) | S (Every END) | |
| SD525 | scan time | Minimum scan time (in 100 μs units) | SD525: Stores the μ s place. (Storage range: 0 to 900) • The accuracy of processing time of scantime is μ 0.1ms. | O (Every END) | |
| SD526 | Maximum | Maximum scan time (in 1 ms units) | • Stores the maximum value of the scan time into SD526 and SD527. (Measurement is made in 100 μ s units.) SD526: Stores the ms place. (Storage range: 0 to 6553) | S (Every END) | |
| SD527 | scan time | Maximum scan time (in 100 μs units) | SD527: Stores the μs place. (Storage range: 0 to 900) • The accuracy of processing time of scantime is $\pm 0.1 ms$. | C (2.0.) 2.1.2/ | 00 |
| SD540 | END processing | 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.) | S (Every END) | QS |
| SD541 | time | END processing time (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 END processing time is $\pm 0.1 ms$. | O (EVOITY EIND) | |
| SD542 | Constant | 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.) | S (Every END) | |
| SD543 | time | Constant scan wait time (in 100 µs units) | SD542: Stores the ms place. (Storage range: 0 to 6553) SD543: Stores the μ s place. (Storage range: 0 to 900) • The accuracy of constant scan wait time is ± 0.1 ms. | 3 (LVery LND) | |
| SD548 | Scan program | 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.) | | |
| SD549 | execution time | Scan program execution time (in 100 μ s units) | SD548: Stores the ms place. (Storage range: 0 to 6553) SD549: Stores the μ s place. (Storage range: 0 to 900) • Stored every scan. • The accuracy of scan program execution time is ± 0.1 ms. | S (Every END) | |

(13) 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 | S (Status change) | QS |
| SD561 | TEST MODE | TEST MODE continuous | Stores the TEST MODE continuous RUN time. (Measured in seconds) (RUN time in TEST MODE. Start measurement when STOP & | 0 (5 5ND) | |
| SD562 | continuous RUN time | RUN time (seconds) | RUN (Time when operation is STOP is not included.) • Stores the measurement valve with the range of 1 to 2147483647. | S (Every END) | |

(14) 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 Drive 4 Fixed at (Standard ROM) "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) | |

(15) CC-Link Safety

TableApp.3.9 Special register

| Number | Name | Meaning | | | Ex | planation | | | Set by | Corresponding |
|------------------------|--|---|--|---|--|--|-------------------|-----------------------|----------------------|---------------|
| | | . | | | us of sa | fety remote station ard remote station. | is store | d. | (When set) | СРИ |
| | Safety remote | 0: No safety | | b15 | b14 | to | b1 | b0 | | |
| SD1000 | station specification | remote station specification | SD1000 | 16 | 15 | to | 2 | 1 | | |
| to | (CC-Link | 1: Safety remote | SD1001 | 32 | 31 | to | 18 | 17 | S (Initial) | |
| SD1003 | Safety master module 1) | station specification | SD1002 | 48 | 47 | to | 34 | 33 | | |
| | module 1) | Specification | SD1003 | 64 | 63 | to | 50 | 49 | | |
| | | | | , | 1 to 64 i | n the table indicate | station | numbers. | | |
| | Safety refresh | 0: Normal communicati on, reserved station, | The refresh stored. "0" is store | | | station is | | | | |
| CD1004 | communication status of each | unused station, | | b15 | b14 | to | b1 | b0 | | |
| to | safety remote | standard | SD1004 | 16 | 15 | to | 2 | 1 | S (Status | |
| | | remote station on | SD1005 | 32 | 31 | to | 18 | 17 | change) | |
| Safety maste | Safety master | CC-Link Safety | SD1006 | 48 | 47 | to | 34 | 33 | | |
| | module 1) | 1: Safety station | SD1007 | 64 | 63 | to | 50 | 49 | | |
| | | communication error | | , | 1 to 64 i | n the table indicate | station | numbers. | | |
| SD1008 to SD1071 | Safety station communication status (CC-Link Safety master module 1) | The status of communication with safety remote station is stored. | is stored. • SD1008: S fixed in the specified, c 0: At normal c 10: At initial 20: During int 30: Link error 8300: Link er | tation in case of case of without communication (Satistron (Satistron (Satistron (Contron (Dairon (Ruinter) (Ruinter) (Ruinter) (Ruinter) | umber of standard ut connection in the connectio | on access ote station detection formation mismatch tor timeout) otor timeout) tor timeout) error) number error) or) umber error) | n numb reserve | er 64 (0 d station | S (Status change) | QS |
| SD1072 to SD1075 | Safety station interlock status (CC-Link Safety master module 1) | 0: Interlock is not executed 1: During interlock | | b15 16 32 48 64 | b14 15 31 47 63 | to t | b1 2 18 34 50 | b0 1 17 33 49 | S (Status change) | |

