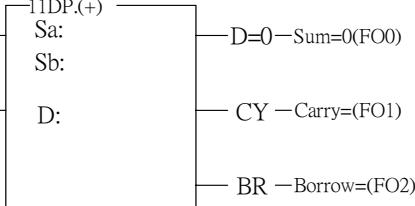


| FUN 11 (+) | ADDITION (Performs addition of the data specified at Sa and Sb and stores the result in D) | FUN 11 (+) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|--------------------|-------------------|-----------------|-----------------|------------------|---------------------|---------------------|---------------------|---------------------|------------------|-------------------------|----------------|---|----|--------------|-------------------|-------------------|--------------------|-------------------|-----------------|-----------------|------------------|---------------------|---------------------|---------------------|---------------------|------------------|-------------------------|----------------|----|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|---|---|---|---|---|---|--|---|----|----|---|--|---|
| Symbol |  <p>Ladder Symbol</p> <p>11DP.(+)</p> <p>Addition control-EN</p> <p>Unsigned/Signed— U/S</p> <p>Sa: D=0—Sum=0(FO0)</p> <p>Sb: CY —Carry=(FO1)</p> <p>D: BR —Borrow=(FO2)</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <u>Operand</u> | | <p>Sa : Augend</p> <p>Sb : Addend</p> <p>D : Destination register to store the results of the addition</p> <p>S, N, D may combine with V·Z·P0~P9 to serve indirect addressing</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Range</th><th>WX</th><th>WY</th><th>WM</th><th>WS</th><th>TMR</th><th>CTR</th><th>HR</th><th>IR</th><th>OR</th><th>SR</th><th>ROR</th><th>DR</th><th>K</th><th>XR</th></tr> <tr> <th style="text-align: left;">Oper- and</th><td>WX0 WX240</td><td>WY0 WY240</td><td>WM0 WM1896</td><td>WS0 WS984</td><td>T0 T255</td><td>C0 C255</td><td>R0 R3839</td><td>R3840 R3903</td><td>R3904 R3967</td><td>R3968 R4167</td><td>R5000 R8071</td><td>D0 D4095</td><td>16/32-bit +/- number</td><td>V · Z P0-P9</td></tr> </thead> <tbody> <tr> <td style="text-align: left;">Sa</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr> <tr> <td style="text-align: left;">Sb</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr> <tr> <td style="text-align: left;">D</td><td></td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td><td>○</td><td>○*</td><td>○*</td><td>○</td><td></td><td>○</td></tr> </tbody> </table> | | Range | WX | WY | WM | WS | TMR | CTR | HR | IR | OR | SR | ROR | DR | K | XR | Oper- and | WX0 WX240 | WY0 WY240 | WM0 WM1896 | WS0 WS984 | T0 T255 | C0 C255 | R0 R3839 | R3840 R3903 | R3904 R3967 | R3968 R4167 | R5000 R8071 | D0 D4095 | 16/32-bit +/- number | V · Z P0-P9 | Sa | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Sb | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | D | | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | ○* | ○* | ○ | | ○ |
| Range | WX | WY | WM | WS | TMR | CTR | HR | IR | OR | SR | ROR | DR | K | XR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Oper- and | WX0 WX240 | WY0 WY240 | WM0 WM1896 | WS0 WS984 | T0 T255 | C0 C255 | R0 R3839 | R3840 R3903 | R3904 R3967 | R3968 R4167 | R5000 R8071 | D0 D4095 | 16/32-bit +/- number | V · Z P0-P9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sa | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sb | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| D | | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | ○* | ○* | ○ | | ○ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Description | <ul style="list-style-type: none"> ● When the add control input "EN" =1 or "EN ↑" (P instruction) from 0 to 1 and unsigned/signed input "U/S"=0, it performs the signed addition of the data specified at Sa and Sb and writes the results to a specified register D. If the result of addition is equal to 0 then set FO0 to 1. If carry occurs (the result exceeds 32767 or 2147483647) then set FO1 to 1. If borrow occurs (adding negative numbers resulting in a sum less than -32768 or -2147483648), then set the FO2 to 1. All the FO statuses are retained until this instruction is executed again and overwritten by a new result. ● When the add control input "EN" =1 or "EN ↑" (P instruction) from 0 to 1 and unsigned/signed input "U/S"=1, it performs the unsigned addition of the data specified at Sa and Sb and writes the results to a specified register D. If the result of addition is equal to 0 then set FO0 to 1. If carry occurs (the result exceeds 65535 or 4294967295) then set FO1 to 1. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Example | <p>. 16-bit signed addition</p>  | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1" style="margin-bottom: 10px;"> <tr> <td style="padding: 5px;">Sa</td> <td style="padding: 5px; text-align: right;">R0</td> <td style="padding: 5px; text-align: right;">12345</td> </tr> <tr> <td style="padding: 5px;">Sb</td> <td style="padding: 5px; text-align: right;">R1</td> <td style="padding: 5px; text-align: right;">20425</td> </tr> </table> <p style="margin-bottom: 10px;">$\downarrow X0 = \uparrow$</p> <table border="1" style="margin-bottom: 10px;"> <tr> <td style="padding: 5px;">D</td> <td style="padding: 5px; text-align: right;">R2</td> <td style="padding: 5px; text-align: right;">2</td> </tr> </table> <p style="margin-bottom: 10px;">$Y0 = 1$ (carry 1 represents +32768)</p> | | Sa | R0 | 12345 | Sb | R1 | 20425 | D | R2 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sa | R0 | 12345 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sb | R1 | 20425 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| D | R2 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p style="margin-bottom: 10px;">$R0 + R1 = 32770$</p> <p style="margin-bottom: 10px;">$32768 + 2 = 32770$</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Basic Function Instruction

