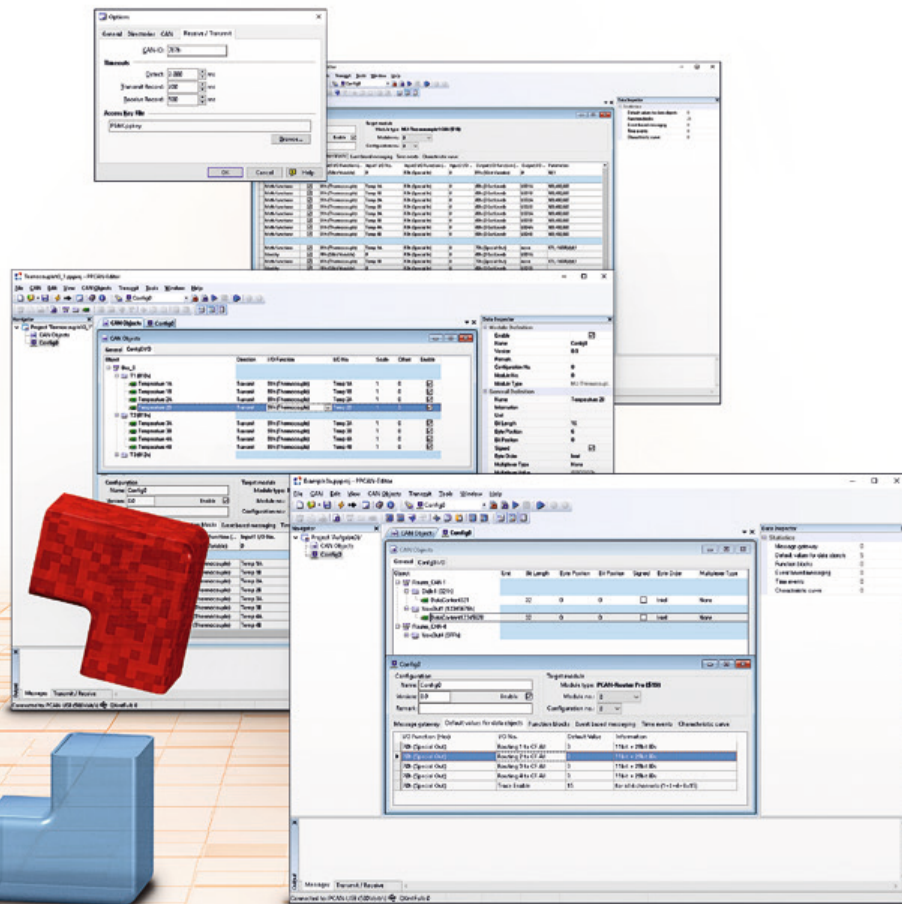


# PPCAN-Editor 2

## Reference Document for Function Blocks and I/O Resources



# IMPRINT

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# FUNCTION BLOCKS OVERVIEW

Depending on the hardware different resources are available. The following table shows the support of the function blocks for the different hardware platforms.

Function Block	ID	PCAN-MIO (32 Bit)	PCAN-Router Pro	MU-Thermocouple
Identity	\$01	■	■	■
Scaling	\$10	■	■	■
Hysteresis	\$11	■	■	■
Monoflop	\$12	■	■	■
Extended Hysteresis	\$14	■	■	■
Switch Delay	\$15	■	■	■
Lowpass	\$20	■	■	■
Characteristic Curve	\$21	■	■	■
Characteristic Curve with Limit	\$22	■	■	■
Characteristic Map	\$23	■	■	-
Characteristic Map with Limit	\$24	■	■	-
Small Map	\$25	■	■	-
Ramp Counter	\$30	■	■	■
Counter with Clock and Reload Input	\$32	■	■	■
PI Element	\$40	■	■	■
PIDT1 Element	\$50	■	■	■
Difference	\$51	■	■	■
Math Function	\$60	■	■	■
Binary Field	\$74	■	■	■

# IDENTITY

## Description

Copies the input variable to the output variable.  
Output = Input1

## Inputs / Outputs

Input1	Range of values Remark	32 bit signed → -2,147,483,648 to +2,147,483,647
Input2	Range of values Remark	
Output	Range of values Remark	32 bit signed → -2,147,483,648 to +2,147,483,647

## Parameters

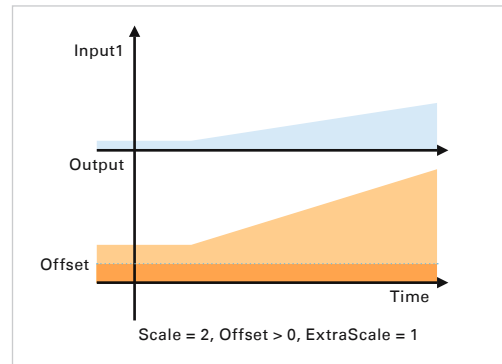
Parameters 1	Designation	
	Range of values	
	Remark	
Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# SCALING

## Description

Conversion of an input value, uses multiplier and offset, result is copied into the output variable.

$$\text{Output} = \text{Input1} * \text{Scale} * \text{ExtraScale} + \text{Offset}$$



## Inputs / Outputs

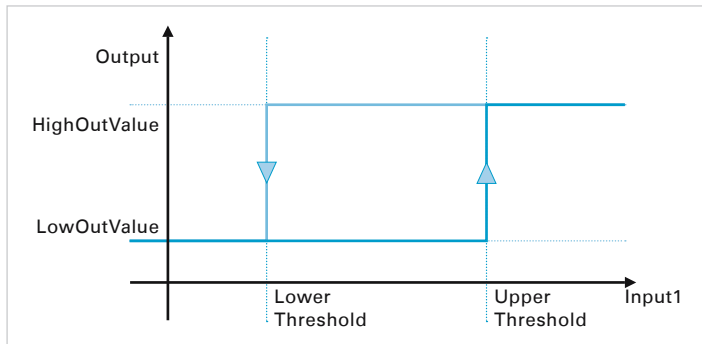
Input1	Range of values Remark	32 bit signed → -2,147,483,648 to +2,147,483,647
Input2	Range of values Remark	
Output	Range of values Remark	32 bit signed → -2,147,483,648 to +2,147,483,647

## Parameters

Parameter 1	Designation	Scale
	Range of values	Fixpoint 16.16 → -32,768.0000 to +32,767.9999
	Remark	
Parameter 2	Designation	Offset
	Range of values	Fixpoint 16.16 → -32,768.0000 to +32,767.9999
	Remark	
Parameter 3	Designation	ExtraScale
	Range of values	1 bis 32,767
	Remark	Extension of the Scale value (multiplication) if the range of values isn't sufficient. Useful values for this parameter are powers of 10 (10, 100, 1000, etc.).
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# HYSTERESIS

## Description



The output is set to one of two predefined values depending on the input value.

Output = LowOutValue if Input1 < LowerThreshold

Output = HighOutValue if Input1 > UpperThreshold

Output stays unchanged if LowerThreshold <= Input1 <= UpperThreshold

## Inputs / Outputs

Input1	Range of values Remark	32 bit signed → -2,147,483,648 to +2,147,483,647
Input2	Range of values Remark	
Output	Range of values Remark	16 bit signed → -32,768 to 32,767

## Parameters

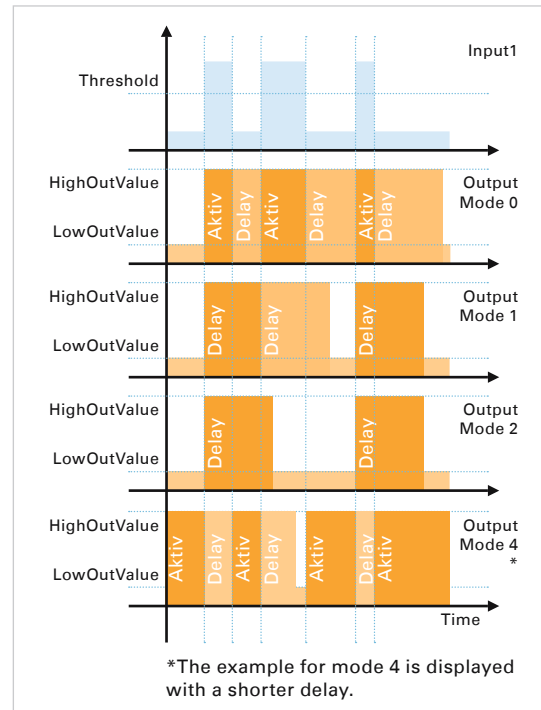
Parameter 1	Designation	LowerThreshold
	Range of values	16 bit signed → -32,768 to 32,767
	Remark	Limit for Input1; when fallen below, Output is set to LowOutValue
Parameter 2	Designation	UpperThreshold
	Range of values	16 bit signed → -32,768 to 32,767
	Remark	Limit for Input1; when exceeded, Output is set to HighOutValue
Parameter 3	Designation	LowOutValue
	Range of values	16 bit signed → -32,768 to 32,767
	Remark	Value for Output if Input1 < LowerThreshold
Parameter 4	Designation	HighOutValue
	Range of values	16 bit signed → -32,768 to 32,767
	Remark	Value for Output if Input1 > UpperThreshold
Parameter 5	Designation	StartMode
	Range of values	0, 1, 2
	Remark	0: Output is HighOutValue, if the starting value is above the average value of the hysteresis. Otherwise, the output is LowOutValue. 1: Output is HighOutValue, if the starting value is greater than UpperThreshold. Otherwise, the output is LowOutValue. 2: Output is LowOutValue, if the starting value is lower than LowerThreshold. Otherwise, the output is HighOutValue.
Parameter 6	Designation	
	Range of values	
	Remark	

# MONOFLOP

## Description

For a predefined period the output is set to one of two predefined values depending on the input value.

