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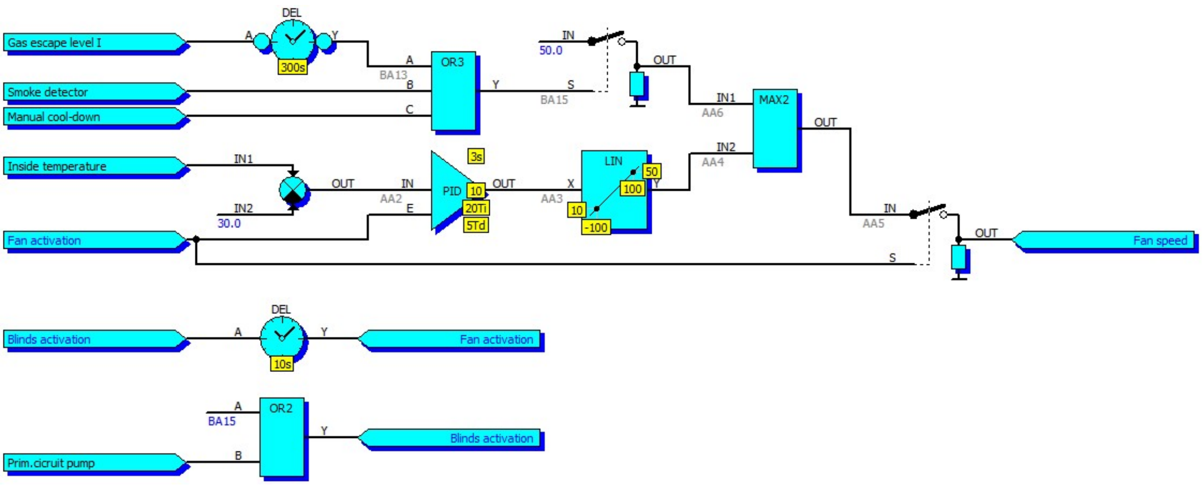
ManagerAP

Mapping and Functions (PLC)

Description of Mapping and Function Configuration

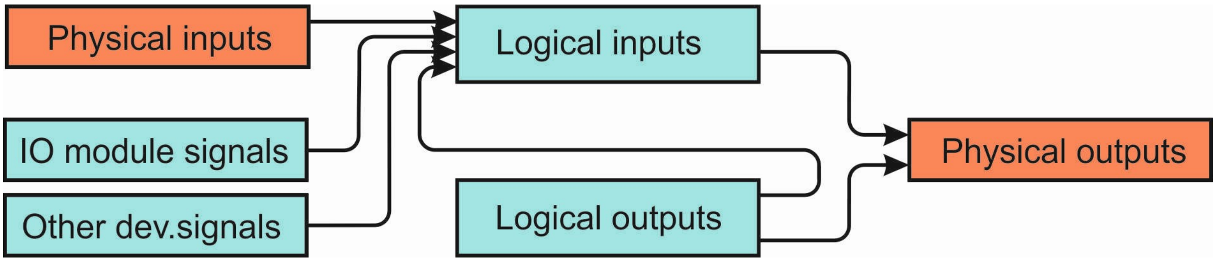


Novemver 2015

Version V 1.20

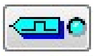
1 Mapping

The meaning of physical inputs and outputs (signals arriving at the terminal connectors) is configurable. The device algorithm works with logical inputs and outputs (internal variable device); the relationship between logical and physical inputs and outputs is defined by mapping. Assigning physical inputs to logical inputs (logical outputs to physical outputs) is called mapping.



1.1 Configuration of Mapping

Mapping configuration window can be activated from the menu "Mapping and function" of each device. After activation, current configuration of mapping and functions will be downloaded from the device (if the device is on-line) or the last known configuration will be displayed (when the device is off-line).
In the upper right part of the window there are icons to select the inputs or outputs (binary or analog) you want to map:

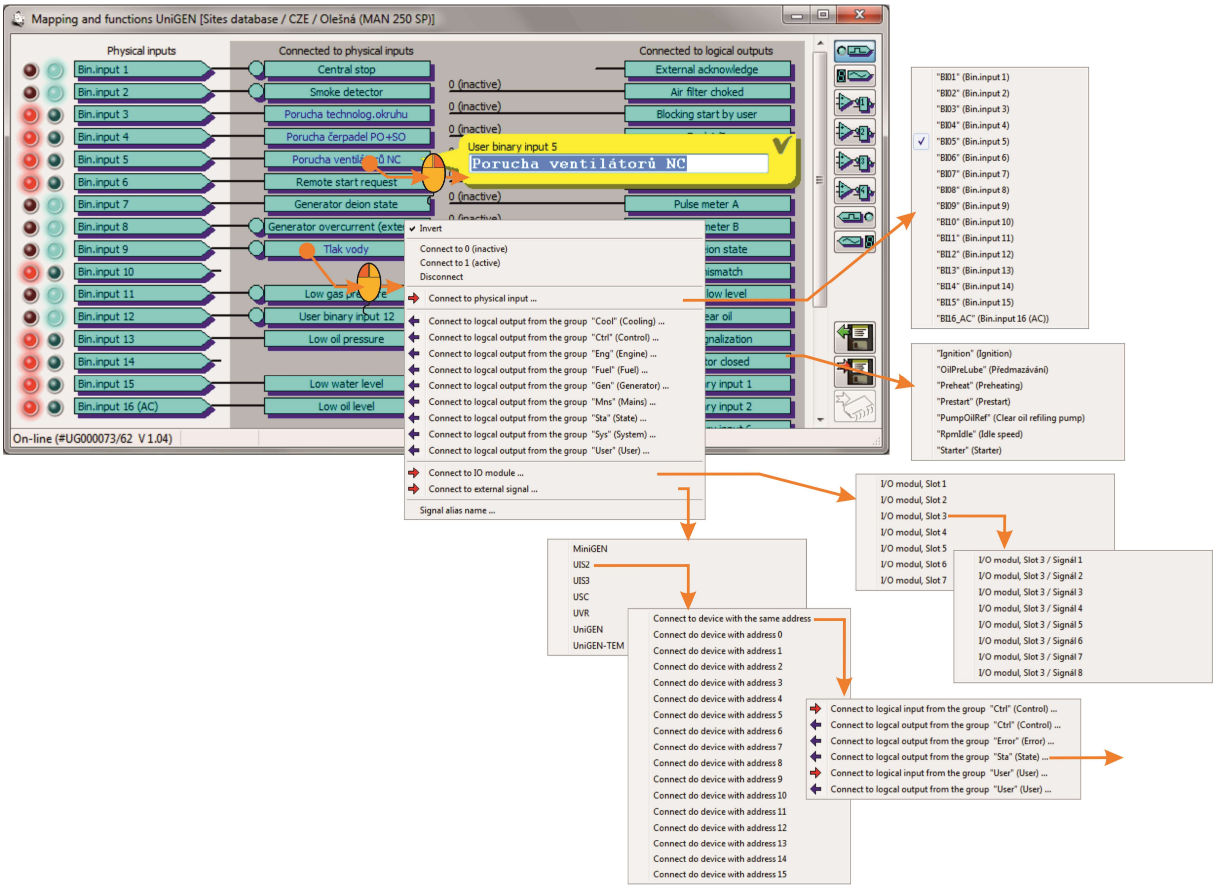
 Mapping binary logical inputs
 Mapping analog logical inputs
 Mapping binary physical outputs
 Mapping analog physical outputs

By selecting the appropriate icon the assignment of selected variables will be displayed.

In the lower right part of the window there are icons to save (download) the mapping configuration to disc and an icon to save the configuration to the device. If you select the page with mapping, only the mapping configuration will be saved to the file. If you select the page with functions (see below), only the configuration of functions will be saved to the file (each configuration has a different file extension). When you click to save the configuration to the device, both configurations (mappings as well as functions) will be sent to the device simultaneously.

1.2 Mapping of Binary Logical Inputs

In the left part of the window there is a list of available binary physical inputs including their immediate situation (when the device is on-line). The red LED indicates a connection control error, blue LED indicates activation of the input.
In the middle part of the window there are two columns of binary logical inputs. In the left column, there are signals mapped to binary physical inputs (or to IO modules or external devices), the signals in the right column are signals that are not connected, connected to a constant value or connected to internal signals of binary logical outputs.
By right-clicking on the user binary logical input it is possible to define the signal name.
By left-clicking on binary logical input a menu is activated to define a signal connection as shown below (the names and numbers of physical signals, groups of logical signals, and logical signals may vary depending on the specific device):



Binary logical input can be:

- Connected permanently to an inactive level;
- Connected permanently to an active level;
- Not connected;
- Connected to a binary physical input of a local device;
- Connected to a binary logical output of a local device;
- Connect to binary signal from I / O module;
- Connected to binary logical input or output of any surrounding device;
- Invert the signal (unless connected to constant level).

After selecting signal connection to binary logical input of a local device there follows selection of signal group and consequently selection of specific signal.

Selection of signal connection to the I / O module is followed by option of the card slot (identification "sub-address" of the card) and selection of signal 1 to 8 from the module. Slot of I / O modules can be set in the range of 1 ÷ 15, but the devices can only read signals from the I / O modules that have a slot set to value from 1 ÷ 7. Slots 8 ÷ 15 are used for addressing purely output I / O modules.
After selecting the connection to external signal there follows the selection of type of external device, the external device address, group of signals in the external device, and finally selection of a particular signal in the external device. In each device, up to eight signals can be connected to external devices.

After selecting the required connection the binary logical input will be displayed as connected to the desired signal.
Description of the meaning of signals (and in what groups the signals are located) is part of the firmware algorithm description of a given device.

1.3 Mapping of Analog Logical Inputs

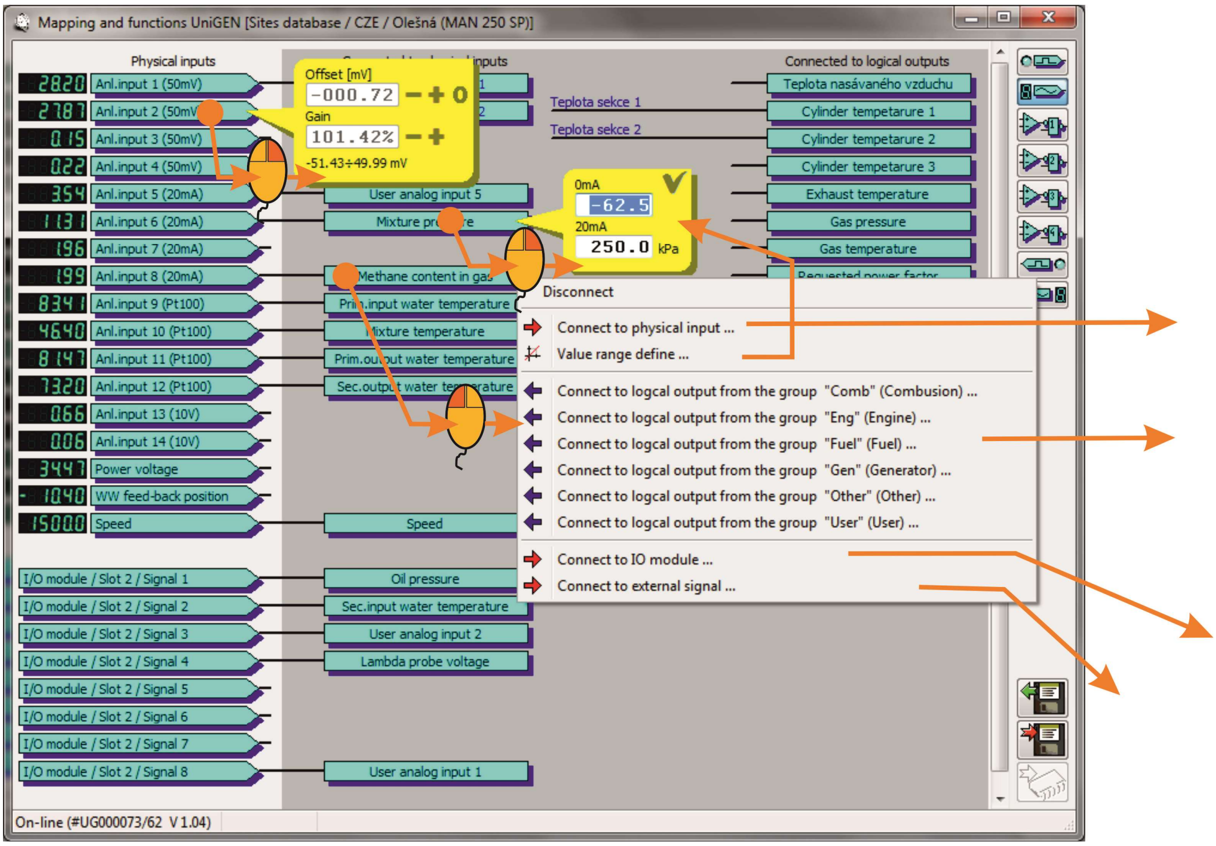
In the left part of the window there is a list of available physical analog inputs including their immediate readings (if the device is on-line).

In the middle part of the window there are two columns of analog logical inputs (similarly as in mapping of binary logical inputs).In the left column there are signals that are mapped to analog physical inputs (or to I / O modules or external devices), in the right column are signals that are not connected or connected to internal signals of logical analog outputs.

By right-clicking on analog logical input it is possible to define a range of values (eg, how many kPa correspond to how many mA of the input signal).Definition of the name of user signals (activated by right-click in the mapping of binary inputs) is available in analog inputs only from the menu by left-click.

A variable can be calibrated by right-clicking on analog physical input .This feature is available only if the user´s permission is defined in his / her login. This quick calibration can be used, for example, to quickly compensate for offset of input. A more detailed calibration window is available in the "Calibration" menu of the device.