TableApp.3.9 Special register

| Safety station interlock cancel request to 10 (C-Link Safety module 1) Safety module 2) Communication to 10 (C-Link Safety module 2) Communication Safety module 2) Communication Safety module 3) Communication status of safety station or CC-Link Safety module 4) Communication status of safety module 5) Communication status of safety module 6 Communication status of safety module 7) Communic | | | | Tabler | .pp.o. | o opec | iai registei | | | | |
|--|-----------|---------------------------------------|--|----------------|-----------|-----------|----------------------|------------|-----------|-------------|----|
| Safety station of Safety station on CC | Number | Name | Meaning | | | E | planation | | | - | |
| Safety station interiods cancel request (CC-Link Safety master module 1) | | | | | | ock of s | afety station by cha | inging t | he bit of | | |
| SD1000 CC-Link Safety master module 1) SD1078 All SD1079 SD | | interlock | station on CC- Link Safety not released | | b15 | b14 | to | b1 | b0 | | |
| CC-Link Safety master module 1 Safety remote station or CC-Link Safety master module 2 Safety remote station Specification CC-Link Safety master module 2 Safety remote station Specification CC-Link Safety master module 2 Safety remote station Specification CC-Link Safety master module 2 Safety remote station Specification CC-Link Safety master module 2 Safety remote station Specification CC-Link Safety master module 2 Safety remote station Specification Specification CC-Link Safety master module 2 Safety remote station Specification Specification Specification Safety remote station Specification Specifica | SD1076 | | | SD1076 | 16 | 15 | to | 2 | 1 | | |
| Safety remote station specification (CC-Link Safety remote station specification specification specification to Safety master module 2) Safety refresh communication specification (CC-Link Safety master module 2) Safety remes Safety remote station specification to specification (CC-Link Safety master module 2) Safety remesh communication specification to specification (CC-Link Safety master module 2) Safety remesh communication specification to specification to specification (CC-Link Safety master module 2) Safety remesh communication specification to specification specification to specification specification (CC-Link Safety master module 2) Safety remesh communication specification speci | to (C | | | SD1077 | 32 | 31 | to | 18 | 17 | U (Request) | |
| SD1204 SD1207 SD1208 SD1209 SD1209 SD1200 to S | 301079 | | | SD1078 | 48 | 47 | to | 34 | 33 | | |
| SD1200 station specification (CC-Link Safety remote station specification to specification (SD1204 to SD1207 to SD1207 to SD1204 to SD1207 to SD12 | module 1) | module 1) | Link Safety | SD1079 | 64 | 63 | to | 50 | 49 | S. | |
| SD1200 to Safety remote station specification (CC-Link Safety remote station specification (CC-Link Safety remote station specification (CC-Link Safety remote station specification specification (CC-Link Safety remote station specification specification (CC-Link Safety remote station specification specification specification (CC-Link Safety remote station specification specification specification specification (CC-Link Safety remote station on CC-Link Safety remote station on CC-Link Safety module 2) SD1207 Safety refresh communication status of safety remote station in stored. SD1208 Safety remote station on CC-Link Safety remote station on CC-Link Safety station on CC-Link Safety station communication error - The status of communication with each safety remote station is stored. - The refresh communication status of safety remote station. - The refresh communication status of safety remote station. - The refresh communication status of safety remote station. - The status of communication with each safety remote station is stored. - 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. - 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. - 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. - 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. | | | released | | | 1 to 64 i | n the table indicate | station | numbers. | | |
| SD1200 to SD1203 Safety remote station specification (CC-Link Safety master module 2) SD1207 SD1207 SD1207 Safety refresh communication status of each safety remote station (CC-Link Safety master module 2) Safety refresh communication status of each safety remote station (CC-Link Safety module 2) Safety master module 2) Safety refresh communication status of the table indicate station numbers. SD1207 Safety refresh communication status of safety remote station is stored. - '0' is stored for the standard remote station. SD1204 16 15 to 2 1 1 | | | | The specifi | ed stat | us of sa | fety remote station | is store | d. | | |