- Mode = 0: level-triggered monoflop  
Output = HighOutValue, as long as Input1 >= Threshold; when Input1 < Threshold, Output is set to LowOutValue after Delay milliseconds.
- Mode = 1: edge-triggered monoflop, repeatedly triggerable  
Output = HighOutValue for the period Delay when a positive edge is detected at Input1; any further positive edge during the active period restarts the Delay period. Output = LowOutValue when the Delay period is over.
- Mode = 2: edge-triggered monoflop  
Output = HighOutValue for the period Delay when a positive edge is detected at Input1. Output = LowOutValue when the Delay period is over.
- Mode = 4: Output = HighOutValue, as long as Input1 < Threshold; when Input1 >= Threshold, Output is set to LowOutValue after Delay milliseconds.



## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	16 bit signed → -32,768 to 32,767
	Remark	

## Parameters

Parameter 1	Designation	Delay
	Range of values	0 to 32,767
	Remark	Delay in milliseconds
Parameter 2	Designation	Threshold
	Range of values	16 bit signed → -32,768 to 32,767
	Remark	Limit for detection of a High or Low input signal
Parameter 3	Designation	Mode
	Range of values	0, 1, 2, 4
	Remark	Operating mode of the monoflop
Parameter 4	Designation	LowOutValue
	Range of values	16 bit signed → -32,768 to 32,767
	Remark	Default output value of the monoflop
Parameter 5	Designation	HighOutValue
	Range of values	16 bit signed → -32,768 to 32,767
	Remark	Output value as long as the monoflop is active
Parameter 6	Designation	TimeScale
	Range of values	0 to 32,767
	Remark	Multiplier for the parameter 1, Delay. If the range of values for Delay is not sufficient, it can be expanded with TimeScale.  TimeScale = 0: An expansion is omitted. TimeScale > 0: The product of Delay and TimeScale is used as delay.



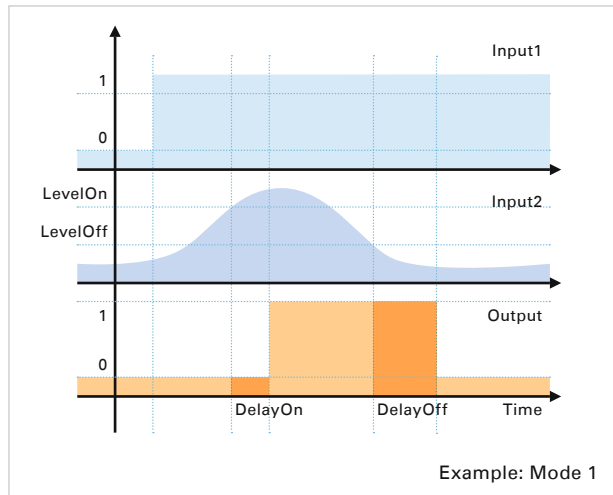
# EXTENDED HYSTERESIS

## Description

Depending on an input value the output is activated (set to 1) for a predefined period Timeout. A second input is used as enable signal.

Output = 1      at change to Input1  $\lt;$  0  
 AND  
 Input2  $>$  ( $\lt$ ) LevelOn  
 AND  
 DelayOn period is over

Output = 0      if Input1 = 0  
 OR  
 Input2  $\lt;$  ( $>$ ) LevelOff AND DelayOff  
 period is over



## Inputs / Outputs

Input1	Range of values Remark	= 0: Disable, $\lt;$ 0: Enable Input1 = Enable
Input2	Range of values Remark	32 bit signed $\rightarrow$ -2,147,483,648 to +2,147,483,647 Level
Output	Range of values Remark	0, 1

## Parameters

Parameter 1	Designation	Mode
	Range of values	1, 2, 5, 6
	Remark	1: Default behavior (see function description) 2: The relation symbols shown in parentheses are valid 5: As Mode = 1, Output = 0 after Timeout period 6: As Mode = 2, Output = 0 after Timeout period
Parameter 2	Designation	LevelOn
	Range of values	16 bit signed $\rightarrow$ -32,768 to 32,767
	Remark	Level for on detection
Parameter 3	Designation	DelayOn
	Range of values	0 to 32,767
	Remark	Minimum period in milliseconds for Input2 $>$ LevelOn
Parameter 4	Designation	LevelOff
	Range of values	16 bit signed $\rightarrow$ -32,768 to 32,767
	Remark	Level for off detection
Parameter 5	Designation	DelayOff
	Range of values	0 to 32,767
	Remark	Minimum period in milliseconds for Input2 $\lt;$ LevelOff
Parameter 6	Designation	Timeout
	Range of values	0 to 32,767
	Remark	Relevant only for Mode = 5, 6 After switching on the output it is switched off again after Timeout milliseconds at the latest.

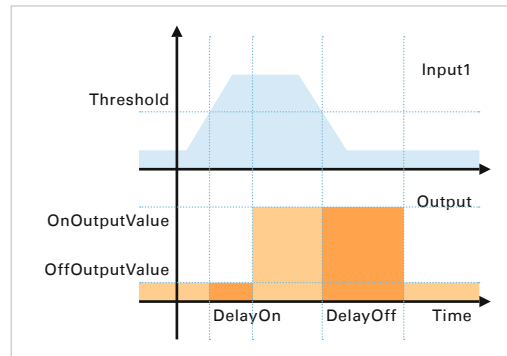
# SWITCH DELAY

## Description

Switch-on delay, switch-off delay, or combination of both.

Switch-on delay: as soon as the input  $\geq$  Threshold for at least SwitchOnDelay milliseconds, the output is set to OnOutputValue.

Switch-off delay: as soon as the input  $<$  Threshold for at least SwitchOffDelay milliseconds, the output is set to OffOutputValue.



## Inputs / Outputs

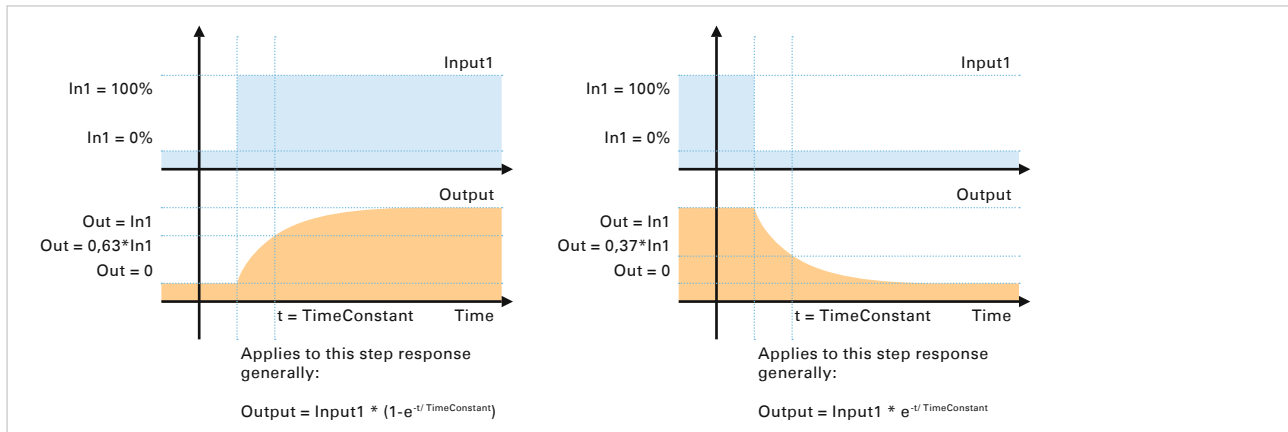
Input1	Range of values Remark	16 bit signed → -32,768 to +32,767
Input2	Range of values Remark	
Output	Range of values Remark	16 bit signed → -32,768 to +32,767

## Parameters

Parameter 1	Designation	SwitchOnDelay
	Range of values	0 to 32,767
	Remark	Period in milliseconds for switch-on delay
Parameter 2	Designation	SwitchOffDelay
	Range of values	0 to 32,767
	Remark	Period in milliseconds for switch-off delay
Parameter 3	Designation	Threshold
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Threshold for comparison with input signal
Parameter 4	Designation	OffOutputValue
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Default output value of the monoflop
Parameter 5	Designation	OnOutputValue
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Output value as long as the monoflop is active
Parameter 6	Designation	TimeScale
	Range of values	0 to 32,767
	Remark	Multiplier for Parameter 1 (Time) if the range of values for Parameter 1 isn't sufficient.  Timescale = 0: Parameter 1 remains unchanged Timescale > 0: the actual Time value is multiplied with Timescale

# LOWPASS

## Description



Implementation of a delay element by a low pass with adjustable time.

