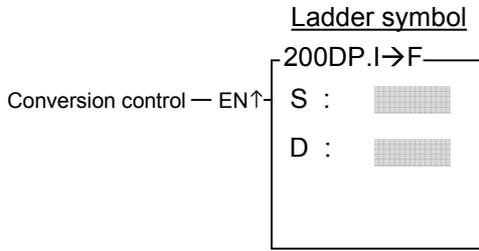


FUN200 D P I→F	CONVERSION OF INTEGER TO FLOATING POINT NUMBER	FUN200 D P I→F
---------------------------------	--	---------------------------------

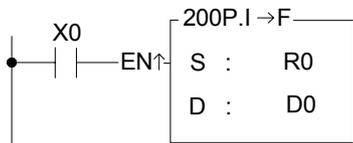


S : Starting register of Integer to be converted
 D : Starting register to store the result of conversion

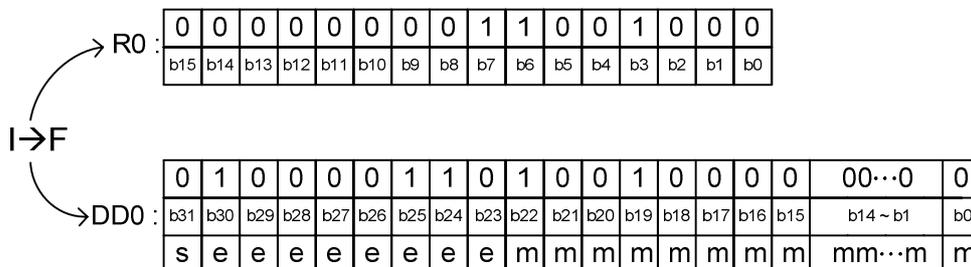
Range	HR	ROR	DR	K	XR
	Operand	R0 R3839	R5000 R8071	D0 D4095	16/32 bit Integer
S	○	○	○	○	○
D	○	○*	○		○

Description

- The format of floating point number of Fatek-PLC follows the IEEE-754 standard. For detail explanation of the format please refer to 5.3 (Numbering System)...page 5-9.
- When conversion control "EN" = 1 or "EN ↑" (**P** instruction) has a transition from 0 to 1, will convert the integer data from S register into D~D+1 32-bits register(floating point number data)



※ R0 = 200 (0000000011001000) → Integer To Floating
 → DD0 = 43480000H



Advanced Function Instruction

FUN201 D P F→I	CONVERSION OF FLOATING POINT NUMBER TO INTEGER	FUN201 D P F→I
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Ladder symbol

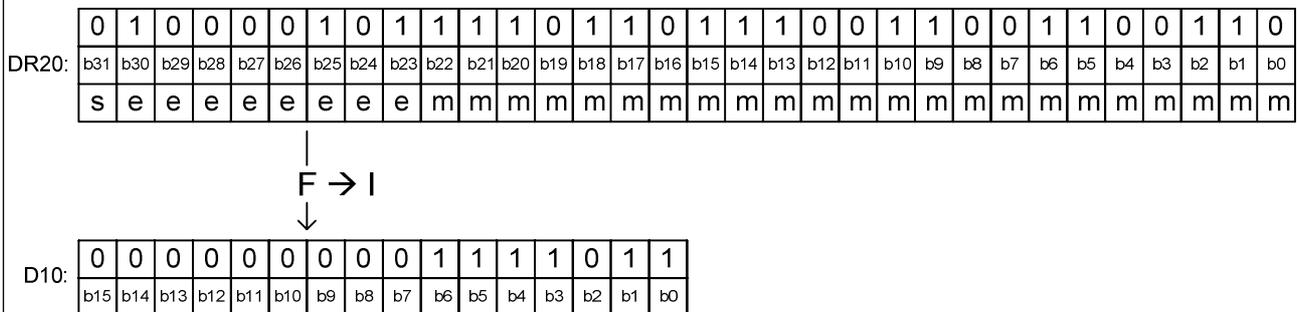
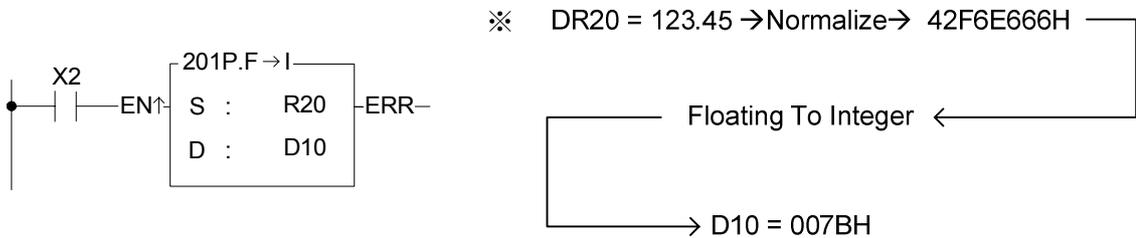