By left-clicking on the analog logical input you will activate menu for defining signal connection similar to mapping of binary inputs (names and numbers of physical signals, groups of logical signals, and logical signals may vary depending on the specific device; the selection of physical input, signals from groups, signal from the I / O-module or external device is made in the same way as in the case of mapping of binary signals):



Analog logical input can be:

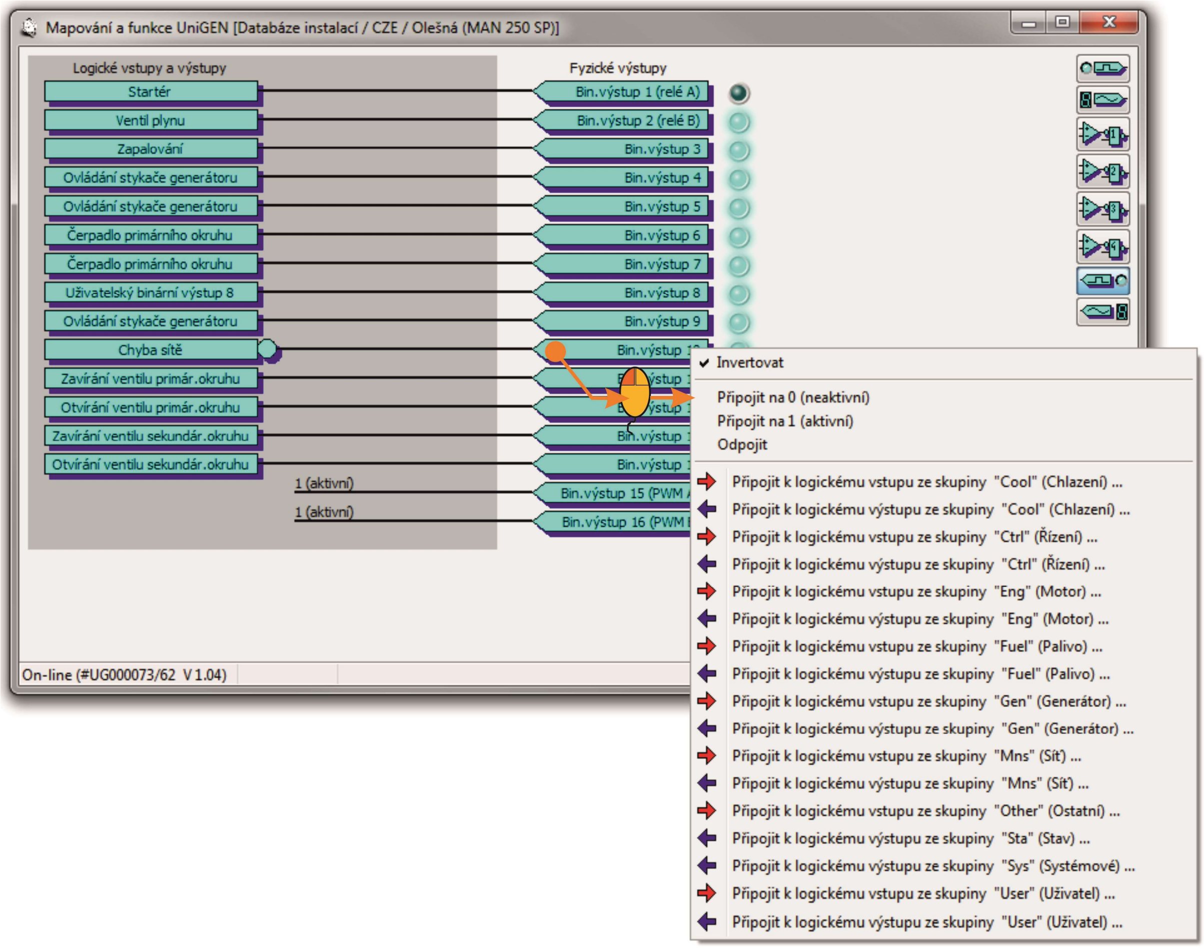
- Not connected;
- Connected to binary physical input of local device;
- After connecting to physical input the range of sensor can be defined;
- Connected to analog logical output of local device;
- Connected to analog signal from the I / O module;
- Connected to analog logical input or output of any surrounding device.

Selecting signal connection to analog logical input of a local device is followed by selecting the group signal and consequently selecting the specific signal.
Selecting signal connection to the I / O module is followed by selecting card slot (identification card "sub-address") and selecting signal from 1 to 8 from the module as with binary logical inputs.
After selecting the connection to external signal there follows the selection of type of external device, the external device address, group of signals in the external device, and finally selection of a particular signal in the external device. In each device, up to eight signals can be connected to external devices.

After selecting the desired connection the analog logical input will be displayed as connected to the desired signal.
Description of the meaning of signals (and in what groups the signals are located) is part of the firmware algorithm description of a given device.
Selection of the range of variable defines, among other things, whether (for example, current sensor) the sensor is in the range of 0 ÷ 20 mA or 4 ÷ 20 mA. By selecting 0 mA = 0 kPa, 20 mA = 250 kPa we define sensor of 0 ÷ 20 mA with a range of 250 kPa. By selecting 0 mA =-62.5 kPa (minus ¼ of sensor range), 20 mA = 250 kPa we define sensor of 4 ÷ 20 mA of the same range.

1.4 Mapping of Binary Physical Outputs

In the right part of the window there is a list of available binary physical inputs including their immediate situation (when the device is on-line).A blue LED indicates input activation.
In the left part of the window there is a list of binary logical inputs and outputs which the physical outputs are mapped to.
By left-clicking on the binary physical output you will activate menu for defining signal connection as shown in the figure (names and numbers of physical signals, groups of logical signals, and logical signals may vary depending on the specific device; the selection of group of signals and the particular signal is made in the same way as in the case of mapping of binary inputs, it is also possible to select binary logical outputs besides binary logical inputs):



Binary physical output can be:

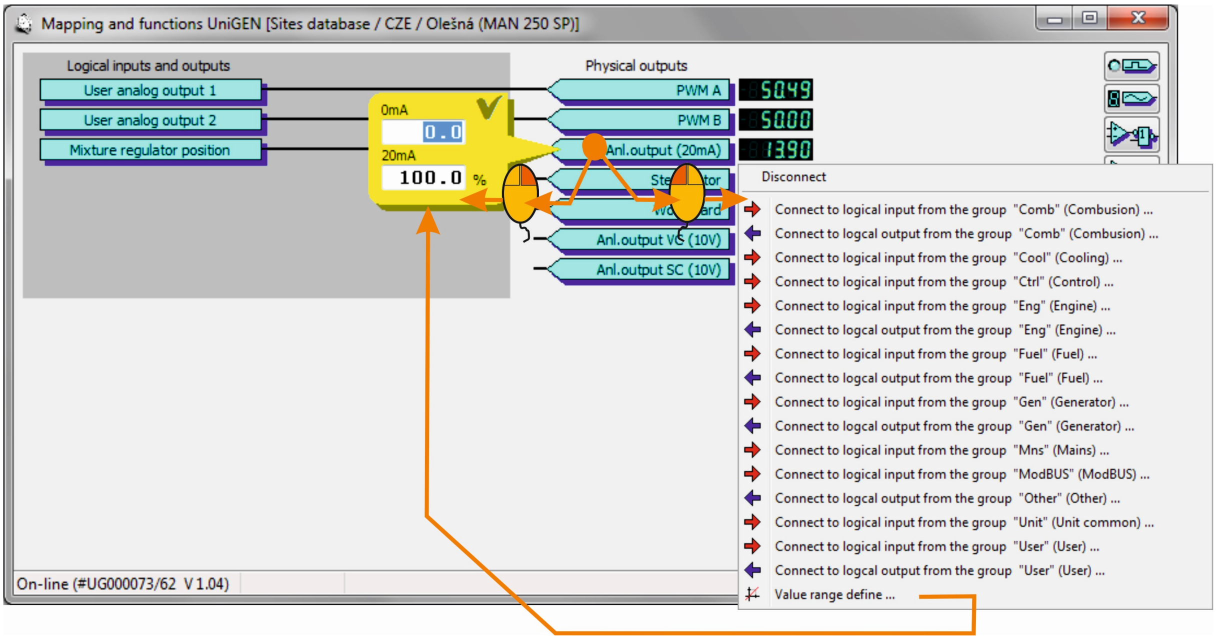
- Connected permanently to an inactive level;
- Connected permanently to an active level;
- Not connected;
- Connected to a binary logical input or output of a local device;
- Invert signal (unless connected to a constant level).

After selecting signal connection to binary logical input or output of a local device there follows selection of signal group and consequently selection of specific signal.

After selecting the desired connection the binary physical output will be displayed as connected to the desired signal.
Describing the meaning of signals (and in what groups the signals are located) is part of the firmware algorithm description of a given device.

1.5 Mapping of Analog Physical Outputs

In the right part of the window there is a list of available analog physical outputs, including their immediate value (if the device is on-line).
In the left part of the window there is a list of analog logical inputs and outputs, which the analog physical outputs mapped to.
By right-clicking on an analog physical output you can define the range of variable (eg, how many per cent correspond to how many output signal mA).
By left-clicking on the analog physical output you will activate menu for defining signal connection as shown in the figure (names and numbers of physical signals, groups of logical signals, and logical signals may vary depending on the specific device; the selection of group of signals and the particular signal is made in the same way as in the case of mapping of analog inputs, it is also possible to select analog logical outputs besides analog logical inputs):



Analog physical output can be:

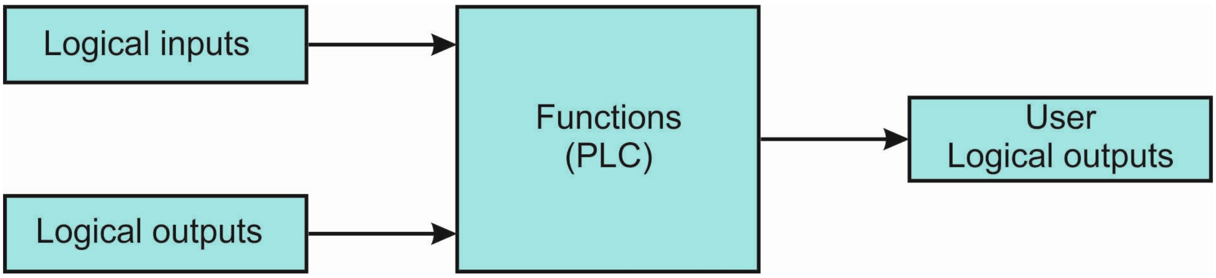
- Not connected;
- Connected to an analog logical input or output of a local device;
- Define the range (scale) of output signal.

After selecting signal connection to binary logical input or output of a local device there follows selection of signal group and consequently selection of specific signal.

After selecting the desired connection the physical output will be displayed as connected to the desired signal.
Describing the meaning of signals (and in what groups the signals are located) is part of the firmware algorithm description of a given device.

2 Functions

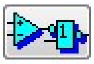
Using functions it is possible to create user output signals that can be assigned in mapping to logical inputs (if not connected to physical inputs) or to physical outputs. User output signals can be created using gates and other functional blocks of all logical signals available in the device.

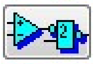


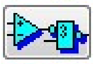
Functions are available in all devices of the "AP" versions (control systems, speed and voltage regulators, ignition, I / O modules, etc.).The user algorithm can thus be "distributed" to different devices, which then only exchange input and output data with their environment. For example, using the input and output I / O module it is possible to compile a simple control system in which the algorithm is composed by PLC functions.

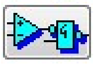
2.1 Configuration of Functions

Function configuration window can be activated from „Mapping and functions" menu of each device. After activation, current configuration of mapping and functions will be downloaded from the device (if the device is on-line) or the last known configuration will be displayed (if the device is off-line).
In the upper right-hand part of the window there are icons for selecting the function scheme (for clarity, you can create up to four schemes divided into groups according to meaning)

 First function scheme

 Second function scheme

 Third function scheme

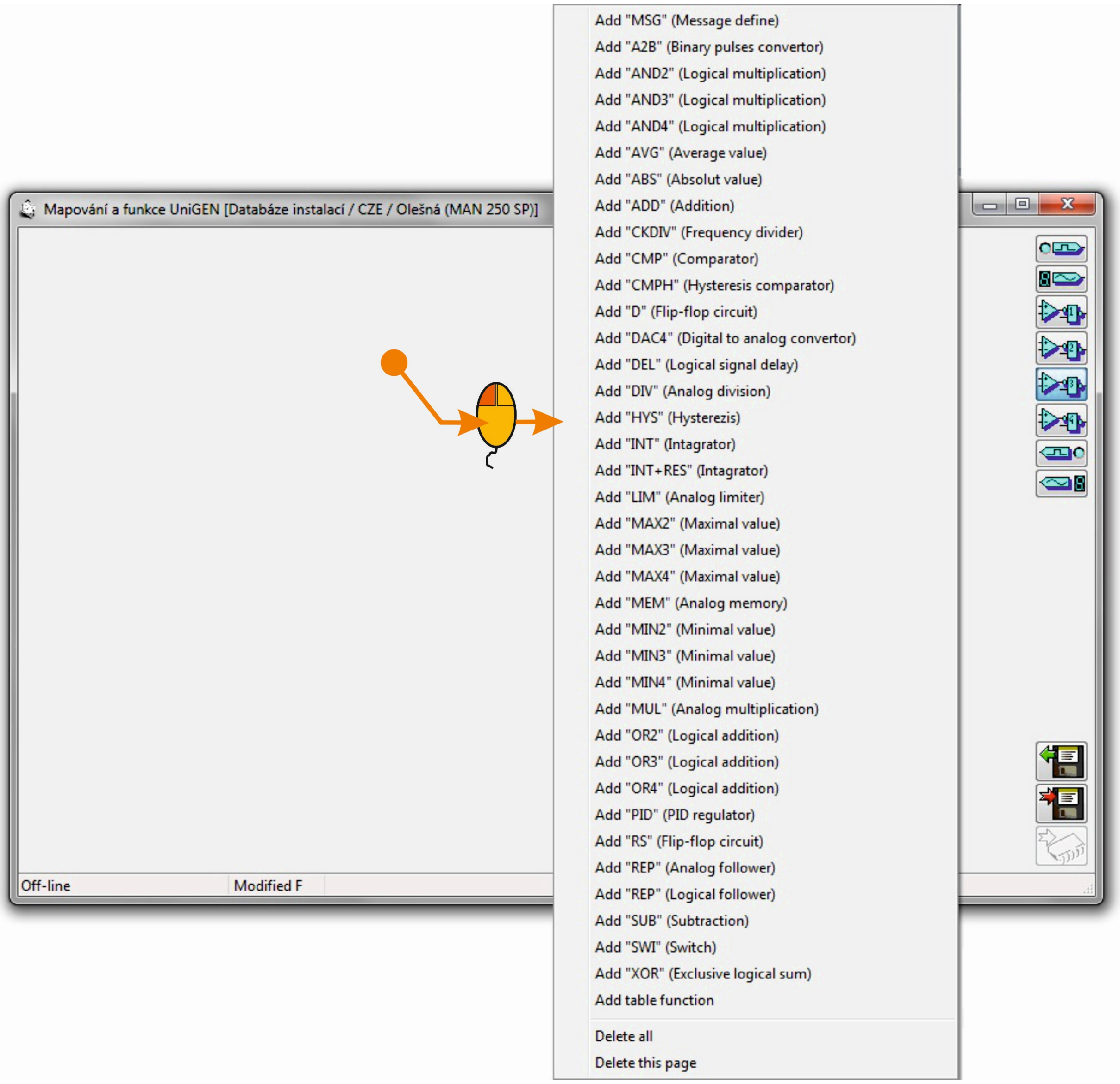
 Fourth function scheme

By selecting the appropriate icon the selected function scheme will be displayed.