## Inputs / Outputs

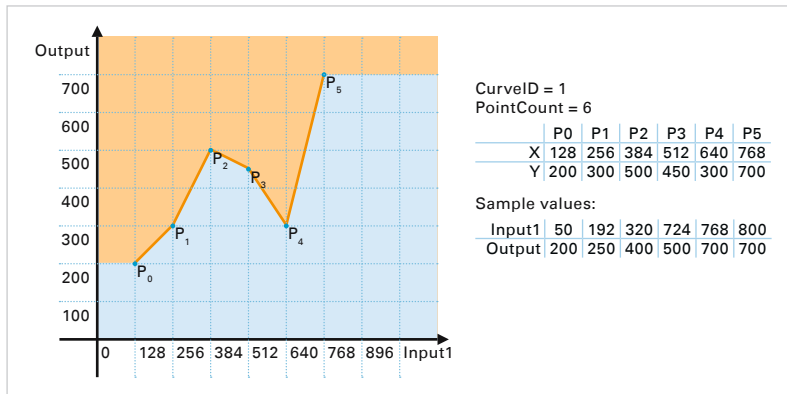
Input1	Range of values Remark	16 bit unsigned → 0 to +65,535
Input2	Range of values Remark	
Output	Range of values Remark	16 bit unsigned → 0 to +65,535

## Parameters

Parameter 1	Designation	TimeConstant
	Range of values	0 to 32,767
	Remark	Time in milliseconds
Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# CHARACTERISTIC CURVE

## Description



The input signal is converted via a predefined characteristic curve. The characteristic curve may have up to 31 nodes (index from 0 to 30). The X values of the nodes must be in an ascending order. Between two nodes a linear interpolation is done.

If the input value is below the smallest X value or above the largest X value, then the first or last corresponding Y value is returned.

Output = Curve(Input1)

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 1	Designation	CurvelD
	Range of values	0 to 32,767
	Remark	ID of the characteristic curve that shall be used. The respective nodes are defined and stored separately for different characteristic curves. The maximum number of available characteristic curves is dependent on the used module type.
Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

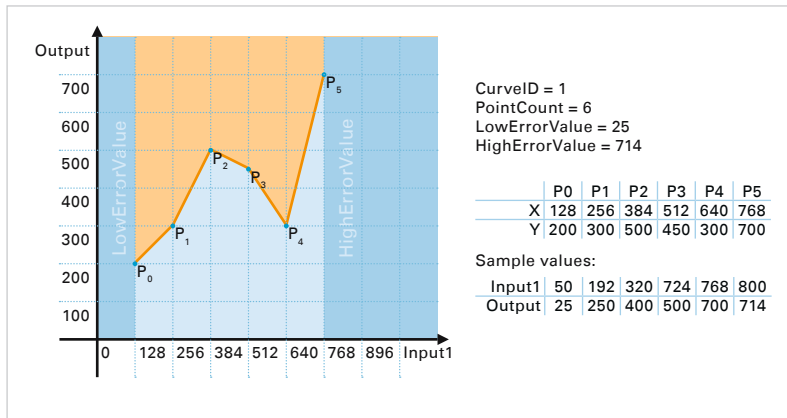
## Creating a Characteristic Curve

Characteristic curves are created in the tab of the same name of the [Configuration](#). A new curve entry is created by right clicking in the empty tab and selecting [Add Record](#).

CurvelD	With the ID function blocks reference the characteristic curve.
Point Count	Number of value pairs which define the curve. Point count does not limit the displayed value pairs. All 31 are always displayed.
X- and Y-values	Specification of the value pairs used to define the course of the curve.

# CHARACTERISTIC CURVE WITH LIMIT

## Description



The input signal is converted via a predefined characteristic curve. The characteristic curve may have up to 31 nodes (index from 0 to 30). The X values of the nodes must be in an ascending order. Between two nodes a linear interpolation is done.

If the input value is below the smallest X value, then LowErrorValue is returned. If the input value is above the largest X value, then HighErrorValue is returned.

Output = Curve(Input1)

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 1	Designation	CurveID
	Range of values	0 to 32,767
	Remark	ID of the characteristic curve that shall be used. The respective nodes are defined and stored separately for different characteristic curves. The maximum number of available characteristic curves is dependent on the used module type.
Parameter 2	Designation	LowErrorValue
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Return value at undercut of the smallest input value defined by the characteristic curve
Parameter 3	Designation	HighErrorValue
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Return value when exceeding the largest input value defined by the characteristic curve
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

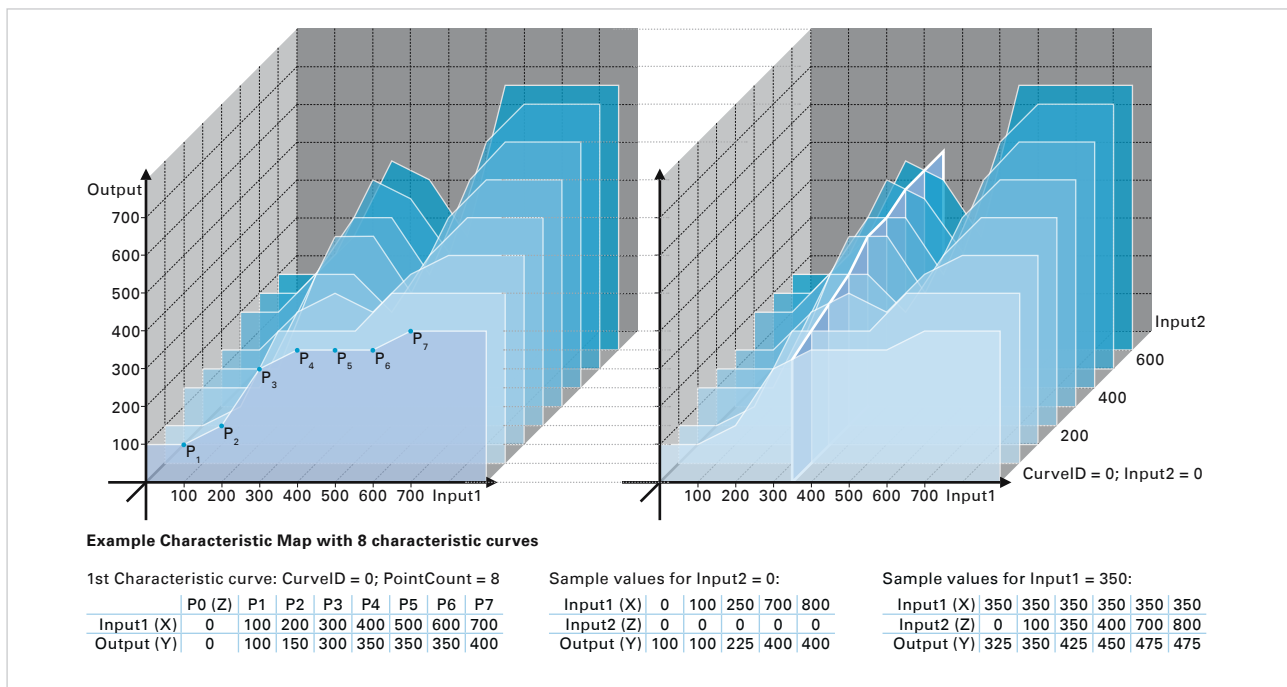
## Creating a Characteristic Curve

Characteristic curves are created in the tab of the same name of the **Configuration**. A new curve entry is created by right clicking in the empty tab and selecting **Add Record**.

- CurveID** With the ID function blocks reference the characteristic curve.
- Point Count** Number of value pairs which define the curve. Point count does not limit the displayed value pairs. All 31 are always displayed.
- X- and Y-values** Specification of the value pairs used to define the course of the curve.