S : Starting register of Integer to be converted
D : Starting register to store the result of conversion

Range	HR	ROR	DR	K	XR
	Operand	R0 R3839	R5000 R8071	D0 D4095	16 bit OR 32 bit
S	○	○	○		○
D	○	○*	○		○

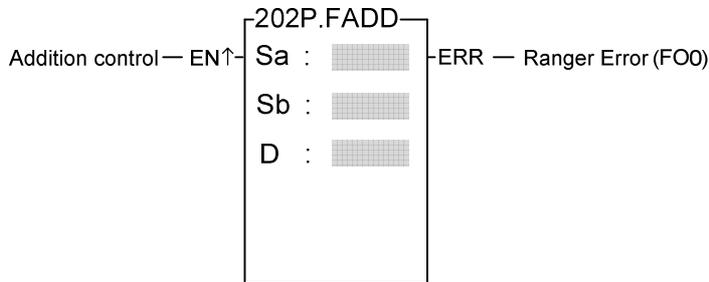
Description

- The format of floating point number of Fatek-PLC follows the IEEE-754 standard. For detail explanation of the format please refer to 5.3 (Numbering System)...page 5-9.
- When conversion control "EN" = 1 or "EN ↑" (**P** instruction) has a transition from 0 to 1, will convert the floating point data from S~S+1 32bits register into D register(integer data).
- If the value exceeds the valid range of destination, then do not carry out this instruction, and set the range-error flag "ERR" as 1 and the D register will be intact.



FUN202 P FADD	FLOATING POINT NUMBER ADDITION	FUN202 P FADD
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Ladder symbol

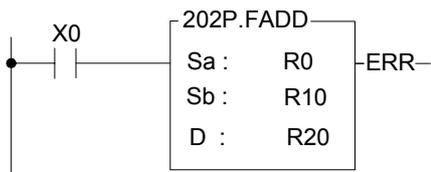


Sa: Augend
 Sb: Addend
 D : Destination register to store the results of the addition
 Sa, Sb, D may combine with V, Z, P0~P9 to serve indirect addressing

Range	HR	ROR	DR	K	XR
	R0	R5000	D0	Floating point number	V - Z
Operand	R3839	R8071	D4095		P0~P9
Sa	○	○	○	○	○
Sb	○	○	○	○	○
D	○	○*	○		○

Description

- The format of floating point number of Fatek-PLC follows the IEEE-754 standard. For detail explanation of the format please refer to 5.3 (Numbering System)...page 5-9.
- Performs the addition of the data specified at Sa and Sb and writes the results to a specified register D when the add control input "EN" =1 or "EN ↑" (**P** instruction) from 0 to 1. If the result exceed the range that the floating point number can be expressed($\pm 3.4 * 10^{38}$) then the error flag FO0 will be set to 1 and the D register will be intact.



