TT200201 – FUP - Exponential and Logarithmic Functions

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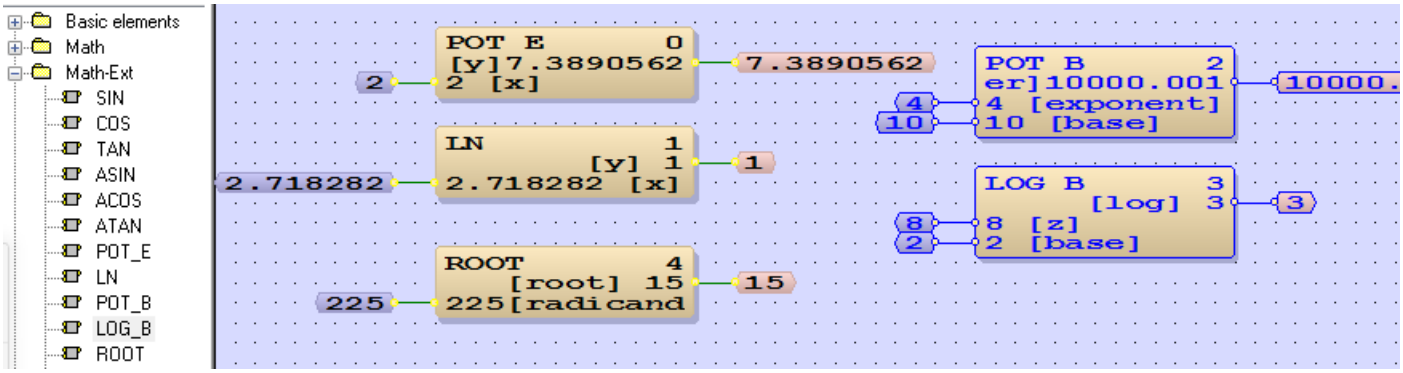
Title	Exponential and Logarithmic Functions (TT200201)
Object	FUP
Reference version	2
Date	02.2020
Author	EK
Goal	To explain the usage of the Exponential and Logarithmic Function Blocks

Content:



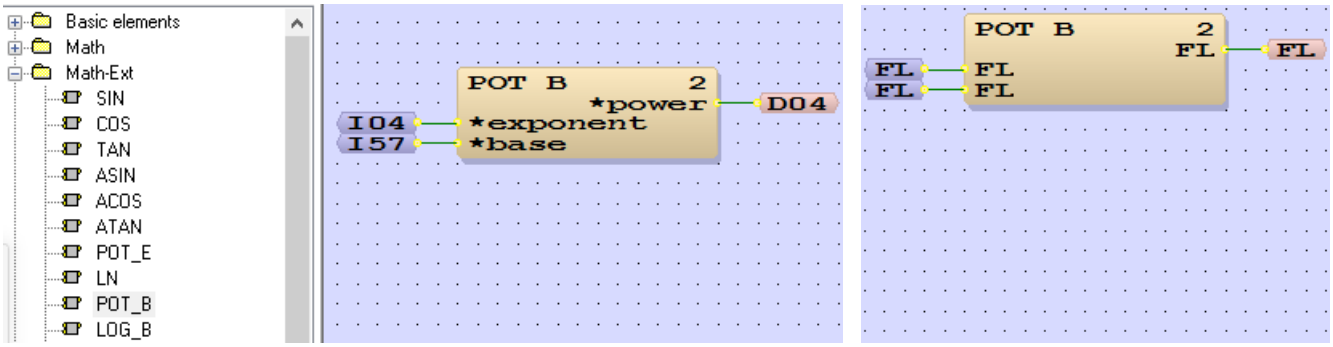
TT200201 – FUP - Exponential and Logarithmic Functions

1. Beside basic calculation, we can also perform complex calculation like exponential and logarithm calculation

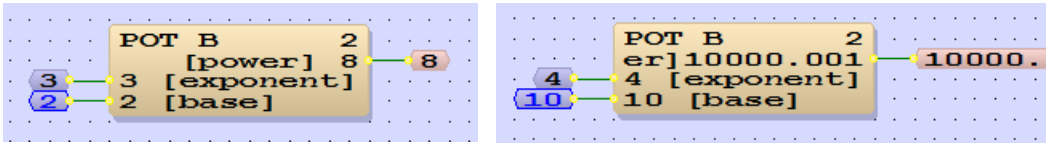
Exponentiation is a mathematical operation, written as b^n, involving two numbers, the *base* b and the *exponent* or *power* n. When n is a positive integer, exponentiation corresponds to repeated multiplication of the base: that is, b^n is the product of multiplying n bases:

$$b^n = \underbrace{b \times \cdots \times b}_{n \text{ times}}.$$

2. The exponentiation module in FUP is POT_B, under the Math_Ext folder. Drag and drop the module, and connect the Input and Output like below for testing