# CHARACTERISTIC MAP

## Description



The input signal is converted via a predefined area that is composed of a list of characteristic curves. Each characteristic curve must have the same number of nodes. The characteristic curves may each have up to 30 nodes (index from 1 to 30).

The value of  $x[0]$  (index = 0) defines the Z-axis intercept for each characteristic curve. The value of  $y[0]$  is insignificant. The IDs of the characteristic curves must be ascendant. The X values of the nodes must be in an ascending order.

Between two nodes a linear interpolation is done for both the X and the Z direction.

$$\text{Output} = \text{Map}(\text{Input1}, \text{Input2})$$

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	X value
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	Z value
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	Y value

## Parameters

Parameter 1	Designation	StartCurveID
	Range of values	0 to 32,767
	Remark	First characteristic curve describing the area
Parameter 2	Designation	NumberOfCurves
	Range of values	0 to 32,767
	Remark	Number of characteristic curves composing an area
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

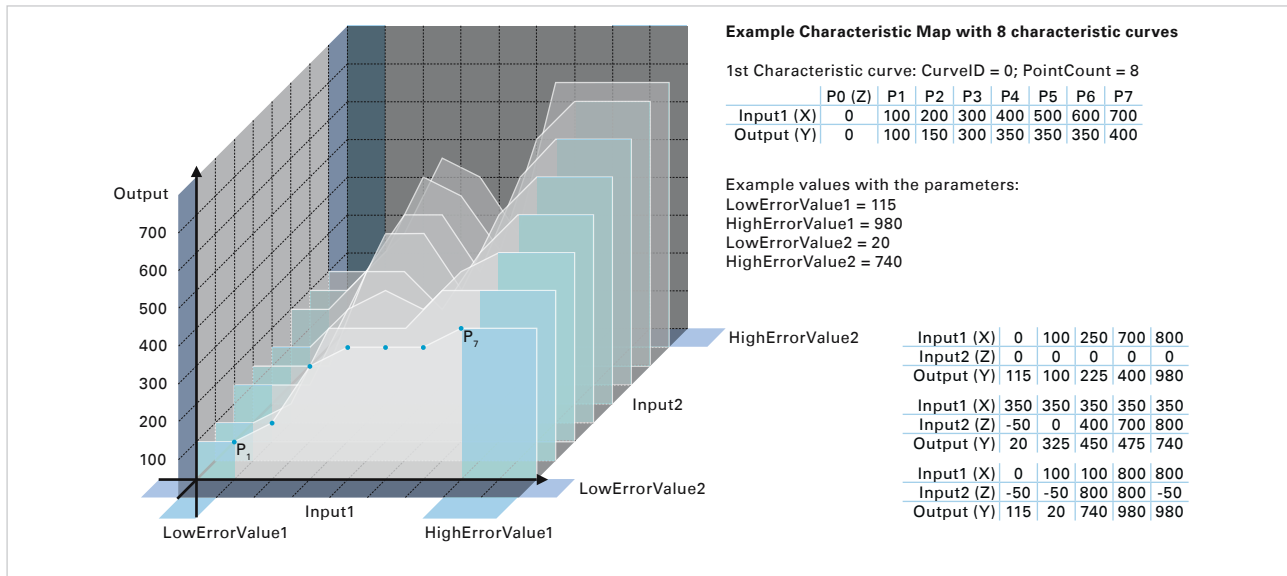
## Creating a Characteristic Curve

Characteristic curves are created in the tab of the same name of the [Configuration](#). A new curve entry is created by right clicking in the empty tab and selecting [Add Record](#).

CurveID	With the ID function blocks reference the characteristic curve.
Point Count	Number of value pairs which define the curve. Point count does not limit the displayed value pairs. All 31 are always displayed.
X- and Y-values	Specification of the value pairs used to define the course of the curve.

# CHARACTERISTIC MAP WITH LIMIT

## Description



The input signal is converted via a predefined area that is composed of a list of characteristic curves. Each characteristic curve must have the same number of nodes. The characteristic curves may each have up to 30 nodes (index from 1 to 30).

The value of x[0] (Index = 0) defines the Z-axis intercept for each characteristic curve. The IDs of the characteristic curves must be ascendant. The X values of the nodes must be in an ascending order. Between two nodes a linear interpolation is done for both the X and the Z direction.

If either Input1 (X) or Input2 (Z) are outside the area being defined by the characteristic curves, the ErrorValues predefined by parameters 3 to 6 are returned. If both inputs are outside the area, either parameter 3 or 4 is decisive.

$$\text{Output} = \text{Map}(\text{Input1}, \text{Input2})$$

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	X value
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	Z value
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	Y value



## Parameters

Parameter 1	Designation	StartCurveID
	Range of values	0 to 32,767
	Remark	First characteristic curve describing the area
Parameter 2	Designation	NumberOfCurves
	Range of values	0 to 32,767
	Remark	Number of characteristic curves composing an area
Parameter 3	Designation	LowErrorValue1
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Return value if Input1 falls below the minimum value
Parameter 4	Designation	HighErrorValue1
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Return value if Input1 exceeds the maximum value
Parameter 5	Designation	LowErrorValue2
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Return value if Input2 falls below the minimum value
Parameter 6	Designation	HighErrorValue2
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Return value if Input2 exceeds the maximum value

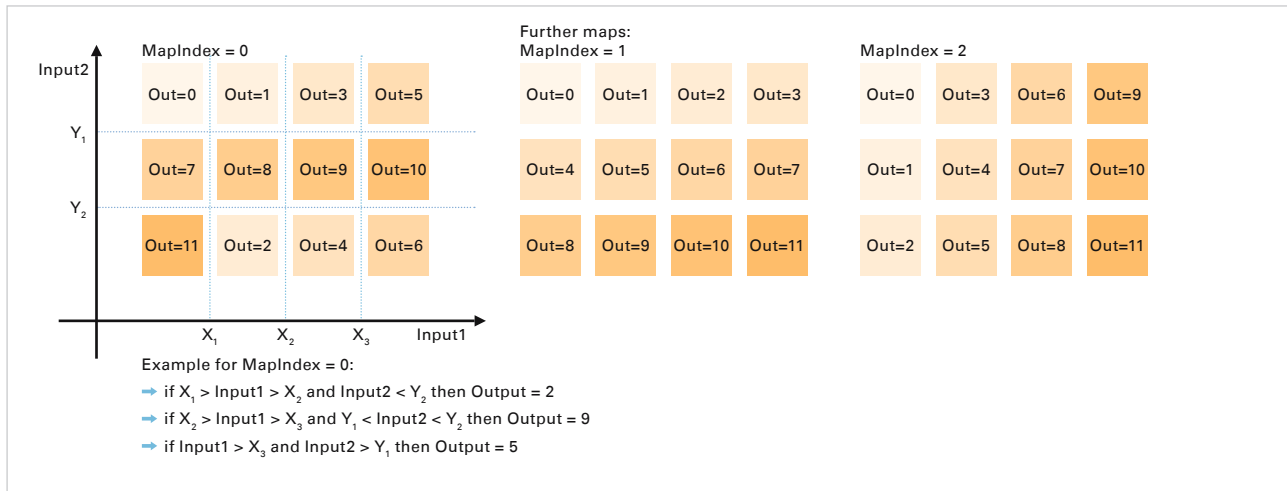
## Creating a Characteristic Curve

Characteristic curves are created in the tab of the same name of the [Configuration](#). A new curve entry is created by right clicking in the empty tab and selecting [Add Record](#).

CurveID	With the ID function blocks reference the characteristic curve.
Point Count	Number of value pairs which define the curve. Point count does not limit the displayed value pairs. All 31 are always displayed.
X- and Y-values	Specification of the value pairs used to define the course of the curve.

# SMALL MAP

## Description



Both inputs indicate a position in a matrix of 12 fields. The return values are determined by predefined reference tables (selectable by MapIndex).

$$\text{Output} = f(\text{Input1}, \text{Input2})$$

Input1 determines the X position in the matrix, Input2 the Y position. The respective limits define the areas (see figures).