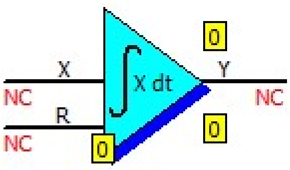
In the lower right-hand part of the window there are icons to save (download) configurations of function to the disc and the icon to save the configuration to the device. If you select the page with functions (see below), only the configuration of functions will be saved to the file. If you select the page with mapping (see above), only the configuration of mapping will be saved to the file (each configuration has a different file extension). When you click to save the configuration to the device, both configurations (mappings as well as functions) will be sent to the device simultaneously.

2.2 Adding a New Block to Functions

After opening the function configuration window and selecting a scheme to which you want to add a new block, click the left mouse button anywhere in the open area. Menu will be displayed for the selection of block, which we want to add:



After selecting the block the unconnected desired new block will appear in the open area:



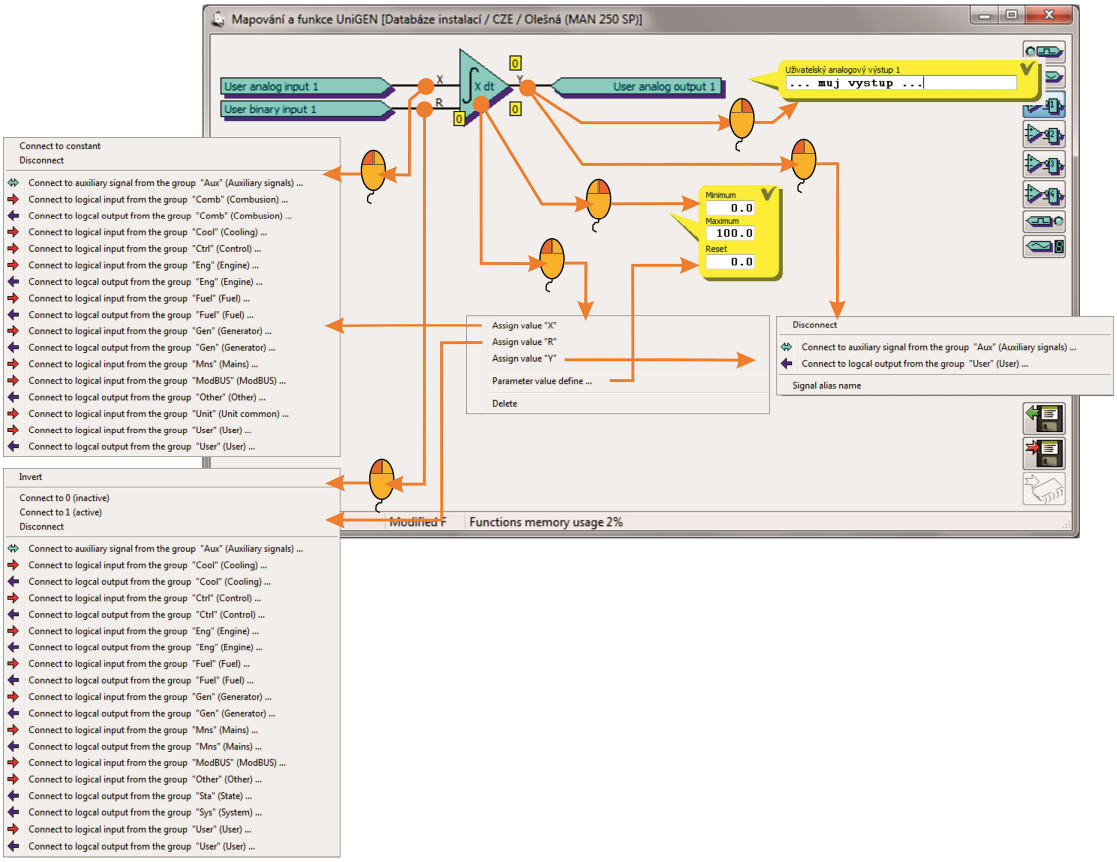
2.3 Editing a Block

By left-clicking on the center of the block the main menu will be displayed for setting the block (input and output connection, block parameter definition, deletion of the block).

By left-clicking on the corresponding input or output of the block a menu will appear to connect inputs and outputs directly (it is not necessary to go via the main menu).The inputs can be connected to a signal in the selected group (similar to mapping), to a constant (in the case of an analog input) permanently to 0 or 1 (in the case of a binary input).Binary inputs and outputs can be inverted. If the output is connected to the user logical signal, the signal name can be edited.

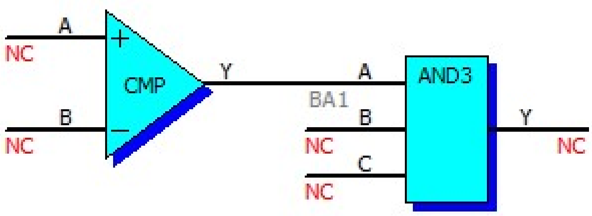
By right-clicking on the center of the block the block parameters will appear directly (it is not necessary to go via the main menu).The parameters are defined only for certain types of blocks.

By right-clicking on the output of the block (which is connected to the user logical output) you can activate the selection of the output signal username directly (it is not necessary to go via the signal connection menu).



2.4 Linking Blocks

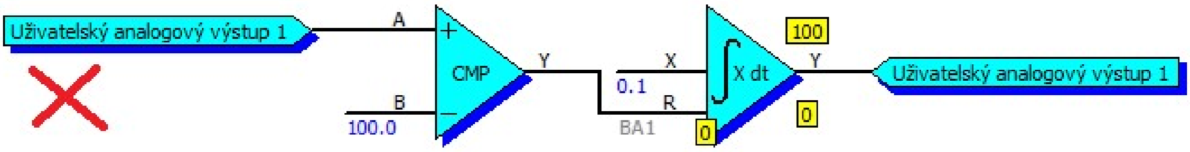
Individual function blocks can be linked in a cascade manner. Auxiliary signals from the "Aux" group are used to link the blocks. First, the output of the first block will connect to the free auxiliary signal, eg, "BinAux01" (auxiliary signals that have already been used remain in grey color in the menu. Subsequently, the input of the second block will connect to the selected auxiliary signal "BinAux01" and the blocks will be depicted as linked.



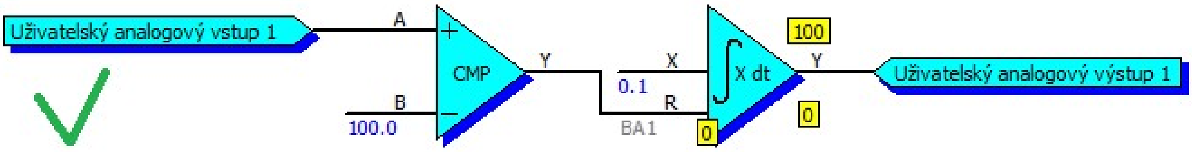
2.5 Feedback from Linked Blocks

When multiple blocks are linked using the "Aux" signal, the output signal from the last block should not be connected to one of the inputs of the preceding block (when such linkage occurs the program will display warning "Circular function blocks definition").If it is necessary to connect the output of a group of blocks in feedback back to its input, it is recommended that the user output of the block be assigned in mapping to user input and used as input of feedback in the block.

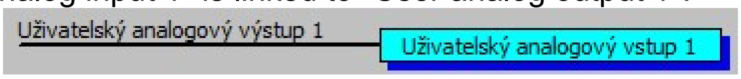
The following connection generates sawtooth signal 0÷100, however, the output of the block is used incorrectly in the input:



Correct linkage is as follows:



Where in mapping "User analog input 1" is linked to "User analog output 1":

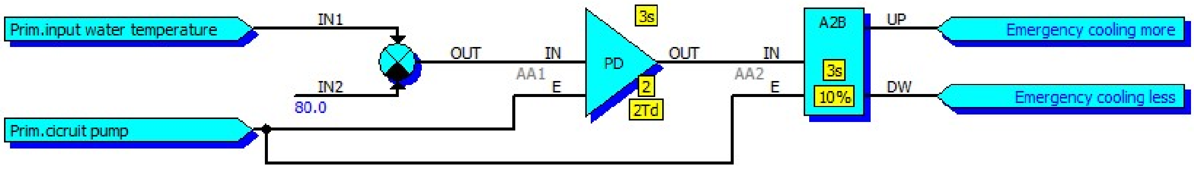


In block inputs or in a group of mutually interconnected blocks user logical output of another block or another group of blocks can be used directly.

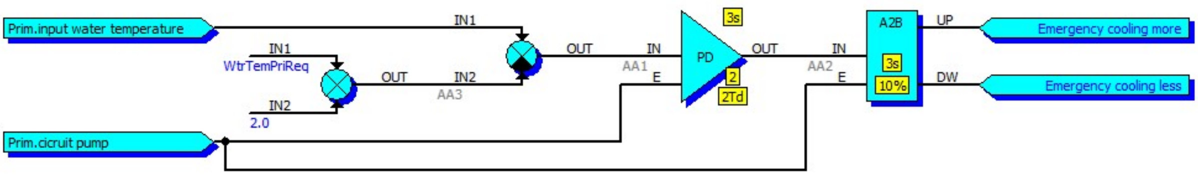
2.6 Connecting of analog inputs to constant or parameter

Block input can be connected not only to the desired signal (logic input or output), but also a constant value. Constant can be determined by firmly defined value or (on some devices) value of the parameter.

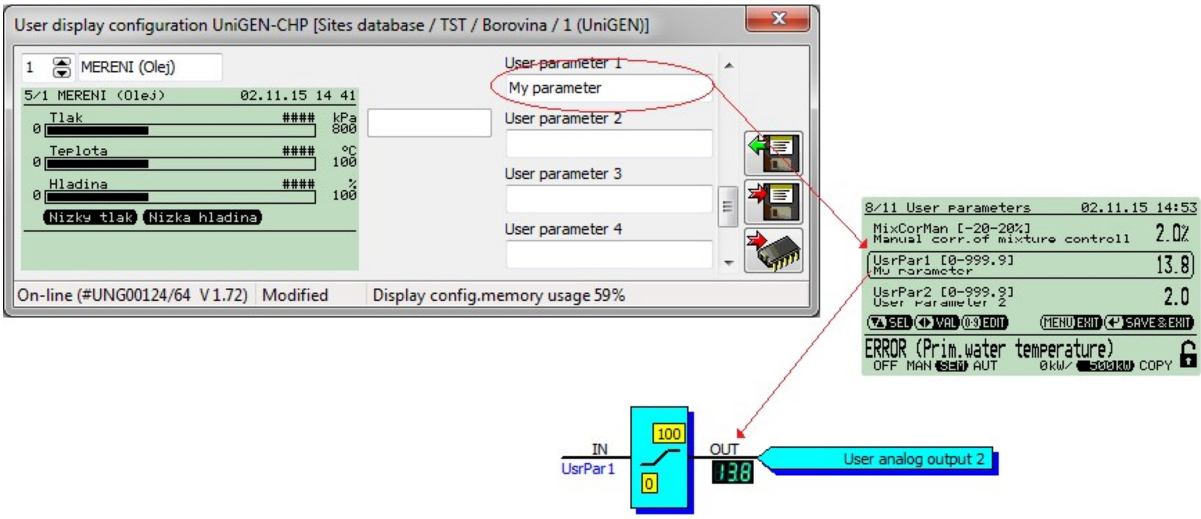
The following example controls the emergency cooling at 80 ° C.



But if you change a parameter required temperature of the primary water (StreeTemPiRe) must change the value of constants for controlling emergency cooling. It is better, therefore, to connect an input to regualce value. Emergency cooling will always be activated if it exceeds the water temperature setpoint by more than (e.g.) 2 °



Inputs functions (for example, some devices. RC Unigene) can be connected to the "user parameters" that can be entered from the keyboard control system. The menu displays the configuration parameter can be any name, the user can adjust its value with which you can work in functions.



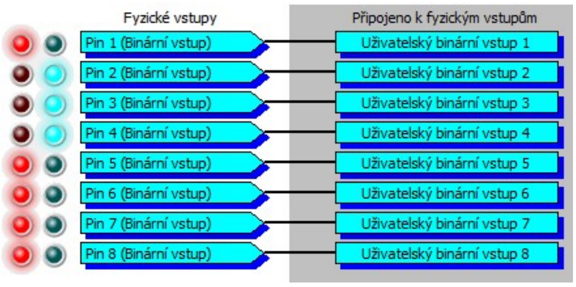
2.7 Functions arithmetic

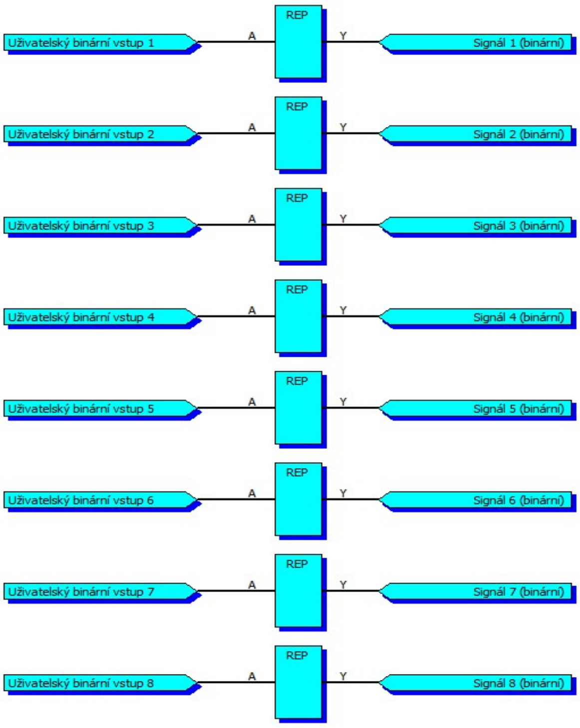
Analog variables in functions are sixteen bits with sign a one decimal place. Therefore, when creating functions necessary to calculate the minimum and maximum value that can be achieved in the calculations: -3276.8, +3276.7.

2.8 Logical Outputs “Signal”

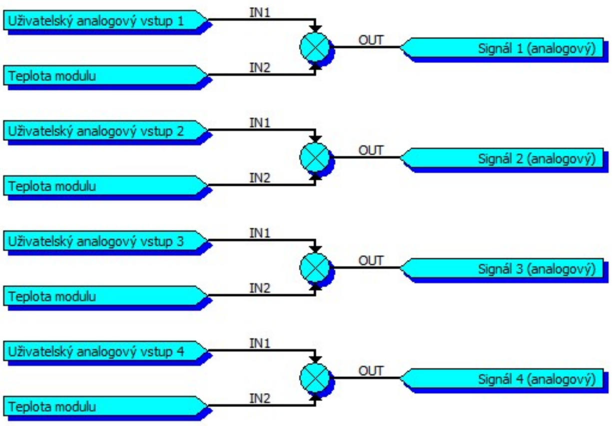
Logical outputs in the "Signal" group (binary as well as analog) are defined in the input modules. If the inputs of a device are mapped to an external module, it reads exactly these signals from the external module. Using these logical signals we thus define which variables from the external input module will be visible for surrounding devices. Each input module can define eight binary and eight analog signals in its functions that can be transferred to surrounding equipment or to other external modules.