| FUN 11 (+) | ADDITION (Performs addition of the data specified at Sa and Sb and stores the result in D) | FUN 11 (+) |
|-----------------|--|-----------------|
| Example | . 16-bit unsigned addition | |
| | <p>M000 X0</p> <p>EN Sa: R0 11P. (+) R0 D=0</p> <p>U/S Sb: R1 R1</p> <p>D: R2 R2 CY Y0</p> <p>BR</p> | |

Sa

| | |
|----|-------|
| R0 | 12345 |
|----|-------|

 R0 + R1 = 32770
 Sb

| | |
|----|-------|
| R1 | 20425 |
|----|-------|

\Downarrow X0 = 1
 D

| | |
|----|-------|
| R2 | 32770 |
|----|-------|

 Y0 = 0 (Carry = 0)

| FUN 12 (-) | SUBTRACTION (Performs subtraction of the data specified at Sa and Sb and stores the result in D) | FUN 12 (-) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|-------------------|--------------------|-------------------|-----------------|-----------------|------------------|---------------------|---------------------|---------------------|---------------------|------------------|-------------------------|--------------|---|----|--------------|-------------------|-------------------|--------------------|-------------------|-----------------|-----------------|------------------|---------------------|---------------------|---------------------|---------------------|------------------|-------------------------|--------------|----|---|---|---|---|---|---|---|---|---|---|---|---|---|----|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|---|---|---|---|---|---|---|---|----|----|---|---|
| Symbol | <p style="text-align: center;">Ladder Symbol</p> <p style="text-align: center;">12DP.(-)</p> <p>Subtraction control-EN ↑</p> <p>Sa: Sb: D:</p> <p>D=0—Difference=0(FO0) CY—Carry=(FO1) BR—Borrow=(FO2)</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <u>Operand</u> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>Sa: Minuend Sb: Subtrahend D : Destination register to store the results of the subtraction Sa, Sb, D may combine with V、Z、P0~P9 to serve indirect addressing</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; padding: 2px;">Range</th><th style="padding: 2px;">WX</th><th style="padding: 2px;">WY</th><th style="padding: 2px;">WM</th><th style="padding: 2px;">WS</th><th style="padding: 2px;">TMR</th><th style="padding: 2px;">CTR</th><th style="padding: 2px;">HR</th><th style="padding: 2px;">IR</th><th style="padding: 2px;">OR</th><th style="padding: 2px;">SR</th><th style="padding: 2px;">ROR</th><th style="padding: 2px;">DR</th><th style="padding: 2px;">K</th><th style="padding: 2px;">XR</th></tr> <tr> <th style="text-align: left; padding: 2px;">Oper- and</th><td style="padding: 2px;">WX0 WX240</td><td style="padding: 2px;">WY0 WY240</td><td style="padding: 2px;">WM0 WM1896</td><td style="padding: 2px;">WS0 WS984</td><td style="padding: 2px;">T0 T255</td><td style="padding: 2px;">C0 C255</td><td style="padding: 2px;">R0 R3839</td><td style="padding: 2px;">R3840 R3903</td><td style="padding: 2px;">R3904 R3967</td><td style="padding: 2px;">R3968 R4167</td><td style="padding: 2px;">R5000 R8071</td><td style="padding: 2px;">D0 D4095</td><td style="padding: 2px;">16/32-bit +/- number</td><td style="padding: 2px;">V、Z P0~P9</td></tr> </thead> <tbody> <tr> <td style="text-align: left; padding: 2px;">Sa</td><td style="padding: 2px;">○</td><td style="padding: 2px;">○</td></tr> <tr> <td style="text-align: left; padding: 2px;">Sb</td><td style="padding: 2px;">○</td><td style="padding: 2px;">○</td></tr> <tr> <td style="text-align: left; padding: 2px;">D</td><td style="padding: 2px;"></td><td style="padding: 2px;">○</td><td