## Inputs / Outputs

Input1	Range of values Remark	16 bit signed → -32,768 to +32,767
Input2	Range of values Remark	16 bit signed → -32,768 to +32,767
Output	Range of values Remark	16 bit signed → -32,768 to +32,767

## Parameters

Parameter 1	Designation	X1
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Limit X1
Parameter 2	Designation	X2
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Limit X2
Parameter 3	Designation	X3
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Limit X3
Parameter 4	Designation	Y1
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Limit Y1
Parameter 5	Designation	Y2
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Limit Y2
Parameter 6	Designation	MapIndex
	Range of values	0, 1, 2
	Remark	Determines which predefined reference table is used

# RAMP COUNTER

## Description

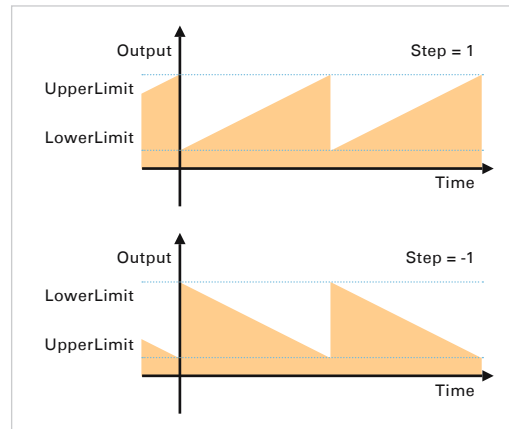
Counter increments or decrements with each call from LowerLimit to UpperLimit and restarts at LowerLimit afterwards.

Output = Output + Step

Step = 1 if UpperLimit > LowerLimit

Step = -1 if UpperLimit < LowerLimit

The counting frequency depends on the Cycle Time that is set for the function block.



## Inputs / Outputs

Input1	Range of values	
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	16 bit signed → -32,768 to +32,767
	Remark	

## Parameters

Parameter 1	Designation	LowerLimit
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Start value of the counter
Parameter 2	Designation	UpperLimit
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	End value of the counter
Parameter 3	Designation	StartValue
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Start value of the counter. This is the first return value of the function.
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# COUNTER WITH CLOCK AND RELOAD INPUT

## Description

Counter for edges on Input1. Depending on the parameter EdgeDetectionMode positive, negative, or both edges are counted. The counter counts from StartValue to EndValue in the preset direction (Direction). When Input2 = 1, the counter is set to ReloadValue.

The counter is a pure software implementation. The counter signal must be steady on a level for the call period of the function block so that the edges are detected reliably.

## Inputs / Outputs

Input1	Range of values Remark	32 bit signed → -2,147,483,648 to +2,147,483,647
Input2	Range of values Remark	0, 1
Output	Range of values Remark	32 bit signed → -2,147,483,648 to +2,147,483,647

## Parameters

Parameter 1	Designation	ReloadValue
	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	Counter is set to this value when Input2 is 1.
Parameter 2	Designation	StartValue
	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	Start value of the counter
Parameter 3	Designation	EndValue
	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	End value of the counter. At the next count pulse the counter restarts at StartValue.
Parameter 4	Designation	Direction
	Range of values	0, 1
	Remark	0: decremental, 1: incremental
Parameter 5	Designation	EdgeDetectionMode
	Range of values	0, 1, 2
	Remark	0: only positive edges on Input1 are counted 1: only negative edges on Input1 are counted 2: both edges on Input1 are counted
Parameter 6	Designation	Reserved
	Range of values	0
	Remark	At this time this parameter is unused; however, it must be set to 0 to be compatible to future extensions.

# PI ELEMENT

## Description

Simple PI controller with reference value and feedback value inputs

$$I = I + (\text{Input1} - \text{Input2}) * kI$$

$$\text{Output} = (\text{Input1} - \text{Input2}) * kP + I$$

The output is limited to the range of values between „LowerLimit“ and „UpperLimit“.

## Inputs / Outputs

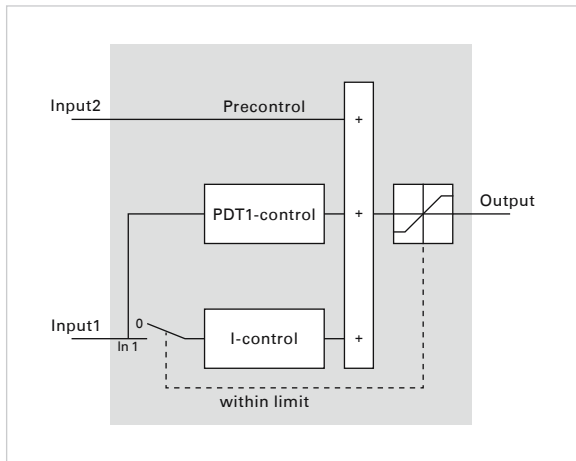
Input1	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Reference value
Input2	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Feedback value
Output	Range of values	16 bit signed → -32,768 to +32,767
	Remark	

## Parameters

Parameter 1	Designation	kP
	Range of values	Fixpoint 16.16 → -32,768.0000 to +32,767.9999
	Remark	Multiplier for input difference, proportional part
Parameter 2	Designation	kI
	Range of values	Fixpoint 16.16 → -32,768.0000 to +32,767.9999
	Remark	Multiplier for input difference, integral part
Parameter 3	Designation	LowerLimit
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Lower limit for the output
Parameter 4	Designation	UpperLimit
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Upper limit for the output
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# PIDT1 ELEMENT

## Description



PIDT1 controller

## Inputs / Outputs

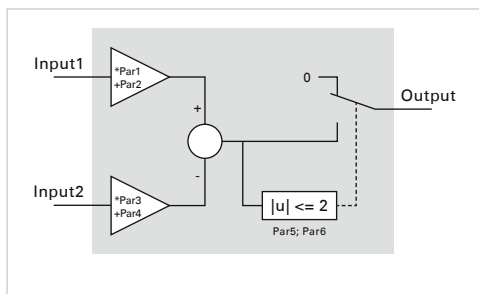
Input1	Range of values Remark	-1024 to +1023 Input1 is the controller input. The difference from the feedback value and the reference value is expected here. For the calculation of the difference the special function block „Difference“ can be used.
Input2	Range of values Remark	16 bit signed → -32,768 to +32,767 Is added to the output value of the PIDT1 controller.
Output	Range of values Remark	16 bit signed → -32,768 to +32,767 Controller output

## Parameters

Parameter 1	Designation	P
	Range of values	Fixpoint 16.16 → -32,768.0000 to +32,767.9999
	Remark	
Parameter 2	Designation	I
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 3	Designation	D
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 4	Designation	T1
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Time constant
Parameter 5	Designation	LowerLimit
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Lower limit of the controller output
Parameter 6	Designation	UpperLimit
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Upper limit of the controller output

# DIFFERENCE

## Description



Auxiliary function block for the PIDT1 controller for calculation of the difference of reference value and feedback value.

Both input values can be converted by Scale and Offset independently in order to bring the reference and the feedback value to a commensurable basis.

If the difference lies within the limits defined by PositiveDeviation and NegativeDeviation, 0 is returned, else the difference is returned.

## Inputs / Outputs

Input1	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Reference value
Input2	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Feedback value
Output	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Input signal 1 for PIDT1 controller

## Parameters

Parameter 1	Designation	Scale1
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	For Input1
Parameter 2	Designation	Offset1
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	For Input1
Parameter 3	Designation	Scale2
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	For Input2
Parameter 4	Designation	Offset2
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	For Input2
Parameter 5	Designation	PositiveDeviation
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 6	Designation	NegativeDeviation
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	

# MATH FUNCTION

## Description

Collection mathematical and logical functions. The desired function or operation is determined by Parameter 1.

Find the description of the functions and operations after the description of the function blocks.

## Inputs / Outputs

Input1	Range of values	depending on the selected function or operation
	Remark	
Input2	Range of values	depending on the selected function or operation
	Remark	
Output	Range of values	depending on the selected function or operation
	Remark	

## Parameters

Parameter 1	Designation	Function/operation
	Range of values	
	Remark	With this parameter the math function can be chosen from a plain text list. No number has to be entered.
Parameter 2	Designation	depending on the selected function or operation
	Range of values	
	Remark	
Parameter 3	Designation	depending on the selected function or operation
	Range of values	
	Remark	
Parameter 4	Designation	depending on the selected function or operation
	Range of values	
	Remark	
Parameter 5	Designation	depending on the selected function or operation
	Range of values	
	Remark	
Parameter 6	Designation	depending on the selected function or operation
	Range of values	
	Remark	



# BINARY FIELD

## Description

Assembles a sequence of digital information to a binary value. Please note: IONumberStart + NumberOfInputs must not be higher than 255.

Example: Digital inputs 3, 4, 5, and 6 make a connected 4-bit value.  
 Output =  $DIN3 * 1 + DIN4 * 2 + DIN5 * 4 + DIN6 * 8$ :  
 IONumberStart = 3  
 NumberOfInputs = 4  
 IOFunction = \$80

32 bit variables and analog inputs can also be used. If their content is != 0, the value is considered to be logically 1.