3. Try in simulation, base is “b” and exponent is “n”, so 2^3 is 8 and 10^4 is 10,000

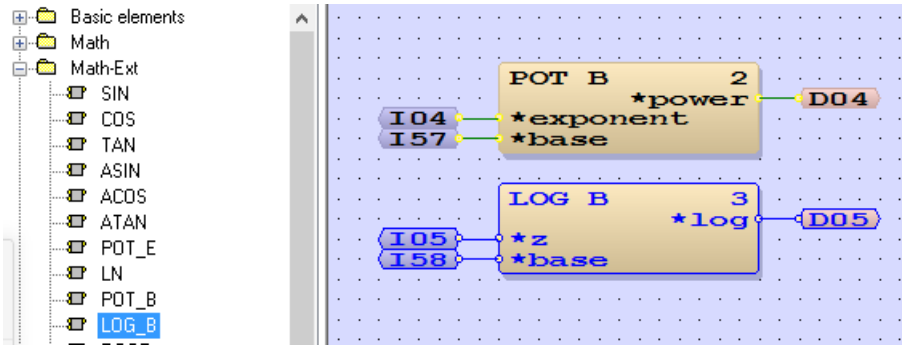


4. In mathematics, the logarithm is the inverse function to exponentiation

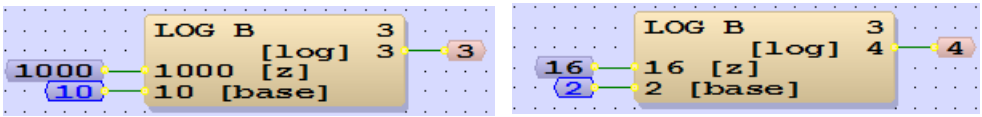
$$\log_b(x) = y \text{ exactly if } b^y = x \text{ and } x > 0 \text{ and } b > 0 \text{ and } b \neq 1.$$

For example, $\log_2 64 = 6$, as $2^6 = 64$.

5. The Logarithmic module in FUP is LOG_B, under the Math_Ext folder.



6. Try in simulation, base is “b” and exponent is “z”, so $\log_{10}(1000)$ is 3 and $\log_2(16)$ is 4



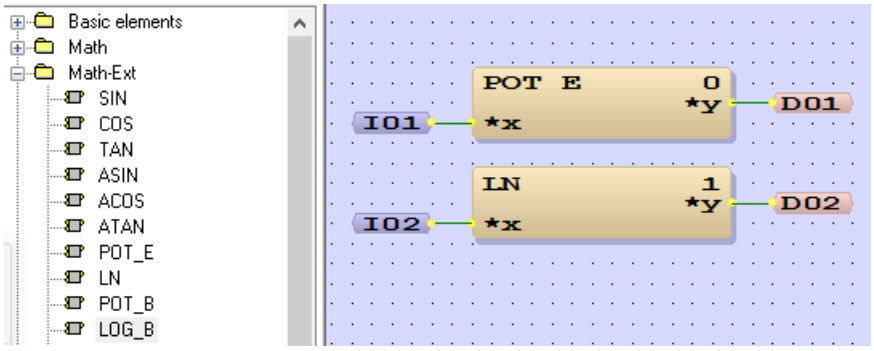
7. We also have natural logarithm calculation in FUP, which is “LN”, same as $\log_e(x)$

> The **natural logarithm** of a number is its logarithm to the base of the mathematical constant e, where e is an irrational and transcendental number approximately equal to 2.718 281 828 459. The natural logarithm of x is generally written as $\ln x$, $\log_e x$, or sometimes, if the base e is implicit, simply $\log x$.[1]

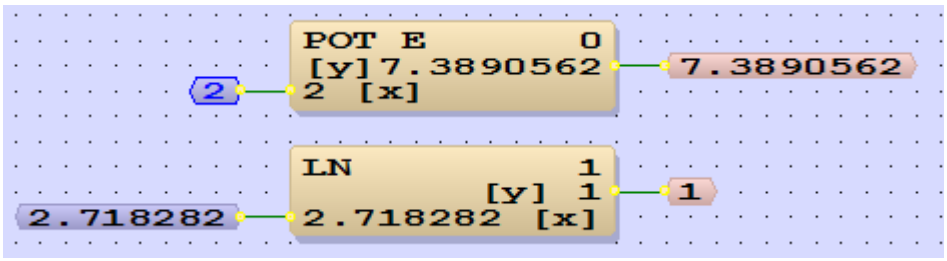
8. The inverse function of “LN” in FUP is POT_E, which is the same as e^x

> The natural logarithm function, if considered as a real-valued function of a real variable, is the inverse function of the exponential function, leading to the identities:
>
> $$e^{\ln x} = x \qquad \text{if } x > 0,$$
> $$\ln e^x = x.$$

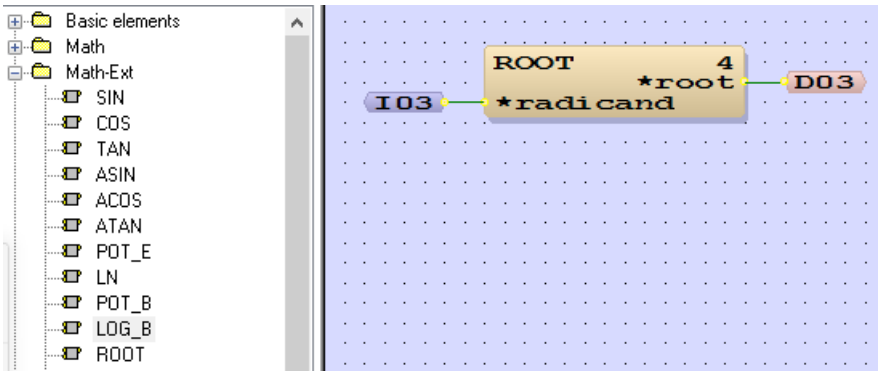
9. Both functions are also under “Math-Ext”



10. Try in simulation, ln (e) is 1 and e^2 is 7.39



11. The last module to show you is square root, which is called “ROOT”, under “Math-Ext”



12. You can easily try it in simulation.