style="padding: 2px;">○*</td><td style="padding: 2px;">○*</td><td style="padding: 2px;">○</td><td style="padding: 2px;">○</td></tr> </tbody> </table> | | Range | WX | WY | WM | WS | TMR | CTR | HR | IR | OR | SR | ROR | DR | K | XR | Oper- and | WX0 WX240 | WY0 WY240 | WM0 WM1896 | WS0 WS984 | T0 T255 | C0 C255 | R0 R3839 | R3840 R3903 | R3904 R3967 | R3968 R4167 | R5000 R8071 | D0 D4095 | 16/32-bit +/- number | V、Z P0~P9 | Sa | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Sb | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | D | | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○* | ○* | ○ | ○ |
| Range | WX | WY | WM | WS | TMR | CTR | HR | IR | OR | SR | ROR | DR | K | XR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Oper- and | WX0 WX240 | WY0 WY240 | WM0 WM1896 | WS0 WS984 | T0 T255 | C0 C255 | R0 R3839 | R3840 R3903 | R3904 R3967 | R3968 R4167 | R5000 R8071 | D0 D4095 | 16/32-bit +/- number | V、Z P0~P9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sa | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sb | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| D | | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○* | ○* | ○ | ○ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Description | <ul style="list-style-type: none"> ● When the subtract control input "EN" =1 or "EN ↑" (P instruction) from 0 to 1 and unsigned-signed input "U/S" =0, it performs the signed subtraction of the data specified at Sa and Sb and writes the results to a specified register D. If the result of subtraction is equal to 0 then set FO0 to 1. If carry occurs (subtracting a negative number from a positive number and the result exceeds 32767 or 2147483647), then set FO1 to 1. If borrow occurs (subtracting a positive number from a negative number and the resulted difference is less than -32768 or -2147483648), then set FO2 to 1. All the FO statuses are retained until this instruction is executed again and overwritten by a new result. ● When the subtract control input "EN" =1 or "EN ↑" (P instruction) from 0 to 1 and unsigned-signed input "U/S" =1, it performs the unsigned subtraction of the data specified at Sa and Sb and writes the results to a specified register D. If the result of subtraction is equal to 0 then set FO0 to 1. If borrow occurs then set FO2 to 1. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Example | <p>.16-bit signed subtraction</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1" style="margin-bottom: 5px;"> <tr> <td style="padding: 2px;">Sa</td><td style="padding: 2px;">R0</td><td style="padding: 2px;">-5 (FFFFBH)</td></tr> <tr> <td style="padding: 2px;">Sb</td><td style="padding: 2px;">R1</td><td style="padding: 2px;">32767 (7FFFH)</td></tr> </table> <p style="text-align: center;">R0 - R1 = -32772</p> <p style="text-align: center;">↓ X0 = <input checked="" type="checkbox"/></p> <table border="1" style="margin-top: 5px;"> <tr> <td style="padding: 2px;">D</td><td style="padding: 2px;">R2</td><td style="padding: 2px;">-4 (FFFCH)</td></tr> </table> <p style="text-align: center;">-32768 - 4 = -32772</p> <p style="text-align: center;">Y2 = 1 (borrow 1 represents -32768)</p> | | Sa | R0 | -5 (FFFFBH) | Sb | R1 | 32767 (7FFFH) | D | R2 | -4 (FFFCH) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sa | R0 | -5 (FFFFBH) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sb | R1 | 32767 (7FFFH) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| D | R2 | -4 (FFFCH) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Basic Function Instruction

