Calculating the exponent of single-precision real number

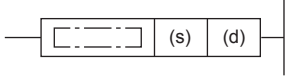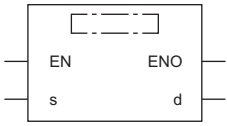## EXP(P)/DEXP(P)

FX5S **FX5UJ** **FX5U** **FX5UC**

These instructions calculate the exponent of a value specified by (s), and store the operation result in the device specified by (d).

The EXP(P) instructions can also be used as DEXP(P).

Ladder diagram	Structured text[1]
	ENO:=EXPP(EN,s,d);

FBD/LD[1]

[1] The EXP instruction is not supported by the ST language and the FBD/LD language. Use EXP of the standard function.
☞ Page 1289 EXP(_E)

## Setting data

■Descriptions, ranges, and data types

Operand	Description	Range	Data type	Data type (label)
(s)	Data whose exponent is calculated or head device number where the data is stored	—	Single-precision real number	ANYREAL_32
(d)	Head device number for storing the operation result	—	Single-precision real number	ANYREAL_32
EN	Execution condition	—	Bit	BOOL
ENO	Execution result	—	Bit	BOOL

■Applicable devices

Operand	Bit	Word		Double word		Indirect specification	Constant			Others
	X, Y, M, L, SM, F, B, SB, S	T, ST, C, D, W, SD, SW, R	U□\G□	Z	LC	LZ		K, H	E	$	
(s)	—	○	○	—	○	—	○	—	○	—	—
(d)	—	○	○	—	○	—	○	—	—	—	—

Processing details

- These instructions calculate the exponent of a value specified by (s), and store the operation result in the device specified by (d).
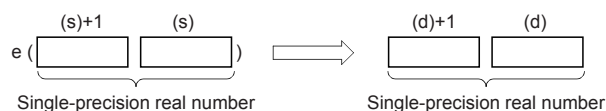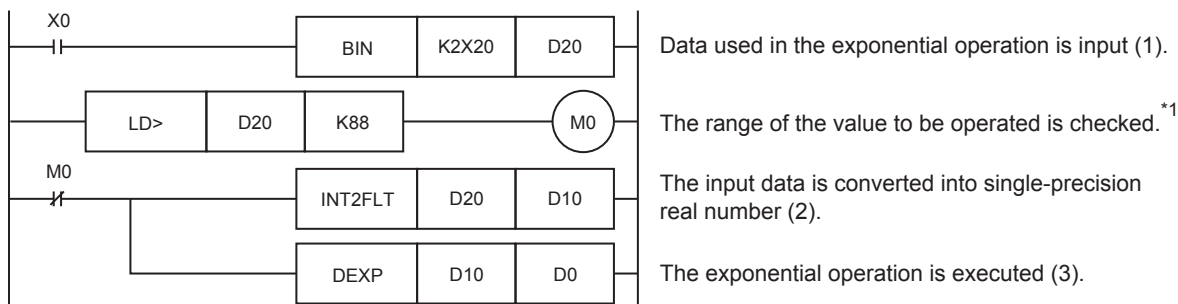

- In the exponential operation, the base (e) is set to "2.71828".
- The table below shows the related devices.

Device	Name	Description	
		Condition	**Operation**
SM700	Carry	The absolute value of the operation result ≥ 2^{128}	The value of (d) is the maximum value (2^{128}) of 32-bit real numbers and the carry flag SM700 turns on.

| Device	Name	Description	
		Condition	**Operation**
SM8021	Borrow	The absolute value of the operation result < 2^{-126}	The value of (d) is the minimum value (2^{-126}) of 32-bit real numbers and the borrow flag SM8021 turns on.
SM8022	Carry	The absolute value of the operation result $\geq 2^{128}$	The value of (d) is the maximum value (2^{128}) of 32-bit real numbers and the carry flag SM8022 turns on.

Program example

In the program example shown below, the exponential operation is executed for a value set in the 2-digit BCD format in X20 to X27, and the operation result is stored in the single-precision real number format to D0 and D1 when X0 turns ON.

Data used in the exponential operation is input (1).

The range of the value to be operated is checked.[*1]

The input data is converted into single-precision real number (2).

The exponential operation is executed (3).

• Operation when "13" is specified in X20 to X27
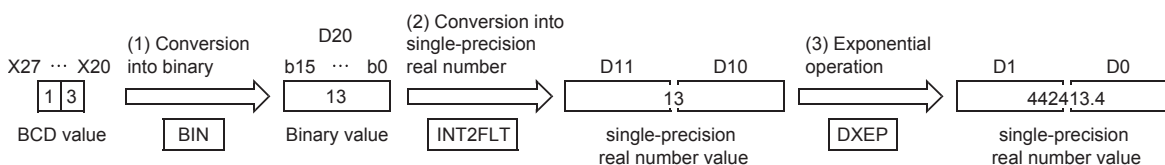
*1 The operation result becomes less than "2^{128}" when the BCD value set in X20 to X27 is "88" or less because of "$\log_e 2^{128}$ = 88.7". If a value "89" or more is set, an operation error occurs. To prevent this operation error, when a value more than "89" is set, M0 is set to ON so that the exponential operation is not executed.

Operation error

Error code (SD0/SD8067)	Description
3402H	The specified device value is -0, denormalized number, NaN (not a number), or $\pm\infty$.

Point

• The EXP(P) instructions execute operations in natural logarithm. For obtaining a value in common logarithm, specify a common logarithm value divided by 0.4342945 in (s).

$$10^X = e^{\frac{X}{0.4342945}}$$