If we have a purely binary input module and we want all 8 binary inputs to be "visible" to surrounding devices, we have to transfer the information from the binary physical inputs 1÷8 of the external module to binary logical outputs Signal 1 ÷ 8. Binary logical outputs cannot be directly mapped to physical inputs, so it is necessary in mapping to first assign binary physical inputs 1÷8 to the user binary logical inputs 1÷8 and subsequently in functions using tracker block convert signals from user binary inputs 1÷8 to binary logical outputs Signal 1 ÷ 8.





The logical output Signal may not be just a copy of the binary physical input. It can be processed or modified in functions. Cylinder temperature measuring using thermocouple may serve as an example here. Before assigning temperature to logical output Signal the temperature of the cold junction can be attributed to the

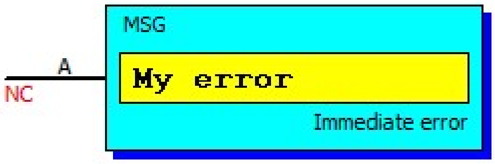


temperature of the thermocouple.

The cold junction can be compensated by the temperature of the module or other temperature sensor.

2.9 Basic Functional Blocks

2.9.1 "MSG" Message Definition

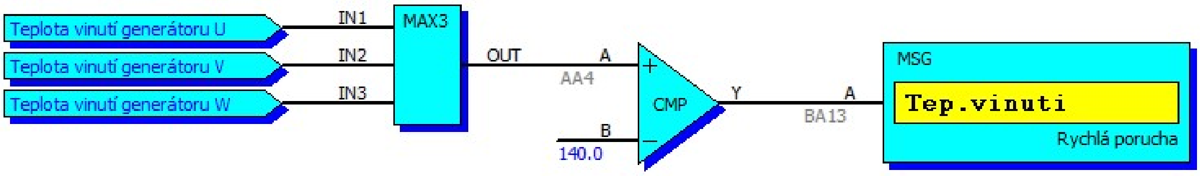
Schematic symbol	Description	Marking
	Generating user fault and warnings	MSG

Inputs	
A	Input binary signal for fault activation

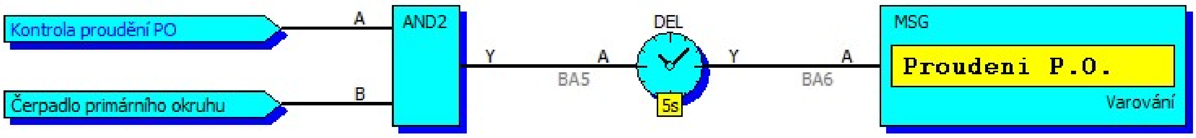
Parameters	
Message type	Selecting message type (warning, slow/fast/immediate fault)
Message text	Message text that will appear on screen and in history

Examples of connections

Generating message “Fault (winding temperature)“ if one of the generator windings exceeds the maximum temperature of 140 °C:



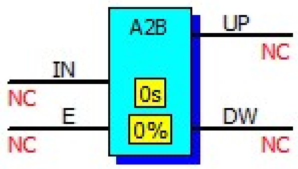
Message “Fault (P.O. flow)” will appear on screen if during pump operation there is failure to confirm the flow control for more than 5 seconds:



Note

In the case of fault signals the message will appear on activation of “A” input. The message will remain on screen even after deactivation of the input and can be cancelled only after acknowledging the fault.
In the case of warning signals the message will appear on activation of “A” input and will disappear automatically when the input is deactivated.

2.9.2 "A2B" Converter to Binary Pulses

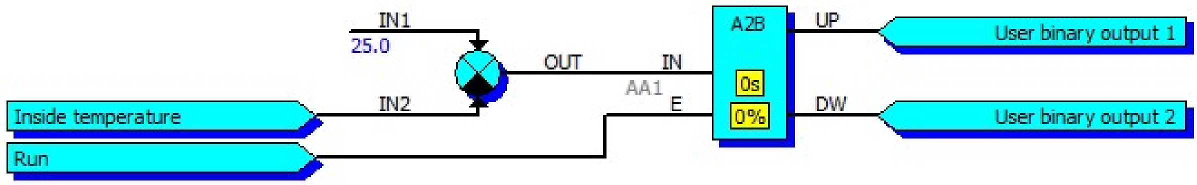
Schematic symbol	Description	Marking
	Convertor of analog signal to binary pulses. The impulse length is directly proportional to the absolute value of the input signal. If the input signal is positive, the pulses are generated in the “UP” output; if the input signal is negative, the pulses are generated in the “DW” output.	A2B

Inputs		Outputs	
IN	Input analog signal	UP	Pulses if input value positive
E	Activation, E=0 blocks outputs	DW	Pulses if input value negative

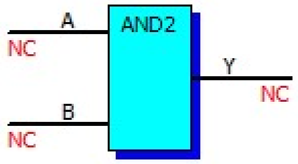
Parameters		
Period	s	Period of output impulses
Amplification	%	Bigger amplification will extend length of impulse on constant input

Examples of connections

Simple proportional temperature regulator to required value of 25 °C. Using user signals 1 and 2 it lowers or increases temperature (eg, by controlling the three-way valve):

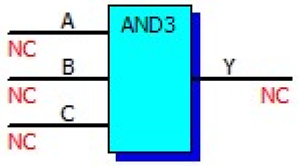


2.9.3 “AND2” Logical Product of Two Signals

Schematic symbol	Description	Marking
	Logical product of two binary signals Y=A*B	AND2

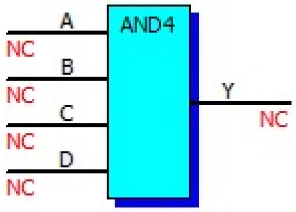
Inputs		Outputs	
A	Input binary signal	Y	Output binary signal
B	Input binary signal		

2.9.4 “AND3” Logical Product of Three Signals

Schematic symbol	Description	Marking
	Logical product of three binary signals Y=A*B*C	AND3

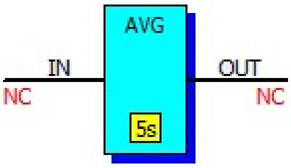
Inputs		Outputs	
A	Input binary signal	Y	Output binary signal
B	Input binary signal		
C	Input binary signal		

2.9.5 “AND4” Logical Product of Four Signals

Schematic symbol	Description	Marking
	Logical product of four binary signals Y=A*B*C*D	AND4

Inputs		Outputs	
A	Input binary signal	Y	Output binary signal
B	Input binary signal		
C	Input binary signal		
D	Input binary signal		

2.9.6 “AVG” Average Value

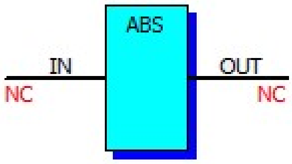
Schematic symbol	Description	Marking
	Weighted moving average of the signal. Out of ten last evenly read samples for the given time parameter the minimum and the maximum values will be discarded and the 8 remaining samples will be averaged.	AVG

Inputs		Outputs	
IN	Input analog signal	OUT	Average output analog signal

Parameters		
Time	s	Time of weighted average (sampling period Time/10)

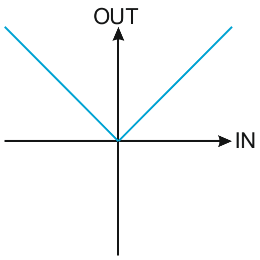
Examples of connections

2.9.7 “ABS” Absolute Value

Schematic symbol	Description	Marking
	Absolute value OUT= |IN|	ABS

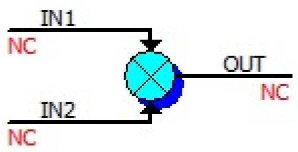
Inputs		Outputs	
IN	Input analog signal	OUT	Output analog signal

Graph



Examples of connections

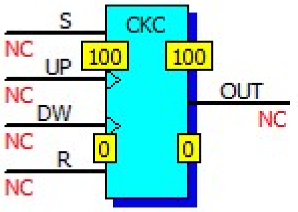
2.9.8 “ADD” Sum

Schematic symbol	Description	Marking
	Analog sum of signals OUT=IN1+IN2	ADD

Inputs		Outputs	
IN1	Input analog signal (addend 1)	OUT	Output analog signal (sum)
IN2	Input analog signal (addend 2)		

Examples of connections

2.9.9 “CKC” Counter

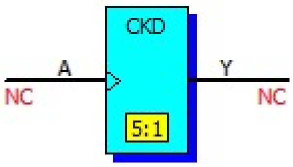
Schematic symbol	Description	Marking
	Two-direction counter of the number of input pulses. Input for increment and decrement in response to the rising edge. With inputs "R" and "S" can be counter output set to the default value	CKC

Inputs		Outputs	
S	Input binary signal “Set”	Y	Output analog signal
UP	Input binary signal “Up” (increment)		
DW	Input binary signal “Down” (decrement)		
R	Input binary signal “Reset”		

Parameters		
Minimum		When decrementing (rising edge "DW") with the counter stops at this minimum value.
Maximum		When incrementing (rising edge "UP") with the counter stops at this maximal value.
Reset		The value to which to set counter with active input "R"
Set		The value to which to set counter with active input "S"

Examples of connections

2.9.10 “CKD” Frequency Divider

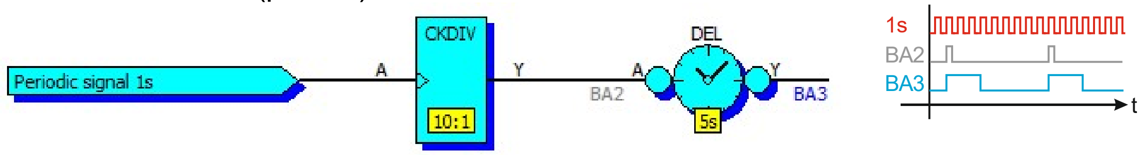
Schematic symbol	Description	Marking
	Input signal frequency divider. Reacts to rising edge. Each n-th positive input pulses will appear in output.	CKD

Inputs		Outputs	
A	Input binary signal	Y	Output binary signal

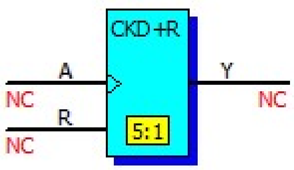
Parameters		
Frequency division	:1	Division ratio of the input frequency

Examples of connections

By placing a monostable circuit after “CKDIV” frequency divider it is possible to generate periodic signal with arbitrary repeating or it is possible to count down the number of events (pulses) to the moment a new event is activated.



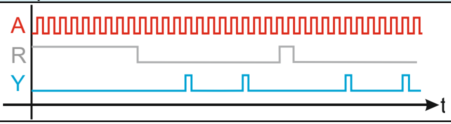
2.9.11 “CKD+R” Frequency Divider with Reset

Schematic symbol	Description	Marking
	Input signal frequency divider with reset. Reacts to rising edge. Each n-th positive input pulses will appear in output, when is reset inactive.	CKD+R

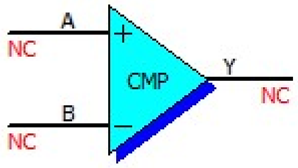
Inputs		Outputs	
A	Input binary signal	Y	Output binary signal
R	Input binary signal reset		

Parameters		
Frequency division	:1	Division ratio of the input frequency

Graph



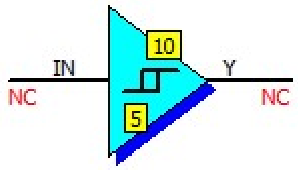
2.9.12 “CMP” Comparator

Schematic symbol	Description	Marking
	Comparing two analog signals Y=1 if A>=B Y=0 if A<B	CMP

Inputs		Outputs	
A	Input analog signal 1	Y	Output binary signal
B	Input analog signal 2		

Examples of connections

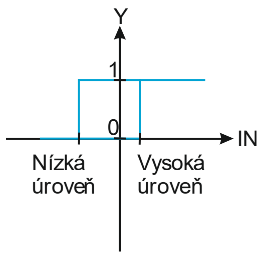
2.9.13 “CMPH” Hysteretic Comparator

Schematic symbol	Description	Marking
	Hysteretic comparator of the analog signal Y=1 if IN>=High level Y=0 if IN<Low level $Y=Y_{n-1}$ if IN<High level and simultaneously IN>=Low level	CMPH

Inputs		Outputs	
IN	Input analog signal	Y	Output binary signal

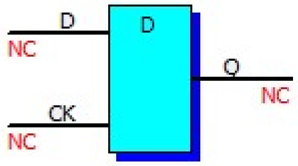
Parameters		
High level		Value to turn output to 1
Low level		Value to turn output to 0

Graph



Examples of connections

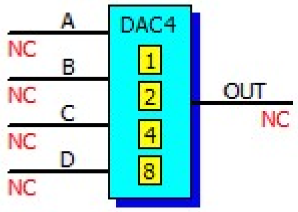
2.9.14 “D” Toggle Circuit D

Schematic symbol	Description	Marking
	“D” type toggle circuit Q=D if CK=1 Q=Q_{n-1} if CK=0	D

Inputs		Outputs	
D	Input binary signal	Q	Output binary signal
CK	Input binary signal of record		

Examples of connections

2.9.15 "DAC4" Digital / Analog Convertor

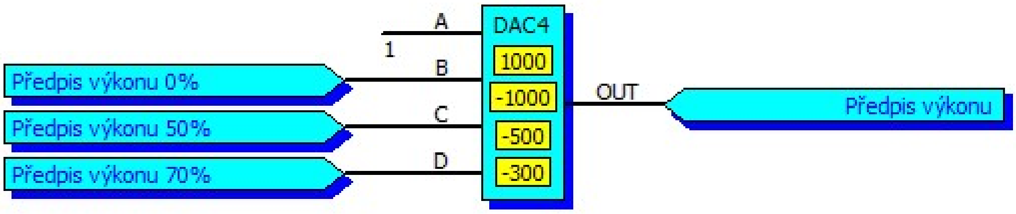
Schematic symbol	Description	Marking
	Digital / Analog convertor Converts a combination of four binary signals to analog values. Each binary input has weight defined by parameter which will be added to the output in the case the relevant input is activated.	DAC 4

Inputs		Outputs	
A	Input binary signal A	OUT	Output analog signal
B	Input binary signal B		
C	Input binary signal C		
D	Input binary signal D		