| | | | | | | | | | | |
|--|--|-----------------|----|----------------|----|----|---------------|---|----|----------------|
| FUN 12 (-) | SUBTRACTION (Performs subtraction of the data specified at Sa and Sb and stores the result in D) | FUN 12 (-) | | | | | | | | |
| Example | .16-bit unsigned subtraction | | | | | | | | | |
| | | | | | | | | | | |
| <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="padding: 2px;">Sa</td> <td style="padding: 2px;">R0</td> <td style="padding: 2px;">65531 (FFFFBH)</td> </tr> <tr> <td style="padding: 2px;">Sb</td> <td style="padding: 2px;">R1</td> <td style="padding: 2px;">32767 (7FFFH)</td> </tr> </table> <p style="margin-left: 20px;">$R0 - R1 = 32764$</p> <p style="text-align: center; margin-top: 10px;"> \downarrow X0 = <input checked="" type="checkbox"/> </p> <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="padding: 2px;">D</td> <td style="padding: 2px;">R2</td> <td style="padding: 2px;">32764 (7FFCCH)</td> </tr> </table> <p style="margin-left: 20px;">$Y2 = 0$ (Borrow = 0)</p> | | Sa | R0 | 65531 (FFFFBH) | Sb | R1 | 32767 (7FFFH) | D | R2 | 32764 (7FFCCH) |
| Sa | R0 | 65531 (FFFFBH) | | | | | | | | |
| Sb | R1 | 32767 (7FFFH) | | | | | | | | |
| D | R2 | 32764 (7FFCCH) | | | | | | | | |