## Inputs / Outputs

Input1	Range of values	
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	32 bit
	Remark	

## Parameters

Parameter 1	Designation	IONumberStart
	Range of values	0 to 255
	Remark	
Parameter 2	Designation	NumberOfInputs
	Range of values	0 to 32
	Remark	
Parameter 3	Designation	IOFunction
	Range of values	\$00 to \$FF
	Remark	Indication of an I/O function with its hexadecimal number (incl. string character „\$“)
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# ADD

## Description

Addition. Output = Input1 + Input2

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	1st summand
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	2nd summand
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	Sum

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# SUBTRACT

## Description

Subtraction. Output = Input1 - Input2

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	Minuend
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	Subtrahend
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	Difference

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# MULTIPLY

## Description

Multiplication.  $\text{Output} = \text{Input1} * \text{Input2}$

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	1st factor
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	2nd factor
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	Product

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# DIVIDE

## Description

Division. Output = Input1 / Input2

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	Dividend
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	Divisor
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	Quotient

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# POWER

## Description

Output = Input1<sup>Input2</sup>

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	Radix
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	Exponent
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	Power

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# LEFT SHIFT

## Description

Variable bit shift to the left by Input2 digit positions  
(multiplication of Input1 with  $2^{\text{Input2}}$ )

Output = Input1 << Input2

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	0 to 31
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# RIGHT SHIFT

## Description

Variable bit shift to the right by Input2 digit positions (division of Input1 by  $2^{\text{Input2}}$ )

Output = Input1 >> Input2

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	0 to 31
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	



# LEFT SHIFT CONST

## Description

Bit shift to the left by Digits digit positions (multiplication of Input1 with  $2^{\text{Digits}}$ )

Output = Input1 << Digits

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	Digits
	Range of values	0 to 31
	Remark	Number of positions
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# RIGHT SHIFT CONST

## Description

Bit shift to the right by Digits digit positions (division of Input1 by  $2^{\text{Digits}}$ )

Output = Input1 >> Digits

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	Digits
	Range of values	0 to 31
	Remark	Number of positions
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# NOT

## Description

Inversion of all bits

Output = NOT(Input1)

The output value is limited to the indicated length.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	ResultLength
	Range of values	0 to 32
	Remark	Limitation of the result to ResultLength digits. Value 0 is similar to 32, use all bits.
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# OR

## Description

Boolean OR function

Output = Input1 OR Input2

The output value is limited to the indicated length. Input1 and Input2 can be inverted in addition.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	ResultLength
	Range of values	0 to 32
	Remark	Limitation of the result to ResultLength digits. Value 0 is similar to 32, use all bits.
Parameter 3	Designation	InvertInput1
	Range of values	0, 1
	Remark	1: invert Input1 bitwise
Parameter 4	Designation	InvertInput2
	Range of values	0, 1
	Remark	1: invert Input2 bitwise
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# NOR

## Description

Boolean NOR function

Output = Input1 NOR Input2

The output value is limited to the indicated length. Input1 and Input2 can be inverted in addition.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	ResultLength
	Range of values	0 to 32
	Remark	Limitation of the result to ResultLength digits. Value 0 is similar to 32, use all bits.
Parameter 3	Designation	InvertInput1
	Range of values	0, 1
	Remark	1: Invert Input1 bitwise
Parameter 4	Designation	InvertInput2
	Range of values	0, 1
	Remark	1: Invert Input2 bitwise
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# AND

## Description

Boolean AND function

Output = Input1 AND Input2

The output value is limited to the indicated length. Input1 and Input2 can be inverted in addition.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	ResultLength
	Range of values	0 to 32
	Remark	Limitation of the result to ResultLength digits. Value 0 is similar to 32, use all bits.
Parameter 3	Designation	InvertInput1
	Range of values	0, 1
	Remark	1: Invert Input1 bitwise
Parameter 4	Designation	InvertInput2
	Range of values	0, 1
	Remark	1: Invert Input2 bitwise
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# NAND

## Description

Boolean NAND function

Output = Input1 NAND Input2

The output value is limited to the indicated length. Input1 and Input2 can be inverted in addition.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	ResultLength
	Range of values	0 to 32
	Remark	Limitation of the result to ResultLength digits. Value 0 is similar to 32, use all bits.
Parameter 3	Designation	InvertInput1
	Range of values	0, 1
	Remark	1: Invert Input1 bitwise
Parameter 4	Designation	InvertInput2
	Range of values	0, 1
	Remark	1: Invert Input2 bitwise
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# XOR

## Description

Boolean XOR function

Output = Input1 XOR Input2

The output value is limited to the indicated length. Input1 and Input2 can be inverted in addition.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	ResultLength
	Range of values	0 to 32
	Remark	Limitation of the result to ResultLength digits. Value 0 is similar to 32, use all bits.
Parameter 3	Designation	InvertInput1
	Range of values	0, 1
	Remark	1: Invert Input1 bitwise
Parameter 4	Designation	InvertInput2
	Range of values	0, 1
	Remark	1: Invert Input2 bitwise
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	



# XNOR

## Description

Boolean XNOR function

Output = Input1 XNOR Input2

The output value is limited to the indicated length. Input1 and Input2 can be inverted in addition.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	ResultLength
	Range of values	0 to 32
	Remark	Limitation of the result to ResultLength digits. Value 0 is similar to 32, use all bits.
Parameter 3	Designation	InvertInput1
	Range of values	0, 1
	Remark	1: Invert Input1 bitwise
Parameter 4	Designation	InvertInput2
	Range of values	0, 1
	Remark	1: Invert Input2 bitwise
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# MODULO

## Description

Modulo function (remainder of a division)

Output = Input1 mod Input2

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	Dividend
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	Divisor
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	Remainder

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# GREATER

## Description

Comparison function: Greater

Output = 1 if Input1 > Input2, else 0

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Output	Range of values	0, 1
	Remark	

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# LESS

## Description

Comparison function: Less

Output = 1 if Input1 < Input2, else 0

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Output	Range of values	0, 1
	Remark	

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# EQUAL

## Description

Comparison function: Equal

Output = 1 if Input1 = Input2, else 0

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Output	Range of values	0, 1
	Remark	

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# GREATER OR EQUAL

## Description

Comparison function: Greater or equal

Output = 1 if Input1 >= Input2, else 0

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Output	Range of values	0, 1
	Remark	

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# LESS OR EQUAL

## Description

Comparison function: Less or equal

Output = 1 if Input1 <= Input2, else 0

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Output	Range of values	0, 1
	Remark	

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# NOT EQUAL

## Description

Comparison function: Not equal

Output = 1 if Input1  $\neq$  Input2, else 0

## Inputs / Outputs

Input1	Range of values	32 bit signed $\rightarrow$ -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	32 bit signed $\rightarrow$ -2,147,483,648 to +2,147,483,647
	Remark	
Output	Range of values	0, 1
	Remark	

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	



# OR CONST

## Description

Boolean OR function with a constant as comparative value

Output = Input1 OR CompareValue

The output value is limited to the indicated length.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	ResultLength
	Range of values	0 to 32
	Remark	Limitation of the result to ResultLength digits. Value 0 is similar to 32, use all bits.
Parameter 3	Designation	CompareValue
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# NOR CONST

## Description

Boolean NOR function with a constant as comparative value

Output = Input1 NOR CompareValue

The output value is limited to the indicated length.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	ResultLength
	Range of values	0 to 32
	Remark	Limitation of the result to ResultLength digits. Value 0 is similar to 32, use all bits.
Parameter 3	Designation	CompareValue
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# AND CONST

## Description

Boolean AND function with a constant as comparative value

Output = Input1 AND CompareValue

The output value is limited to the indicated length.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	ResultLength
	Range of values	0 to 32
	Remark	Limitation of the result to ResultLength digits. Value 0 is similar to 32, use all bits.
Parameter 3	Designation	CompareValue
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# NAND CONST

## Description

Boolean NAND function with a constant as comparative value

Output = Input1 NAND CompareValue

The output value is limited to the indicated length.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	ResultLength
	Range of values	0 to 32
	Remark	Limitation of the result to ResultLength digits. Value 0 is similar to 32, use all bits.
Parameter 3	Designation	CompareValue
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# XOR CONST

## Description

Boolean XOR function with a constant as comparative value

Output = Input1 XOR CompareValue

The output value is limited to the indicated length.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	ResultLength
	Range of values	0 to 32
	Remark	Limitation of the result to ResultLength digits. Value 0 is similar to 32, use all bits.
Parameter 3	Designation	CompareValue
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# XNOR CONST

## Description

Boolean XNOR function with a constant as comparative value

Output = Input1 XNOR CompareValue

The output value is limited to the indicated length.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	ResultLength
	Range of values	0 to 32
	Remark	Limitation of the result to ResultLength digits. Value 0 is similar to 32, use all bits.
Parameter 3	Designation	CompareValue
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# MODULO CONST