DR0 | 2 0 0 ⇒ Floating Point Number : DR0 | 4 3 4 8 0 0 0 0 H

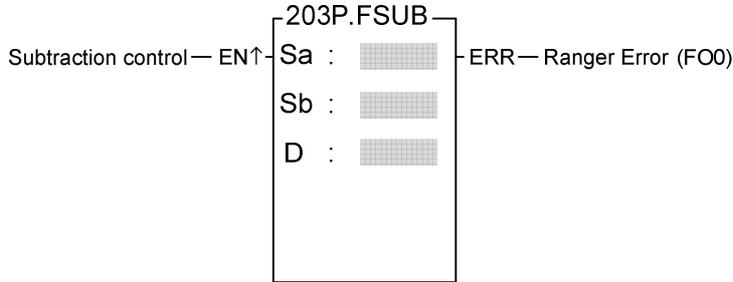
DR10 | 1 5 0 ⇒ Floating Point Number : DR10 | 4 3 1 6 0 0 0 0 H

+

—————
 DR20 | 4 3 A F 0 0 0 0 H

FUN 203 P FSUB	FLOATING POINT NUMBER SUBTRACTION	FUN 203 P FSUB
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Ladder symbol

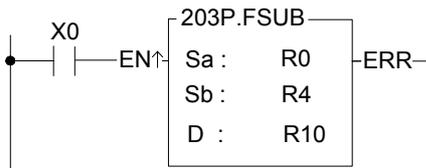


Sa: Minuend
 Sb: Subtrahend
 D : Destination register to store the results of the subtraction
 Sa, Sb, D may combine with V, Z, P0~P9 to serve indirect addressing

Range Operand	HR	ROR	DR	K	XR
	R0 R3839	R5000 R8071	D0 D4095	Floating point number	V · Z P0~P9
Sa	○	○	○	○	○
Sb	○	○	○	○	○
D	○	○*	○		○

Description

- The format of floating point number of Fatek-PLC follows the IEEE-754 standard. For detail explanation of the format please refer to 5.3 (Numbering System)...page 5-9.
- Performs the subtraction of the data specified at Sa and Sb and writes the results to a specified register D when the subtract control input "EN" =1 or "EN↑" (**P** instruction) from 0 to 1. If the result exceed the range that the floating point number can be expressed ($\pm 3.4 * 10^{38}$) then the error flag FO0 will be set to 1 and the D register will be intact.



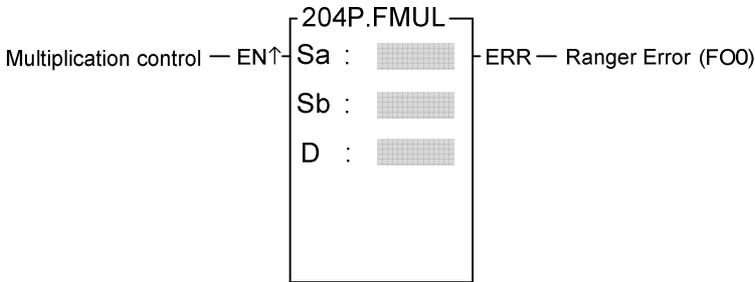
DR0	2 0 0	⇒	Floating Point Number :	DR0	4 3 4 8 0 0 0 0 H
-----	-------	---	-------------------------	-----	-------------------

DR4	5 0 0	⇒	Floating Point Number :	DR4	4 3 F A 0 0 0 0 H
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DR10	C 3 9 6 0 0 0 0 H
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FUN 204 P FMUL	FLOATING POINT NUMBER MULTIPLICATION	FUN 204 P FMUL
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Ladder symbol

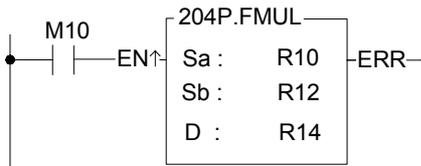


Sa: Multiplicand
 Sb: Multiplier
 D : Destination register to store the results of the multiplication
 Sa, Sb, D may combine with V, Z, P0~P9 to serve indirect addressing

Range Operand	HR	ROR	DR	K	XR
	R0 R3839	R5000 R8071	D0 D4095	Floating point number	V · Z P0~P9
Sa	○	○	○	○	○
Sb	○	○	○	○	○
D	○	○*	○		○

Description

- The format of floating point number of Fatek-PLC follows the IEEE-754 standard. For detail explanation of the format please refer to 5.3 (Numbering System)...page 5-9.
- Performs the multiplication of the data specified at Sa and Sb and writes the results to a specified register D when the multiplication control input "EN" =1 or "EN ↑" (**P** instruction) from 0 to 1. If the result exceed the range that the floating point number can be expressed ($\pm 3.4 * 10^{38}$) then the error flag F00 will be set to 1 and the D register will be intact.