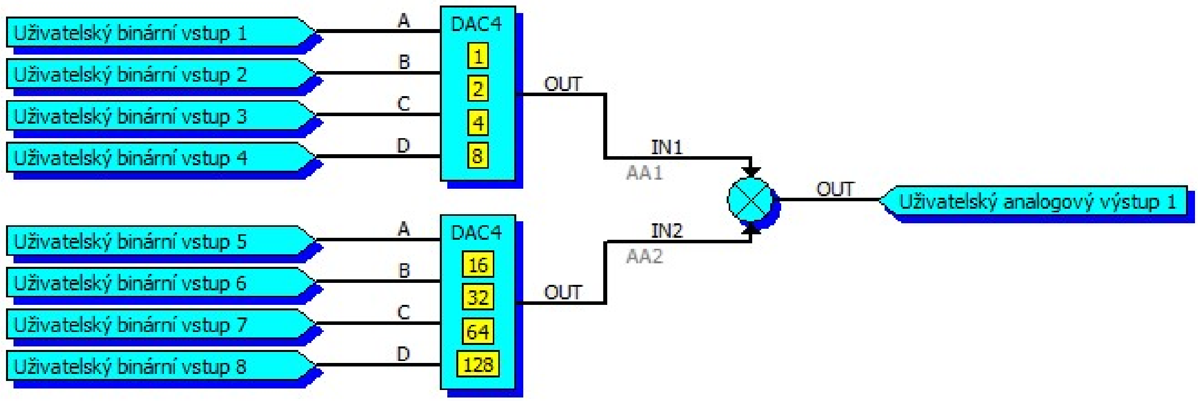
Parameters		
Input A weight		Value to be added to the output if input A is active
Input B weight		Value to be added to the output if input B is active
Input C weight		Value to be added to the output if input C is active
Input D weight		Value to be added to the output if input D is active

Examples of connections

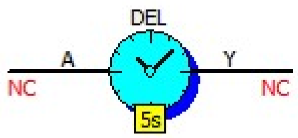
The following function will make analog signal of 1000 kW, 700 kW, 500 kW a 0 kW from binary signals for specification of output of 0%, 50%, and 70% including information on maximum allowed output (which can be mapped to the logical input "Restricting output by the distributor"):



In this case only one of the inputs is always active. If more than one input is active the output will be given by the sum of weights of the active inputs.
The following example illustrates the engagement of an 8-bit D/A convertor which converts user binary signals 1÷8 to analog values 0÷255:



2.9.16 "DEL" Delaying Logical Signal

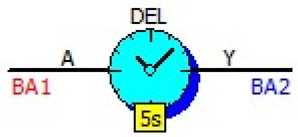
Schematic symbol	Description	Marking
	Delays the rising edge of the output signal by a defined time against the rising edge of the input signal.	DEL

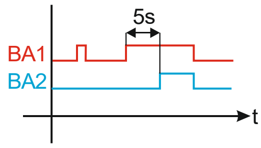
Inputs		Outputs	
A	Input binary signal	Y	Delayed output binary signal

Parameters		
Delay	s	Delay of the rising edge of the output signal against the input

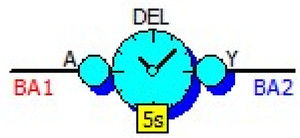
Examples of connections

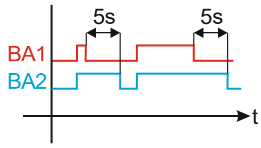
Delay with a direct input and output delays the rising edge of the output signal against the input. This can be used to filter off impulses shorter than the delay or to put off reactions to the input signal.



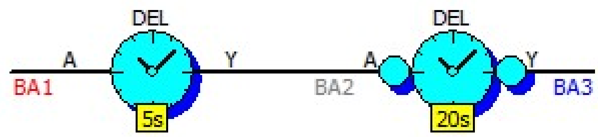


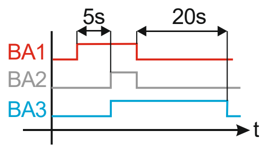
Delay with inverted input and output delays the falling edge of the output signal against the input (monostable circuit). For example, this can be used to lengthen the reaction to the input signal.



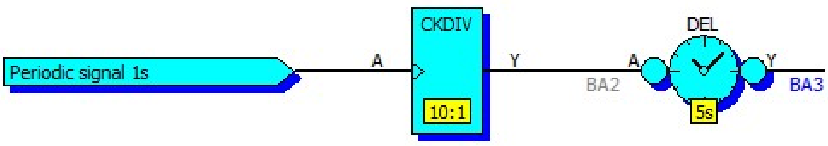


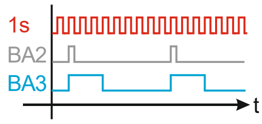
By engaging non-inverted and inverted delays it is possible to control delays of the rising as well as falling edges. For example, it may be thus possible to define delay of some of its protection and its duration until subsiding of the cause.



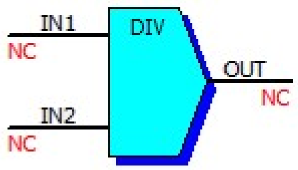


By engaging a monostable circuit after "CKDIV" divider it is possible to generate periodic signal with arbitrary repeating or it is possible to count down the number of events (pulses) to the activation of another event.





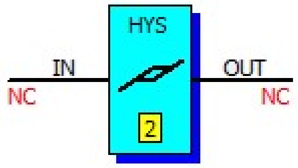
2.9.17 "DIV" Analog Divider

Schematic symbol	Description	Marking
	Dividing two analog signals OUT = IN1 / IN2	DIV

Inputs		Outputs	
IN1	Input analog signal (dividend)	OUT	Output analog signal (quotient)
IN2	Input analog signal (divisor)		

Examples of connections

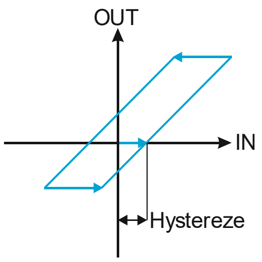
2.9.18 “HYS” Hysteresis

Schematic symbol	Description	Marking
	Hysteresis of signal OUT=OUTn-1 if |OUT-IN|<hysteresis OUT=IN-hysteresis if OUT<IN- hysteresis OUT=IN+ hysteresis if OUT>IN+ hysteresis	HYS

Inputs		Outputs	
IN	Input analog signal	OUT	Output analog signal

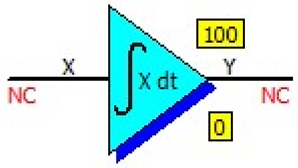
Parameters		
Hysteresis		Hysteresis defines the maximum by which output and input may differ

Graph



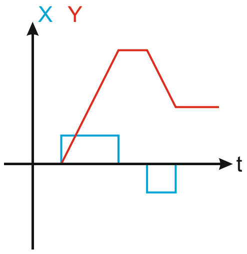
Examples of connections

2.9.19 “INT” Integrator

Schematic symbol	Description	Marking
	Integrator Y=∫X dt Output value is restricted within interval <Minimum, Maximum>	INT

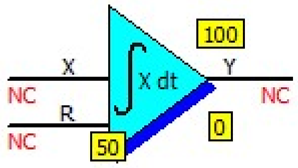
Inputs		Outputs	
X	Input analog signal	Y	Output analog signal

Parameters		
Minimum		Minimum value at integrator output
Maximum		Maximum value at integrator output

Graph


Examples of connections

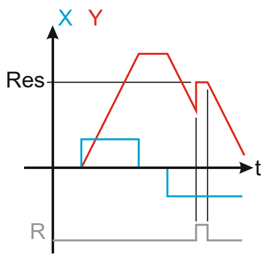
2.9.20 “INT+RES” Integrator with Reset Feature

Schematic symbol	Description	Marking
	Integrator with reset feature Y=∫X dt if R=0 Y=Reset if R=1 Output value is restricted within the interval <Minimum, Maximum>	INT+ RES

Inputs		Outputs	
X	Input analog signal	Y	Output analog signal
R	Input binary signal resetting		

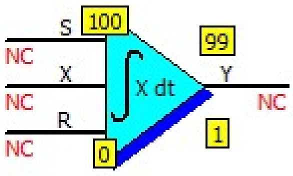
Parameters		
Minimum		Minimum value at integrator output
Maximum		Maximum value at integrator output
Reset		The value for which the integrator output is set in active resetting

Graph



Examples of connections

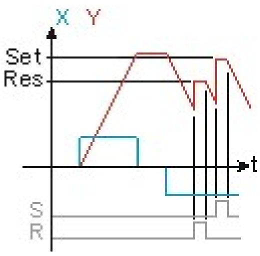
2.9.21 “INT+R+S” Integrator with Reset and Set Feature

Schematic symbol	Description	Marking
	Integrator with reset feature Y=∫X dt if R=0 Y=Reset if R=1 Y=Set if S=1 and R=0 Output value is restricted within the interval <Minimum, Maximum>	INT+ R+S

Inputs		Outputs	
X	Input analog signal	Y	Output analog signal
R	Input binary signal resetting		
S	Input binary signal setting		

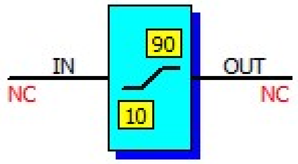
Parameters		
Minimum		Minimum value at integrator output
Maximum		Maximum value at integrator output
Reset		The value for which the integrator output is set in active resetting
Set		The value for which the integrator output is set in active setting

Graph



Examples of connections

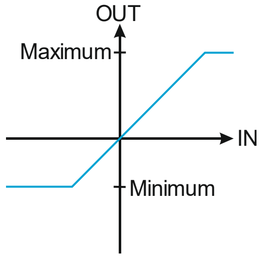
2.9.22 "LIM" Analog Limiter

Schematic symbol	Description	Marking
	Limiter of analog value OUT=IN if IN>=MIN a IN<MAX OUT=MIN if IN<MIN OUT=MAX if IN>=MAX	LIM

Inputs		Outputs	
IN	Input analog signal	OUT	Output analog signal

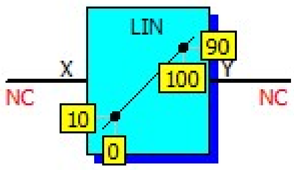
Parameters		
Minimum		Minimum value at limiter output
Maximum		Maximum value at limiter output

Graph



Examples of connections

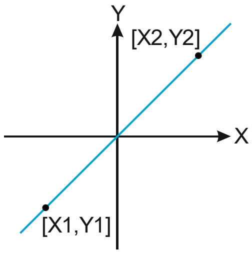
2.9.23 „LIN“ Linear interpolation

Schematic symbol	Description	Marking
	The input value of "X" will find the appropriate output value of "Y", which is on the definition line defined by two points	LIN

Inputs		Outputs	
X	Input analog signal	Y	Output analog signal

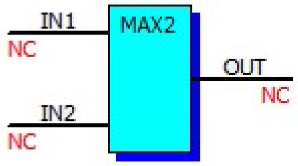
Parameters		
X1		The first point on the line definition
Y1		
X2		The seconf point on the line definition
Y2		

Graph



Examples of connections

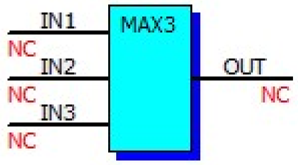
2.9.24 “MAX2” Higher Value out of Two Values

Schematic symbol	Description	Marking
	Higher value out of two values OUT=IN1 if IN1>=IN2 OUT=IN2 if IN2>IN1	MAX2

Inputs		Outputs	
IN1	Input analog signal	OUT	Output analog signal
IN2	Input analog signal		

Examples of connections

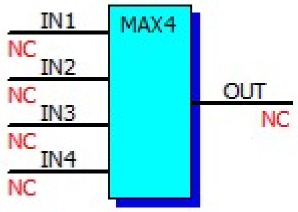
2.9.25 “MAX3” Maximum Value out of Three Values

Schematic symbol	Description	Marking
	Highest value out of three values OUT=IN1 if IN1>=IN2 and IN1>=IN3 OUT=IN2 if IN2>IN1 and IN2>IN3 OUT=IN3 if IN3>IN1 and IN3>IN2	MAX3

Inputs		Outputs	
IN1	Input analog signal	OUT	Output analog signal
IN2	Input analog signal		
IN3	Input analog signal		

Examples of connections

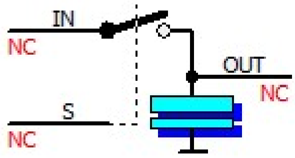
2.9.26 “MAX4” Maximum Value out of Four Values

Schematic symbol	Description	Marking
	Highest value out of four values OUT=IN1 if IN1>=IN2 and IN1>=IN3 and IN1>=IN4 OUT=IN2 if IN2>IN1 and IN2>IN3 and IN2>IN4 OUT=IN3 if IN3>IN1 and IN3>IN2 and IN3>IN4 OUT=IN4 if IN4>IN1 and IN4>IN2 and IN4>IN3	MAX4

Inputs		Outputs	
IN1	Input analog signal	OUT	Output analog signal
IN2	Input analog signal		
IN3	Input analog signal		
IN4	Input analog signal		

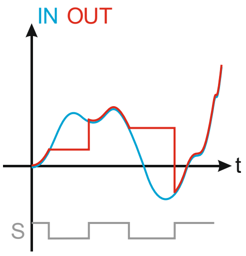
Examples of connections

2.9.27 "MEM" Analog Memory

Schematic symbol	Description	Marking
	Analog memory OUT=IN if S=1 OUT=OUT_{n-1} if S=0	MEM

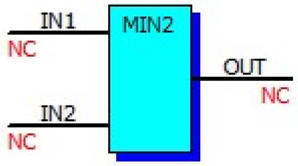
Inputs		Outputs	
IN	Input analog signal	OUT	Output analog signal
S	Input binary signal of recording		

Graphs



Examples of connections

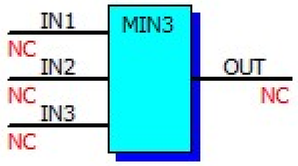
2.9.28 “MIN2” Lower Value out of Two Values

Schematic symbol	Description	Marking
	Lower Value out of Two Values OUT=IN1 if IN1<=IN2 OUT=IN2 if IN2<IN1	MIN2

Inputs		Outputs	
IN1	Input analog signal	OUT	Output analog signal
IN2	Input analog signal		

Examples of connections

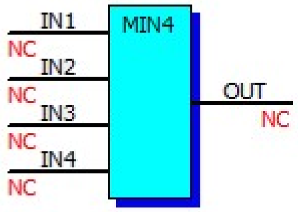
2.9.29 “MIN3” Minimum Value out of Three Values

Schematic symbol	Description	Marking
	The lowest value out of three values OUT=IN1 if IN1<=IN2 and IN1<=IN3 OUT=IN2 if IN2<IN1 and IN2<IN3 OUT=IN3 if IN3<IN1 and IN3<IN2	MIN3

Inputs		Outputs	
IN1	Input analog signal	OUT	Output analog signal
IN2	Input analog signal		
IN3	Input analog signal		

Examples of connections

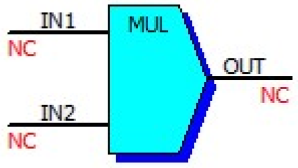
2.9.30 “MIN4” Minimum Value out of Four Values

Schematic symbol	Description	Marking
	The lowest value out of four values OUT=IN1 if IN1<=IN2 and IN1<=IN3 and IN1<=IN4 OUT=IN2 if IN2<IN1 and IN2<IN3 and IN2<IN4 OUT=IN3 if IN3<IN1 and IN3<IN2 and IN3<IN4 OUT=IN4 if IN4<IN1 and IN4<IN2 and IN4<IN3	MIN4