| station specification (CC-Link Safety master module 2) Safety refresh communication status of each safety remote station status of each safety master module 2) Safety master module 2) Safety refresh communication status of each safety master module 2) Safety master module 2) Safety master module 2) O: Normal communication status of each safety memote station is stored. Safety master module 2) Safety master module 2) The refresh communication status of safety remote station is stored. Safety master module 2) Safety station (CC-Link Safety master module 2) The status of each station is stored. Safety master module 2) Safety station is stored. Safety master module 2) The status of communication is stored. Safety station number 64 (0 fixed in the case of standard remote station, reserved station specified, or without connection) O: At normal communication O: Normal communication is stored. SD1204 48 47 to 34 33 SC (Status change) S (Status change) S (Status change) | | | | • "0" is store | d for th | e standa | | | | | |
| SD1204 Safety refresh communication status of each safety remote station on status of each safety master module 2) SD1204 to SD1207 SD1207 Safety master module 2) The refresh communication status of safety remote station is stored. SD1204 to SD1207 Safety master module 2) SD1206 4 6 15 to 2 1 SD1207 SD1208 4 4 7 to 34 33 SD1208 4 6 6 3 to 50 49 The refresh communication status of safety remote station is stored. SD1208 S S (Initial) | | Safety remote | | | b15 | b14 | to | b1 | b0 | | |
| SD1203 Safety master module 2) Safety refresh communication station (CC-Link Safety master module 2) SD1204 to SD1207 Safety master module 2) SD1204 to SD1207 Safety master module 2) SD1206 safety refresh communication status of each safety remote station, unused station, communication status of each safety remote station on CC-Link Safety master module 2) SD1207 Safety master module 2) SD1208 Safety master module 2) SD1209 48 47 to 34 33 - The refresh communication status of safety remote station is stored. - "O" is stored for the standard remote station. SD1204 16 15 to 2 1 SD1205 32 31 to 18 17 SD1206 48 47 to 34 33 SD1207 64 63 to 50 49 1 to 64 in the table indicate station numbers. S (Status change) The status of communication with each safety remote station is stored. - 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) O: At normal communication | | | | SD1200 | 16 | 15 | to | 2 | 1 | | |
| SD1204 to SD1207 Safety master module 2) Safety refresh communication status of each station (CC-Link Safety master module 2) SD1207 Safety master module 2) SD1208 Safety refresh communication status of each station on CC-Link Safety master module 2) SD1209 Safety master module 2) SD1200 Safety refresh communication status of safety remote station is stored. The refresh communication status of safety remote station is stored. The refresh communication status of safety remote station is stored. The refresh communication status of safety remote station is stored. "O" is stored for the standard remote station. SD1204 16 15 to 2 1 SD1205 32 31 to 18 17 SD1206 48 47 to 34 33 SD1207 64 63 to 50 49 The status of communication with each safety remote station numbers. S (Status change) The status of communication with each safety remote station is stored. SD1207 64 63 to 50 49 SD1208 Station number 1 to SD1271: Station number 64 (0 fixed in the case of standard remote station, reserved station specified, or without connection) O: At normal communication | | (CC-Link | 1: Safety remote | SD1201 | 32 | 31 | to | 18 | 17 | S (Initial) | |
| SD1204 to SD1207 SD1207 SD1207 SD1207 SD1208 Safety refresh communication status of each safety remote station on CC-Link Safety module 2) SD1208 SD1209 SD1208 SSTation numbers SD1207 SD1208 SSTation number 1 to SD1271: Station number 64 (0 fixed in the case of standard remote station, reserved station specified, or without connection) O: At normal communication | 3D1203 | | | SD1202 | 48 | 47 | to | 34 | 33 | | |
| SD1204 to SD1207 Safety refresh communication status of each safety remote station (CC-Link Safety master module 2) Safety refresh communication status of each safety remote station (CC-Link Safety master module 2) Solvent Solve | | , | | SD1203 | 64 | 63 | to | 50 | 49 | | |