DR10 | 1 2 3 . 4 5 ⇒ Floating Point Number : DR10 | 4 2 F 6 E 6 6 6 H

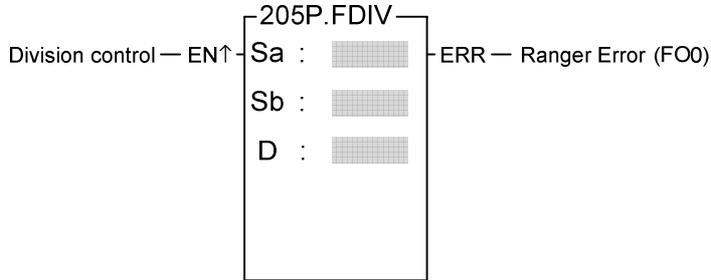
DR12 | 6 7 8 . 5 4 ⇒ Floating Point Number : DR12 | 4 4 2 9 A 2 8 F H

✘

DR14 | 4 7 A 3 9 A E 2 H

FUN 205 P FDIV	FLOATING POINT NUMBER DIVISION	FUN 205 P FDIV
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Ladder symbol

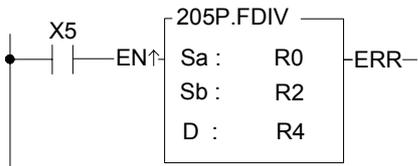


Sa: Dividend
 Sb: Divisor
 D : Destination register to store the results of the division
 Sa, Sb, D may combine with V, Z, P0~P9 to serve indirect addressing

Range	HR	ROR	DR	K	XR
	R0 R3839	R5000 R8071	D0 D4095	Floating point number	V · Z P0~P9
Operand					
Sa	○	○	○	○	○
Sb	○	○	○	○	○
D	○	○*	○		○

Description

- The format of floating point number of Fatek-PLC follows the IEEE-754 standard. For detail explanation of the format please refer to 5.3 (Numbering System) page 5-9.
- Performs the division of the data specified at Sa and Sb and writes the result to the registers specified by register D when the division control input "EN" =1 or "EN ↑" (**P** instruction) from 0 to 1. If the result exceed the range that the floating point number can be expressed ($\pm 3.4 * 10^{38}$) then the error flag FO0 will be set to 1 and the D register will be intact.



DR0 | 1 2 5 . 2 5 ⇒ Floating Point Number : DR0 | 4 2 F A 8 0 0 0 H

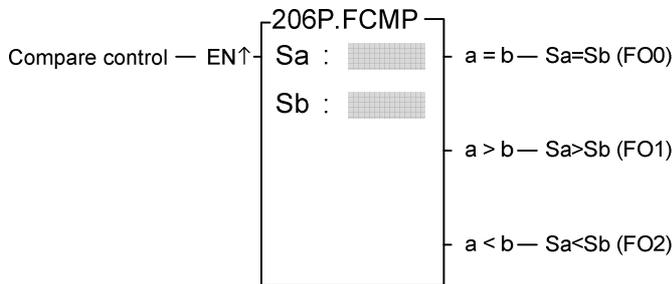
DR2 | 5 ⇒ Floating Point Number : DR2 | 4 0 A 0 0 0 0 0 H

$$\frac{42FA8000H}{40A00000H} = 41C86666H$$

DR4 | 4 1 C 8 6 6 6 6 H

FUN 206 P FCMP	FLOATING POINT NUMBER COMPARE	FUN 206 P FCMP
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Ladder symbol