| FUN 13 (*) | MULTIPLICATION (Performs multiplication of the data specified at Sa and Sb and stores the result in D) | FUN 13 (*) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|-------------------|--------------------|-------------------|-----------------|-----------------|------------------|---------------------|---------------------|---------------------|------------------|-------------------------|--------------|----|---|----|---------------|-------------------|-------------------|--------------------|-------------------|-----------------|-----------------|------------------|---------------------|---------------------|---------------------|------------------|-------------------------|--------------|----|---|---|---|---|---|---|---|---|---|---|---|---|---|----|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|---|---|---|---|---|--|---|----|----|---|--|---|
| Symbol | <u>Operand</u> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>Ladder Symbol</p> <p>Multiplication control-EN ↑</p> <p>Unsigned/Signed—U/S</p> <p>13DP.(*)</p> <p>Sa: Sb: D:</p> <p>D=0—Product=0(FO0)</p> <p>D<0—Product is negative (FO1)</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>Sa : Multiplicand Sb : Multiplier D : Destination register to store the results of the multiplication. Sa, Sb, D may combine with V、Z、P0~P9 to serve indirect addressing</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Range</th> <th>WX</th> <th>WY</th> <th>WM</th> <th>WS</th> <th>TMR</th> <th>CTR</th> <th>HR</th> <th>IR</th> <th>OR</th> <th>SR</th> <th>ROR</th> <th>DR</th> <th>K</th> <th>XR</th> </tr> </thead> <tbody> <tr> <td style="text-align: left;">Oper- rand</td> <td>WX0 WX240</td> <td>WY0 WY240</td> <td>WM0 WM1896</td> <td>WS0 WS984</td> <td>T0 T255</td> <td>C0 C255</td> <td>R0 R3840</td> <td>R3904 R3967</td> <td>R3968 R4167</td> <td>R5000 R8071</td> <td>D0 D4095</td> <td>16/32-bit +/- number</td> <td>V、Z P0~P9</td> </tr> <tr> <td style="text-align: left;">Sa</td> <td>○</td> </tr> <tr> <td style="text-align: left;">Sb</td> <td>○</td> </tr> <tr> <td style="text-align: left;">D</td> <td></td> <td>○</td> <td>○</td> <td>○</td> <td>○</td> <td>○</td> <td></td> <td>○</td> <td>○*</td> <td>○*</td> <td>○</td> <td></td> <td>○</td> </tr> </tbody> </table> | | Range | WX | WY | WM | WS | TMR | CTR | HR | IR | OR | SR | ROR | DR | K | XR | Oper- rand | WX0 WX240 | WY0 WY240 | WM0 WM1896 | WS0 WS984 | T0 T255 | C0 C255 | R0 R3840 | R3904 R3967 | R3968 R4167 | R5000 R8071 | D0 D4095 | 16/32-bit +/- number | V、Z P0~P9 | Sa | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Sb | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | D | | ○ | ○ | ○ | ○ | ○ | | ○ | ○* | ○* | ○ | | ○ |
| Range | WX | WY | WM | WS | TMR | CTR | HR | IR | OR | SR | ROR | DR | K | XR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Oper- rand | WX0 WX240 | WY0 WY240 | WM0 WM1896 | WS0 WS984 | T0 T255 | C0 C255 | R0 R3840 | R3904 R3967 | R3968 R4167 | R5000 R8071 | D0 D4095 | 16/32-bit +/- number | V、Z P0~P9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sa | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sb | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| D | | ○ | ○ | ○ | ○ | ○ | | ○ | ○* | ○* | ○ | | ○ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Description | <ul style="list-style-type: none"> When the multiplication control input "EN" =1 or "EN ↑" (P instruction) from 0 to 1 and unsigned-signed input "U/S" =0, it performs the signed multiplication of the data specified at Sa and Sb and writes the results to a specified register D. If the product of multiplication is equal to 0 then set FO0 to 1. If the product is a negative number, then set FO1 to 1. When the multiplication control input "EN" =1 or "EN ↑" (P instruction) from 0 to 1 and unsigned-signed input "U/S" =1, it performs the unsigned multiplication of the data specified at Sa and Sb and writes the results to a specified register D. If the product of multiplication is equal to 0 then set FO0 to 1. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Example | <p>.16-bit signed multiplication</p> <p>13P. (*)</p> <p>EN</p> <p>-U/S</p> <p>Sa: R0 (-5 FFFFBH) Sb: R1 (4567 11D7H) D: R3 R2 (-22835 FFFFA6CDH)</p> <p>0=0- 0<0 Y0</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p style="text-align: center;">Sa Multiplicand R0 -5 (FFFFBH)</p> <p style="text-align: center;">×</p> <p style="text-align: center;">Sb Multiplier R1 4567 (11D7H)</p> <hr/> <p style="text-align: center;">D Product R3 R2 -22835 (FFFFA6CDH)</p> <p style="text-align: center;">Y0 = 1 (D < 0)</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Basic Function Instruction

| | | |
|--|--|------------------------|
| FUN 13 $(*)$ | MULTIPLICATION (Performs multiplication of the data specified at Sa and Sb and stores the result in D) | FUN 13 $(*)$ |
| Example | .16-bit unsigned multiplication | |
|  | <p style="margin: 0;">Sa: R0 65531(FFFBH)</p> <p style="margin: 0;">Sb: R1 4567 (11D7H)</p> <hr/> <p style="margin: 0;">D R3 R2 299280077 (11D6A6CDH)</p> <p style="margin: 0;">Y0 = 0</p> | |
| Example | .32-bit signed multiplication | |
|  | <p style="margin: 0;">Sa: R1 R0 12345678</p> <p style="margin: 0;">Sb: R3 R2</p> <hr/> <p style="margin: 0;">D R7 R6 R5 R4 5629629168</p> <p style="margin: 0;">Product</p> | |