## Description

Modulo function (remainder of a division) with a constant as divisor

Output = Input1 mod DivisorValue

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	Divident
Input2	Range of values	
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	DivisorValue
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Divisor
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# IF GREATER

## Description

Conditional execution of function blocks: Greater

Output = 1 if Input1 > Input2, else 0

If the condition is true, the LinesPerformedIfTrue number of the following function blocks are activated and therefore executed, else they are deactivated.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Output	Range of values	0, 1
	Remark	

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	LinesPerformedIfTrue
	Range of values	16 bit signed → 1 to +32,767
	Remark	Number of the following function blocks that are executed depending on the condition.
Parameter 6	Designation	
	Range of values	
	Remark	



# IF LESS

## Description

Conditional execution of function blocks: Less

Output = 1 if Input1 < Input2, else 0

If the condition is true, the LinesPerformedIfTrue number of the following function blocks are activated and therefore executed, else they are deactivated.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Output	Range of values	0, 1
	Remark	

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	LinesPerformedIfTrue
	Range of values	16 bit signed → 1 to +32,767
	Remark	Number of the following function blocks that are executed depending on the condition.
Parameter 6	Designation	
	Range of values	
	Remark	

# IF EQUAL

## Description

Conditional execution of function blocks: Equal

Output = 1 if Input1 = Input2, else 0

If the condition is true, the LinesPerformedIfTrue number of the following function blocks are activated and therefore executed, else they are deactivated.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Output	Range of values	0, 1
	Remark	

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	LinesPerformedIfTrue
	Range of values	16 bit signed → 1 to +32,767
	Remark	Number of the following function blocks that are executed depending on the condition.
Parameter 6	Designation	
	Range of values	
	Remark	

# IF GREATER OR EQUAL

## Description

Conditional execution of function blocks: Greater or equal

Output = 1 if Input1 >= Input2, else 0

If the condition is true, the LinesPerformedIfTrue number of the following function blocks are activated and therefore executed, else they are deactivated.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Output	Range of values	0, 1
	Remark	

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	LinesPerformedIfTrue
	Range of values	16 bit signed → 1 to +32,767
	Remark	Number of the following function blocks that are executed depending on the condition.
Parameter 6	Designation	
	Range of values	
	Remark	

# IF LESS OR EQUAL

## Description

Conditional execution of function blocks: Less or equal

Output = 1 if Input1 <= Input2, else 0

If the condition is true, the LinesPerformedIfTrue number of the following function blocks are activated and therefore executed, else they are deactivated.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Output	Range of values	0, 1
	Remark	

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	LinesPerformedIfTrue
	Range of values	16 bit signed → 1 to +32,767
	Remark	Number of the following function blocks that are executed depending on the condition.
Parameter 6	Designation	
	Range of values	
	Remark	

# IF NOT EQUAL

## Description

Conditional execution of function blocks: Not equal

Output = 1 if Input1 <> Input2, else 0

If the condition is true, the LinesPerformedIfTrue number of the following function blocks are activated and therefore executed, else they are deactivated.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Output	Range of values	0, 1
	Remark	

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	LinesPerformedIfTrue
	Range of values	16 bit signed → 1 to +32,767
	Remark	Number of the following function blocks that are executed depending on the condition.
Parameter 6	Designation	
	Range of values	
	Remark	

# GREATER CONST

## Description

Comparison with a constant: Greater

Output = 1 if Input1 > CompareValue, else 0

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	0, 1
	Remark	

## Parameters

Parameter 2	Designation	CompareValue
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# LESS CONST

## Description

Comparison with a constant: Less

Output = 1 if Input1 < CompareValue, else 0

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	0, 1
	Remark	

## Parameters

Parameter 2	Designation	CompareValue
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# EQUAL CONST

## Description

Comparison with a constant: Equal

Output = 1 if Input1 = CompareValue, else 0

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	0, 1
	Remark	

## Parameters

Parameter 2	Designation	CompareValue
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	



# WITHIN RANGE

## Description

Comparison function: Within a range

Output = 1 if LowerLimit <= Input1 <= UpperLimit, else 0

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	0, 1
	Remark	

## Parameters

Parameter 2	Designation	LowerLimit
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 3	Designation	UpperLimit
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# OUTSIDE RANGE

## Description

Comparison function: Outside of a range

Output = 1 if Input1 < LowerLimit or Input1 > UpperLimit, else 0

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	0, 1
	Remark	

## Parameters

Parameter 2	Designation	LowerLimit
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 3	Designation	UpperLimit
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# ABS

## Description

Absolute value

Output = Abs(Input1)

Positive values remain unchanged, the sign of negative values is removed.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	32 bit signed → 0 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# LIMIT

## Description

Limitation of the input value to a range of values

Output = Input1 if LowerLimit <= Input1 <= UpperLimit

Output = LowerLimit if Input1 < LowerLimit

Output = UpperLimit if Input1 > UpperLimit

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	16 bit signed → -32,768 to +32,767
	Remark	

## Parameters

Parameter 2	Designation	LowerLimit
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 3	Designation	UpperLimit
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# LIMIT SUM

## Description

Limitation of a sum to a range of values

Sum = Input1 + Input2

Output = Sum if LowerLimit <= Sum <= UpperLimit

Output = LowerLimit if Sum < LowerLimit

Output = UpperLimit if Sum > UpperLimit

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Output	Range of values	16 bit signed → -32,768 to +32,767
	Remark	

## Parameters

Parameter 2	Designation	LowerLimit
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 3	Designation	UpperLimit
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# ABS DIFFERENCE

## Description

Absolute value of a difference

Output = Abs(Input1 - Input2)

Positive differences remain unchanged, the sign of negative differences is removed.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Output	Range of values	32 bit signed → 0 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# LIMIT SUM FIXPOINT

## Description

Limitation of a sum to a range of values

Sum = Input1 + Input2

Output = Sum if LowerLimit <= Sum <= UpperLimit

Output = LowerLimit if Sum < LowerLimit

Output = UpperLimit if Sum > UpperLimit

The values are interpreted as fixpoint numbers in the format 16.16 (<16-bit value>.<1 / 16-bit value>)

## Inputs / Outputs

Input1	Range of values Remark	Fixpoint 16.16 → -32,768.0000 to +32,767.9999
Input2	Range of values Remark	Fixpoint 16.16 → -32,768.0000 to +32,767.9999
Output	Range of values Remark	Fixpoint 16.16 → -32,768.0000 to +32,767.9999

## Parameters

Parameter 2	Designation	LowerLimit
	Range of values	Fixpoint 16.16 → -32,768.0000 to +32,767.9999
	Remark	
Parameter 3	Designation	UpperLimit
	Range of values	Fixpoint 16.16 → -32,768.0000 to +32,767.9999
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# MIN

## Description

Returns the smaller of two values.

Output = Min(Input1, Input2)

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	



# MAX

## Description

Returns the larger of two values.

Output = Max(Input1, Input2)

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# SQUARE

## Description

Square function

Output = Input<sup>2</sup>

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	
	Range of values	
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# POWER CONST

## Description

Exponentiation with a constant

Output = Input1Exponent

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	Radix
Input2	Range of values	
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	Exponent
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Power
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# E FUNCTION

## Description

Exponential function with the Euler number as radix

$$\text{Output} = \text{Scale1} * e(\text{Input1} * \text{Scale2})$$

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	Scale1
	Range of values	Fixpoint 16.16 → -32,768.0000 to +32,767.9999
	Remark	Scaling of the power
Parameter 3	Designation	Scale2
	Range of values	Fixpoint 16.16 → -32,768.0000 to +32,767.9999
	Remark	Scaling of the exponent
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# LN FUNCTION

## Description

Natural logarithm (Euler number as radix)

$$\text{Output} = \text{Scale1} * \ln(\text{Input1} * \text{Scale2})$$

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	Scale1
	Range of values	Fixpoint 16.16 → -32,768.0000 to +32,767.9999
	Remark	Scaling of the logarithm
Parameter 3	Designation	Scale2
	Range of values	Fixpoint 16.16 → -32,768.0000 to +32,767.9999
	Remark	Scaling of the antilogarithm
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# SIGN-DEPENDENT OFFSET

## Description

Offset depending on the sign

Input1 < 0: Output = Scale \* Input1 + OffsetIfNeg

Input1 >= 0: Output = Scale \* Input1 + OffsetIfPos

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	Scale
	Range of values	Fixpoint 16.16 → -32,768.0000 to +32,767.9999
	Remark	
Parameter 3	Designation	OffsetIfPos
	Range of values	Fixpoint 16.16 → -32,768.0000 to +32,767.9999
	Remark	Offset if Input1 >= 0
Parameter 4	Designation	OffsetIfNeg
	Range of values	Fixpoint 16.16 → -32,768.0000 to +32,767.9999
	Remark	Offset if Input1 < 0
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# DEAD ZONE

## Description

Dead zone

Output = 0 if LowerLimit < Input1 < UpperLimit

Output = Scale \* (Input1 - LowerLimit) if Input1 <= LowerLimit

Output = Scale \* (Input1 - UpperLimit) if Input1 >= UpperLimit

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	

## Parameters

Parameter 2	Designation	Scale
	Range of values	Fixpoint 16.16 → -32,768.0000 to +32,767.9999
	Remark	Set to 1 if not required
Parameter 3	Designation	LowerLimit
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 4	Designation	UpperLimit
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	

# RANDOM

## Description

Random number from a range of values

Output = Random number ( $\geq$  MinValue and  $\leq$  MaxValue)

## Inputs / Outputs

Input1	Range of values	
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	16 bit signed → -32,768 to +32,767
	Remark	

## Parameters

Parameter 2	Designation	MinValue
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Smallest possible value of the random number
Parameter 3	Designation	MaxValue
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Largest possible value of the random number
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	
	Range of values	
	Remark	
Parameter 6	Designation	
	Range of values	
	Remark	



# SCALE WITH LIMIT

## Description

Conversion of an input value with multiplier and offset, the output is limited by LowerLimit and UpperLimit.