Sa: The register to be compared

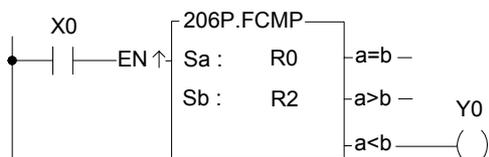
Sb: The register to be compared

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

Range	HR	ROR	DR	K	XR
	R0	R5000	D0	Floating point number	V · Z
Operand	R3839	R8071	D4095		P0~P9
Sa	○	○	○	○	○
Sb	○	○	○	○	○

Description

- The format of floating point number of Fatek-PLC follows the IEEE-754 standard. For detail explanation of the format please refer to 5.3 (Numbering System) page 5-9.
- Compares the data of Sa and Sb when the compare control input "EN" =1 or "EN ↑" (**P** instruction) from 0 to 1. If the data of Sa is equal to Sb, then set FO0 to 1. If the data of Sa>Sb, then set FO1 to 1. If the data of Sa<Sb, then set FO2 to 1. If the data of Sa < Sb, then set the FO2 to 1.



- From the above example, we first assume the data of DR0 is 200.1 and DR2 is 200.2, and then compare the data by executing the CMP instruction. The FO0 and FO1 are set to 0 and FO2 (a<b) is set to 1 since a<b.
- If you want to have the compound results, such as \geq , \leq , $<$, $>$ etc., please send $=$, $<$ and $>$ results to relay first and then combine the result from the relays.

FUN 207 P FZCP	FLOATING POINT NUMBER ZONE COMPARE	FUN 207 P FZCP
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Ladder Symbol

Compare control — EN ↑

207P.FZCP

S : INZ — Inside zone

Su : S>U — Higher than upper limit

SL : S<L — Lower than lower limit

ERR — Limit value erroe

S : Register for zone comparison

SU: The upper limit value

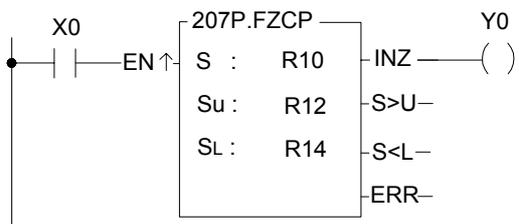
SL: The lower limit value

S, SU, SL may combine with V, Z, P0~P9 to serve indirect address application

Range	HR	ROR	DR	K	XR
	R0 R3839	R5000 R8071	D0 D4095	Floating point number	V · Z P0~P9
Operand					
S	○	○	○	○	○
Su	○	○	○	○	○
SL	○	○	○	○	○

Description

- The format of floating point number of Fatek-PLC follows the IEEE-754 standard. For detail explanation of the format please refer to 5.3 (Numbering System) page 5-9.
- When compare control "EN" = 1 or "EN ↑" (**P** instruction) changes from 0 to 1, compares S with upper limit SU and lower limit SL. If S is between the upper limit and the lower limit ($S_L \leq S \leq S_U$), then set the inside zone flag "INZ" to 1. If the value of S is greater than the upper limit S_U , then set the higher than upper limit flag "S>U" to 1. If the value of S is smaller then the lower limit S_L , then set the lower than lower limit flag "S<L" as 1.
- The upper limit S_U should be greater than the lower limit S_L . If $S_U < S_L$, then the limit value error flag "ERR" will set to 1, and this instruction will not carry out.



- The instruction at left compares the value of DR10 with the upper and lower limit zones formed by DR12 and DR14. If the values of DR10~DR14 are as shown in the diagram at bottom left, then the result can then be obtained as at the right of this diagram.
- If want to get the status of out side the zone, then OUT NOT Y0 may be used, or an OR operation between the two outputs S>U and S<L may be carried out, and move the result to Y0.