| FUN 14 (/) | DIVISION (Performs division of the data specified at Sa and Sb and stores the result in D) | FUN 14 (/) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|--|---------------|--------------|------------|------------|-------------|----------------|----------------|----------------|----------------|-------------|-------------------------|--------------|---|----|---------|--------------|--------------|---------------|--------------|------------|------------|-------------|----------------|----------------|----------------|----------------|-------------|-------------------------|--------------|----|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|---|---|---|---|---|---|--|----|----|---|--|--|---|
| Symbol | <u>Operand</u> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>Ladder Symbol</p> <p>Division control-EN ↑</p> <p>Sa:</p> <p>Sb:</p> <p>D:</p> <p>D=0- Quotient = 0(FO0)</p> <p>ERR-Divisor is 0 (FO1)</p> | | <p>Sa: Dividend</p> <p>Sb: Divisor</p> <p>D : Destination register to store the results of the division.</p> <p>Sa, Sb, D may combine with V、Z 、P0~P9 to serve indirect addressing</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Range | WX | WY | WM | WS | TMR | CTR | HR | IR | OR | SR | ROR | DR | K | XR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Operand | WX0 WX240 | WY0 WY240 | WM0 WM1896 | WS0 WS984 | T0 T255 | C0 C255 | R0 R3839 | R3840 R3903 | R3968 R3967 | R3904 R4167 | R5000 R8071 | D0 D4095 | 16/32-bit +/- number | V、Z P0~P9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sa | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sb | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| D | | ○ | ○ | ○ | ○ | ○ | ○ | | ○* | ○* | ○ | | | ○ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Description | <ul style="list-style-type: none"> When the division control input "EN" =1 or "EN ↑" (P instruction) from 0 to 1 and unsigned-signed input "U/S"=0, it performs the signed division of the data specified at Sa and Sb and writes the quotient and remainder to registers specified by register D. If the quotient of division is equal to 0 then set FO0 to 1. If the divisor Sb=0 then set the error flag FO1 to 1 without executing the instruction. When the division control input "EN" =1 or "EN ↑" (P instruction) from 0 to 1 and unsigned-signed input "U/S"=1, it performs the unsigned division of the data specified at Sa and Sb and writes the quotient and remainder to registers specified by register D. If the quotient of division is equal to 0 then set FO0 to 1. If the divisor Sb=0 then set the error flag FO1 to 1 without executing the instruction. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Example | <p>.16-bit signed division</p> <p>M000 → X0 → EN</p> <p>14DP(/)</p> <p>Sa: R0 Sb: R1 D : R2</p> <p>R0=0- ERR-</p> <p>R0 256</p> <p>÷</p> <p>Sb R1 12</p> <p>D R3 4</p> <p>R2 21</p> <p>Dividend Divisor Remainder Quotient</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Basic Function Instruction

| FUN 14 (/) | DIVISION (Performs division of the data specified at Sa and Sb and stores the result in D) | FUN 14 (/) |
|---------------|---|---------------|
| Example | .16-bit unsigned division | |
| N000 | | |
| | $ \begin{array}{r} \begin{array}{c c} \text{Sa} & \text{R0} \\ \hline & 65530 (\text{FFFAH}) \\ \end{array} & \text{Dividend} \\ \div & \\ \begin{array}{c c} \text{Sb} & \text{R1} \\ \hline & 12 (\text{000CH}) \\ \end{array} & \text{Divisor} \\ \hline \end{array} $ $ \begin{array}{cc} \begin{array}{c c} \text{D} & \text{R3} \\ \hline & 10 (\text{000AH}) \\ \end{array} & \begin{array}{c c} & \text{R2} \\ \hline & 5460 (\text{1554H}) \\ \end{array} \\ \text{Remainder} & \text{Quotient} \end{array} $ | |
| Example | .32-bit signed division | |
| N000 | | |
| | $ \begin{array}{r} \begin{array}{c c} \text{Sa} & \text{R1} \quad \text{R0} \\ \hline & 2147483647 \\ \end{array} & \text{Dividend} \\ \div & \\ \begin{array}{c c} \text{Sb} & \text{R3} \quad \text{R2} \\ \hline & 1234567 \\ \end{array} & \text{Divisor} \\ \hline \end{array} $ $ \begin{array}{cc} \begin{array}{c c} \text{D} & \text{R7} \quad \text{R6} \\ \hline & 571634 \\ \end{array} & \begin{array}{c c} & \text{R5} \quad \text{R4} \\ \hline & 1739 \\ \end{array} \\ \text{Remainder} & \text{Quotient} \end{array} $ | |