Var = Input1 \* Scale + Offset

Output = Var if LowerLimit <= Var <= UpperLimit

Output = LowerLimit if Var < LowerLimit

Output = UpperLimit if Var > UpperLimit

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	16 bit signed → -32,768 to +32,767
	Remark	

## Parameters

Parameter 2	Designation	Scale
	Range of values	Fixpoint 16.16 → -32,768.0000 to +32,767.9999
	Remark	
Parameter 3	Designation	Offset
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 4	Designation	LowerLimit
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Lower limit of the output
Parameter 5	Designation	UpperLimit
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	Upper limit of the output
Parameter 6	Designation	
	Range of values	
	Remark	

# IF GREATER CONST

## Description

Conditional execution of function blocks: Greater as constant

Output = 1 if Input1 > CompareValue, else 0

If the condition is true, the LinesPerformedIfTrue number of the following function blocks are activated and therefore executed, else they are deactivated.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	0, 1
	Remark	

## Parameters

Parameter 2	Designation	CompareValue
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	LinesPerformedIfTrue
	Range of values	16 bit signed → 1 to +32,767
	Remark	Number of the following function blocks that are executed depending on the condition.
Parameter 6	Designation	
	Range of values	
	Remark	

# IF LESS CONST

## Description

Conditional execution of function blocks: Less as constant

Output = 1 if Input1 < CompareValue, else 0

If the condition is true, the LinesPerformedIfTrue number of the following function blocks are activated and therefore executed, else they are deactivated.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	0, 1
	Remark	

## Parameters

Parameter 2	Designation	CompareValue
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	LinesPerformedIfTrue
	Range of values	16 bit signed → 1 to +32,767
	Remark	Number of the following function blocks that are executed depending on the condition.
Parameter 6	Designation	
	Range of values	
	Remark	

# IF EQUAL CONST

## Description

Conditional execution of function blocks: Equal constant

Output = 1 if Input1 = CompareValue, else 0

If the condition is true, the LinesPerformedIfTrue number of the following function blocks are activated and therefore executed, else they are deactivated.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	0, 1
	Remark	

## Parameters

Parameter 2	Designation	CompareValue
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 3	Designation	
	Range of values	
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	LinesPerformedIfTrue
	Range of values	16 bit signed → 1 to +32,767
	Remark	Number of the following function blocks that are executed depending on the condition.
Parameter 6	Designation	
	Range of values	
	Remark	

# IF WITHIN RANGE

## Description

Conditional execution of function blocks: Within a range

Output = 1 if LowerLimit <= Input1 <= UpperLimit, else 0

If the condition is true, the LinesPerformedIfTrue number of the following function blocks are activated and therefore executed, else they are deactivated.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	0, 1
	Remark	

## Parameters

Parameter 2	Designation	LowerLimit
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 3	Designation	UpperLimit
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	LinesPerformedIfTrue
	Range of values	16 bit signed → 1 to +32,767
	Remark	Number of the following function blocks that are executed depending on the condition.
Parameter 6	Designation	
	Range of values	
	Remark	

# IF OUTSIDE RANGE

## Description

Conditional execution of function blocks: Outside of a range

Output = 1 if Input1 < LowerLimit or Input1 > UpperLimit, else 0

If the condition is true, the LinesPerformedIfTrue number of the following function blocks are activated and therefore executed, else they are deactivated.

## Inputs / Outputs

Input1	Range of values	32 bit signed → -2,147,483,648 to +2,147,483,647
	Remark	
Input2	Range of values	
	Remark	
Output	Range of values	0, 1
	Remark	

## Parameters

Parameter 2	Designation	LowerLimit
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 3	Designation	UpperLimit
	Range of values	16 bit signed → -32,768 to +32,767
	Remark	
Parameter 4	Designation	
	Range of values	
	Remark	
Parameter 5	Designation	LinesPerformedIfTrue
	Range of values	16 bit signed → 1 to +32,767
	Remark	Number of the following function blocks that are executed depending on the condition.
Parameter 6	Designation	
	Range of values	
	Remark	

# I/O FUNCTIONS OVERVIEW

All resources of a module are addressable with a combination of I/O function and pertinent I/O number. The I/O function represents a basic functionality and the I/O number is a numbered element of this basic function. The available I/O functions are listed in the table.

I/O Function		Description
00h	DOut Level	Digital output, level
01h	DOut Frequency	Digital output, frequency signal
02h	DOut Pulse Width	Generates a variable frequency signal with configurable duty cycle. Digital output, PWM signal, indication of the pulse width in time
03h	DOut Ratio	Digital output, PWM signal, indication of the duty cycle in %  Generates a PWM signal with variable duty cycle and configurable frequency.
10h	AOut Level	Analog output
70h	Special Out	Diverse module-specific output functions which generally provide additional configuration options.
71h	Special In/Out	Diverse module-specific functions which can have both input as well as output functions.
80h	DIn Level	Digital input, level
81h	DIn Frequency	Digital input, frequency measurement
82h	DIn Pulse Width	Digital input, PWM measurement, measurement of the pulse width in time
83h	DIn Ratio	Digital input, PWM measurement, measurement of the duty cycle in %
84h	DIn UD Counter	Digital input, counter function for quadrature encoder (e.g., for manual operation)
85h	Fast UD Counter	Digital input, counter function for quadrature encoder (e.g., for motor control)
88h	Pull-Up/Down	Activate pull-up or pull-down resistor for digital inputs
90h	AIn Level	Analog input
91h	Thermocouple	Analog input, thermocouple
98h	Tau	Time constant of a software low-pass for an analog input
CCh	Const	Pre-defined constants for internal computations
CDh	Positive Const	Pre-defined positive constants from 0 to 255
CEh	Negative Const	Pre-defined negative constants from 0 to -255
EEh	EEPROM Variable	EEPROM variables, are automatically archived in the EEPROM and are available again after a power cycle
F0h	Special In	Diverse module-specific input functions which primarily provide general and status information.
FFh	32 Bit Variable	32-bit variable for internal computations

## Examples:

You want your configuration to influence digital output number 4 of the module. This is executed by the I/O function 00h (digital output) together with I/O number 4.

You want the status of digital input number 3 to be queried. This is executed by the I/O function 80h (digital input) together with I/O number 3.

Depending on the hardware different resources are available. The following table shows the support of the I/O functions for the different hardware platforms.

I/O Function	ID	PCAN-MIO (32 Bit)	PCAN-Router Pro	MU-Thermocouple
Dout Level	00h	■	■	■
Dout Frequency	01h	■	-	■
Dout Pulse Width	02h	-	-	-
Dout Ratio	03h	■	-	■
Aout Level	10h	■	-	-
Special Out	70h	■	■	■
Special In Out	71h	-	-	-
Din Level	80h	■	-	-
Din Frequency	81h	■	-	-
Din Pulse Width	82h	-	-	-
Din Ratio	83h	■	-	-
Din UpDown Counter	84h	-	-	-
Fast UpDown Counter	85h	-	-	-
Din Low Frequency	86h	■	-	-
PullUp/PullDown	88h	■	-	-
Ain Level	90h	■	-	-
ThermoCouple	91h	-	-	■
Tau	98h	■	-	-
Const	CCh	■	■	■
Positive Const	CDh	■	■	■
Negative Const	CEh	■	■	■
EEPROM Variable	EEh	-	-	-
Special In	F0h	■	■	■
Extensionboard	F1h	-	-	■
32-bit Variable	FFh	■	■	■