Inputs		Outputs	
IN1	Input analog signal	OUT	Output analog signal
IN2	Input analog signal		
IN3	Input analog signal		
IN4	Input analog signal		

Examples of connections

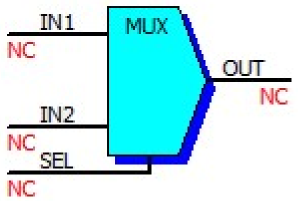
2.9.31 "MUL" Analog Multiplier

Schematic symbol	Description	Marking
	Multiplying two analog signals OUT=IN1*IN2	MUL

Inputs		Outputs	
IN1	Input analog signal (multiplicand)	OUT	Output analog signal (product)
IN2	Input analog signal (multiplier)		

Examples of connections

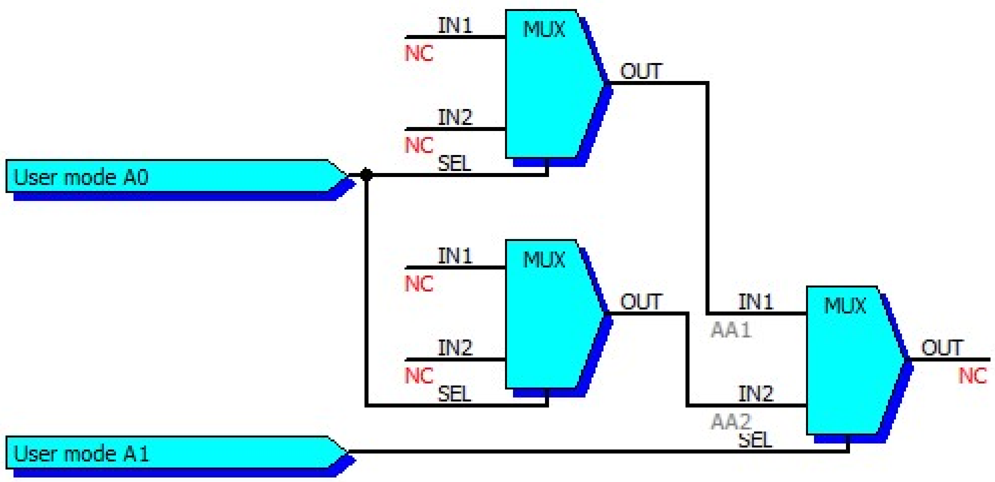
2.9.32 "MUX" Analog Multiplexer

Schematic symbol	Description	Marking
	Select one of two analog signals OUT=IN1 when SEL=0 OUT=IN2 when SEL=1	MUX

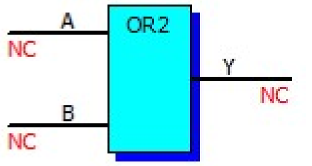
Inputs		Outputs	
IN1	Input analog signal 1	OUT	Output analog signal (product)
IN2	Input analog signal 2		
SEL	Input binary signal selection		

Examples of connections

Switching of four analog signals base on menu of user mode



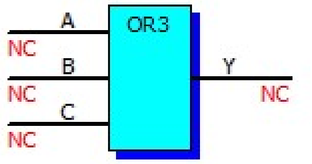
2.9.33 “OR2” Logical Sum of Two Signals

Schematic symbol	Description	Marking
	Logical sum of two binary signals Y=A+B	OR2

Inputs		Outputs	
A	Input binary signal	Y	Output binary signal
B	Input binary signal		

Examples of connections

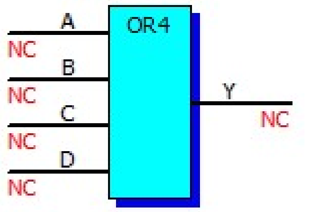
2.9.34 “OR3” Logical Sum of Three Signals

Schematic symbol	Description	Marking
	Logical sum of three binary signals Y=A+B+C	OR3

Inputs		Outputs	
A	Input binary signal	Y	Output binary signal
B	Input binary signal		
C	Input binary signal		

Examples of connections

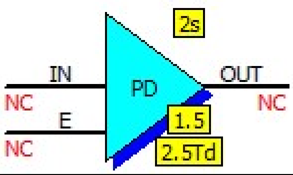
2.9.35 “OR4” Logical Sum of Four Signals

Schematic symbol	Description	Marking
	Logical sum of four binary signals Y=A+B+C+D	OR4

Inputs		Outputs	
A	Input binary signal	Y	Output binary signal
B	Input binary signal		
C	Input binary signal		
D	Input binary signal		

Examples of connections

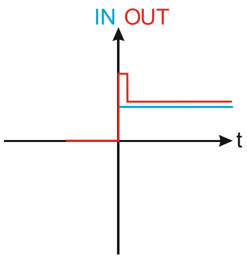
2.9.36 “PD” PD Regulator

Schematic symbol	Description	Marking
	PD regulator	PD

Inputs		Outputs	
IN	Input analog signal	OUT	Output analog signal
E	Input Binary signal activation		

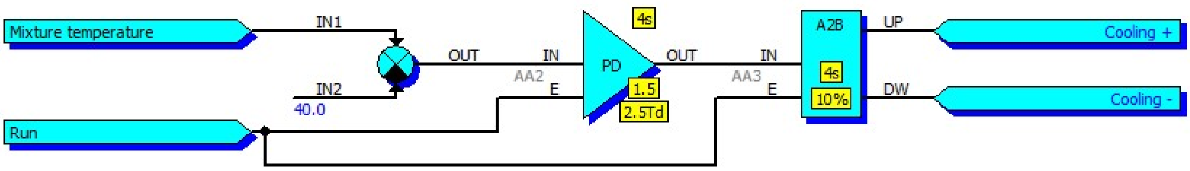
Parameters		
Period	s	Repetitive period of regulation
Amplification		Proportional amplification of regulation
Derivation		Derivative component of regulation

Graph



Examples of connections

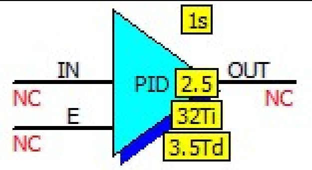
PD regulation of mixture temperature to the requested value 40°C. User binary outputs control the 3-way valve of mixture cooler.



Note

The integrator output is in the range of -100÷100. If PID is deactivated, the output is zeroed.

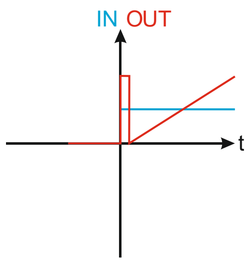
2.9.37 “PID” PID Regulator

Schematic symbol	Description	Marking
	PID regulator	PID

Inputs		Outputs	
IN	Input analog signal	OUT	Output analog signal
E	Input Binary signal activation		

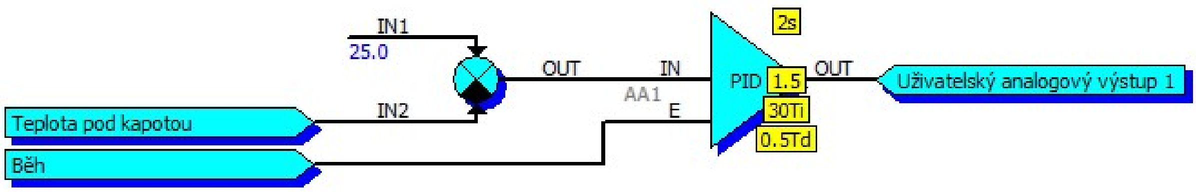
Parameters		
Period	s	Repetitive period of regulation
Amplification		Proportional amplification of regulation
Integration		Integrative component of regulation
Derivation		Derivative component of regulation

Graph



Examples of connections

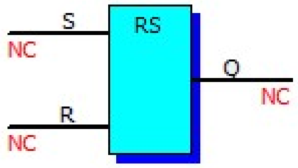
PID temperature regulation in bonnet to required value of 25 °C. User analog output 1 controls ventilator speed:



Note

The integrator output is in the range of -100÷100. If PID is deactivated, the output is zeroed.
For example, it the integrator output signal mapped to the physical output of 10 V and the required range of the output voltage is 0÷10 V, it is necessary to set the range of the output to 0 V=-100, 10 V=+100. With the PID deactivated, the physical output will be 5 V.

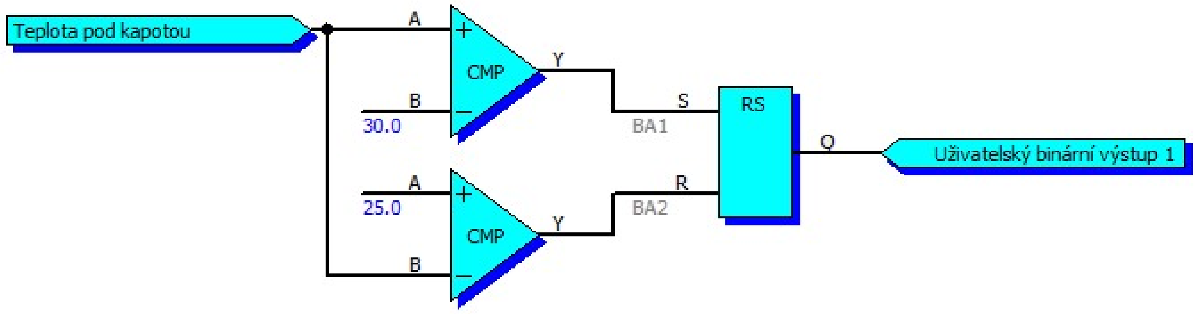
2.9.38 "RS" Toggle Circuit RD

Schematic symbol	Description	Marking
	"RS" type toggle circuit Q=1 if S=1 Q=0 if R=1 $Q=Q_{n-1}$ if S=R=0	RS

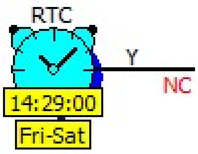
Inputs		Outputs	
S	Input binary signal of setting	Q	Output binary signal
R	Input binary signal of zero setting		

Examples of connections

User analog output will be activated if the temperature under the bonnet is higher than 30 °C and will be deactivated if the temperature is lower than 25 °C.



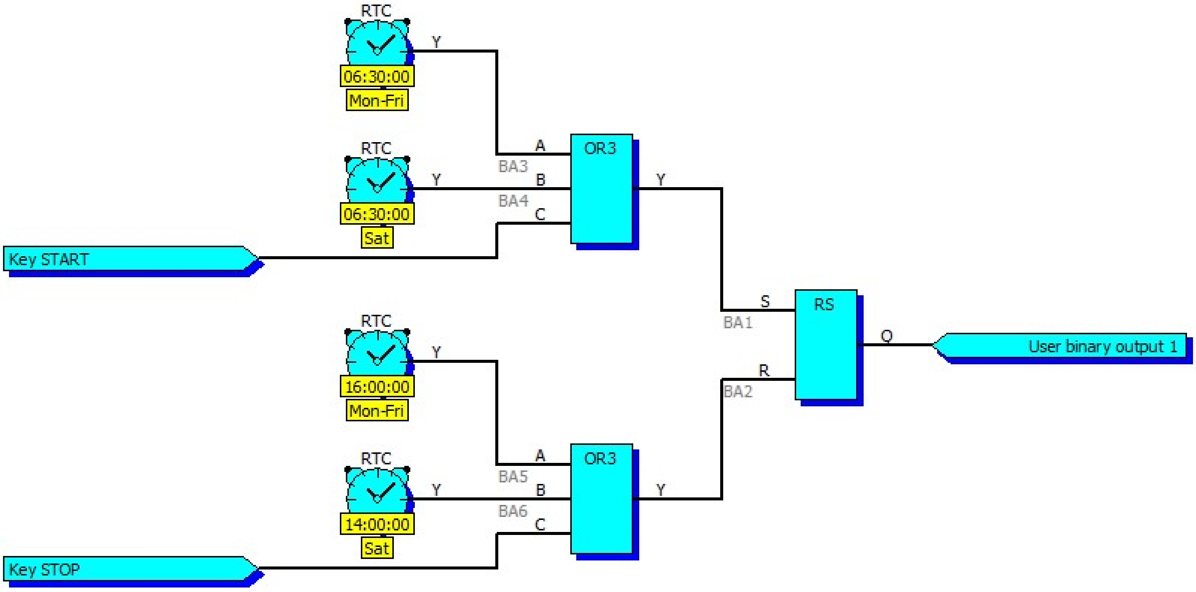
2.9.39 “RTC” Real time source

Schematic symbol	Description	Marking
	Real time source. Generate one second long pulse in defined time and day of week.	RTC

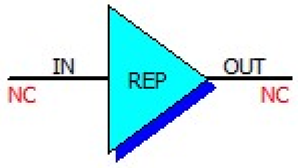
Inputs		Outputs	
	No inputs	Y	Output binary signal

Examples of connections

This will generate an signal, activated at 6:30 (Monday till Saturday) and deactivated at 16:00 (working day) and 14:00 (Saturday). Outside this times is posible (to the next timestamp) controll signal by START and STOP keys.
Block is an alternative to the signals "Timer1" and "Timer2", but which can generate only a half-hour schedule. But the number of blocks RTC is not limited.