| SD1204 to SD1207 SD1207 SD1207 Safety refresh communication, reserved station, unused station (CC-Link Safety master module 2) SD1207 SD1207 SD1207 SD1208 Safety master module 2) SD1208 Safety master module 2) SD1209 1: Safety station communication error SD1208: Station number 1 to SD1271: Station number 64 (0 fixed in the case of standard remote station, reserved station specified, or without connection) O: At normal communication Safety remote station. SS(Status change) S (Status change) S (Status change) | | | | | | 1 to 64 i | n the table indicate | station | numbers. | | |
| Safety refresh communication status of each safety remote station (CC-Link Safety master module 2) Safety refresh communication status of each safety remote station on CC-Link Safety master module 2) Safety refresh communication status of each safety remote station, standard remote station on CC-Link Safety master module 2) Safety refresh communication status of each station, unused station, standard remote station on CC-Link Safety master module 2) SD1204 16 15 to 2 1 SD1205 32 31 to 18 17 SD1206 48 47 to 34 33 SD1207 64 63 to 50 49 The status of communication with each safety remote station numbers. **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 | | | | The refresh | n comm | unicatio | emote s | station is | | | |
| SD1204 to SD1207 SD1207 SD1207 SD1207 SD1207 SD1208 SD1209 SD | | Cafat rafraab | | | d for th | e stand | ard remote station | | | | |
| SD1207 to Safety remote station (CC-Link Safety module 2) | | , | | 0 13 31016 | | | | | | | |
| to station (CC-Link Safety master module 2) station communication error standard remote station on CC-Link Safety 1: Safety station communication error standard remote station on CC-Link Safety 1: Safety station communication error standard remote station on CC-Link Safety 1: Safety station communication error standard remote station is stored. • 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 | SD1204 | | station, standard remote station on CC-Link Safety 1: Safety station communication | | | | | | | S (Status | QS |
| Link Safety master module 2) 1: Safety station communication error 1 to 64 in the table indicate station numbers. • 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 | | station (CC- Link Safety master | | | | | | | | , | |
| module 2) 1: Safety station communication error 1 to 64 in the table indicate station numbers. • 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 | SD1207 | | | | | | | | | - | |
| communication error 1 to 64 in the table indicate station numbers. • 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 | | | | | | | | | | | |
| 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) Herein the status of communication with each safety remote station number 64 (0 fixed in the case of standard remote station, reserved station specified, or without connection) Herein the status of communication with each safety remote station is stored. | | | | 051201 | | | | | | | |
| 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 | | | error | The status | | | | | | | |
| fixed in the case of standard remote station, reserved station specified, or without connection) 0: At normal communication | | | | | | | | | | | |
| specified, or without connection) 0: At normal communication | | | | | | | - | | | | |
| 0: At normal communication | | | | | | | | | | | |
| | | | | | | | | | | | |
| 10: At initial | | | | 10: At initial | | | | | | | |
| Safety station The status of The status of | | Safety station | The status of | 20: During in | ternal ir | nformati | on access | | | | |
| SUIZUO Communication Communication S. (Status | | | | | | | | | | S (Status | |
| to status (CC-Link SD1271 Safety master with safety with safety with safety safety master with safety safety master station detection error) with safety safety master saf | | , | with safety | | | | | |) | change) | |
| module 2) station is stored. 8320: Link error (Initial monitor timeout) | 301211 | - | station is stored. | | • | | | 1) | | | |
| 8321: Link error (Safety monitor timeout) | | , | | | • | | • | | | | |
| 8322: Link error (Error monitor timeout) | | | | | | - | · | | | | |
| 8330: Link error (Command error) | | | | 8330: Link er | ror (Co | mmand | error) | | | | |
| 8331: Link error (Data split number error) | | | | | | | • | | | | |
| 8332: Link error (Link ID error) | | | | | , | | , | | | | |
| 8333: Link error (Running number error) 8334: Link error (Received data error) | | | | | | - | | | | | |