FUN 207 P FZCP	FLOATING POINT NUMBER ZONE COMPARE	FUN 207 P FZCP
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S	DR10	2 0 0 0 . 2	⇒ Floating Point Number :	DR10	4 4 F A 0 6 6 6 H	
Su	DR12	3 0 0 0 . 3	⇒ Floating Point Number :	DR12	4 5 3 B 8 4 C D H	(Upper limit value)
SL	DR14	1 0 0 0 . 1	⇒ Floating Point Number :	DR14	4 4 7 A 0 6 6 6 H	(Lower limit value)



Before-execution

X0 = \int → FLOATING ZONE COMPARE → Y0 = 1

└─┘

 Results of execution

FUN 208 P FSQR	FLOATING POINT NUMBER SQUARE ROOT	FUN 208 P FSQR
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Ladder symbol

S : Source register to be taken square root

D : Register for storing result (square root value)

S, D may combine with V, Z, P0~P9 to serve indirect address application

Range Ope- rand	HR	ROR	DR	K	XR
	R0 R3839	R5000 R8071	D0 D4095	Floating point number	V · Z P0~P9
S	○	○	○	○	○
D	○	○*	○		○

Description

- The format of floating point number of Fatek-PLC follows the IEEE-754 standard. For detail explanation of the format please refer to 5.3 (Numbering System) page 5-9.
- When operation control "EN" = 1 or "EN ↑" (**P** instruction) from 0 to 1, take the square root of the data specified by the S value or S~S+1 register, and store the result into the register specified by D~D+1.
- If the value of S is negative, then the error flag "ERR" will be set to 1, and do not execute the operation.

S :

K	2520.04
---	---------

↓ X0 = ↑

D :

D1	D0	50.2
----	----	------

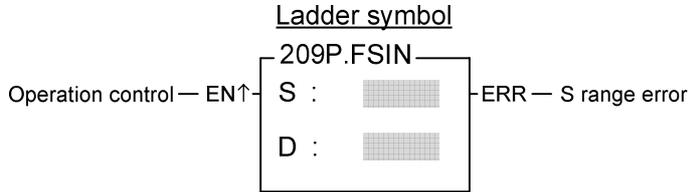
 ⇒ Floating Point Number :

4248	CCCD	H
------	------	---

$\sqrt{2520.04} = 50.2$

D1
D0

FUN 209 P FSIN	SIN TRIGONOMETRIC INSTRUCTION	FUN 209 P FSIN
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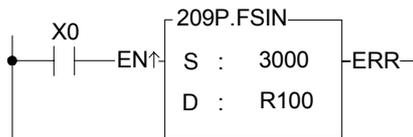


S : Source register to be taken SIN
 D : Register for storing result (SIN value)
 S, D may combine with V, Z, P0~P9 to serve indirect address application.

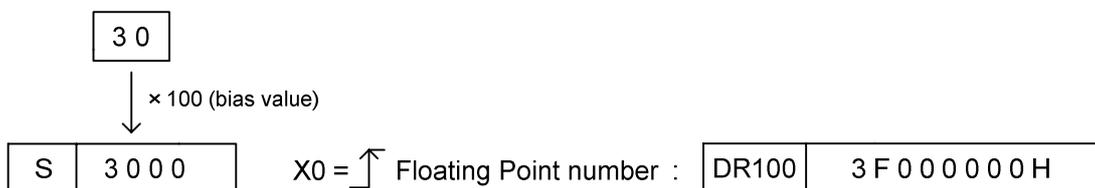
Range Ope- rand	HR	ROR	DR	K	XR
		R0 R3839	R5000 R8071	D0 D4095	Integer 16 Bit number
S	○	○	○	○	○
D	○	○*	○		○

Description

- The format of floating point number of Fatek-PLC follows the IEEE-754 standard. For detail explanation of the format please refer to 5.3 (Numbering System) page 5-9.
- When operation control "EN" = 1 or "EN ↑" (**P** instruction) from 0 to 1, take the SIN value of the angle data specified by the S register and store the result into the register D~D+1 in floating point number format. The valid range of the angle is from -18000 to +18000, unit in 0.01 degree.
- If the S value is not within the valid range, then the S value error flag "ERR" will be set to 1, and do not execute the operation.



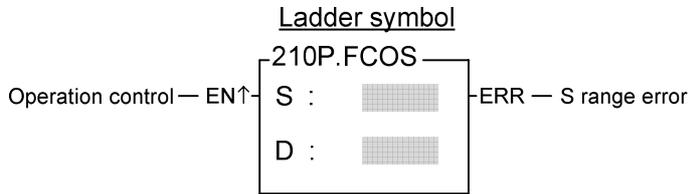
- At left, the example program gets the SIN value of 30, and stores the results the register DR100.