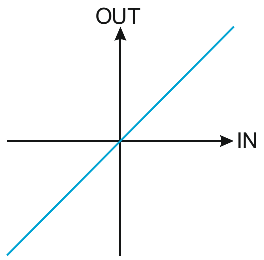


2.9.40 "REP" Analog Follower

Schematic symbol	Description	Marking
	Follower of the analog signal OUT=IN Is used to convert analog signal to user output (only this can be possibly mapped for logical input)	REP

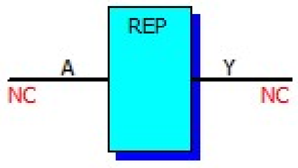
Inputs		Outputs	
IN	Input analog signal	OUT	Output analog signal (copy)

Graph



Examples of connections

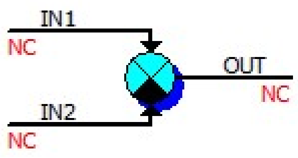
2.9.41 "REP" Logical Follower

Schematic symbol	Description	Marking
	Follower of the binary signal Y=A Is used to convert binary signal to user output (only this can be possibly mapped for logical input)	REP

Inputs		Outputs	
A	Input binary signal	Y	Output binary signal (copy)

Examples of connections

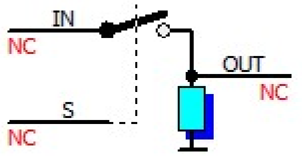
2.9.42 “SUB” Difference

Schematic symbol	Description	Marking
	Subtracting two analog signals OUT=IN1-IN2	SUB

Inputs		Outputs	
IN1	Input analog signal (minuend)	OUT	Output analog signal (difference)
IN2	Input analog signal (subtrahend)		

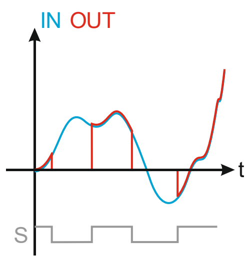
Examples of connections

2.9.43 “SWI” Switch

Schematic symbol	Description	Marking
 	Analog signal switch OUT=IN if S=1 OUT=0 if S=0	SWI

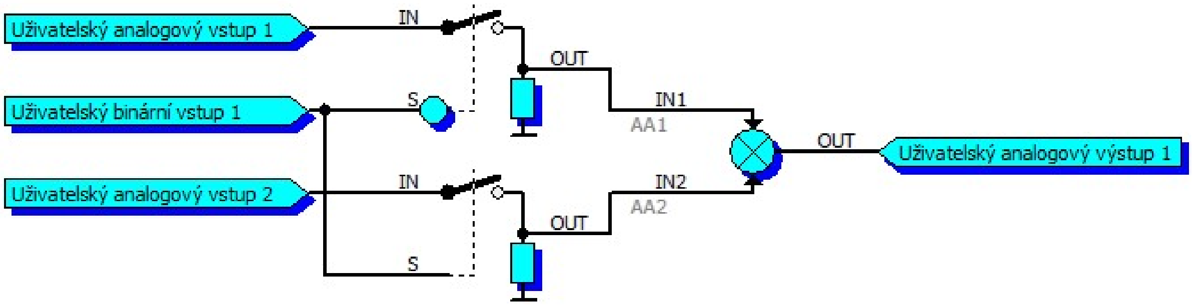
Inputs		Outputs	
IN	Input analog signal	OUT	Output analog signal
S	Input binary signal (fastening together)		

Graph

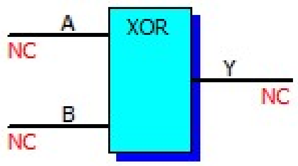


Examples of connections

According to the state of the user binary input 1 either the user analog input 1 or user analog input 2 will switch to user analog output (analog multiplexer).



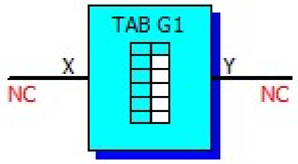
2.9.44 “XOR” Exclusive Logical Sum

Schematic symbol	Description	Marking
	Exclusive logical sum Y=0 if A=B Y=1 if A≠B	XOR

Inputs		Outputs	
A	Input binary signal	Y	Output binary signal
B	Input binary signal		

Examples of connections

2.9.45 Table Function 1

Schematic symbol	Description	Marking
	Table dependence of output variable on one input variable. Among the items defined by the table the output value is linearly interlaid.	TAB

Inputs		Outputs	
X	Input analog signal	Y	Output analog signal

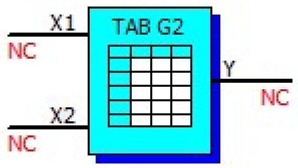
Parameters

Dependence of output on input is defined in the corresponding one-dimensional table.

Výstup []		
Vstup X	0.0	1.0
	20.0	2.0
	40.0	4.0
	60.0	8.0
	80.0	16.0
	100.0	32.0

Examples of connections

2.9.46 Table Function 2

Schematic symbol	Description	Marking
	Table dependence of output variable on two input variables. Among the items defined by the table the output value is linearly interlaid.	TAB

Inputs		Outputs	
X1	Input analog signal	Y	Output analog signal
X2	Input analog signal		

Parameters

Dependence of output on input is defined in the corresponding two-dimensional table.

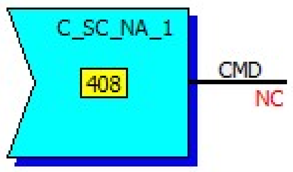
Výstup []		Vstup X2					
		0.0	20.0	40.0	60.0	80.0	100.0
Vstup X1	0.0	1.0	2.0	4.0	8.0	16.0	32.0
	20.0	2.0	4.0	8.0	16.0	32.0	64.0
	40.0	4.0	8.0	16.0	32.0	64.0	128.0
	60.0	8.0	16.0	32.0	64.0	128.0	256.0
	80.0	16.0	32.0	64.0	128.0	256.0	512.0
	100.0	0.0	64.0	128.0	256.0	512.0	1024.0

Examples of connections

2.10 Special Functional Blocks (Bridge-104)

This special function blocks can be used only in „Bridge-104“ device, used for dispatching control. Blocks serving for receiving of commands and transmiting of values via protocol IEC 60870-5-104.

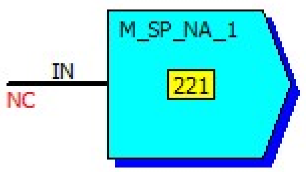
2.10.1 „C_SC_NA_1“ Single command from 104 protocol

Schematic symbol	Description	Marking
	Receive from protocol IEC 60870-5-104 single command from given IEC address	C_SC_NA_1

Inputs		Outputs	
		CND	Received birary signal

Parameters		
IEC address		Address of command

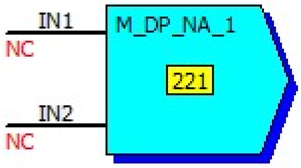
2.10.2 „M_SP_NA_1“ One-bit information for observation on 104 protocol

Schematic symbol	Description	Marking
	Transmit via protocol IEC 60870-5-104 one-bit information to given IEC address	M_SP_NA_1

Inputs		Outputs	
IN	Binary signal for transmiting		

Parameters		
IEC address		Address of value

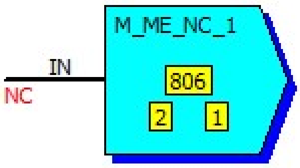
2.10.3 „M_DP_NA_1“ Two-bits information for observation on 104 protocol

Schematic symbol	Description	Marking
	Transmit via protocol IEC 60870-5-104 two-bits information to given IEC address	M_DP_NA_1

Inputs		Outputs	
IN1	Binary signal 1 for transmiting		
IN2	Binary signal 2 for transmiting		

Parameters		
IEC address		Address of value

2.10.4 „M_ME_NC_1“ Short floating point number for observation on 104 protocol

Schematic symbol	Description	Marking
	Transmit via protocol IEC 60870-5-104 analog information to given IEC address	M_ME_NC_1

Inputs		Outputs	
IN	Analog signal for transmiting		

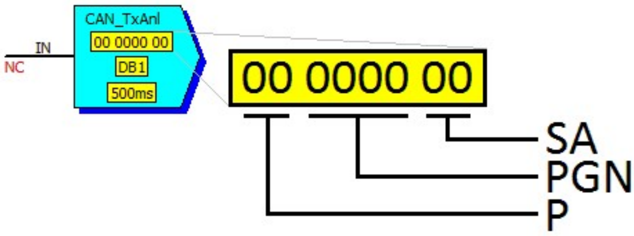
Parameters		
IEC address		Address of value
Deviation		Value deviation for spontaneous transmiting
Divisor		Value divisor (will be transmited value divided by this constant)

2.11 Special Functional Blocks (CAN)

This special functional blocks are available only in devices, where is CAN interface and is enabled to send and receive information using CAN in functions. Blocks use for data send and receive protocol SAE J1939 (page 0 parameter group).

CAN identifier frame is 29-bit length, consist of priority (P), parameters group address (PGN) and device address (SA):

CAN ID							
P Priority			PGN				SA Source address
			R	DP	PF (PDU format)	PS (PDU specific)	
28	27	26	25	24	23 22 21 20 19 18 17 16	15 14 13 12 11 10 9 8	7 6 5 4 3 2 1 0
0	0	0			Highest priority		
…							
1	1	1			Lowest priority		
			0	0	SAE J1939 Page 0 Parameters group (thisbits in CAN ID UNIMA-KS always 0)		
			0	1	SAE J1939 Page 1 Parameters group		
			1	0	SAE J1939 reserved		
			1	1	ISO 15765-3 def		



CAN data frame is 8 byts. Position of value in frame is defined by DB parameter (depend on one or two bytes value):

CAN Data								
Bytes	B0	B1	B2	B3	B4	B5	B6	B7
DB (1byte value)	1	2	3	4	5	6	7	8
DB (2bytes value)	1&2		3&4		5&6		7&8	
		2&3		4&5		6&7		

Analog values are send and received as a signed number with one decimal point. If the value have another dimension per bit and offset, need to use “LIN” block.

Each binary value is defined using two bits:

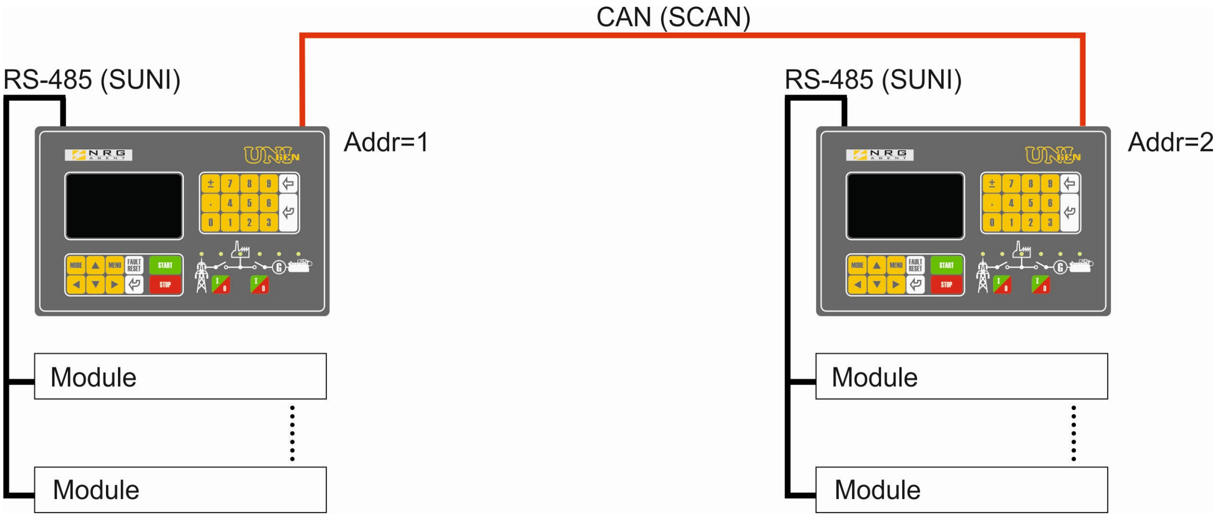
0	0	Inactive
0	1	Active
1	0	Undefined
1	1	Unavailable

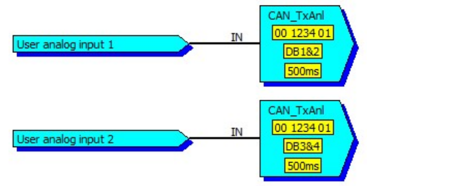
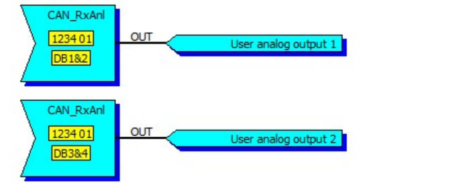
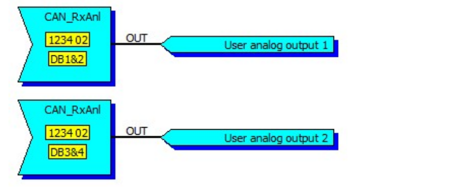
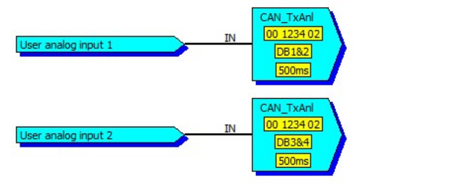
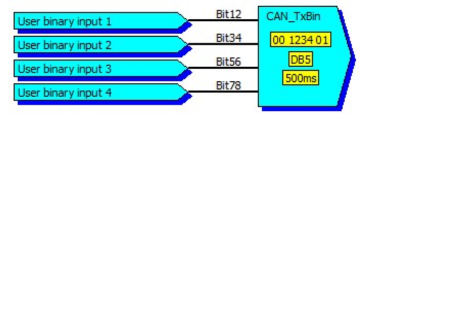
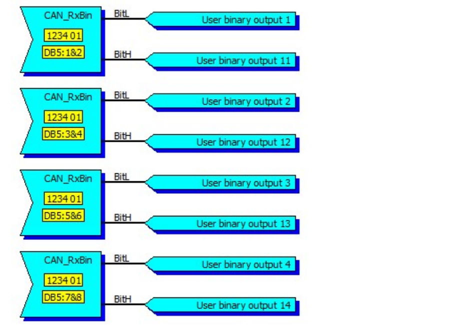
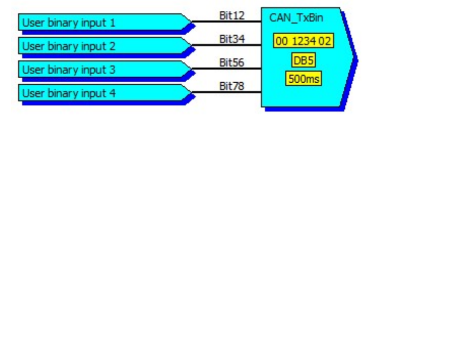
If there is more values sent by the same frame (more blocks with the same CAN ID), period of sending is given by the shortest sending period in this blocks with the same CAN ID.

Parameter “CANbr” define CAN bus speed, parameter “CANto” define read timeout (no incomming CAN frame in this time limit, received value is set to “Undefined”, analog value to 3276.7.

CAN blocks can be used for reading of data from other devices (e.g. some engine control unit).

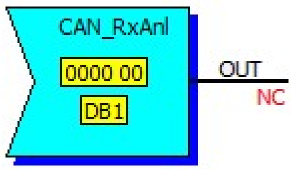
Next, CAN blocks can be used for data exchange between units with separated RS-485 bus (separation of RS-485 bus for each unit can be appropriate, when each unit have a lot of modules).