TableApp.3.9 Special register

| Number | Name | Meaning | | | E | xplanation | | Set by (When set) | Corresponding CPU | |
|--------------|---|--|----------------------------|-----------|----------------|--|-----------|----------------------|----------------------|--|
| | Safety station | 0: Interlock is not executed 1: During interlock | | to the in | nterlock 1. | tion number turns 1 status after the err | | | | |
| to SD1275 | interlock status (CC-Link Safety master module 2) | | | b15 | b14 | to | b1 | b0 | S (Status | |
| | | | SD1272 | 16 | 15 | to | 2 | 1 | change) | |
| | | | SD1273 | 32 | 31 | to | 18 | 17 | _ | |
| | | | SD1274 | 48 | 47 | to | 34 | 33 | | |
| | | | SD1275 | 64 | 63 | to | 50 | 49 | | |
| | | | | | 1 to 64 | in the table indicate | | QS | | |
| | | 0: I/O interlock of safety station on CC- Link Safety not released 1: I/O interlock of safety station on CC- Link Safety | Cancel the I/register from | | ock of s | | | | | |
| | Safety station interlock | | | b15 | b14 | to | b1 | b0 | | |
| SD1276 to | cancel request | | SD1276 | 16 | 15 | to | 2 | 1 | II (Paguast) | |
| SD1279 | (CC-Link | | SD1277 | 32 | 31 | to | 18 | 17 | U (Request) | |
| | Safety master module 2) | | SD1278 | 48 | 47 | to | 34 | 33 | | |
| | | | SD1279 | 64 | 63 | to | 50 | 49 | | |
| | | released | | | 1 to 64 | in the table indicate | e station | numbers. | | |

(16) CC-Link IE Field Network

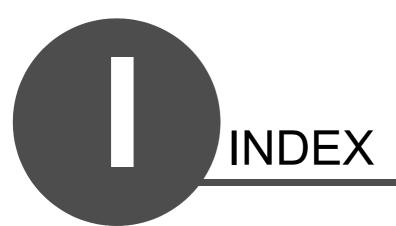
TableApp.3.9 Special register

| Number | Name | Meaning | Explanation | Set by (When set) | Corresponding CPU |
|------------------------|---|---|--|------------------------|-------------------|
| SD1400 to SD1407 | Setting status of safety communicatio n with each station | 0: Not set 1: Set | The safety communication setting status for each station is stored. For standard stations, "0" is stored. D15 D14 to D9 D8 D7 D6 D5 D4 D3 D2 D1 D0 | (When set) S (Initial) | QS*1 |
| SD1420 to SD1427 | Safety refresh communicatio n status of each safety station | 0: Normal, Reserved station specified, unused station, standard station on CC-Link IE Field Network, or own station 1: Communicati on error of safety station on CC-Link IE Field Network | -: Fixed to "0" The communication status with each safety station is stored. For standard stations, "0" is stored. | S (Status change) | QS*1 |
| SD1440 to SD1560 | Safety communicatio n status of each safety station | Stores the communication status with each safety station. | The communication status with each safety station is stored. SD1440: Station number 0 to SD1560: Station number 120 (For reserved stations, unused stations, standard stations, or own station, "0" is stored.) Safety refresh communication to 15: Safety initial communication communication error or interlocked 8400: Safety communication target station detection error 8420, 8421, 8422, 8423, 8424, 8425: Safety monitoring timeout error 8430, 8431, 8432: Safety station reception data error 8440: Safety connection setting error | S (Status change) | QS*1 |