SIN(30) = 0.5

Advanced Function Instruction

FUN 210 P FCOS	COS TRIGONOMETRIC INSTRUCTION	FUN 210 P FCOS
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S : Source register to be taken COS

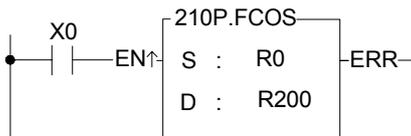
D : Register for storing result (COS value)

S, D may combine with V, Z, P0~P9 to serve indirect address application

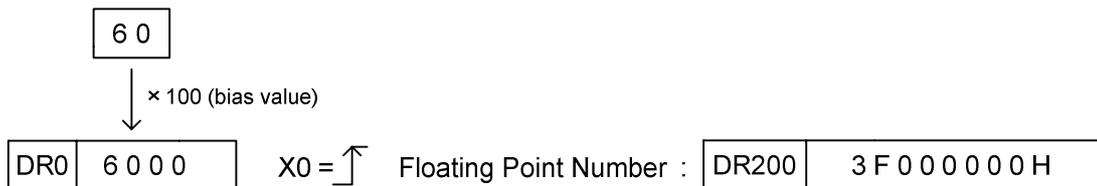
Range Ope- rand	HR	ROR	DR	K	XR
		R0 R3839	R5000 R8071	D0 D4095	Integer 16 Bit number
S	○	○	○	○	○
D	○	○*	○		○

Description

- The format of floating point number of Fatek-PLC follows the IEEE-754 standard. For detail explanation of the format please refer to 5.3 (Numbering System) page 5-9.
- When operation control "EN" = 1 or "EN ↑" (**P** instruction) from 0 to 1, take the COS value of the angle data specified by the S register and store the result into the register D~D+1 in floating point number format. The valid range of the angle is from -18000 to +18000, unit in 0.01 degree.
- If the S value is not within the valid range, then the S value error flag "ERR" will be set to 1, and do not execute the operation.

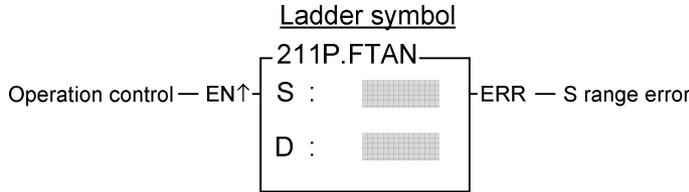


- At left, the example program gets the COS value of 60, and stores the results the register DR200.



COS(60) = 0.5

FUN 211 P FTAN	TAN TRIGONOMETRIC INSTRUCTION	FUN 211 P FTAN
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S : Source register to be taken TAN

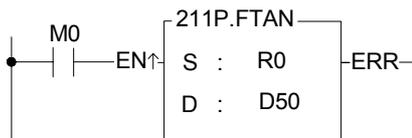
D : Register for storing result (TAN value)

S, D may combine with V, Z, P0~P9 to serve indirect address application

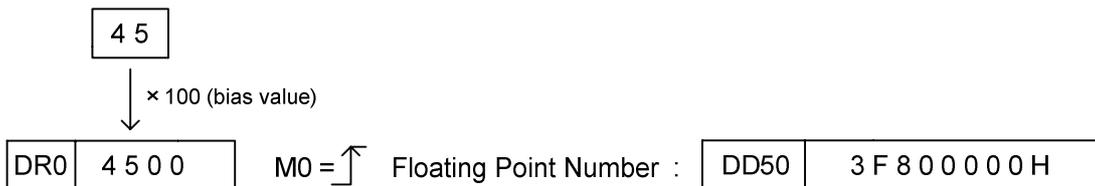
Range Ope- rand	HR	ROR	DR	K	XR
		R0 R3839	R5000 R8071	D0 D4095	Integer 16 Bit number
S	○	○	○	○	○
D	○	○*	○		○

Description

- The format of floating point number of Fatek-PLC follows the IEEE-754 standard. For detail explanation of the format please refer to 5.3 (Numbering System) page 5-9.
- When operation control "EN" = 1 or "EN ↑" (**P** instruction) from 0 to 1, take the COS value of the angle data specified by the S register and store the result into the register D~D+1 in floating point number format. The valid range of the angle is from -18000 to +18000, unit in 0.01 degree.
- If the S value is not within the valid range, then the S value error flag "ERR" will be set to 1, and do not execute the operation.