	UniGEN at address 1 definition (A)	UniGEN at address 2 definition (B)
Sends User anl.input 1 and 2 from UniGEN A to User anl.output 1 and 2 in UniGEN B		
Sends User anl.input 1 and 2 from UniGEN B to User anl.output 1 and 2 in UniGEN A		
Sends User bin.input 1-4 from UniGEN A to User bin.output 1-4 in UniGEN B User bin.output 10-14 Inform, that received signals are valid (no CAN communication error e.g.)		
Sends User bin.input 1-4 from UniGEN B to User bin.output 1-4 in UniGEN A		

In this example all data from each unit is transmited using one CAN frame PGN=1234 every 500ms

2.11.1 „CAN RxAnl“ Reading of analog value from CAN bus

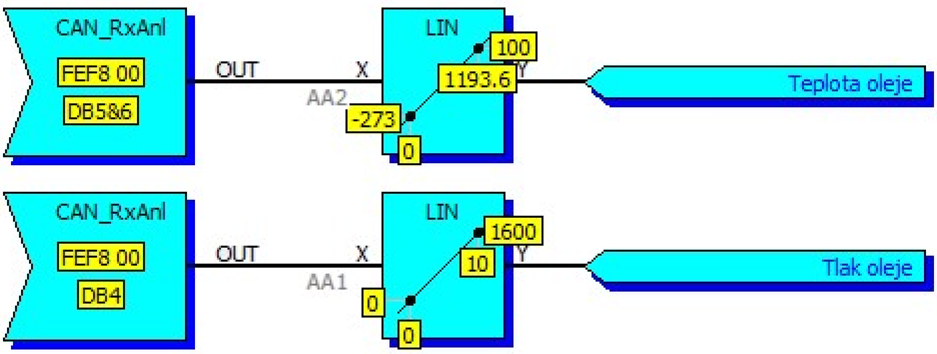
Schematic symbol	Description	Marking
	Receive by J1939 protocol analog value from the CAN bus at defined address and byte position.	CAN RxAnl

Inputs		Outputs	
		OUT	Received analog value

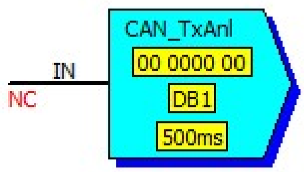
Parameters		
PGN		Parameter Group Number
SA		Source Address
DB		Position in CAN data frame

Examples of connections

Reading of oil pressure and temperature. Relevant user signals (LIN block outputs) must be assigned to oil temperature and pressure in functions.



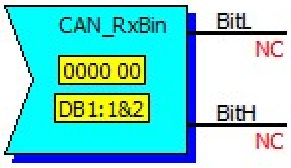
2.11.2 „CAN TxAnl“ Sending of analog value to CAN bus

Schematic symbol	Description	Marking
	Sends by J1939 protocol analog value to CAN bus at defined address and byte position.	CAN TxAnl

Inputs		Outputs	
IN	Analog value to send		

Paremeters		
P		Priority
PGN		Parameter Group Number
SA		Source Address
DB		Position in CAN data frame
TxDel	ms	Transmit period

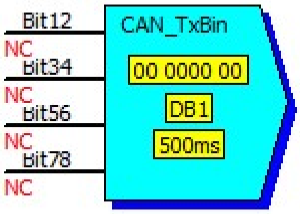
2.11.3 „CAN RxBin“ Reading of binary value from CAN bus

Schematic symbol	Description	Marking
	Receive by J1939 protocol binary value from the CAN bus at defined address and byte position. If BitH=0 than BitL define value state. if BitH=1, than value is unavailable or is not defined.	CAN RxBin

Inputs		Outputs	
		BitL	Received binary value
		BitH	

Parameters		
PGN		Parameter Group Number
SA		Source Address
DB		Position in CAN data frame
Bit		

2.11.4 „CAN TxBin“ Sending of binary value to CAN bus

Schematic symbol	Description	Marking
	Sends by J1939 protocol binary value to CAN bus at defined address and byte position. If the input is not connected, the higher bit is set to 1. If connected, higher bit is 0 and lower bit define value state.	CAN TxBin

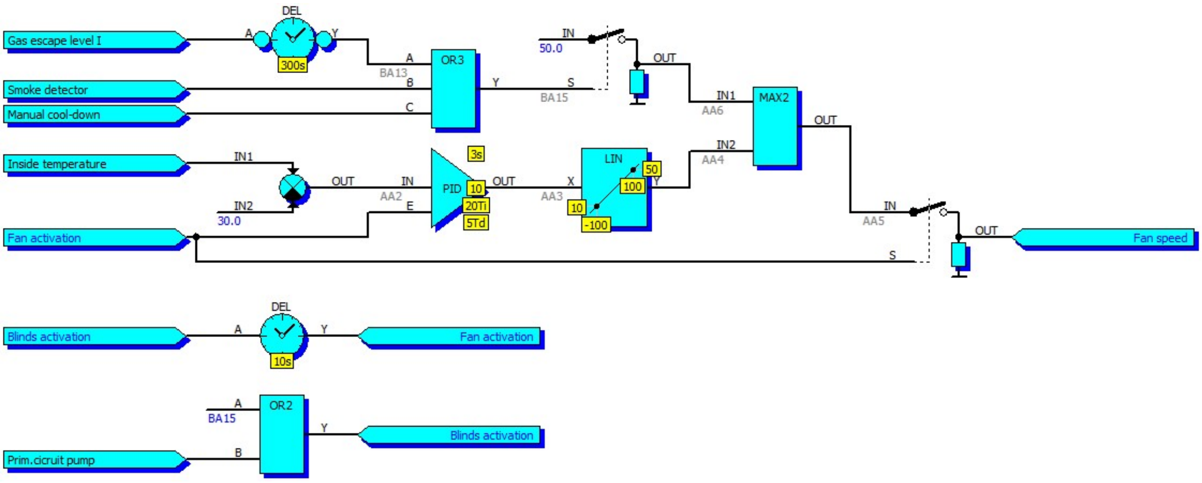
Inputs		Outputs	
Bit12	Binary values to send		
Bit34			
Bit56			
Bit78			

Parameters		
P		Priority
PGN		Parameter Group Number
SA		Source Address
DB		Position in CAN data frame
TxDel	ms	Transmit period

2.12 Examples and Use of Functions

2.12.1 Fan speed regulation

The following function implements the "PID" control the temperature in the hood of controlling the speed of the drive fan hood.



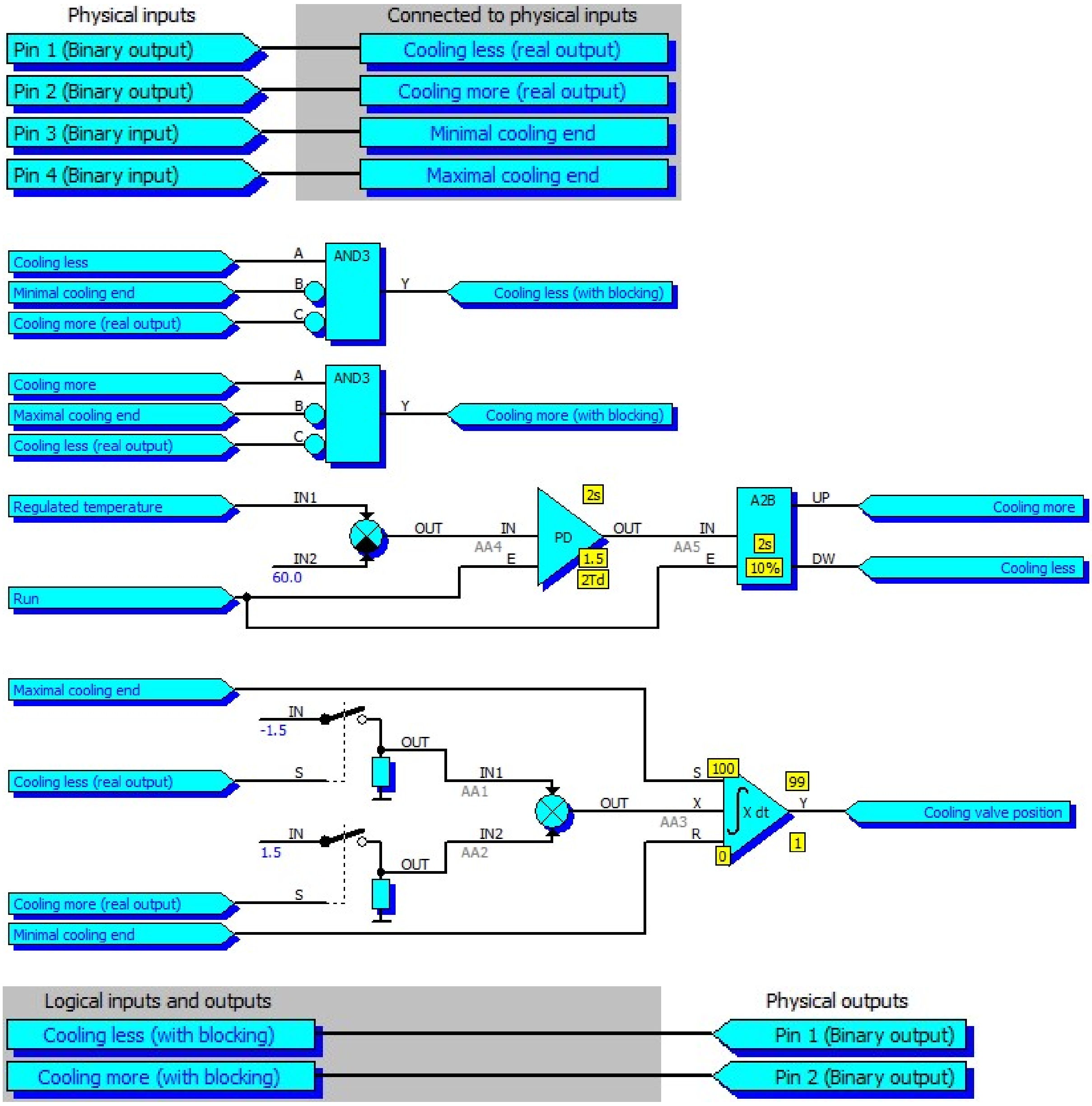
The drive is activated in example 10 seconds after the command to open the blinds. Difference between the actual temperature in the hood and the desired temperature (30°C) enters the PID controller. The output of the PID controller (in the range of -100 to 100) in the block "LIN" interpolated linearly to value 10 to 50, which corresponds directly to the desired Hz of frequency inverter (minimum fan speed will in this case 10Hz).

If an active signal "Gas escape", "Smoke detector" or "Manual cooling down" power ventilation is switched on regardless of the temperature in the hood at full power.

Signal "Fan activation" is mapped to a physical output which enable frequency inverter. Signal "Fan speed" is mapped to physical output 0 to 10V (10V which corresponds to 50Hz).

2.12.2 3-way valve regulation with position interpolation

Followed mapping and function implement on I/O module “PD” regulation of temperature by 3-way valve by “open” and “close” signals with position interpolation. Prerequisite is the sensing of the valve end positions and using I/O module (in which is possible mapping logical inputs to its physical outputs to interpolate position even in case of valve manual control)

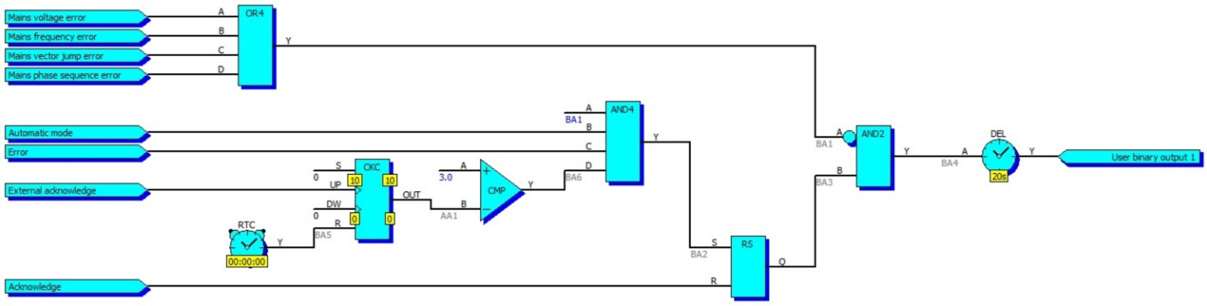


Constants “1.5” and “-1.5” define the valve crossing time of valve in [%/s]. If the interpolated valve position is beetwen 1÷99%, no end position signal active. If the interpolated valve position is 0%, minimal end position signal is active. If the interpolated valve position I s100%, maximal end position signal is active.

2.12.3 Automatic acknowledge of mains error

The following function automatically acknowledge the unit fault caused by network error.
The automatic acknowledgment occurs under the following conditions:

- Mains is more than 20s OK
- for automatic acknowledgment not more than 3 times in 24 hours
- unit is in automatic mode



Output function (in this case "User binary output 1") must be in mapping the binary inputs connected to the signal "External acknowledgment".
This function can be used only with devices that have a real-time clock and a logic input for external acknowledgment (UniGEN, MicroGEN).

2.12.4 Generating Sinusoidal Signal

The following function can generate a sinusoidal signal. "User analog output 1" is the time base (triangular signal ± 90), the shape of sine (90 °) is defined in Table A, a sinusoidal signal with amplitude of 100 is generated in "User analog output 2" generates (in mapping "User analog input 1 " is assigned to "User analog input 2").

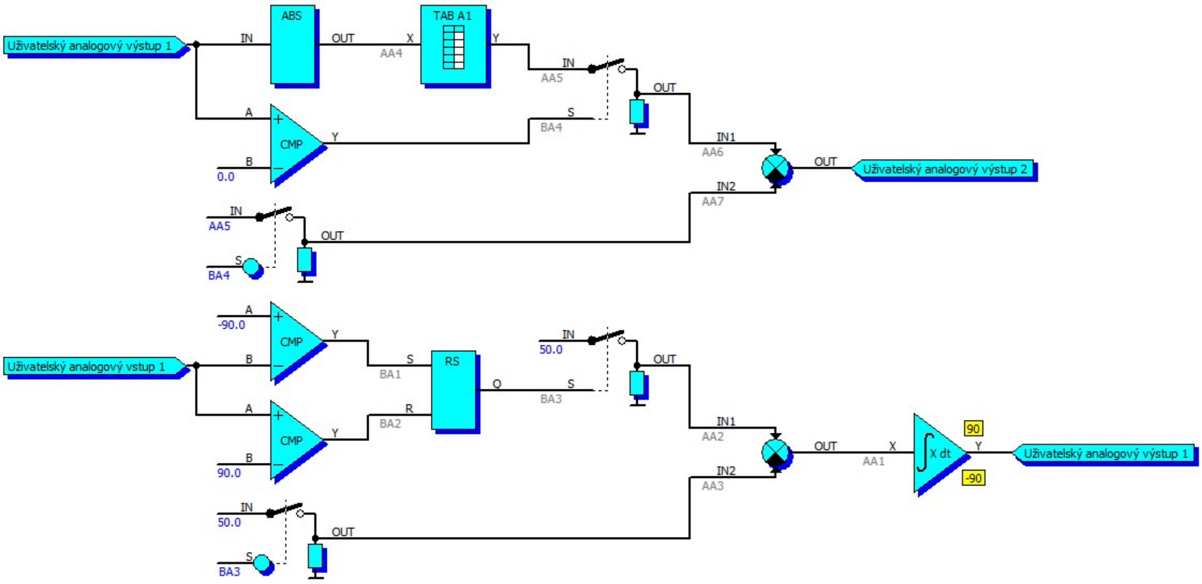


Table defining the shape of sine 0÷90 ° with amplitude of 100:

Vstup X	Výstup []
0.0	0.0
10.0	17.3
20.0	34.2
30.0	50.0
40.0	64.3
45.0	70.7
50.0	76.6
55.0	81.9
60.0	86.6
65.0	90.6
70.0	94.0
75.0	96.6
80.0	98.5
85.0	99.6
90.0	100.0