TableApp.3.9 Special register

| Name | Meaning | Explanation | | | | | | | | | Set by (When set) | Corresponding CPU | | | | | | |
|----------------|-------------------|---|------------|--|------------------|----------------------|--|---|--|--|--|---|--|--|--|--|--|---|
| | | | | | | | | | | | | | ivat | ed, t | the b | it | | |
| | | | b15 | b14 | to | b9 | b8 | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 | | | |
| | | SD1700 | 16 | 15 | to | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | | | |
| | | SD1701 | 32 | 31 | to | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | | | |
| Safety station | 0: Not | SD1702 | 48 | 47 | to | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | | 0 (01-1 | |
| nterlock | interlocked | SD1703 | 64 | 63 | to | 58 | 57 | 56 | 55 | 54 | 53 | 52 | 51 | 50 | 49 | | , | QS ^{*1} |
| status | 1: Interlocked | SD1704 | 80 | 79 | to | 74 | 73 | 72 | 71 | 70 | 69 | 68 | 67 | 66 | 65 | | onango) | |
| | | SD1705 | 96 | 95 | to | 90 | 89 | 88 | 87 | 86 | 85 | 84 | 83 | 82 | 81 | | | |
| | | SD1706 | 112 | 111 | to | 106 | 105 | 104 | 103 | 102 | 101 | 100 | 99 | 98 | 97 | | | |
| | | SD1707 | - | - | to | - | - | 120 | 119 | 118 | 117 | 116 | 115 | 114 | 113 | | | |
| | | | | | 1 to | 120 | in th | ne ta | hle | indi | icati | e sta | tion | nur | nher | ۹. | | |
| | | | | | . 10 | 0 | | 10 10 | | | out | | | | | - | | |
| | | The interlock status of a safety station is released when the | | | | | | | | | | | | | | | | |
| | 0: I/O interlock | corresponding bit in this register is changed from "0" to "1". | | | | | | | | | | | | | | | | |
| | , | | b15 | b14 | to | b9 | b8 | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 | | | |
| | | SD1720 | 16 | 15 | to | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | | | |
| | Field | SD1721 | 32 | 31 | to | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | | | |
| Safety station | Network not | SD1722 | 48 | 47 | to | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | | | |
| nterlock | released | SD1723 | 64 | 63 | to | 58 | 57 | 56 | 55 | 54 | 53 | 52 | 51 | 50 | 49 | | U (Request) | QS*1 |
| | | SD1724 | 80 | 79 | to | 74 | 73 | 72 | 71 | 70 | 69 | 68 | 67 | 66 | 65 | | , | |
| | station on | | | 95 | to | 90 | 89 | 88 | 87 | 86 | 85 | 84 | 83 | 82 | 81 | | | |
| | CC-Link IE | | | 111 | to | 106 | 105 | 104 | 103 | 102 | 101 | 100 | 99 | 98 | 97 | | | |
| | Field | | - | - | to | - | - | 120 | 119 | 118 | 117 | 116 | 115 | 114 | 113 | | | |
| | | | | | | | | | | | | | | | | | | |
| | reieaseu | | | • | 1 to | 120 | in th | ne ta | ble | indi | icat | e sta | | | | | | |
| Sir | aterlock tatus | 0: I/O interlocked 1: Interlocked | Correspond | Corresponding Correspondin | Corresponding to | Corresponding to the | Corresponding to the error SD1700 16 15 10 10 10 10 10 10 10 | Corresponding to the error strong to the strong station atterlock at the strong station of safety station on CC-Link IE Field Network SD1722 48 47 to 42 41 41 42 41 43 44 44 44 44 44 44 | Corresponding to the error station corresponding to the error station (interlock tatus) D: Not interlock (interlock tatus) | Corresponding to the error station turn Shift Sh | Corresponding to the error station turns of the lease disafety station atterlock alease equest Corresponding to the error station turns of the lease disafety station on CC-Link IE Field Network Corresponding to the error station turns of the lease disafety station on CC-Link IE Field Network Corresponding to the error station turns of the lease disafety station on CC-Link IE Field Network Corresponding to the error station turns of the lease disafety station on CC-Link IE Field Network Corresponding to the error station turns of the lease disafety station on CC-Link IE Field Network Corresponding to the error station turns of the lease disafety station on CC-Link IE Field Network Corresponding to the error station turns of the lease disafety station on CC-Link IE Field Network Corresponding to the error station turns of the lease disafety station on CC-Link IE Field Network Corresponding to the error station turns of the lease disafety station on CC-Link IE Field Network Corresponding to the error station turns of the lease disafety station on Corresponding to the error station turns of the lease display to the lease of the lease display to the lease of the lea | Corresponding to the error station turns to "1" | Corresponding to the error station turns to "1". | Corresponding to the error station turns to "1". | Corresponding to the error station turns to "1". | Corresponding to the error station turns to "1". | SD1700 16 15 10 10 9 8 7 6 6 5 6 4 3 2 1 1 1 1 1 1 1 1 1 | **Surface of safety station or CC-Link IE Field Network released **The interlock status of a safety station or CC-Link IE Field Network released **The interlock of safety station or CC-Link IE Field Network released **The interlock of safety station or CC-Link IE Field Network released **To be by |

 $^{^{\}star}1$: This applies when the serial number (first five digits) of the CPU module is "13042" or later.



| [Symbols] | BIN (Conversion from BCD 4-digit data to BIN data) |
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| <>(BIN 16-bit data comparisons)6-2 | OR (=, <>, >, <=, <, >=)6-2 |
| =(BIN 16-bit data comparisons)6-2 | BIN 16-bit multiplication and division operations (*, /) |
| >(BIN 16-bit data comparisons)6-2 | 6-14 |
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QSCPU

Programming Manual (Common Instructions)

| MODEL | QSCPU-P-KY-E |
|-----------------------------|--------------|
| MODEL CODE | 13JW01 |
| SH(NA)-080628ENG-D(1105)MEE | |



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