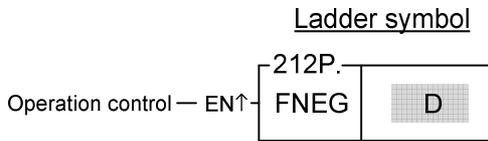


- At left, the example program gets the TAN value of 45, and stores the results the register DD50.



TAN(45) = 1

FUN 212 P FNEG	CHANGE SIGN OF THE FLOATING POINT NUMBER	FUN 212 P FNEG
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D : Register to be changed sign
 D may combine with V, Z, P0~P9 to serve indirect address application

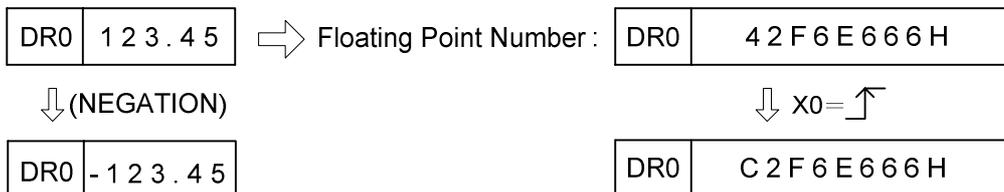
Range	HR	ROR	DR	K	XR
Ope- rand	R0 R3839	R5000 R8071	D0 D4095	Integer 16 Bit number	V · Z P0~P9
D	○	○*	○		○

Description

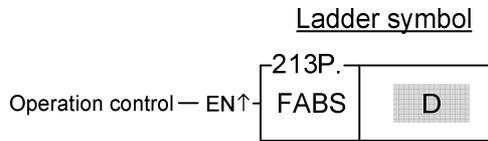
- The format of floating point number of Fatek-PLC follows the IEEE-754 standard. For detail explanation of the format please refer to 5.3 (Numbering System) page 5-9.
- When operation control "EN" = 1 or "EN ↑" (**P** instruction) from 0 to 1, the sign of the floating point number register specified by D will be toggled.



- The instruction at left negates the value of the DR0 register, and stores it back to DR0.



FUN 213 P FABS	FLOATING POINT NUMBER ABSOLUTE VALUE	FUN 213 P FABS
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D : Register to be taken absolute value
 D may combine with V, Z, P0~P9 to serve indirect address application

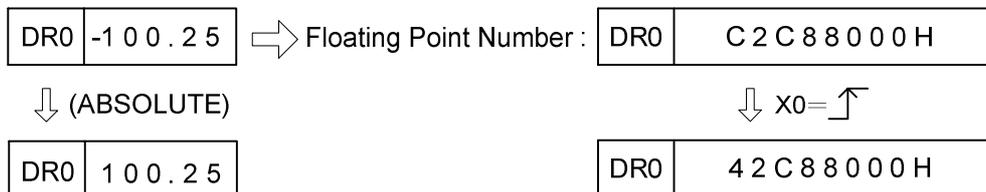
Range	HR	ROR	DR	K	XR
Ope- rand	R0 R3839	R5000 R8071	D0 D4095	Integer 16 Bit number	V · Z P0~P9
D	○	○*	○		○

Description

- The format of floating point number of Fatek-PLC follows the IEEE-754 standard. For detail explanation of the format please refer to 5.3 (Numbering System) page 5-9.
- When operation control "EN" = 1 or "EN ↑" (**P** instruction) from 0 to 1, calculate the absolute value of the floating point number register specified by D, and write it back into the original D register.



- The instruction at left calculates the absolute value of the DR0 register, and stores it back in DR0.





MEMO

