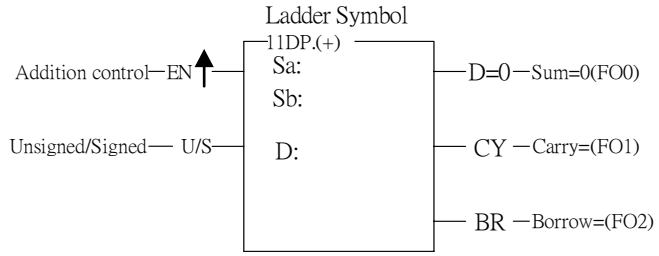
FUN 11 (＋)	ADDITION (Performs addition of the data specified at Sa and Sb and stores the result in D)	FUN 11 (＋)

Symbol

Ladder Symbol



Operand

Sa : Augend
Sb : Addend
D : Destination register to store the results of the addition
S, N, D may combine with V、Z、P0~P9 to serve indirect addressing

Range / Ope-rand	WX	WY	WM	WS	TMR	CTR	HR	IR	OR	SR	ROR	DR	K	XR
	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

- 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

. 16-bit signed addition

Sa	R0	12345	R0＋R1＝32770
Sb	R1	20425	

⇩X0＝⇑

D	R2	2	32768+2=32770

Y0＝1 (carry 1 represents ＋32768)

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

Sa	R0	12345
Sb	R1	20425

R0＋R1＝32770

⇩X0＝⇑

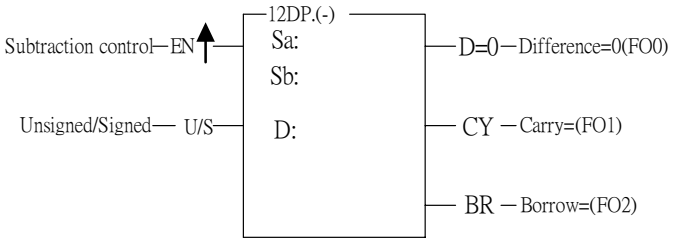
D	R2	32770

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

Ladder Symbol



Operand

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

Range / Ope-rand	WX	WY	WM	WS	TMR	CTR	HR	IR	OR	SR	ROR	DR	K	XR
	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

- 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

.16-bit signed subtraction

Sa	R0	－5 (FFFBH)
Sb	R1	32767 (7FFFH)

R0－R1＝－32772

⇩ X0＝↑

D	R2	－4 (FFFCH)

－32768－4＝－32772

Y2＝1（borrow 1 represents－32768）

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

Sa	R0	65531 (FFFBH)
Sb	R1	32767 (7FFFH)

R0－R1＝32764

⇩X0＝↑

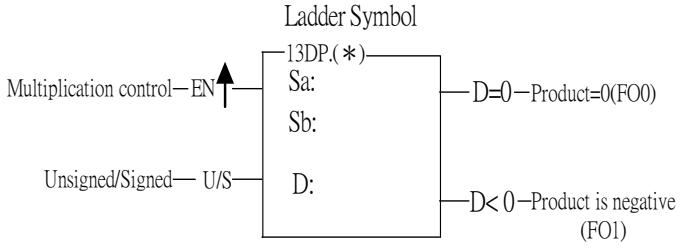
D	R2	32764 (7FFCH)

Y2＝0（Borrow = 0）

FUN 13 （＊）	MULTIPLICATION (Performs multiplication of the data specified at Sa and Sb and stores the result in D)	FUN 13 （＊）

Symbol

Operand



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

Range / Operand	WX	WY	WM	WS	TMR	CTR	HR	IR	OR	SR	ROR	DR	K	XR
	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

- 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

.16-bit signed multiplication

Sa	R0	-5 (FFFBH)		Multiplicand
× Sb	R1	4567 (11D7H)		Multiplier
D	R3	R2	-22835 (FFFFA6CDH)	Product

Y0 = 1 (D < 0)

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

Sa	R0	65531(FFFBH)	Multiplicand
× Sb	R1	4567 (11D7H)	Multiplier
D	R3	R2	Product
	299280077 (11D6A6CDH)		

Y0 = 0

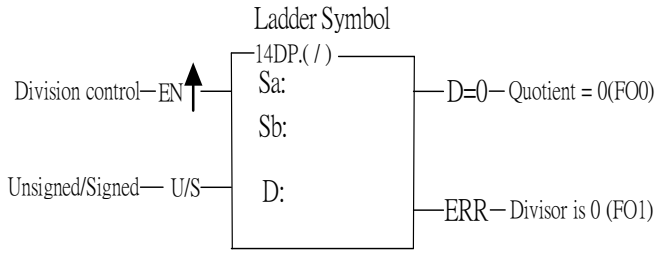
Example .32-bit signed multiplication

Sa	R1	R0	12345678		Multiplicand
× Sb	R3	R2			Multiplier
D	R7	R6	R5	R4	Product
	5629629168				

FUN 14 (／)	DIVISION (Performs division of the data specified at Sa and Sb and stores the result in D)	FUN 14 (／)

Symbol

Ladder Symbol



Operand

Sa: Dividend

Sb: Divisor

D : Destination register to store the results of the division.

Sa, Sb, D may combine with V、Z 、P0~P9 to serve indirect addressing

Range / Ope-rand	WX	WY	WM	WS	TMR	CTR	HR	IR	OR	SR	ROR	DR	K	XR
	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

- 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

.16-bit signed division

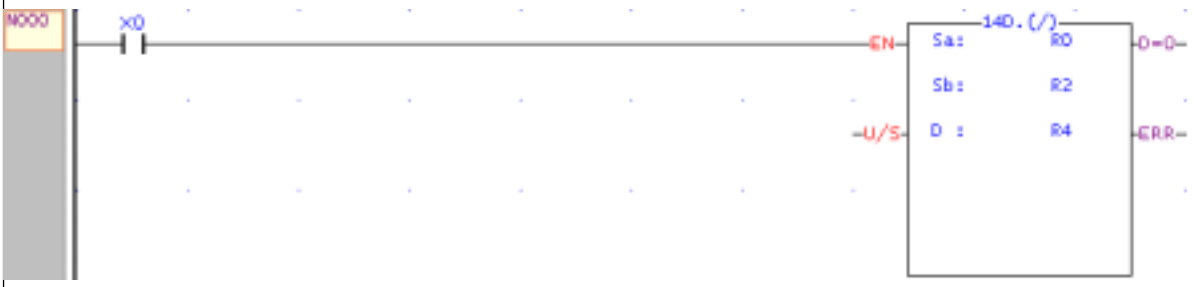
Sa	R0	256	Dividend
÷ Sb	R1	12	Divisor
D	R3	R2	
	4	21	
	Remainder	Quotient	

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

Sa	R0	65530 (FFFAH)	Dividend
÷ Sb	R1	12 (000CH)	Divisor
D	R3	10 (000AH)	Remainder
	R2	5460 (1554H)	Quotient

Example .32-bit signed division



Sa	R1	R0	2147483647	Dividend
÷ Sb	R3	R2	1234567	Divisor
D	R7	R6	571634	Remainder
	R5	R4	1739	Quotient